

TPWKY	This is Exactly Right.
	(This Podcast Will Kill You intro theme)
Erin Welsh	Hi there.
Erin Allmann Updyke	We're the Erins!
Erin Welsh	And this is This Podcast Will Kill You.
Erin Allmann Updyke	Welcome to Episode 2.
Erin Welsh	This week we'll be talking all about leprosy, starting with the biology-
Erin Allmann Updyke	The history-
Erin Welsh	And finally the current state of affairs.
Erin Allmann Updyke	Jumping right in with us.
Erin Welsh	Before we start things off...
Erin Allmann Updyke	(singing) It's quarantini time! It's quarantini time!
Erin Welsh	Yeah, you heard her. It's quarantini time.
Erin Allmann Updyke	(laughs) It is.
Erin Welsh	And in case you don't remember what a quarantini is, it is our signature cocktail for each episode. This week we're calling it-
Erin Allmann Updyke	The 'Harmadillo'.
Erin Welsh	Why are we calling it the Harmadillo?
Erin Allmann Updyke	Well it turns out that armadillos are the only known carrier of the bacteria that causes leprosy besides humans.
Erin Welsh	Oh, I get it. So like 'harm'; 'Harmadillo'...A joke is never funnier when fully explained.
Erin Allmann Updyke	(laughs) That's so true. So, if you'd like to drink along at home you can make your own Harmadillo by mixing 1 1/2 oz of your favorite tequila-
Erin Welsh	1 1/2 oz of passion fruit juice-
Erin Allmann Updyke	And 1 1/2 oz of Cointreau and serve it in a glass rimmed with a little salt and tajin or li hing mui powder, if you have either of those.
TPWKY	(transition theme)

Erin Welsh: We want to start off each episode by defining some of the words that we will be using which may be new to you or not. But just in case, we're gonna give you some brief definitions, so keep these in mind as you're listening.

Erin Welsh: For this week, let's talk about 'incidence'. What is incidence, Erin?

Erin Allmann Updyke: Incidence is the number of new cases during a certain time period, so it's the rate of new infections.

Erin Welsh: Okay, now what about 'prevalence'?

Erin Allmann Updyke: Prevalence is the proportion of cases in the population at a given time.

Erin Welsh: Okay. How about 'the incubation period'?

Erin Allmann Updyke: Incubation period is the time from when you are infected to when symptoms first appear.

Erin Welsh: Gotcha. Okay, let's see, what else? 'Genome'.

Erin Allmann Updyke: The genome of an individual or an organism is the entirety of the genetic material that makes up that organism. So for most organisms, that's all of your DNA, which is made up of nucleotides.

Erin Welsh: What about 'gene'?

Erin Allmann Updyke: A gene is a sequence of nucleotides in your DNA that actually codes for a protein.

Erin Welsh: Okay, and what about 'allele'?

Erin Allmann Updyke: An allele is a variant form of a given gene.

Erin Welsh: Okay.

Erin Allmann Updyke: I think that's all we need to do for today.

Erin Welsh: I think so. I think we got it, at least so far.

Erin Allmann Updyke: Cool.

TPWKY: (transition theme)

Erin Allmann Updyke: So Erin, can you start us off with some first-hand accounts of what it is like to live with leprosy?

Erin Welsh: I would love to. So I found a couple of first-hand accounts from a place that we'll be talking a lot about later in the episode, Kalaupapa, which is a leper colony on the island of Moloka'i on the island of Hawaii. So this is from a Hawaiian female around the 1970s, late 1970s. This is a direct quote from her:

"I remained in Kalaupapa for 30 years. I was finally paroled in 1966. My mother was still alive so I wrote to her and told her I was finally cured, I could come home. After a long while her letter came. She said, 'Don't come home. You stay at Kalaupapa.' I wrote her back and said I wanted to just visit to see the place where I was born. Again she wrote back, this time she said, 'No, you stay there.' You see, my mother had many friends and I think she felt shamed before them. I was disfigured even though I was cured, so she told me, her daughter, 'Don't come home'. She said, 'You stay right where you are. Stay there, and leave your bones at Kalaupapa'. This place is finally my real home. They take good care of me here."

Erin Allmann Updyke

That's so sad. One of the reasons that we are talking about leprosy today, besides the fact that it's just an interesting infectious disease that's been around a long time, is the fact that it is associated with so very much stigma. So even though it's a disease that today is technically curable, it is still very much relevant today just because of how much we have learned from how people were treated when they had this disease.

Erin Welsh

So the next quote that I have comes from someone who probably became the island's, Moloka'i, most famous resident, Father Damien. And so Father Damien was sent to Moloka'i to act as a spiritual advisor for the people there and ended up making a huge impact, which you'll hear more about later. But when he first arrived he was horrified by the conditions. This is what he wrote to his brother:

"It was a common sight to see people going around with fearful ulcers, which, for the want of a few rags or a piece of mint and a little salve, were left exposed to dirt, flies, and vermin. Not only their sores were neglected, but anyone getting a fever, diarrhea, or any other of the numerous ailments that lepers are so often heir to, was carried off for want of some simple medicine."

TPWKY

(transition theme)

Erin Allmann Updyke

Yeah, wow.

Erin Welsh

Okay, so that set the stage, I think, for this week's topic.

Erin Allmann Updyke

Yeah, definitely, I think so.

Erin Welsh

Before we go into the history of leprosy, let's get into the bones of what it actually is, what this disease is. Is it a virus, is it bacteria, what is it?

Erin Allmann Updyke

Right, let's talk about it. So we'll talk about the biology of leprosy. Leprosy, which is now in the U.S. also called Hansen's disease - because leprosy was associated with such stigma for so long, in the United States it is now referred to as Hansen's disease. But worldwide it is still known and referred to by the WHO, for example, mostly as leprosy. So throughout the episode I'll mostly be referring to it as leprosy.

Leprosy is caused by a bacterium named *Microbacterium leprae*, which is not too distantly related to the bacterium that also causes tuberculosis. But this is a particularly interesting bacteria for a number of reason. One is that it's super, super slow growing. So what that means is, for example *E. coli*, which is sort of the common laboratory bacteria, divides or reproduces about every 15-20 minutes. So if you leave it overnight on a plate, the next day you come back and there's just millions of *E. coli* bacteria on there. *Microbacterium leprae* on the other hand reproduces about once every 13 days. So for a bacterium that's incredibly slow.

Erin Welsh

That's crazy slow!

Erin Allmann Updyke I know, yeah. I read that and I was actually a little bit shocked.

Erin Welsh 13 days?

Erin Allmann Updyke 13 days is what it takes just to reproduce from one cell into two cells. Just to divide one time.

Erin Welsh Wow.

Erin Allmann Updyke Yeah, it's super slow. Another thing that's interesting about it is that its genome, or its genetic material, is super reduced. So compared to most other bacteria, it has a really, really small genome. And what that means is it has actually lost a lot of functional genes.

Erin Welsh What does that mean in practice? What are the functional genes that it has lost?

Erin Allmann Updyke Well I don't know the exact functional genes that it's lost, cause I didn't look that up. But I'll tell you that what it means is that this bacteria is what we call an 'obligate intracellular pathogen'. So it doesn't live, for example on the surface of things. It has to actually infect another cell in order to complete its life cycle, much like a virus has to do.

Erin Welsh So it's obligated to live inside a cell.

Erin Allmann Updyke Exactly, yeah. And so that's very different than most other bacteria because most bacteria, they often can live in the environment because they are able to just reproduce all on their own. Leprosy is actually transmitted, funnily enough, by respiratory droplets.

Erin Welsh (laughs)

Erin Allmann Updyke I guess I don't know why that's funnily enough, but I guess I would assume that you would have to have skin-to-skin contact because it tends to manifest in your skin. But actually it is so similarly related to tuberculosis, which is also transmitted in what we call respiratory droplets - that is water droplets that are expelled when you cough or sneeze or breathe. So you really do need prolonged close contact with a person who is infected in order to become infected yourself.

Erin Welsh And also an immune system that can't quite kick it.

Erin Allmann Updyke Exactly, right. Another thing about it is that the incubation period of this disease can range from 1-20 years, and on average it's about 5 years.

Erin Welsh So that means that you could be exposed, become infected, and not show symptoms for 1-20 years.

Erin Allmann Updyke Yep.

Erin Welsh Whoa, so how would you ever know where you picked up the infection?

Erin Allmann Updyke

Exactly, it's really difficult. And so we'll talk a lot about this when we get to the section on talking about the state of leprosy in the world today, but that's one of the things that makes diagnosis really, really difficult, is that this incubation period is just so long that it's really hard to detect. It also has made it so that it's really, really difficult to culture. It's impossible to culture this bacteria in the way that we normally culture other bacteria, which is on a plate or in a little jar full of liquid that we call 'media'. So this bacteria can only be cultured in living cells, so armadillos actually serve as the model organism to study leprosy.

Erin Welsh

Why armadillos?

Erin Allmann Updyke

Well, the leprosy bacteria survives best at low temperatures. So most other animals have a much higher body temperature, for example, than humans do. But armadillos happen to have quite a low body temperature so they serve as a perfect little host for leprosy. And additionally, in humans, we tend to get infected in our extremities where our body temperature tends to be lower. So hands, feet, ballsacks, etc.

Erin Welsh

(laughs) Etc.

Erin Allmann Updyke

What else about this bacteria do you want to know?

Erin Welsh

I wanna know about disease progression.

Erin Allmann Updyke

Right, let's talk about the clinical presentation. I was about to just do that, even. There are three main forms of leprosy that are expected to be sort of mediated by differences in individual immune response rather than differences in strain of the bacterium. So the first is what's called a tuberculoid form. This is the least severe form of the three types. This is when the bacterium infects peripheral nerves and what happens is it causes a loss of sensation and can also cause a swelling of the nerves.

Erin Welsh

Peripheral nerves meaning fingers or toes or nose? At what point is it peripheral?

Erin Allmann Updyke

Oh, that's a good question that I don't know the answer to. Yep. Well I mean, peripheral as in not part of your central nervous system, so it doesn't attack your brain stem or spinal cord in general.

Erin Welsh

Gotcha, so extremities.

Erin Allmann Updyke

Yeah, it attacks the nerves of your extremities and it can cause loss of sensation which can be dangerous because if you can't feel things then you might injure yourself or be prone to another infection that you don't feel the pain of.

Erin Welsh

Which is how a lot of cases become apparent in the first place, is that all of a sudden you've burned yourself but you didn't feel it.

Erin Allmann Updyke

That's actually how Father Damien first found out. Sorry if I'm preempting your section a little bit. The second form is called the lepromatous - I think that's how you pronounce it - form. This has generalized involvement of the skin, including the eyes, the nose, the testes, it can even infect your bone. And this is the form that causes those nodular, what's called granulomatous, which just means sort of these lesions that often are sort of blistery, that can be full of actual active bacteria as well as immune cells. So that's the most severe form of leprosy. And the third form is called borderline, which is sort of in between tuberculoid and lepromatous form.

Erin Welsh	And so can a case of leprosy go from tuberculoid to lepromatous?
Erin Allmann Updyke	I don't know. I don't think so. But I don't know. Does it? Do you know?
Erin Welsh	I thought I wrote it down somewhere.
Erin Allmann Updyke	Most of what I have seen talks about differences in individual immune response leading to presentation as one of the three forms.
Erin Welsh	Individuals whose clinical course vacillates between the two polar types are also viewed as intermediate. So it is possible to go between the two.
Erin Allmann Updyke	But then it's kind of called an intermediate form.
Erin Welsh	Oh, it's interesting, yeah. So it's like the degree of immune system reaction is what-
Erin Allmann Updyke	Is what determines, yeah. So it's not a difference in bacterial strain or anything like that, it's a difference in your individual immune response that determines which form you end up presenting with.
	Another thing that's really interesting is that it's estimated that around 95% of the human population is essentially immune to leprosy. Unfortunately I couldn't find the exact source of this number, but it's all over the CDC and a bunch of other websites. And the reason is that most of the population's immune response is sufficient to sort of squash the infection to the point where you never end up being symptomatic. So, yeah.
Erin Welsh	I wonder if we're part of the 5 or the 95?
Erin Allmann Updyke	I'm very, very curious to know about that. There's a lot of genes, a lot of alleles that are known to be associated with immunity in one way or another, but there is not a single allele or a single gene that confers complete immunity.
Erin Welsh	And so does that... Do we know if that 95% number has anything to do with the risk of exposure or is it just... You know, if you are not living in a place where leprosy is common, are you part of the 95% regardless of your immune system status?
Erin Allmann Updyke	That's a good question that I don't entirely know the answer to based on the literature that I've looked at. What it seems to me is that, for example, in the last episode we talked a lot about infectivity. Leprosy has a very, very low infectivity. So if, for example, you took a random sample of 100 people and inoculated them with the microbacterium bacterium, only about five of them would actually become infected.
Erin Welsh	Okay, okay.
Erin Allmann Updyke	Yeah, it's just very low infectivity. And I think that's all I have, actually, on the biology. It evolved millions of years ago, along with humans. It's a really interesting little bacterium.
TPWKY	(transition theme)
Erin Welsh	So I wanna talk a bit about the history of leprosy, both in evolutionary history and then also prehistory through the middle ages, the dark ages, all the way through present day.

Erin Allmann Updyke: Awesome. (laughs)

Erin Welsh: Leprosy probably arose in people around 10,000 years ago or so, is what it's estimated to be.

Erin Allmann Updyke: Wow. Interesting. Those are the first records of it?

Erin Welsh: No, the first skeletal records come from around 500 AD, actually. But it's just looking at its evolutionary history in its genome, and like the traces in its genome. It suggests that it was around 10,000 years ago.

Erin Allmann Updyke: I saw estimates of up to 2 million years ago, with the evolution of humans, even.

Erin Welsh: Sure. I mean, microbacterium has long ties with humans and so whether it was *Microbacterium leprae* or a different-

Erin Allmann Updyke: Similar...

Erin Welsh: Yeah, the origin of the ancestor of *Microbacterium leprae*. But either way it could have spread into humans in a variety of ways. One theory suggests it came from mice originally, another suggests that it came from using the hides of water buffalo.

Erin Allmann Updyke: Like wearing them like clothing, kind of?

Erin Welsh: Yeah, yeah. Kind of weird.

Erin Allmann Updyke: Just wearing them water buffalo, getcha all kinds of sick. (laughs)

Erin Welsh: I didn't read further into that, but I did find that to be a little interesting tidbit. But what we do know is that the bacterium likely originated somewhere in India or East Asia. So as I mentioned, the first skeletal evidence comes from mummies in Egypt around 500, but it was likely present throughout Egypt, throughout China, throughout India and East Asia. 4000 years ago it was like rampant in those areas, which is really interesting. And that usually comes from information in texts and old medical records and such.

You may have heard of leprosy from its many mentions in the bible or from watching Ben Hur, that classic movie.

Erin Allmann Updyke: You know I've never actually seen Ben Hur.

Erin Welsh: My mom forced me to watch it.

Erin Allmann Updyke: Is it good? Should I watch it?

Erin Welsh: I don't remember cause I just remember hating the experience. The movie could've been fine.

Erin Allmann Updyke: If you're forced to watch a movie then you're probably gonna hate it.

Erin Welsh: Right, especially if it's like four hours long.

Erin Allmann Updyke Oh good god.

Erin Welsh It was like, 'Oh it's Easter, time to watch Ben Hur'.

Erin Allmann Updyke Oh is it an Easter movie?

Erin Welsh I think so.

Erin Allmann Updyke I know nothing.

Erin Welsh I don't know, I didn't bother to look up any more.

Erin Allmann Updyke (laughs)

Erin Welsh But honestly what I do remember from Ben Hur, watching it, was this scene where there are two leper women.

Erin Allmann Updyke And that's the part that you remember. Budding disease ecologist. Even at that young age.

Erin Welsh Ooh, what do they have? Leprosy?

Erin Allmann Updyke How do I diagnose this?

Erin Welsh But what you may not know is that the leprosy of the Old Testament is almost certainly not actual leprosy, the disease that we call leprosy today, caused by *Mycobacterium leprae*.

Erin Allmann Updyke I always assumed, growing up in a Catholic household, that Lazarus died of leprosy. The one that was raised from the dead, right? His name was Lazarus, so he died of leprosy, and leprosy was named after Lazarus. I think that's what I thought.

Erin Welsh And alliteration causation? Sure.

Erin Allmann Updyke Right, exactly. So that's probably not true?

Erin Welsh No. Not true.

Erin Allmann Updyke All right. Well then.

Erin Welsh And the reason it wasn't leprosy in the bible is because at the time that the Old Testament was being translated into Greek in the 3rd century BC, leprosy hadn't even reached Europe yet.

Erin Allmann Updyke Interesting.

Erin Welsh So by the time that the word 'leper' and 'leprosy' was used in the Old Testament, it wasn't actually about leprosy but more likely it was used for any sort of skin condition, such as psoriasis or advanced syphilis or fungal infections.

Erin Allmann Updyke But leprosy itself, as a bacterium, did exist at the time of dear Jesus, right?

Erin Welsh	Dear Jesus. Yes. The word leprosy though, comes from - I love etymology, so I just want to throw this in here.
Erin Allmann Updyke	Do it. I love it. I wanna learn things.
Erin Welsh	It comes from the Greek word 'lepra' which means, quote: "A disease which makes the skin scaly."
Erin Allmann Updyke	Wow. That's such a long definition for one word.
Erin Welsh	For one word, yeah. Which is probably why it was used later on for the disease leprosy, because it still is a skin condition, blah blah blah. I wanna talk a little about the treatment of leprosy victims from the time of the earliest writings, which were in like the 1st century or before that, to about 50 years ago. I'll take you through leprosy victim experiences all over the world and ending in Hawaii.
Erin Allmann Updyke	Great.
Erin Welsh	What comes to mind, Erin, when you hear the word 'leper'?
Erin Allmann Updyke	I think of someone who is sort of shunned. I think of sort of grotesque skin conditions, I think of... Honestly it just makes me feel sad when I hear that word.
Erin Welsh	Someone who's an outcast. You're afraid of them.
Erin Allmann Updyke	Yeah, it's almost, that word I feel like I almost synonymous at this point with the idea of an outcast.
Erin Welsh	Yeah, I absolutely is and that's part of the history of the treatment of victims of leprosy.
Erin Allmann Updyke	Yeah.
Erin Welsh	I mean maybe you or I or you, dear listener, have used the word 'leper' to refer to the feeling of feeling shunned or of being rejected or whatever it is. And these associations exist because of how victims of leprosy have been treated throughout history and into present day. In fact, many health organizations such as the CDC no longer use the word 'leper' or, as Erin mentioned, 'leprosy' anymore. And 'leper' is actually not used at all. So throughout the episode I may use the word 'leper', Erin may use the word 'leper'. We're not doing it to call someone a leper, it's usually to put it in its historical context or we're reading from a quote. I'll use the term 'leper colony' as synonymous with some of the other terms where victims of leprosy were-
Erin Allmann Updyke	Quarantined.
Erin Welsh	Exactly.

Erin Allmann Updyke Right. Yeah, this is sort of a disclaimer that we recognize that that word is extremely stigmatized and it's not commonly used today. So when we're using it in this episode it is based in its historical context.

Erin Welsh Although specific practices differed region by region, the common thread in how victims of leprosy were treated was rejection and stigma. Yeah, it's horrible. In some places victims were made to wear cloaks and bells or clappers so that whenever they went through a village-

Erin Allmann Updyke (gasp) You could hear them coming?

Erin Welsh Yeah. Their presence had to be announced.

Erin Allmann Updyke That's awful. Humans, we're terrible to each other. Goodness.

Erin Welsh Yeah, we're terrible. That's like lucky. If you have to wear a cloak and have a bell, you were well-off.

Erin Allmann Updyke You were one of the lucky ones.

Erin Welsh Oh yeah. If you were a little bit less lucky you were made to, for instance, stand in a freshly dug grave while a priest stood over you, threw dirt on you, and then said 'You are dead to the world. All your earthly possessions are taken away. Your marriage is dissolved, and your kids are going to be orphans,' if you and your partner were both afflicted.

Erin Allmann Updyke Can you describe my face right now for listeners?

Erin Welsh It's horrified!

Erin Allmann Updyke Yeah.

Erin Welsh Her eyebrows are like S's!

Erin Allmann Updyke That is...wow. So they were essentially declared dead in the eyes of god and men. Wow.

Erin Welsh Exactly. Exactly. Then that person who was made to stand in the grave was forcefully sent to a leprosaria, lazar house, or a leper colony. Those are the interchangeable terms for an area in which it was secluded and you were sent off-

Erin Allmann Updyke Sidebar! A lazar house! This explains why I assumed that Lazarus had leprosy!

Erin Welsh I mean, I don't know about the etymology of Lazar.

Erin Allmann Updyke I'm gonna go ahead and just claim it. I was right, Lazarus had leprosy. He was the one and only person in the bible that really did actually have leprosy.

Erin Welsh Actually that would be funny.

Erin Allmann Updyke Wouldn't it? I would be really proud of my six-year-old intuition.

Erin Welsh So you think, 'Okay, that sounds pretty bad. I wouldn't want that.'

Erin Allmann Updyke: Nope, I definitely wouldn't.

Erin Welsh: Do you know that that's not the worst off that someone was?

Erin Allmann Updyke: Don't tell me. I don't know if I want to know this.

Erin Welsh: Yeah, you do. You're gonna know it anyway.

Erin Allmann Updyke: Okay tell me.

Erin Welsh: If you were really unlucky you were forced to undergo, quote, "assisted suicide" by burning or drowning.

Erin Allmann Updyke: (gasp) Are you serious? So they burned alive and drowned people who had leprosy?

Erin Welsh: Right.

Erin Allmann Updyke: Victims of a disease that we now know, obviously they didn't know then, but is so curable. It wasn't curable then.

Erin Welsh: The other thing though is that back then, people weren't certain that it was contagious, that it was contagious in origin. So there was a lot of discussion as to the cause. Whether it was immorality, so you were drinking too late or sleeping around or whatever it was.

Erin Allmann Updyke: You're a bad boy. You need to be killed... Wow, jeez. There's no excuse for it! Uh-uh.

Erin Welsh: In other cases it was thought to be familial, and if you parents had it... So people who were victims of leprosy were not allowed to have kids often.

Erin Allmann Updyke: Oh, so were they sort of forcefully sterilized or just prevented from having children or something?

Erin Welsh: Exactly.

Erin Allmann Updyke: Without, it's not like anyone does that today. Just kidding, we absolutely do.

Erin Welsh: All the time. (sigh) And there were other regions that did think, 'Yes, this is contagious'. But even still, despite the fact that it is an infectious disease, the forceful quarantines probably did not prevent any future cases because of the extremely low infectivity.

Erin Allmann Updyke: Extremely low infectivity and extremely long incubation period where it just doesn't really make sense for a disease like this to quarantine people the way that they did. But it just was so incredibly stigmatized and people were... Is there another word for stigmatized?

Erin Welsh: Ostracized?

Erin Allmann Updyke: Ostracized.

Erin Welsh: One thing to note is that for thousands of years of leprosy's existence, diagnosis was done by priests or other religious authorities.

Erin Allmann Updyke: Well that's fun.

Erin Welsh: And not with a lab or microscope.

Erin Allmann Updyke: Well, I mean, for thousands of years... We haven't had microscopes for thousands of years. In their defense.

Erin Welsh: No, no, no, of course not. But this did mean that many leprosy victims probably didn't have leprosy.

Erin Allmann Updyke: Oh, because priests were just like, 'Yep, I see that. That looks like it to me, so-'

Erin Welsh: That's a weird skin condition'!

Erin Allmann Updyke: (old-timey voice) 'You've got a bump there, you're definitely, I'm burning you alive!' That's what they just did.

Erin Welsh: That's exactly how it went. Direct quotes.

Erin Allmann Updyke: Direct quote. We were there.

Erin Welsh: Leprosy probably reached peak global prevalence in the late Dark Ages, Early Middle Ages.

Erin Allmann Updyke: Can you remind me when that was?

Erin Welsh: 500-1500 AD.

Erin Allmann Updyke: Oh, okay. That's a long time ago.

Erin Welsh: It's a long time ago. And after that time, leprosy began to decline rapidly. And many leprosaria or lazar houses were abandoned. Interestingly, this decline in leprosy happened around the same time that tuberculosis started to become super widespread.

Erin Allmann Updyke: Interesting.

Erin Welsh: And so tuberculosis and leprosy are closely related.

Erin Allmann Updyke: Right.

Erin Welsh: So this suggests that tuberculosis outcompeted leprosy.

Erin Allmann Updyke: Right because you only have so much surface area or cells in your body so if you have two really closely related bacteria, they might be competing for space in your body. And so what you're saying is that tuberculosis might be a better competitor than the leprosy *Microbacterium leprae*.

Erin Welsh: Precisely.

Erin Allmann Updyke: Wow, that is so interesting.

Erin Welsh: Isn't that interesting?

Erin Allmann Updyke: Yeah.

Erin Welsh: Basically humans traded one evil for another.

Erin Allmann Updyke: They really did. And you know, we'll have a whole episode to talk about tuberculosis.

Erin Welsh: So don't worry. Don't research it.

Erin Allmann Updyke: Well I mean, research it if you want to. You could send us stuff you want us to check out.

Erin Welsh: Fact-check us.

Erin Allmann Updyke: (laughs)

Erin Welsh: All right, leprosy declined but did it disappear? No way.

Erin Allmann Updyke: No way!

Erin Welsh: Did the horrible ways that victims were treated come to an end?

Erin Allmann Updyke: Hell no!

Erin Welsh: As humans grew more compassionate and understanding?

Erin Allmann Updyke: If only!

Erin Welsh: Right?

Erin Allmann Updyke: That was so good. (laughs)

Erin Welsh: Earlier in the episode you heard some first hand accounts of what life was like in Kalaupapa, the leper colony on the Hawaiian island of Moloka'i. In 1865 the Hawaiian king Lot Kamehameha signed into law, quote, "An act to prevent the spread of leprosy" which basically made it a criminal act to have leprosy.

Erin Allmann Updyke: Oh my god. Humans.

Erin Welsh: This act remained in effect for - guess how long?

Erin Allmann Updyke: Ugh, way too long.

Erin Welsh: More than 100 years.

Erin Allmann Updyke	That means 1960s.
Erin Welsh	1969 is when it was finally repealed.
Erin Allmann Updyke	I'm sorry, but how many of you listening were alive then? I wasn't but my parents were alive. Like I know a lot of humans that were alive at the time that they were still forcibly putting leprosy victims into a colony on the island of Moloka'i.
Erin Welsh	Under this act, that's exactly what happened. If you were found to have leprosy, your will was executed, your marriage was dissolved and you were forcibly removed from your home and sent to Moloka'i.
Erin Allmann Updyke	This is exactly what you were saying with the putting someone in a grave and declaring them dead. In the 60s!
Erin Welsh	In the 60s.
Erin Allmann Updyke	Also I would like to point out that Hawaii was incorporated as a state in the 1950s, and that means that this was also happening in the United States of America, so...
Erin Welsh	Oh and Hawaii had been under American/U.S. influence probably since the 1860s cause the whole act was done under the influence of the United States.
Erin Allmann Updyke	Yeah.
Erin Welsh	Cause they were worried about whatever trade and like, 'Oh well we can't dirty the hands of Americans who are coming to visit'.
	Under this act, if you were found to have leprosy you were exiled. And the place you were exiled to? Moloka'i. You could say, 'Oh, exiled to a beautiful Hawaiian island? That sounds like paradise. What's so bad about that?'
Erin Allmann Updyke	(laughs)
Erin Welsh	How about the fact that you were stripped of your rights, any material goods, and forbidden from ever seeing your family again. And then that's just leaving whatever island you were on and going to Moloka'i. Once you were on the island, food and shelter was in no way guaranteed and forget about any medical treatment cause it's not going to happen.
Erin Allmann Updyke	No they weren't bringing people to a great hospital to give them treatment, they were just sending them away to die.
Erin Welsh	There weren't structures. They thought, 'Oh, you know, we don't wanna...Hawaii you can just grow your own food! Doesn't matter if your fingers don't work anymore, if you can't walk. Figure it out'.
Erin Allmann Updyke	And what's interesting is that that area of the island was very productive. For 900 years native Hawaiians were living there in sort of a traditional Hawaiian system, but because they decided to take that over and turn it into a colony for leprosy victims, those structures that were in place were destroyed. So there wasn't a way to just live happily on this part of the island.

Erin Welsh	No, it was horrible conditions. If you were unlucky enough to be a female victim of leprosy on Moloka'i, you were probably taken as a sex slave by another sufferer. And if you were a child you were taken as a slave, period. It's horrible.
Erin Allmann Updyke	Wow. Just keeps getting better. I swear there's gonna be an uplifting point at the end of this episode, just bear with us.
Erin Welsh	Just hang in there, guys. During the first five years - it's not gonna happen now though. Because I'm gonna hit you with some bad stats.
Erin Allmann Updyke	No, not yet. (laughs) It's gonna get worse before it gets better.
Erin Welsh	During the first five years of exile on Moloka'i, the mortality rate for the victims who were sent there - 46%. Which is around 150-200 people out of the 300-400 sent to Moloka'i in the first five years.
Erin Allmann Updyke	Oh my god.
Erin Welsh	Leprosy is not a fatal disease. You do not need to die of leprosy. Before there was treatment for it, it was still, leprosy itself was not going to kill you. It was the lack of adequate medical attention to other ailments that would get you.
Erin Allmann Updyke	Right. Cause like we mentioned before what happens is that this bacterium attacks parts of your body and then makes it so that you're very susceptible to other infections. So if you can keep yourself clean and if you have access to even the most basic medical care, you don't need to die from leprosy, even if it's not ever cured.
Erin Welsh	And so these people who were exiled did not need to die. And the other thing is that - so you've been there.
Erin Allmann Updyke	I have.
Erin Welsh	And so I want you to give a little description about what it would have been like to be dropped off by a boat, which is how a lot of these exiles were dropped off.
Erin Allmann Updyke	Yeah. So I had the opportunity to go there a few years ago and we were taken to the point, this sort of rocky outcropping. So, I'm gonna back up a minute actually. Kalaupapa is this peninsula on Moloka'i that is surrounded by the tallest sea cliffs. So it's isolated from the rest of the island of Moloka'i by these giant sea cliffs. And this peninsula extends out into the middle of the Pacific ocean, right, and it is extremely rocky coastline. So we went to the edge and the waters there are so rough that often the boats that were dropping people off couldn't get anywhere near the shore to actually let people-
Erin Welsh	Or didn't want to.
Erin Allmann Updyke	Or didn't want to. There were no docks or anything like that, so they would dump people off the side of the boat and they had to swim through extremely treacherous water to try and climb up a rocky face to actually make it to the colony itself.

Erin Welsh	If they can even make it. I mean, if you are a victim of leprosy, you don't have nerve function at some of your extremities which are the ones that you would use the most in swimming. And so drownings happened all of the time. People trying to escape to go back to Hawaii would drown, not make it.
Erin Allmann Updyke	Right. And even if you were a very young, healthy person, like I wouldn't have been able to swim that, to swim from a boat to the shore? I don't even think that I could have made it. So if you are a person who's ill it's incredibly, amazingly horrific that they sent people there in the first place and then that they did it in this way. When we stood at the edge of this peninsula, there's a lighthouse there, and the wind itself was so incredibly strong and powerful that you couldn't talk to the person standing next to you because it was just so loud from the wind. And that's sort of just what it's like there all the time. So I can't even imagine what it must have been like besides absolutely horrific.
Erin Welsh	Horrible.
Erin Allmann Updyke	Yeah.
Erin Welsh	It sounds from all accounts terrifying. The population at Kalaupapa peaked at 1,174 in 1890.
Erin Allmann Updyke	Wow.
Erin Welsh	Yeah. And even though it no longer functions as a leprosy colony, former residents are still living there and the area is now a national historical park.
Erin Allmann Updyke	It is! Yeah.
Erin Welsh	Perhaps the most famous resident of the colony at Moloka'i is Father Damien, who was a Belgian Catholic priest. So he was there from the time 1870-1889. He was one of the first people to treat leprosy victims with dignity and compassion on the island. He was sent to Moloka'i to save souls and all that.
Erin Allmann Updyke	Convert people to Catholicism.
Erin Welsh	Exactly. And unlike any previous doctor or priest, he embraced the residents, he opened his doors to them, he embraced them. He actually touched them.
Erin Allmann Updyke	Yeah, not just mentally and spiritually but physically, because these people were so ostracized that people wouldn't touch them. And so that's hugely influential.
Erin Welsh	He humanized leprosy which had never been done before. He grew crops for them, he built houses because he was able-bodied, he really did a lot of good. And his positive impact on the colony brought him recognize while he was alive. But when he revealed that after 11 years of living amongst these victims of leprosy that he had actually contracted the disease, then he became an international sensation. The martyr of Molokai.
Erin Allmann Updyke	The martyr of Moloka'i. It's gotta be a white guy. Let's just throw that one out there.
Erin Welsh	(laughs) Father Damien died in 1889, 17 years after landing at Moloka'i and it has been said about him that his death did more good for the residents of Moloka'i than his life because it brought in tons of money, a lot of recognition. People started visiting from all over. Robert Louis Stevenson, Jack London, Shirley Temple, John Wayne.

Erin Allmann Updyke Wait, Shirley Temple?!

Erin Welsh Yeah! She lasted an afternoon, I think.

Erin Allmann Updyke That's so random.

Erin Welsh Yeah. Eventually he was canonized and is now Blessed Damien. #blessed

Erin Allmann Updyke #blessed

Erin Welsh Even though the causative agent of leprosy was described in 1873, it took another 70 years for someone to come up with any successful treatment, partially because as Erin mentioned it is so hard to culture and study in a lab. Once these drugs were introduced to Moloka'i the effects were felt immediately. The disease progression for many stopped entirely, a lot of the sores went away and people felt a lot better. Now that there was a cure, though, the government tried to kick all of the residents out of Kalaupapa so that they could take advantage of this beautiful, fertile land.

Erin Allmann Updyke Right, like, 'Oh we want that land back now, thanks. Bye!'

Erin Welsh Exactly. But the residents fought and fought and were eventually allowed to remain in the place that they had called home for decades. Now that an effective treatment for leprosy was on the scene, it should no longer be a public health problem, right?

Erin Allmann Updyke Yeah right. If only. Well, let's find out, let's talk about it. What's the state of leprosy today?

TPWKY (transition theme)

Erin Allmann Updyke So this is where we finally get to some kind of good news.

Erin Welsh Yay!

Erin Allmann Updyke Yay. (laughs) So leprosy has not been eradicated, which means it still does exist in the world but there has been some pretty incredible strides made towards seriously decreasing the burden of leprosy in the world. So I'll just throw some numbers out and then we'll sort of talk about what they mean. That sound good?

Erin Welsh I love it.

Erin Allmann Updyke So the World Health Organization has a global leprosy strategy that has three main targets. The first is to completely eliminate what they call disabilities associated with leprosy in children. So no more children having disabilities associated with leprosy. That's one of their goals.

Erin Welsh Sounds like a great goal.

Erin Allmann Updyke A great goal. The second goal is to decrease the disabilities associated with leprosy in adults to less than one per million people.

Erin Welsh Okay. Can we talk about what that sentence means? Disabilities associated with adults?

Erin Allmann Updyke Well disabilities associated with leprosy in adults. So in children they want to eliminate it completely and in adults they want to decrease it so that it's less than one in every one million people that has that.

Erin Welsh Why is it saying disabilities associated with leprosy and not just leprosy?

Erin Allmann Updyke Well I think that they want to eliminate leprosy entirely but this is their strategic plan that they want to accomplish by 2020. So the World Health Organization tends to set a variety of different goals and to me what this seems like is a more achievable goal.

Erin Welsh Like a 5 year plan, a 10 year plan, a millennial plan...

Erin Allmann Updyke Yeah, so this is their 2020 plan. And the third, which I think is the most important and I'm shocked that they're still working on this, is that they want to make sure there are zero countries in the world with legislation that allows for discrimination on the basis of leprosy.

Erin Welsh Oh, Japan only recently in the 2000s still had a law on the books.

Erin Allmann Updyke Right, yeah. And clearly there are other countries that still do as well, so one of their goals is to make that go away, essentially. So that people with leprosy can no longer legally be discriminated against.

Erin Welsh Can we just do a quick sidebar and talk about the recent bit of news?

Erin Allmann Updyke Yeah! Betty Price.

Erin Welsh Betty Price. Betty Price is a Georgia State Representative who recently inquired about the legality of segregating-

Erin Allmann Updyke Quarantining.

Erin Welsh Quarantining HIV patients so that they would no infect others.

Erin Allmann Updyke Like, seriously humanity?

Erin Welsh This is 2017, thanks.

Erin Allmann Updyke Have we learned nothing from how many mistakes we have made in the past? Are you kidding me?

Erin Welsh No, we haven't learned anything.

Erin Allmann Updyke Clearly. It's so disgusting. Betty Price, shame on you.

Erin Welsh You're a bad person.

Erin Allmann Updyke Bad.

Erin Welsh And I don't like you.

Erin Allmann Updyke	She said, 'Um, I don't want to say the quarantine word, but I guess I just said it'. Ew.
Erin Welsh	My nostrils are flaring, I'm trying not to curse.
Erin Allmann Updyke	You have your extremely angry face on. Like, ugh. Let's get back to leprosy because it's a happier outlook there.
Erin Welsh	It's a happier outlook but just so you know, this is still going on.
Erin Allmann Updyke	Right, this is something that still is extremely relevant, depressingly enough. Getting back to leprosy. The worldwide prevalence, that is the people who are known to be infected and are currently receiving treatment for leprosy in the world was 174,608 people as of 2015.
Erin Welsh	And do you think that that is an underestimate?
Erin Allmann Updyke	Well, every year there are new cases diagnosed, so certainly that's not everyone who's currently infected. It is possible that it's an under-diagnosis because there is still a stigma associated... Maybe you might think you have something like leprosy but you don't want to go to the doctor to get treated because you might be stigmatized in your society because of it. It's also because, like we talked about the incubation period for this disease is so long, there are going to be new cases that crop up every year even though we've been treating for a number of years now. The new incidence of disease in 2015 was 210,758 new cases. So that's how many new cases were identified in 2015.
Erin Welsh	Okay so just as a reminder, there were 174,000-ish cases total in 2015-
Erin Allmann Updyke	That were receiving treatment already.
Erin Welsh	And then in 2016-
Erin Allmann Updyke	No, in 2015 there were an additional 210,000 cases identified.
Erin Welsh	And so in total 370-380,000 cases total. Gotcha.
Erin Allmann Updyke	And the World Health Organization in association with another organization that I forget the name of who fronted the money for it, offers free multi-drug therapy to every single person infected with leprosy. So every person who has this disease has the opportunity for completely free treatment as long as they have access to it, which is still a problem in a lot of areas.
Erin Welsh	Where are the areas?
Erin Allmann Updyke	Right. The area with the most number of cases every year, by far, is India. For example in 2015, out of those 210,000 new cases, 127,000 of them were in India alone. That's 60% of the burden of leprosy is faced by India alone. So it is a very big problem there. There are around 16 countries that still have leprosy transmission sort of on an annual basis, but only three countries that have more than 10,000 cases, or that had more than 10,000 cases in 2015. And India by far had over 10x as many as Brazil and Indonesia, which were the next two countries that were the most burdened by leprosy.

One of the things that may contribute to the high burden of disease in India, besides the fact that it's a really massively huge population, is the fact that it was a few years later than other countries that they started implementing multi-drug therapy.

Erin Welsh

There was also something I read about how during British colonization of India there were several laws enacted to try and prevent the spread of leprosy, except that wasn't really their intention. It wasn't to actually solve a public health problem, it was more like 'let's get these unsightly people out of the way'.

Erin Allmann Updyke

That's such a common theme in dealing with leprosy historically. So to sort of put an even happier spin on this, while 210,000 new cases may sound like quite a lot, and it is quite a lot, no mistaking it, that number has dropped drastically in the last 10-15 years. For example, in 2002 there was over 700,000 people known to be infected already receiving treatment and an additional 500,000 people that were affected or diagnosed in 2002.

Erin Welsh

That's crazy. And that's crazy that we don't hear about this.

Erin Allmann Updyke

Exactly! And part of the reason, I'm sure, is that it's not that big of a problem in the United States. This tends to be a problem in the poorest regions of poor countries and so it's very easy for the western world to ignore it.

Erin Welsh

The western world doesn't have an incentive-

Erin Allmann Updyke

Right, we have no skin in the game. Can we say that for leprosy?

Erin Welsh

Skin in the game?

Erin Allmann Updyke

Yeah, it's a thing you say about football, like-

Erin Welsh

Oh I say 'horse in the race'.

Erin Allmann Updyke

Oh, cause you're from Kentucky! (laughs)

Erin Welsh

(laughs) Skin in the game? Like football?

Erin Allmann Updyke

I feel like that's a phrase. Can someone correct us on that?

Erin Welsh

Oh are we keeping this in? (laughs)

Erin Allmann Updyke

Yeah, yeah. For sure. 100%.

Erin Welsh

It's horse in this race.

Erin Allmann Updyke

Horse in the race, skin in the game, the U.S. doesn't have a lot of it. However-

Erin Welsh

Dog in the sled team.

Erin Allmann Updyke

Okay, that's cute. However, in 2015 there were 178 new cases of leprosy reported in - guess where - (singing) the United States. (laughs)

Erin Welsh (laughs)

Erin Allmann Updyke Oh my god I'm getting loopy.

Erin Welsh I know, we're almost at the end.

Erin Allmann Updyke 178 new cases.

Erin Welsh Okay so were these people infected in the United States?

Erin Allmann Updyke They were. Of those 178 new cases, 72% of them were reported by Arkansas, California, Florida, Hawaii, Louisiana, New York, and Texas. So with the exception of say, Florida and Hawaii and New York, those are all areas where armadillos live.

Erin Welsh Florida as well.

Erin Allmann Updyke Oh in Florida too!

Erin Welsh Yeah, it's the state speed bump.

Erin Allmann Updyke Are you serious? I never knew. Florida. (laughs) Got them Florida associations.

Erin Welsh Yup.

Erin Allmann Updyke So it is possible that some of these cases were contracted abroad or were from immigrants that immigrated to the United States.

Erin Welsh But what you're telling me...

Erin Allmann Updyke There is absolutely transmission that happens because of 'Harmadillos'! What else?

Erin Welsh You're telling me that people are getting leprosy from armadillos.

Erin Allmann Updyke That is possible.

Erin Welsh How is that happening?

Erin Allmann Updyke Well like we said before, armadillos are a known reservoir host.

Erin Welsh Right, but what are people doing to actually get infected?

Erin Allmann Updyke One case that I hear, which I probably should have fact-checked even more, is that a bunch of kids were playing soccer with an armadillo. Like the armadillo was their soccer ball.

Erin Welsh Okay, they deserve it.

Erin Allmann Updyke (laughs) So part of the problem with both detection and treatment of something like leprosy is that the treatment itself is very long and arduous. So it's generally treated by what's called multi-drug therapy, which means exactly what it sounds like. You have to take multiple different antibiotic drugs and you have to take them for 1-2 years.

Erin Welsh 1-2 years? I can't even take a multivitamin everyday.

Erin Allmann Updyke Oh god, me neither. (laughs) Right, so it's a really long course of treatment and if you think about, especially because this tends to be a disease that infects and affects people in the poorest areas, it's exceptionally difficult to make sure that people are staying on a treatment regimen and not relapsing back into disease even though they've been on treatment in the past.

Erin Welsh Right. And I can imagine it would be hard to go to a medical center every month or however frequently you need to go to get your-

Erin Allmann Updyke Yeah. Refill your prescription or whatever it is. So even though these drugs are being provided to countries and to governments and to individuals by the World Health Organization, it is not a perfect system, it is still difficult to treat the disease. All in all, the World Health Organization has done a really great job at trying to combat leprosy. They're not all the way there, but they're really putting a lot of effort in and you gotta give them props, you know.

Erin Welsh The reduction in cases is really impressive.

Erin Allmann Updyke Right, yeah.

Erin Welsh I mean hundreds of thousands fewer cases.

Erin Allmann Updyke Yeah. Since 2002 the drop has been over 500,000 cases in just ten years.

Erin Welsh Well, listeners, there you have it. That's leprosy.

Erin Allmann Updyke That's leprosy.

Erin Welsh That's leprosy. An old, old, old disease that, not very biblical, turns out.

Erin Allmann Updyke Turns out, except for dear old Lazarus.

Erin Welsh Still extraordinarily relevant.

Erin Allmann Updyke Absolutely.

Erin Welsh And on its way out. Hopefully.

Erin Allmann Updyke Hopefully on its way out, yeah. That's hopefully the good news that we can look forward to.

If you wanna read more we have a number of books and citations that we will post on our website and we'll give you a brief rundown right now.

Erin Welsh	I got most of my information on the history of leprosy from a few books. One is called 'The Colony' by John Tayman, the other is called 'A Disease Apart: Leprosy in the Modern World' by Tony Gould, and there is an interesting fiction book that we haven't read but it got great reviews-
Erin Allmann Updyke	But we want to. We just haven't had time yet.
Erin Welsh	-called 'Moloka'i'. And also from 'Plagues and Peoples' by Arlo Carlin.
Erin Allmann Updyke	And most of the statistics on the status of leprosy today come from the centers for disease control and the World Health Organization who publishes every year what they call a weekly epidemiological report. They also, if you're interested, have the global leprosy strategy document so you can see exactly what they're doing to try and combat leprosy. If you're interested in more of the genetics of immunity to leprosy, which is a really interesting field of research, honestly there's a bunch of papers out there. My favorite one that I read was called 'On the age of leprosy', it was in the journal PLoS tropical neglected diseases, published 2014.
TPWKY	(transition theme)
Erin Welsh	Thank you guys so much for listening.
Erin Allmann Updyke	Don't forget to rate, review, and subscribe. That's how other people will be able to find out podcast so please, please, please do that for us.
Erin Welsh	You can find us on Facebook @thispodcastwillkillyou.
Erin Allmann Updyke	Instagram @thispodcastwillkillyou.
Erin Welsh	And Twitter @TPWKY. Our acronym.
Erin Allmann Updyke	And you can always download this podcast from anywhere that you get your podcasts. That's where we're at.
Erin Welsh	And tune in next episode when we talk about smallpox. Wash your hands!
Erin Allmann Updyke	Ya filthy animals. Apparently that's our thing now.