

Robert Rowe

As a general surgery resident, you tend to expect the unexpected and very little surprises you. But one morning during my plastic surgery rotation during my intern year stands out as a once in a lifetime experience. A patient had come in overnight who while working with machinery completely severed their thumb from their hand. One of the microsurgeons was able to painstakingly reattach it, giving the patient a small but very real chance to keep their thumb. Excited to meet the patient and see the aforementioned thumb, I waited outside the room for the plastic surgery residents to join me for rounds. Once they did, I noticed a small styrofoam cup in the chief resident's hand which I thought was interesting considering we typically don't get coffee until after rounds. He then asked me and the other residents if we were ready for this as he showed us what was in the cup. Starkly contrasting the inside of the white cup were four dark undulating masses. And then it all kind of clicked at once for me.

Reattached thumb, we need to restore blood flow. Of course these are leeches. I feel like a lot of my medical training was a process of either dispelling or reaffirming random bits of information I collected from unknown sources throughout my life. And leeches ended up being the latter. The leeches had been literally bred for this in a sterile environment to be used once and only once, placed on a suture line where the reattached flesh met the hand. The leeches would feed, promoting blood flow by keeping the blood from clotting. Then when full they would fall off at which point they'd be collected and a new leech would be placed. Rinse and repeat. I was told the hospital had a policy where the first leech had to be placed by a physician and once it took to the patient, the following leeches could be placed by nurses.

So we were there that morning to place the first one. The patient only spoke Spanish so we had an interpreter via phone service help with informed consent. This is when things truly got weird. After the chief resident explained the plan, the patient became very uneasy and upset. After a bit of confusion we decided to wait for an in-person interpreter to try again. It turns out during our literal game of telephone, the word 'leech' somehow transformed into 'venomous snake'. Despite taking Spanish in high school, I am not fluent and I have no idea how this happened. So already off to a poor start, we spent some time basically finding different ways to say no, it's not venomous snakes, it's just leeches. Which I feel is like saying no, no, don't worry, I'm not going to steal your car, just your engine and your tires. It's definitely better but by how much?

The misinterpretation was finally sorted out. And shout out to medical interpreters and all interpreters everywhere, we would be totally lost without you. And the patient finally consented to leech therapy. The resident then tried to place the first leech onto the area but the leech had other plans and wasn't really into latching on at the time. During what seemed like hours but was probably just a couple of minutes, the resident tried again and again to get the leech to literally bite to no avail. With everyone in the room singularly focused on the reluctant creature, no one noticed that the cup with the other leeches in his other hand was precariously tilted over the patient and one adventurous leech had made its way to the lip of the cup and onto the gloved finger of the resident.

Another resident in the room finally noticed and brought it to his attention. But instead of very calmly stopping what he was doing and making very simple movements to remedy the situation, his fight or flight response kicked in. He let out what I can only describe as a genuine shriek and inadvertently dumped the cup and its contents onto the patient's lap. Needless to say the patient was about as freaked out as humanly possible at this point. But we did eventually get the leeches to latch. Unfortunately and independent of these hectic events, the tissue was too far gone, did not regain enough blood flow, and the thumb could not be saved. I wish more could have been done for the patient especially under those circumstances and I really hope they're doing well wherever they are. But I truly appreciate the experience to learn how leeches can potentially help us even in modern times.

TPWKY

(This Podcast Will Kill You intro theme)

Erin Welsh	Just the visual of the leech slowly making its way and then-
Erin Allmann Updyke	Just creeping up the cup.
Erin Welsh	The scream. Yeah. Results in chaos.
Erin Allmann Updyke	The shriek, I believe.
Erin Welsh	The shriek specifically. Ugh. That amazing firsthand account comes from friend of the pod Dr. Robert Rowe who is a preventative medicine physician who serves as adjunct faculty with both the University of North Carolina Preventative Medicine Residency Program and the Gillings School of Global Public Health. He is also the creator and host of TarHeal Wellness, spelled H-E-A-L, which is a podcast dedicated to the health and wellbeing of medical residents and it touches on physical and mental challenges that many other people face as well. And it's available wherever you get your podcasts, you should definitely check it out.
Erin Allmann Updyke	Yeah.
Erin Welsh	We're going to be on it at some upcoming time I think.
Erin Allmann Updyke	Yeah.
Erin Welsh	Which I'm really excited about it. Yeah.
Erin Allmann Updyke	It's going to be so fun.
Erin Welsh	But yeah, what an amazing story. Thank you so much, Dr. Rowe.
Erin Allmann Updyke	Thank you. Thank you so much for not only telling us that story and then being willing to tell it again so that we could share it on the podcast because the first time we heard it we were like I'm sorry, that's too good of a story.
Erin Welsh	Please, please share.
Erin Allmann Updyke	Yeah.
Erin Welsh	Hi, I'm Erin Welsh.
Erin Allmann Updyke	And I'm Erin Allmann Updyke.
Erin Welsh	And this is This Podcast Will Kill You.
Erin Allmann Updyke	Today's as promised an incredible companion episode to last week, all about leeches.
Erin Welsh	Just when you thought it couldn't get simultaneously grosser and cooler, it's about to.
Erin Allmann Updyke	Before researching for these two episodes, was there one or the other of these that grossed you out more just as a general thing? Because I feel I have an opinion about that.

Erin Welsh: Oh yeah. For me it's maggots.

Erin Allmann Updyke: Interesting!

Erin Welsh: Yeah.

Erin Allmann Updyke: Leeches for some reason absolutely creep me out. I don't think I've ever seen one in real life but they just... Something about the idea of them freaks me out.

Erin Welsh: That is very interesting because I love them both so much now, like now, but I think I would still have a difficult time like getting over the visual of maggots. Leeches don't bother me. And maybe-

Erin Allmann Updyke: Interesting.

Erin Welsh: I don't know why. Also I need to apologize in advance to you because I have some gnarly leech facts that I'm gonna share with you.

Erin Allmann Updyke: I can't wait.

Erin Welsh: That may reinforce some of this leech wariness that you have.

Erin Allmann Updyke: It's okay. I'm mostly a saltwater girl so I think I'm going to be fine.

Erin Welsh: You're not, there are saltwater leeches.

Erin Allmann Updyke: Oh no. This is going to be up there. Okay, because do you know the other thing that actually terrifies me more than anything in the ocean is snakes, like sea snakes?

Erin Welsh: Oh yeah.

Erin Allmann Updyke: So now I get to also be afraid of sea leeches apparently.

Erin Welsh: Are you afraid of terrestrial snakes?

Erin Allmann Updyke: No, not at all. Love them.

Erin Welsh: Okay. Just sea snakes.

Erin Allmann Updyke: Sea snakes. Have you seen them swim?

Erin Welsh: Yeah, I have.

Erin Allmann Updyke: Yeah.

Erin Welsh: And I also feel like there was a formative documentary that I watched probably on like Animal Planet growing up where it was like sea snakes are the deadliest of all animals.

Erin Allmann Updyke: And that is still what's burned into my memory as truth, so.

Erin Welsh: Yeah.

Erin Allmann Updyke: But today we're not talking about snakes.

Erin Welsh: No.

Erin Allmann Updyke: We're here to talk about leeches.

Erin Welsh: Yes. And because this is a companion piece to last week's episode on maggots, which if you haven't listened to yet, oh my gosh, really don't be too like discouraged or grossed out. Well it's kind of a hard thing to ask but I promise you there are some really cool nuggets of information in the maggots episode.

Erin Allmann Updyke: Yeah, definitely.

Erin Welsh: But because this is a companion piece, we are doing one quarantini for both episodes because it is A Tale of Two Worms.

Erin Allmann Updyke: Get it, huh?

Erin Welsh: And in A Tale of Two Worms, in case you missed out on the maggots episode which again, go listen to it, you can find ingredients such as vodka, lime juice, cranberry juice, pineapple juice, orange juice, ginger ale. Basically fruit punch.

Erin Allmann Updyke: Fruit punch.

Erin Welsh: With some extra zhuzh.

Erin Allmann Updyke: It's fantastic. The full recipe, it's already up on our website [thispodcastwillkillyou.com](http://thispodcastwillkillyou.com) and all of our socials. So hopefully you've got one in hand for this episode.

Erin Welsh: Yeah. Socials, follow us on them.

Erin Allmann Updyke: Socials.

Erin Welsh: We've got some good content.

Erin Allmann Updyke: Really.

Erin Welsh: We really do. It's pretty cool. That's all I've got to say about that. But we also have a website where you can find all sorts of cool things including but not limited to transcripts, links to [bookshop.org](http://bookshop.org) and our Goodreads list, sources for all of our episodes, links to merch, links to our Patreon, links to a firsthand account form. There's more stuff.

Erin Allmann Updyke: There's so much. Our website, check it out, [thispodcastwillkillyou.com](http://thispodcastwillkillyou.com).

Erin Welsh: Yeah.

Erin Allmann Updyke: Well with that, should we get into leeches?

Erin Welsh	100% we should right after this break.
TPWKY	(transition theme)
Erin Allmann Updyke	<p>So leeches are actually worms, surprise, surprise. Specifically leeches are a type of annelid worm which are the segmented worms like your earthworms, worms that people know about. And there are a lot of different species of leech, the vast majority of which are either permanent or temporary external parasites. So they suck on blood and that is what they live on. All of the ones that are used in medicine fall under the family Hirudinidae which suck our blood. But also like amphibians' blood, like they'll eat a lot of different things.</p> <p>And a couple of the most commonly used species in medicine are <i>Hirudo medicinalis</i>, what a logical name, and several other species of <i>Hirudo</i> as well and then at least a few other species as well. In nature, like when not grown in a lab because spoilers, just like with maggots, the ones that we use in medicine are all grown in a lab and they're all sterilized before they're used. But in nature they tend to live in warm, shallow, still pools, the types of habitats that amphibians prefer because amphibians are apparently quite a good food source for them. And leeches have classically, if you think of a leech, if you've ever seen what's that movie?</p>
Erin Welsh	Stand By Me?
Erin Allmann Updyke	Yes!
Erin Welsh	I was thinking the same thing.
Erin Allmann Updyke	That's what I think of when I think of leeches every single time. And he goes bong! Okay. So leeches have two suckers, right? They've got one on their front end and one on their back end. And the front end is the business end, that's the end that we'll focus on. The posterior sucker they use just for clinging and for moving. You like that?
Erin Welsh	I do, I do.
Erin Allmann Updyke	And while maggots that we talked about have no biting mouth of which to speak, leeches on the other hand are equipped with not one, not two, but three jaws that are arranged like a pyramid. Each one of these jaws has 60-100 teeth on them, Erin.
Erin Welsh	What?
Erin Allmann Updyke	I know! It's terrifying. If you look at close up images of leech jaws, it is... They look like an alien, they look like... They're terrifying. But that's why they leave, if you've ever seen a leech bite mark, it's like a little Y-shaped bite.
Erin Welsh	Yeah.
Erin Allmann Updyke	It's because they've got these three jaws that come together and take a whole chunk out of you.
Erin Welsh	That's so cool.

Erin Allmann Updyke

I know. And also cool are leeches themselves. Leeches, they're very fascinating. And the most useful part of leeches medicinally is by far their saliva. Leech saliva contains over 100 bioactive substances. I'm sorry. So after they bite us with their like hundreds of teeth, leeches inject their saliva into us and then they suck up our blood. That's what they're feeding on. When they do this, they're sucking up several times their body weight in blood so that they can go several months, in fact up to a year, between blood meals.

Erin Welsh

Erin.

Erin Allmann Updyke

Erin.

Erin Welsh

I have read, let me pull up my notes real quick because I wrote this in a random spot.

Erin Allmann Updyke

Okay.

Erin Welsh

And I have just written, "Leeches live for 18-27 years in the wild???"

Erin Allmann Updyke

I love that you wrote that because I have, "How long does a leech live for? I still don't know but they can fast for a year and a half. What the heck?"

Erin Welsh

That is amazing.

Erin Allmann Updyke

18-27 years?

Erin Welsh

Yeah. And now I'm about to fact check myself because I want to make sure that that has a citation involved.

Erin Allmann Updyke

That's amazing.

Erin Welsh

All right, so we did just do some fact checking.

Erin Allmann Updyke

We fact checked.

Erin Welsh

Because we couldn't resist. And years, it's definitely on a scale of years. Some sources say up to 20 years. I did find a couple of sources that quoted the 18-27 and a lot of them also say like 2-8. So it seems like there might be a range but it seems like the maximum lifespan in a suitable environment could be upwards of 20 years. Which is, I mean I never would have expected more than one year.

Erin Allmann Updyke

Exactly. That's like anything beyond a year, I'm sorry, it's a worm.

Erin Welsh

It's a worm.

Erin Allmann Updyke

It's amazing.

Erin Welsh

What's the longest lived worm, do you think? Someone let us know. Too many rabbit holes.

Erin Allmann Updyke

Too many, too many. Let's get back to leeches. They're sucking all this blood, a whole bunch so that they can live their years inbetween blood meals. So for this blood to not just coagulate on removal from the body, which is what blood wants to do, that's what it does when it removes from the body, leeches have a whole bunch of compounds in their saliva that function as anticoagulants. The first most important and most well known and well studied is called hirudin, like named after the leeches. And this is pretty cool.

It inhibits thrombin, which if you want to throw all the way back to our hemophilia episode, we talked a lot in that episode about the cascade of reactions that happens in order for our blood to clot. One compound has to be activated which activates another and on and on and on. Thrombin is one of the final enzymes in this cascade. So that is what hirudin is blocking. It's kind of like the bottom or top depending on which way you want to look at it of this cascade. And it's one of the major regulatory steps in coagulation. So it's a really effective way to block coagulation. Hirudin was synthesized via recombinant DNA and it's used medicinally today. We use it all the time in medicine, especially if people can't use heparin either because they've had a reaction to it or because they're allergic or for whatever reason.

But that's not all. I said they have 100 bioactive substances. They have a bunch of other substances that block other parts of the coagulation cascade, like Factor Xa, etc, blah, blah, blah. They also have a bunch of compounds that block platelets from aggregating, à la aspirin. Which means that they're stopping that first part of the coagulation because platelets are one of the first things. But what it also means in us is that our wounds from a leech are going to ooze for a long time because platelets are one of the first things that we would use to stop and they injected that saliva into us.

Erin Welsh

Right.

Erin Allmann Updyke

But that's not even all. They also have a whole bunch of other enzymes, some of them serve to increase the permeability of our connective tissue which for the leech allows for their secretions to penetrate more deeply into our tissues so that they work more. Medicinally what this can do is promote resorption of fluid and blood because it's increasing the permeability of the connective spaces. They also have enzymes that help to dissolve any blood clots that have already formed. And a lot of the things that they release, there's so much, Erin-

Erin Welsh

There's so much.

Erin Allmann Updyke

Helps with vasodilation and reducing scar tissue formation. The list goes on and we still don't know the mechanisms of every one of these compounds. There's also analgesic properties that we definitely don't understand which makes the biting of those hundreds of leech teeth or at least the sucking process a little bit less painful perhaps. So you can imagine that with so many amazing things present in their saliva, leeches are used for a pretty wide variety of things, or I should say they've been studied for a pretty wide variety of things. Because today they're most often used for post surgical care, especially in complicated procedures like what we heard in our firsthand account with the reattachment of a finger.

They're for things like skin flaps, reconstructions, places where you really don't want a lot of venous swelling or a lot of edema, like overall swelling in the tissue, because leeches are really good at reducing that kind of swelling, both by physically removing that venous blood but also by just reducing inflammation overall. And they leave these little wounds open to ooze for a few days which can also be beneficial. But leeches have been evaluated for a lot of other things that I found fascinating and would never have expected people to use leeches for. The one that has the most evidence thus far is in the treatment of osteoarthritis of all things.

Erin Welsh

Huh.

Erin Allmann Updyke

Yeah, that's my face too. So leeches have been studied for treatment of a lot of different kinds of arthritis. The idea being very similar that it's reducing inflammation around the joints which is the cause of a lot of pain in arthritis. And a few larger meta analyses seem to show some benefit in osteoarthritis at least for pain reduction and an increase in mobility. For other types of things like rheumatoid arthritis or even ankylosing spondylitis, there's been at least case studies, not necessarily large studies. But people have also tried to use leeches for things like migraines, TMJ, high blood pressure, heart disease, even some neurologic disorders. And at least the published studies on these seem to show benefit but it's a really minimal amount of data for any of these other conditions. You're not going to find people who are going to give you leeches for your blood pressure. Like that's not a thing. But for reconstructive surgery it absolutely is a thing.

Erin Welsh

Yeah.

Erin Allmann Updyke

And some people have used leeches for the treatment of chronic wounds, so you could use leeches and maggots together in harmony.

Erin Welsh

In combination. That's amazing.

Erin Allmann Updyke

I know. That is leeches.

Erin Welsh

You know I love them.

Erin Allmann Updyke

Their saliva is incredible.

Erin Welsh

It's magic.

Erin Allmann Updyke

Yeah.

Erin Welsh

It's more powerful than magic. It's nature.

Erin Allmann Updyke

More powerful. So Erin, tell me.

Erin Welsh

Yeah.

Erin Allmann Updyke

Tell me about the history of these little suckers. Get it?

Erin Welsh

Nice. Yeah, I can absolutely do that. Let's take a quick break and then I'll tell you as much as I can about leeches.

TPWKY

(transition theme)

Erin Welsh

All right. Before I get into the long, long history of leeches used in medicine, I wanted to first take a bit of time to just get to know this group of animals a little bit more broadly.

Erin Allmann Updyke

Okay.

Erin Welsh

So much fun. An estimated 700 species of leeches have been described. Did know?



Erin Allmann Updyke

Wow. No.

Erin Welsh

700. Yeah. And they can be found on all continents and seas except Antarctica. They live in caves, in saltwater, in freshwater, in hot water, in freezing water, in shallow water, in deep water. The record is over 7800 meters.

Erin Allmann Updyke

What?

Erin Welsh

Yup.

Erin Allmann Updyke

I have to say these last two episodes are making me feel like I did all of my invertebrate zoology classes poorly by not remembering any of this.

Erin Welsh

Oh if I once knew this, I have long forgotten it.

Erin Allmann Updyke

I mean maybe I just never learned it but like oof, okay.

Erin Welsh

Yeah.

Erin Allmann Updyke

Keep going please.

Erin Welsh

Okay, okay. Leeches also live in arsenic-laced water, in super alkaline water, not in water at all but on moist land. It's pretty rad.

Erin Allmann Updyke

Okay, a land leech.

Erin Welsh

A land leech. And okay, if we say picture a leech, most of us are going to picture those leeches from Stand By Me that we talked about.

Erin Allmann Updyke

Right.

Erin Welsh

Or something very similar. But did you know that only about half of leeches feed on blood?

Erin Allmann Updyke

No. I thought most of them did.

Erin Welsh

Half.

Erin Allmann Updyke

Half.

Erin Welsh

Half.

Erin Allmann Updyke

But are most of them still parasitic?

Erin Welsh

Well the other ones feed on things like earthworms, gastropods, crustaceans, and insect larvae.

Erin Allmann Updyke

But not like as parasites, more as like just carnivores.

Erin Welsh

Just predators, yeah.

Erin Allmann Updyke

Huh.

Erin Welsh

Yeah. One of the biggest leeches, reaching length of up to 300 millimeters which is nearly 1 ft, 11.8 inches-

Erin Allmann Updyke

Whew.

Erin Welsh

Preys on worms.

Erin Allmann Updyke

It eats other worms.

Erin Welsh

It eats other worms. But the biggest leech, I'm gonna try to pronounce this, *Haementeria ghilianii*, gets up to 450 millimeters long, 17.7 inches, Erin.

Erin Allmann Updyke

That is very large for a worm.

Erin Welsh

Nearly four inches in width. And this guy does feed on blood.

Erin Allmann Updyke

Whose blood?

Erin Welsh

Lots of different types of blood.

Erin Allmann Updyke

Okay.

Erin Welsh

So humans have been observed, rabbits, cows, birds. Okay but how do leeches find their prey, you might ask? They use many different sensory clues as a matter of fact. So terrestrial leeches sense things like ground vibrations, whether the leaves and dirt or whatever they're laying in gets moved around or disturbed, shadows, air currents, and maybe, although it's been debated, CO2 from the breath of their intended prey. Aquatic leeches use things like water currents or temperature or disturbance to detect prey. It's amazing. And I have several more if you don't mind me sharing a few more cool bits of leech trivia. Okay.

Erin Allmann Updyke

Please.

Erin Welsh

Leeches can live in extreme temperatures, not like the same leech or the same leech species but for example the freshwater leech, this is... The names of these leeches, I'm telling you what, challenging. *Ozobranchus jantseanus*, quote, "survived at -196°C for 24 hours and up to 32 months at -90°C."

Erin Allmann Updyke

Wow.

Erin Welsh

And on the other side of the spectrum, the marine leech, this is the hardest one of all, I think it's the last one. No, it's not. I see another one down there. *Zeylanicobdella arugamensis* has been found to survive at temperatures from 20°C to 40°C which is 68°F to 104°F. Blood feeding leeches can also get creative with where they feed, such as up the nostrils or behind the eyeballs of humans and livestock.

Erin Allmann Updyke

Did you just say behind the eyeballs?

Erin Welsh

Yeah, apparently.

Erin Allmann Updyke: No, no. Stop it.

Erin Welsh: At least I think. The eyelid, yeah.

Erin Allmann Updyke: Okay.

Erin Welsh: But I think the one in terms of unique feeding location choices, the one that takes the cake is *Placobdelloides jaegerskioeldi*.

Erin Allmann Updyke: Okay.

Erin Welsh: Which I know that I totally did not pronounce correctly but like I'm sorry. This leech actively swims, it can actively swim and it does this, swims to its hippopotamus host where it will invade the hippo's rectum and commence blood feeding.

Erin Allmann Updyke: No. Only in the rectum.

Erin Welsh: Only in the rectum.

Erin Allmann Updyke: Poor hippo.

Erin Welsh: Yeah. But now that I've completely spent all of the goodwill that we had previously built up for leeches, let me attempt to like bring you all back on board.

Erin Allmann Updyke: Get you to like a leech again?

Erin Welsh: Yeah. I know that it's an uphill battle but I think that we can do it.

Erin Allmann Updyke: Okay.

Erin Welsh: Because I want to tell you about leech reproduction, especially parental care.

Erin Allmann Updyke: What? Parental care?

Erin Welsh: Exactly. See, goodwill returned. So first of all, leeches have both male and female reproductive organs which means that while they don't always or even often self fertilize, they absolutely can and this does happen. And second, leeches produce these things called cocoons which come in lots of different textures. But that's where leech eggs develop.

Erin Allmann Updyke: Okay.

Erin Welsh: Inside this cocoon with like a nutrient soup that lasts until the eggs turn into juveniles and then can strike out on their own.

Erin Allmann Updyke: Aw.

Erin Welsh: It's so cute. But some leeches go beyond the cocoon. Leeches in the Glossiphoniidae care for their eggs both before and after they hatch, either in a little cocoon nest or on their body or in a little pouch like a kangaroo.

Erin Allmann Updyke

Little kangaroo leech pouch?

Erin Welsh

And once the eggs have hatched, some leeches will bring them food like snails or mosquito larvae or quote "by transferring nutrients across the body wall to the developing young in a manner reminiscent of a placenta".

Erin Allmann Updyke

Aw.

Erin Welsh

Isn't that amazing? But there's more. Because researchers have observed that in times where food is scarce, some leech parents will starve themselves so that their young can feed.

Erin Allmann Updyke

Wow.

Erin Welsh

Some species live in groups with adults and young together, sharing food and even caring for young that aren't their own.

Erin Allmann Updyke

I don't think I ever thought about leeches, even worm behavior this much.

Erin Welsh

I know. And it is incredible. I am in awe.

Erin Allmann Updyke

Wow. Interesting.

Erin Welsh

Yeah. Yeah. The diversity found among leeches is incredible and there are so many species that haven't yet been studied or haven't been studied very much or have yet to be discovered. On their own, leeches are amazing. But if you want a human-centric perspective to convince you that leeches are worthy of study and conservation, consider the powerful anticoagulant hirudin found in the medicinal leech's saliva and how it's now used in medicine. That's just one of the amazing compounds found in that leech species' saliva.

Erin Allmann Updyke

Right.

Erin Welsh

And there are many more leeches with many other cool salivary compounds like hementin, an anticoagulant found in the giant Amazon leech that targets fibrinogen-formed blood clots; theromin which inhibits thrombin like hirudin but it seems to be different. And then there's the bacterial and endosymbionts of leeches. Leeches that feed on blood have bacteria that will help break down blood and provide essential vitamins. So if you want this human-centric reason for why preserving biodiversity is important, consider the leech, like not just the medicinal leech but all leeches. But now turning towards the medicinal leech, which actually turns out might be made up of multiple species or like morphs or something-

Erin Allmann Updyke

Species complex.

Erin Welsh

Yeah.

Erin Allmann Updyke

Yeah.

Erin Welsh

Let's get into how humans have used these leeches throughout history.

Erin Allmann Updyke

Okay.

Erin Welsh	Like maggots, the use of leeches in medicine goes way, way back. I'm talking 1500 BCE Ancient Egypt murals in a tomb depicting the blood sucking powers of a leech, way back.
Erin Allmann Updyke	Wow!
Erin Welsh	Yeah. Ancient Mesopotamia, Ancient India, Ancient Greece and Rome, likely in Ancient Central and South America, Ancient China. There's evidence that leeches have been used medicinally all around the world for thousands of years. And this isn't a case of like an occasional mention or reaching for the leech only when everything else failed. Leeches were a very regular treatment in many places around the world for millennia, so much so that... Okay, the etymology does get a little tricky because when we were setting up for this episode I was like let me just refresh my etymology notes and make sure that I am right in this. And it turns out I wasn't. It turns out the truth is a little more complicated.
Erin Allmann Updyke	Okay.
Erin Welsh	So my initial reading and a lot of papers will say that the word 'leech' may have come from the old English word 'læce' meaning physician.
Erin Allmann Updyke	Okay.
Erin Welsh	Turns out that there were two, from what I can tell there's one paper that talks about there being two independent origins and meanings for that word 'læce', one meaning physician and one for leech. And then the two kind of merged. Because for a really long time, one of the synonyms for a physician was leech.
Erin Allmann Updyke	Interesting.
Erin Welsh	Because doctors used leeches so frequently.
Erin Allmann Updyke	So it wasn't that like the name leech came from doctors, it was like they called them the same thing because they used them so much maybe?
Erin Welsh	Yes, I think that definitely their meanings merged to a certain degree or something to that effect.
Erin Allmann Updyke	Okay.
Erin Welsh	I'll link to the paper that goes more into the etymology. But it's like we don't know which came first and whether leech was for the worm and then physician became known as a leech or leech became known from physician and it sounded maybe like the worm.
Erin Allmann Updyke	Okay.
Erin Welsh	Something like that.
Erin Allmann Updyke	Okay.

Erin Welsh  
Anyway, it makes sense that the two would be synonymous over much of the ancient world up until the 1800s or so because of what we know about medicine during this long period of time, ie that it was obsessed with blood and bloodletting. So these leeches took up residence as a permanent tool almost in the phlebotomist's toolkit. So I've talked about the humoral theory of disease like one million times exactly on this podcast.

Erin Allmann Updyke  
Exactly.

Erin Welsh  
So here's 1,000,001 just for a refresher. Essentially there were thought to be four humors in the body. Yellow bile, black bile, phlegm, and blood. Diseases resulted from an imbalance in the four humors. So that could mean too much blood, in which case you do some bloodletting until the balance is restored. In the bloodletter's toolkit you could find things like lances, little pocket knives called fleams, bleeding cups, syringes, because certain situations required certain solutions. Many of these tools were just like a brute force attack. Like we need to get a lot of blood out of you and we need to do it now. Leeches came in handy when a gentle touch was warranted.

Erin Allmann Updyke  
Okay.

Erin Welsh  
When the desired volume of blood removed was on the order of milliliters rather than liters or when the area that needed bleeding was in a particularly sensitive or hard to reach zone.

Erin Allmann Updyke  
Okay.

Erin Welsh  
Like in cases of hemorrhoidal congestion-

Erin Allmann Updyke  
Yep.

Erin Welsh  
Rectal prolapse, vulvovaginitis, orchiepididymitis, hydrocele, laryngitis, tonsillitis. Tonsillitis, Erin. Tonsillitis. What?

Erin Allmann Updyke  
Tonsillitis.

Erin Welsh  
I know. Inflammation of the cervix.

Erin Allmann Updyke  
Ouch.

Erin Welsh  
Yeah. Even some eye conditions. Yeah.

Erin Allmann Updyke  
Ow, ow, ow.

Erin Welsh  
But even though it's like really hard to think about and makes me feel squirmy, this would have been less painful than like a blade on a spring like some of these bloodletter's tools.

Erin Allmann Updyke  
Definitely.

Erin Welsh  
And like you mentioned, Erin, leeches were also used for wound healing. Abd al-Laṭīf al-Baghdādī in the 12th century described how leeches were helpful in tissue cleansing after surgery which is amazing.

Erin Allmann Updyke

I love it.

Erin Welsh

And unlike maggots who, like we talked about, their popularity seemed to wax and wane over the centuries, leeches were just like on the up until the late 19th century. In the middle ages and the renaissance, sometimes referred to as the golden age for bloodletting and leeching, leeches were used by barber surgeons who would have their patients grip a rod which would possibly later inspire the barber pole, like the poles that have the... Yep. So that might have been a symbolism for like grip the rod because this will cause your veins to swell and that'll make it easier for the leeches to latch onto to start the bleeding.

Erin Allmann Updyke

Interesting.

Erin Welsh

Yeah. And then just because I want to expand a little bit on the classic barber pole because when else am I going to be able to do it on the podcast? Okay. You can picture one, right?

Erin Allmann Updyke

Yeah.

Erin Welsh

Like it has the pole, it has the spinning ribbons, it has blue, red, and white often.

Erin Allmann Updyke

Yeah.

Erin Welsh

It has been suggested that the red ribbon... These all carry meaning. The red ribbon originally came from barbers advertising their services by wrapping the bloody linen from a former patient around the pole, showing hey, we do bloodletting here. The red means hey, I can bleed you. The white ribbon was I can pull teeth and set bones. And the blue said I can give you a nice trim or shave. Those were allegedly, it's one idea as to the possible origins of those ribbons. Isn't that great?

Erin Allmann Updyke

What a wild time to live in, huh?

Erin Welsh

I know, I know, I know.

Erin Allmann Updyke

Wow.

Erin Welsh

And so if you're like okay, I really want to go get my hair cut but you see the barber pole just has red and white, you can get blood but you're not going to have a fresh trim.

Erin Allmann Updyke

They're not going to do a trim. Okay.

Erin Welsh

Yeah. Anyway, as the popularity of leeches grew over the middle ages and renaissance, so did its possible applications from neurological and psychiatric conditions like epilepsy to STIs, gastritis, diseases of the eye. I just keep seeing uterine applications mentioned. Ambroise Paré, that French surgeon from the 1500s, he dedicated an entire chapter to leeches in his massive treatise.

Erin Allmann Updyke

Wow.

Erin Welsh

And things were only going to get leechier. I don't know what exactly constitutes the golden age of something but I find it hard to believe that the middle ages and renaissance were the golden age when their popularity only continued to grow into the 1700s and 1800s to really unbelievable levels. So the peak use was in the early 1800s.

Erin Allmann Updyke Okay.

Erin Welsh In Europe, physicians and barbers kept leeches handy in their offices in leech jars. Some of these jars, Erin, have you seen pictures of them?

Erin Allmann Updyke No.

Erin Welsh They're beautiful. They're like these beautiful ornate jars that have carved little accessories with gilded whatever. And it says 'leeches' across the front of it. I immediately went on eBay in the middle of researching and I was like I need to find an antique leech jar.

Erin Allmann Updyke Did you get one?

Erin Welsh I can't, I can only find a replica but it's going to be now my life's quest to find a leech jar.

Erin Allmann Updyke We should go back to the Surgical Sciences Museum in Chicago.

Erin Welsh Yep.

Erin Allmann Updyke Because I bet if they don't have it, they will know where you get it.

Erin Welsh 100%. I love them. We'll post a picture because we have to. But perhaps no one loved leeches more than François-Joseph-Victor Broussais, one of Napoleon's physicians.

Erin Allmann Updyke Okay.

Erin Welsh Napoleon himself had leeches to treat his hemorrhoids. So cool thing.

Erin Allmann Updyke I feel like that would be effective.

Erin Welsh I think so too.

Erin Allmann Updyke Yeah.

Erin Welsh Is that one of the proposed treatments for today?

Erin Allmann Updyke No. I mean varicose veins, yes.

Erin Welsh I saw that.

Erin Allmann Updyke But usually in the legs. I think that we just have other options these days. But I didn't see anything about people using leeches instead of surgery for hemorrhoids. So it's a good thought.

Erin Welsh All right, somebody propose it.

Erin Allmann Updyke Maybe it's out there and I just missed it.



Erin Welsh: Anyway, Broussais was such a fan of bloodletting and especially leeching that he was nicknamed, quote, "the vampire of medicine".

Erin Allmann Updyke: Love it.

Erin Welsh: He thought that every disease was attributable to inflammation, especially of the GI tract. So like no matter what the condition, asthma, broken wrist, smallpox, sore throat, pink eye, it all came down to gastroenteritis.

Erin Allmann Updyke: Of course.

Erin Welsh: All of it.

Erin Allmann Updyke: Logical.

Erin Welsh: And so in one example I saw he prescribed the patient a starvation diet and all of the leeches that could fit on their abdomen because that's where he thought the inflammation would come out of their abdomen.

Erin Allmann Updyke: Oh no.

Erin Welsh: Somebody was described as looking like they were wearing quote "a black glittering coat of mail". End quote. Ugh.

Erin Allmann Updyke: Oh gosh.

Erin Welsh: Totally. Yep. And his enthusiasm for leeches may have been unmatched but he was not alone in his love for them. Between 1829-1836, so over those seven years, do you have a rough guess as to how many leeches were used yearly in Parisian hospitals?

Erin Allmann Updyke: Just in Paris.

Erin Welsh: Yeah. You don't have to guess if you're like I don't even know.

Erin Allmann Updyke: I don't know.

Erin Welsh: Okay.

Erin Allmann Updyke: Hundreds of thousands?

Erin Welsh: 5-6 million each year.

Erin Allmann Updyke: Stop it. Is that why they're basically extinct in the wild?

Erin Welsh: Yes, this is exactly why. This is why. This was a total of 84,000 kg of blood drawn annually. Unfathomable.

Erin Allmann Updyke: It really is. Oh wow.

Erin Welsh: Millions more of the medicinal leech, the *Hirudo medicinalis*, were exported to the US from Europe, at one point 30 million leeches per year.

Erin Allmann Updyke: Exported to the US.

Erin Welsh: Exported to the US, yeah.

Erin Allmann Updyke: Oh my.

Erin Welsh: And so this huge demand even at the time drove leeches close to extinction and rewards were offered for people who could find a way to breed them in the US or find alternative species that were as effective without causing harm.

Erin Allmann Updyke: Wow.

Erin Welsh: And eventually this demand would die down as the medicinal leech faced the same fate in the late 1800s as did maggot therapy. Medical advancements like germ theory, a better understanding of human anatomy and physiology, and the use of statistics showing that bloodletting overall was useless to harmful for most conditions that it had been used for all sent these leeches mostly packing, with a few physicians hanging on to the practice. And also, I get that, like you have this beautiful leech jar and you're like what do you want me to do, just like not use this? Put something else in it? No thank you.

Erin Allmann Updyke: Just keep one for just a couple of years and just use it every...

Erin Welsh: Yeah. Right, it's gotta come back, right? It's just like low waisted jeans, lowriders. It's going to come back.

Erin Allmann Updyke: No. Those can't come back.

Erin Welsh: It's terrible. I'm not happy about it. But anyway, also like the maggot, the leech would experience a renaissance later in the 20th century. Barbers, because barber surgeons, and physicians had noticed the anticoagulant effects of leeches for a long time, how like an area where a leech had been attached would continue to bleed longer than if the wound had been made by something else, like you talked about. And in the 1880s researchers succeeded in extracting the substance that led to this anticoagulant effect, which was called hirudin in 1904. For decades, challenges with extractions, like how it would take an estimated 50,000 leeches a year to get enough hirudin for scientific study, and that people who were treated with the extract experienced shock because it probably wasn't like properly purified in its extraction, this limited its use or investigation.

But then like you mentioned, Erin, in the 1980s researchers succeeded in engineering the substance and that's allowed people to study this incredibly powerful anticoagulant for all kinds of applications. And leeches themselves have experienced a bit of renaissance in the field of surgery, especially plastic and reconstructive or microsurgeries beginning in the 1960s. In 2004 is when the FDA certified leeches as a medical device and it seems like people are getting back on board with these powerful little parasitic worms. Like I'm fully on board. I feel like what it comes down to not just with leeches but with maggots too in terms of medicine is that we don't always have to reinvent the wheel.

Erin Allmann Updyke: Yeah.

Erin Welsh: And that there may exist things that people have used for a really long time that could be really powerful. Or maybe they're not powerful but also maybe we should check it out on like a case by case basis and see what we find. Because it could be something like leeches, it could be something like maggots. And I think that these past couple episodes have just been so thrilling and fun and interesting to put together. And I can absolutely say that I have so much more appreciation for both leeches and maggots and now I can't pick a favorite.

Erin Allmann Updyke: Yeah, same. I love that they both exist, I love that they both were licensed by the FDA for use.

Erin Welsh: I know!

Erin Allmann Updyke: Fascinating.

Erin Welsh: Yeah. Well, sources?

Erin Allmann Updyke: Well. Sources? I think so.

Erin Welsh: Okay.

Erin Allmann Updyke: We can all learn more.

Erin Welsh: We can. I am going to shout out two. So if you want to learn some more leech facts and that wasn't enough for you, which like-

Erin Allmann Updyke: Who doesn't?

Erin Welsh: Honestly there's so much more in this great paper by Phillips et al from 2020 titled 'Leeches in the Extreme: Morphological, Physiological, and Behavioral Adaptations to Inhospitable Habitats'.

Erin Allmann Updyke: Leeches in the extreme. I love that title.

Erin Welsh: I know, I know. And then the second paper that was mostly about the history of leeches in medicine was a paper by Montinari and Minelli from 2022 titled 'From Ancient Leech to Direct Thrombin Inhibitors and Beyond: New from Old'.

Erin Allmann Updyke: Fab. I had just a few papers and one book that I used predominantly one chapter of and this book actually had some information about maggot therapy as well. The book was titled 'Biotherapy: History, Principles, and Practice'. And they had an entire chapter on hirudotherapy or the use of leeches. And then a chapter on maggot therapy that I used a little bit of last episode. And then a few other papers on how leeches are used today and on all of the incredible compounds that we found in their saliva and the future of all of that. But you can find the list of all of the sources from this episode and every single one of our episodes on our website [thispodcastwillkillyou.com](http://thispodcastwillkillyou.com) under the EPISODES tab.

Erin Welsh: A big thank you again to Dr. Rowe for just an amazing story.

Erin Allmann Updyke: Such an incredible story. Thank you so much for sharing it with us. Thank you also to Bloodmobile for providing the music for this episode and every single one of our episodes.

Erin Welsh: Thank you to Leanna Squillace and Tom Breyfogle for the audio mixing.

Erin Allmann Updyke

Thank you to Exactly right network.

Erin Welsh

And thank you to you, listeners. You made it.

Erin Allmann Updyke

You did. Congratulations.

Erin Welsh

What do you think about leeches and maggots? Do you have a favorite? Do you have a favorite fun fact? Do you have a favorite gross fact?

Erin Allmann Updyke

Do you love them?

Erin Welsh

Do you love them as we love them?

Erin Allmann Updyke

And as always an extra thank you to our patrons. Thank you so much for your support. We really appreciate it.

Erin Welsh

We do. Until next time, wash your hands.

Erin Allmann Updyke

You filthy animals.