

Ep 206: Oropouche Virus

[00:00:00]

EW: By US standards, Brazil's Highway BR-14 is certainly no Indiana Turnpike or New York State Thruway. Meandering 1,350 miles from Belém to Brasília through the jungles and scrub of Brazil's wild interior, it is barely two lanes wide; the surface is dust in the dry season, mud in the wet, and some of the ruts could swallow a Volkswagen alive. Yet in the eyes of former President Juscelino Kubitschek, who built the road between 1956 and 1960, BR-14 is "the highway of dreams" for underdeveloped Brazil and the means to "a new civilization on the central plateau." So it is. Since the road's opening in 1960, some 600,000 settlers have poured into the area to tap Brazil's immense riches. Every day long lines of trucks rumble north and south carrying out lumber, rubber, and vegetable oil. New farmlands produce beans, rice, corn, and fruit to feed Brazil's exploding population; what was once useless scrub in the central state of Goiás is now pasture land for 4 million head of cattle. And prospectors fanning out from the road have found a vast mineral potential with deposits of nickel, tin, lead, zinc, copper, gold, diamonds, and quartz. Towns are sprouting every few miles. "If I don't pass a certain stretch of road for two or three weeks," says one road engineer, "I almost always find a new cluster of shacks there when I get back." Araguaína, which got its start in 1958 as a road-construction camp 500 miles north of Brasília, is now up to 8,000 people, has its own branch of the Bank of Brazil and will soon have a \$1.6 million factory that will refine oil from native babaçú nuts, peanuts, cotton, and sunflower seeds, and produce the cans in which to export the oil and cut up local mahogany to make cases for the cans.

EAU: I love your newscaster voice and I hate everything else about that whole.

EW: I think it, so that was from excerpted from a Time article published on January 7th, 1966, titled "Brazil: On the Road to Dreams."

EAU: Okay.

EW: And it's such a fascinating reflection, I think, of how forward progress was viewed at the time. Like we must go forward and like it's, it's also understandable, right? Like there's, there's, this is the economy that's driving

EAU: this,

Mm-hmm.

EW: but the reason that we picked this particular article or this excerpt is because that construction on that road is what is thought to have led to the spillover and spread initially of the focus of today's episode, which is

EAU: Oropouche

EW: virus.

Hi, I'm Erin Welsh.

EAU: And I'm Erin Allmann Updyke.

EW: This is, this podcast will kill you

EAU: Welcome to Oropouche Virus.

EW: Oropouche virus

EAU: Yeah.

EW: we've gotten?

EAU: to learn how to say that.

EW: Yeah. Uh, like this morning, um, we've gotten some requests over the years for this virus and it's interesting. I feel like we've been seeing it trickle more and more in the news lately. And so we wanted to just kind of like get a lay of the land, what's going on? How is it transmitted? Why is it suddenly making headlines?

EAU: uh, it's gonna be a great episode. 'cause I feel like it's really going back to you and my roots Erin, of like what got us wanting to make this podcast in the first place. And it's been a really long time since we've done a vector-borne disease, since we've done an infectious disease, so

EW: like, how do we do this?

EAU: know,

EW: There aren't many books to read on

EAU: this. Yeah.

EW: Uh,

EAU: yeah, we've got, we've got a lot for this episode and I'm excited about it.

EW: Me too. Me

EAU: Yeah.

EW: Uh, what are we drinking this week, Erin?

EAU: We are drinking a sloth spritz.

EW: Yeah. Oropouche virus is often called sloth fever or sloth flu. I've even seen it

EAU: Oh God,

EW: love it. But we are gonna honor the sloth in this

EAU: way. Love sloths.

EW: Do too. I do

EAU: too.

EW: Tell what's in sloth spritz

EAU: you know, it's a delicious little concoction of passion fruit juice or whatever,

EW: nectar.

EAU: nectar, passion fruit, uh, lime, mint, and, you know, some bubbly of some kind. Your choice.

EW: Easy ps. Delicious, refreshing, et cetera. All the above. We'll post it

EAU: On our our and our socials, on our socials, not our website, but on our website, you can find a lot of other great stuff. Like, for example, uh, transcripts from all of our episode sources from this [00:05:00] and every single episode, blood Mobile. Who does the music? We've got merch. This is an old one. I don't know if it's still available. Um, me too. Uh, we've got, um, Patreon. We've got a Contact us form, a firsthand account form. Listen, it's big.

EW: and look.

EAU: This podcast will kill you.com. Thanks.

EW: It's there. I have a piece of business because this has been bothering me since we listened to the episode QC purposes. You know what I'm gonna say,

EAU: I do.

EW: Elephant

EAU: I didn't at first.

EW: Bothered me deeply that messed this up. Elephant's poop. If I had thought about it, I would've, I would've, I would've realized that 15 pounds sounds like a lot to us, but for an elephant, which is gargantuan, actually doesn't sound like that much in a day. And it's true. It's not that much for an elephant in a day. 15 pounds is more like in one poop sesh throughout the day. It's about 220 pounds that

EAU: they poop.

EW: And they poop like 12 to 15 times a day. So that's

EAU: how the math,

EW: maths, yeah,

EAU: 12 to 15 times a day.

EW: basically, it's just,

EAU: They're just poop machines.

EW: yeah. Constant.

EAU: Wow. I love knowing that fact. I think what's,

EW: poop facts.

EAU: what's really funny, Erin, is in that episode, when you say 15 pounds, I'm like 15 pounds because I also clearly was like, that sounds like so much. I Numbers are really hard to conceptualize sometimes.

EW: I mean, when you're talking about pounds of poop, it really feel, yeah,

EAU: Yeah. So anyways,

EW: Anyways, that's my correction oh, I just wanted to mention, this is technically the start of season nine.

EAU: I know,

EW: no break. Um, and so if we, if you hear us say season nine or new season or whatever, it's only for, at this point our file organizational system.

EAU: Our file, but, and also like, I think our hearts, because I'm really proud that we've made it to season nine. Are you kidding me? We've been doing this for that long.

EW: yeah, Halloween 2017,

EAU: Yeah. So

EW: there's still things that can kill you.

EAU: Yeah. got a whole season planned. first we begin with Oropouche virus.

EW: After this break.

EAU: Oropouche virus is an arbovirus, which means that it's a virus that is transmitted by arthropods, an arthropod borne virus. Some of our favorites that we've ever covered, I think are Arboviruses, arthropod, vector born diseases. In general,

EW: I mean, disease ecology, really, you know? Yeah,

EAU: it's in our heart of hearts, but one of the things that's quite unique about this virus compared to any other that we have covered before, is that it's transmitted by a whole new arthropod that we have never talked about on this podcast, and that is a midge. So let's talk about what a midge is, shall we?

EW: Yeah, I am. I can't, I truly can't wait. I mean that sincerely.

EAU: So a midge or a biting midge is a type of biting fly. And the term biting midge is not a very scientific grouping of biting fly whatsoever, because in some places these might be called sand flies, even though they might not be what we would've called sand flies. In other places they might be called no-see-ums, and there's probably even more other terms that people use for these. But in any case, these are teeny tiny, and by teeny tiny, I mean they're like one to three millimeters long. Like the, there's pictures of them online on someone's thumbnail where they barely take up the space. That like between your cuticle and your thumb?

EW: Like barely see em

EAU: Yeah, no, barely see 'em. There's other pictures online of them next to a mosquito. And you think of mosquitoes, like they're not very large compared to many other types of flies.

EW: I feel like depending on the mosquito, but yeah,

EAU: Yeah. Some of them are, are hefty.

EW: scary ones. Yeah.

EAU: Right. But they're, but compared to a mosquito, they're like so teeny. They're like the size of a mosquito's head and they're

EW: That is teeny.

EAU: I know.

EW: Teeny,

EAU: Kind of adorable. And in this case we're talking about these biting midges in the family. Ceratopogonidae. Specifically this species. There's one major species that we think is the primary vector for Oropouche virus, and that is *Culicoides paraensis*

EW: yes.

EAU: And these biting midges in, in this family and in this genus. They share some similarities with mosquitoes, but also quite a lot of differences. First of all, they're quite small. Their proboscis that they use to bite us and do their blood feeding is not nearly as long or robust as mosquitoes, so they can't as easily bite through our clothing.

EW: Oh, good news.

EAU: it is good news. However, they're so small that they can fit through things like most of our screens. Uh [00:10:00] yes. So they're harder to keep out of your house and things like that.

EW: Okay.

EAU: But similar to mosquitoes, their larvae are aquatic, and similar to mosquitoes, it is only the females who blood feed in order to mature their eggs. So in the case of Oropouche Virus, this midge, *Culicoides paraensis*, will take a blood meal from an infected person or animal, we'll get there, and then upon their next blood meal, we'll spit that virus back out into another host. And that is kind of all that I can say about the transmission cycle. Sometimes in these virus or arbovirus or vector-borne disease episodes, we can get into a lot more detail about what's going on inside that vector, about how long it takes for this virus to disseminate and then be able to be transmitted. It is amazing how relatively little we know about this virus. So. We think that this one species, *Culicoides paraensis*, this one species of biting midge is the primary vector to humans and probably to other animals too. But much like many other vector-borne diseases that we've covered on this podcast, there are kind of two different cycles of this virus. There's a wild cycle or a sylvatic cycle and there's an urban cycle, and in the wild or sylvatic cycle, it's thought that sloths, especially three toe sloths as well as I know, right, that

EW: like, they, I'm sorry, but they're the cuter

EAU: Oh, but you don't have to apologize. It's like by far yeah. Yeah. It's,

EW: it's

EAU: quite it is. They're, they're the ones with the mask. If you haven't, if you don't distinctly know off top of your head, the differences between a two toe a three toe sloth in addition to the berg toes, the three toes are the ones with the black and white little mask, and the two toes are brown.

EW: Have a little pig nose, which is also cute,

EAU: cute.

EW: way,

EAU: I know. And I do like how fuzzy like their fur is, like longer and anyways, this is not an episode about sloths.

EW: it should be. It could another time.

EAU: So it is thought that sloths as well as non-human primates, like capuchins and howler monkeys and some bird species, these are probably the most important vertebrate hosts of this virus. But when it comes to the vector species, we don't really know exactly which arthropods, which biting insects are playing the biggest role in transmission in this wild cycle, especially. So we know that this biting midge, the *Culicoides paraensis*, is definitely present in the sylvatic cycle. It definitely can and does bite freely other animals in addition to humans. But there's some evidence that various mosquito species, including some *Culex* mosquitoes, which transmit a wide variety of other illnesses and some *Aedes* mosquitoes, which are the primary vectors for things like Dengue virus, which circulates in the same area as Oropouche virus. Some of these mosquitoes have been found to be infected with Oropouche virus, but we don't really know, are they what we call competent vectors? Can they actually transmit this virus to other animals and like how big of a role do they play in the environment? We don't know, which is fascinating

EW: Okay, so a question about that, like what is the midge's habitat preferences.

EAU: Great question. We don't really know. We don't really know. Apparently the larva especially of these species, this species in particular wasn't even like described and identified until the 1990s. Which is so recent. And so we really just don't know nearly as much as we should about the natural ecology. And while other biting mid species are known to be important vectors of a variety of

animal diseases like blue tongue, um, virus and other viral infections as well, I don't think that they have historically been considered as important of a vector of human diseases compared to something like mosquitoes. And so that's probably part of why their natural ecology and just their understanding as vectors and just in general is not as robust as

EW: It's just, it's just so interesting because I feel like they, they occupy, well, do they occupy a similar niche as mosquitoes? They, uh, yeah. But there's, there's like, why do midges play less of a role? This is like a bigger question then,

EAU: and I

EW: like, why in general? You know, mosquitoes are what we think of when we think of like, vector-borne diseases. Like mosquitoes, ticks and, and Midges don't feature very heavily. Why?

EAU: Why? Great question. I don't know. Uh, so, yeah. But, so that's, we think though that this is the main vector species. There's one other species of Culicoides as well that has sometimes been found to be infected [00:15:00] that might play a role, especially in the urban cycle as well. And in the urban cycle, meaning in the human cycle of Oropouche virus. It really is us humans who play the primary, uh, vertebrate host. Our domestic animals do not seem to play a big role in the maintenance of this virus in urban cycles, except maybe chickens. But even then, maybe,

EW: knows? It's

EAU: who knows, we don't study it enough. Uh, we'll know a lot more in the coming years,

EW: Yeah.

EAU: But there is still so much that we don't really know about this virus. What we do know is how it tends to present, even though the symptoms of Oropouche virus really overlap with so many other arboviral, so like vector-borne, viral illnesses, and just other viral illnesses in general. So they're very nonspecific. The symptoms tend to start with a fever.

EW: Classically

EAU: Classically. Um, headache is a very, very common symptom as well as muscle aches, joint aches, dizziness. You might get chills. Oftentimes people will have like ocular symptoms, eye symptoms like photophobia, like your eyes hurt if you're trying to look at the light. Or sometimes people get like redness in their eyes, uh, not like as full on as like a, a, you know, red eye, like pink eye infection, but just a bit of like redness overall in the eyes.

EW: doesn't that happen with Zika or chikungunya?

EAU: It can happen with many, so non-specific. Yeah. Okay.

EW: I just feel like it was like a feature symptom in one of those mosquito born once.

EAU: That is more than I can remember, Erin.

EW: It could be a false memory.

EAU: I don't know.

EW: That's possible.

EAU: Sometimes people will have some like GI symptoms like nausea, vomiting, abdominal pain. Sometimes they might have anorexia, like you just feel so sick, you don't really want to eat anything. Sometimes people can get a rash and I've seen it described as kind of a rubella type of rash. And rubella, if you don't remember, is another viral illness, not vector borne, um, that causes this red splotchy, um, pin prickly type of rash that often is on like the torso and then can spread to the face and, and spread downward. But it's really like a very kind of non-specific viral looking rash is the way I would describe it. And rarely, sometimes people can have hemorrhagic symptoms, so that might be things that look like you're having a bit of bleeding, but not like bleeding everywhere, but maybe your gums or maybe a nose bleed or other kind of mucosal type of bleeding

EW: how is the virus causing these symptoms?

EAU: Great question, Erin. No idea.

EW: Okay.

EAU: We know so little. I have, I have a bit on this later on, but I'll tell you now, Erin, we know so little about the like pathophysiology of what this virus is doing in our bodies. What cells is it even infecting? What cells does it preferentially infect and where does it replicate? Like are there specific tropisms, meaning are there certain types of cells that it preferentially is going to infect, and how and why those cells and what are these symptoms We, we don't know. We don't know any of that as far as I can tell. Okay. So yeah, we don't know why it's causing these very non-specific viral type symptoms. But it is, another thing though that we see with oropouche virus that we see with a lot of other arboviral diseases is that the course of your symptoms can be what we call biphasic,

EW: Mm-hmm.

EAU: Meaning that three to 10 days or so after you get infected, that's the usual incubation period. So after you get these bites from this, these midges and you get infected, you start with these symptoms that I've described. And that first phase usually lasts like two to four days or so, and then you will get better. But then a week to 10 days later you might have a resurgence of very similar symptoms. How often does this happen? We don't really know. 'cause again, there's so much that we don't know, but it's suggested that it's like in up to 60% of cases, which is quite high. So quite common that you would have this kind of biphasic illness. And most of the time I think the best news about Oropouche Virus is that the vast majority of the time, this is a self-limited disease, meaning those symptoms that I describe, you feel miserable. You feel sick. Maybe it comes back and it lasts for quite a while, but then you get better. When this disease causes more severe symptoms, which it can, it can result in a meningitis or a meningo encephalitis, meaning infection in the brain, brainstem causing swelling in your central nervous system. Even in those cases, people almost always recover and recover completely as far as we know, and there are asterisk there. But up until 2024, [00:20:00] Oropouche Virus had not been known to cause any deaths. That's no longer true, but we'll talk more about it later. Okay.

EW: Okay. Uh, immunity.

EAU: Immunity. Great question. We don't know.

EW: Okay.

EAU: don't know how good of immunity we generate. Is our antibody immunity like long lasting? Can you get reinfected with this? We don't know.

EW: Are there different strains or like subtypes?

EAU: there definitely are.

EW: Okay.

EAU: There definitely are, and this is actually a really important part of or Oropouche biology that we do know quite a bit about. So similar to flu viruses Oropouche viruses are an RNA virus that has a segmented genome, which means their genome is not just like one piece of RNA, it's three different chunks. They're named small, medium, and large s, m and L, and similar to flu viruses. If a host, like say, a sloth is infected with two different strains of this virus at the same time, it can lead to a mixing up of different chunks of their genome and result in a completely new version of this virus. Often one that is drastically different than either of the so-called parent viruses. There's actually a few other viruses that have different names. Iquitos virus, Madre de Dios virus, and Perdões virus. I might be pronouncing that one wrong, which that one doesn't infect humans. But these contain parts of the Oropouche virus. And then another segment from a related virus in the same, what we call sero group, the same group of, of viruses. So yes, the, the fact that Oropouche can recombine is a really important aspect of the, like virology of this virus. And we think it was probably involved in the most recent outbreak that we saw. 2024, 2025. And we'll talk a little bit more about that later in this episode.

EW: Changing virulence patterns

EAU: Exactly. Transmission and speaking of transmission. So this is a virus that is transmitted via vectors, right, via these biting midges. There has not been shown so far any direct human to human transmission. So even if you're sick and miserable, you're not transmitting it to other people. However, similar to Zika virus, there is now evidence that Oropouche can be transmitted across the placenta. So if someone is infected while they're pregnant, it can infect the fetus, and it's been thought to be associated with a number of stillbirths, fetal losses, so miscarriages, and things like microcephaly, which is when the brain does not fully develop, similar to how we saw with Zika virus. Unlike with Zika virus, we don't know enough about the virology yet to understand what's going on or how common or any of that. Um, but epidemiologically, this pattern seems to have come out of this most recent outbreak that we've seen. And so we do think that it's crossing the placenta and can cause damage to the fetus, which is pretty serious.

EW: But no sexually transmitted

EAU: Great question. Great question. Um, at least one paper that I saw said that they thought that they had detected it in semen. Does that mean that it's able to be transmitted? We don't know it. It's a huge open question. Yep.

EW: Um, question about the habits of these biting midges. When, you know how like mosquitoes dawn and dusk doesn't mean that they don't bite you in other times of day, but like, where do they bite you? When do they bite you? Do, I'm assuming because they are, their larval stage develops in water that there's like a seasonal or climate component to this.

EAU: Yes, you're very right. So there is definitely a seasonal and climate component. So we see that the highest burden of these of APU virus tends to be during rainy season, and that's going to be when you have more water available for larvae to, you know, mature, um, and for the females to lay their eggs and things like that. So that's definitely the case in terms of when exactly they bite, they can potentially be kind of throughout the day. They do tend to be dawn and dusk, similar to a lot of some mosquito species. Not all mosquitoes are, are like that. Um, but like I said, because they can't bite through clothing, they're gonna tend to go towards areas that are more available. So a lot of times they're biting on legs, they're biting on arms, they're biting on things that they can actually access. Um, and they're really voracious their bites hurt.

EW: Mm-hmm.

EAU: And then beyond that, there's probably more that either I don't know, or that we don't know yet about, about these vectors in general

EW: And maybe you're getting there in the, in the current section, but distribution, geographic distribution of

EAU: Yeah. Yeah.

So this species of Midge is found throughout Central and South America and throughout the southern part of North America, all the way up into like the eastern seaboard. You can even find them sometimes in Michigan and Wisconsin and things like that. And then all [00:25:00] throughout the south, southern United States, which is an important part of the distribution of this virus so far, is that this virus has not been found everywhere. But the vector does exist far beyond the range that we have seen the virus so far.

EW: Right. Which just means potential for

EAU: Potential for spread. Exactly. Yeah.

EW: Which is also, I mean, I know that we'll get there, but like the fact that this virus can infect so many vertebrates, seems like, uh,

EAU: And we don't know even. Right. Like we don't know the extent we, we, from what we have found so far, we think sloths, capuchins, howler and some birds. But like birds is a huge category alone. Right.

EW: Nah, it's just

EAU: fine. Just a couple species of birds in Central and South America,

EW: I know. Some of the most biodiverse areas on this

EAU: Right, exactly. So, yeah. So we don't, we, we don't know. You know? And, and who is playing the biggest role? Who is involved in the spillover events and why? Like, we don't know any of those things. We don't dunno. We don't

EW: know.

EAU: Uh, and as is the case for so many, uh, tropical, especially viral and other infectious diseases, diagnosis remains a really big challenge. And that severely limits our understanding of the true epidemiology and spread of this, because you can't diagnose it without adequate identification. Especially because the symptoms are so nonspecific and they overlap so much with other diseases that are in the same geographic areas. So you have to have access to either serology or like PCR or RT-PCR, which isn't available everywhere, especially in the range of where this virus is found.

EW: Right.

EAU: Um, and as with so many other viral illnesses, we have no specific treatment for it. We have no vaccine. And spoiler alert, no vaccines on the horizon that I have seen. Like as of 2022. There was like one paper about vaccine development for oropouche virus. So this is a pretty neglected viral illness, even though it's not technically considered a neglected tropical disease yet, which is wild. Oh.

EW: I mean, I think it's, it is, it's really interesting to read back through some of these outbreaks and epidemics and it's like so much, it is so much a, a shot, I

don't wanna say shot in the dark, but like the, these estimates are based on the information that was available, which is, can be very often limited based said, how you have to have testing, you have to have. And because the, the virus itself is so, tends to cause these self-limited infections, someone's better in a few days. They may never they may never get Yeah, they may never know that they had Oropouche virus.

EAU: Exactly. Yeah. Yeah. And our, so our estimates are very, very limited. So, but that Erin is Oropouche. Can you tell me where it came from?

EW: I can, I can.

EAU: Okay.

EW: On September 26th, 1955, a 24-year-old man entered the Fever Clinic. It was run by the Trinidad Regional Virus Laboratory in Sangre Grande Trinidad.

EAU: Okay. I love that there's a fever clinic.

EW: Oh. Those, I'll tell you more about

EAU: it.

EW: He hadn't been feeling ill for very long, just like one day. And his symptoms weren't too extreme. He had just like had a back ache and a little cough, no sore throat, with the exception of his fever, which was 104 degrees Fahrenheit.

EAU: Ooh,

EW: Pretty high. Pretty I didn't write that down in Celsius,

EAU: it's high. 30,

EW: maybe over 40. Maybe Yeah. Was referred to this clinic, which was kind of standard practice at the time. Uh, but it, his symptoms were so vague that it was like, well, we don't really know what this could be. Let's run some standard tests, which included, you know, looking at blood smears under the microscope. There was one smear that looked like there, maybe there was one single malaria parasite, but it wasn't conclusive. And then people who looked at it later were like, there's nothing here. So it was kind of like, well, this guy got better really

quickly. He, the, his illness lasted three days total. In normal circumstances, like in many of the time, we would think that like that person would fly under the radar and you're done with that's not what happened. And in retrospect, it's, it's kind of amazing that he made it to the clinic in the first place while that illness was still ongoing, which meant that the doctors could, the researchers there could take blood samples while he was acutely ill, so then they could take that blood and run more tests on it. So they took serum from that blood sample, gave it to mice who died, suggested, which suggested that a pathogenic virus was involved. What virus was it? Like this is not, this is, this is

EAU: Right.

EW: This is a great question. It didn't seem to be one of the usual, or even one of the unusual suspects, [00:30:00] and so it was given a new name. Oropouche virus.

EAU: Hmm.

EW: Yeah. Why Oropouche? Well, the man who had visited the clinic that kicked off this pathogen hunt, he lived nearby in a small community called Vega de Oropouche.

EAU: Oh, okay.

EW: that's, it's place name? Yeah.

EAU: is where you're from,

EW: Yeah, it was before that became against the, you know, when it was right. While naming diseases after places was still the conventional thing to do,

EAU: but,

EW: um, subsequent tests with the virus revealed that it could cause disease in a range of animals like mice, Guinea pigs, and chicken embryos. So it definitely wasn't nothing to worry about. Whether or not those animals could play a strong role in its spread is not clear, but just the fact that it could cause disease and death in is

EAU: You could, you could have symptoms enough. Also, they were just like, culturing this virus from this dude's serum. This whole.

EW: Yeah,

EAU: Wow.

EW: I know. I know.

EAU: He just went to the best possible clinic, huh?

EW: Yeah.

EAU: I mean, he got better on his own, so I guess they much for him, but,

EW: right. Um, they were running all these tests, finding that it was indeed some sort of, uh, you know, previously undescribed, potentially pathogenic or seeming seemingly pathogenic virus. Where did it come from? And this was the question that the Trinidad Regional Virus Laboratory was very motivated and equipped to answer. The first clue came from the patient himself. Although he resided in the village like most of the time, Vega de Oropouche, for two weeks before his illness, he had actually been working and sleeping in a forest a few miles away where he worked as a charcoal burner.

EAU: Okay.

EW: So if you didn't know, I certainly did not. A charcoal burner is someone who makes charcoal by burning a bunch of wood. So you, you know, deforest an area chop down a bunch of trees, you burn those trees and you have to stand by your, your, uh, charcoal pit for weeks, often on end while charcoal is being made. It's a long lonely job. There's even like a poem by the creator I think of Winnie the Pooh about it, like how sad it is. Um, because you have to stay by your charcoal pit in the woods around where no one else is there. not like this is a group activity. And so learning that this guy was a charcoal burner, it immediately set off red flags for the researchers. 'cause they were like, okay, you are spending a lot of time in the forest. This suggests that it's probably vector borne. There's mosquito or something else out there. This is a spillover event.

EAU: Oh, I love that they, that, that, oh,

EW: Mm-hmm.

EAU: I love, I love this story, Erin. going.

EW: And so they, they went out there. So in the 1961 paper that first describes this virus quote, "when it became evident that an agent pathogenic for mice had been isolated from a forest worker, steps were taken to attempt recovery of virus from blood sucking, diurnal insects, prevalent about the patient's home and charcoal pit in the forest." Reasonable next steps.

EAU: Very,

EW: very, and mostly, as far as I could tell, it was mosquito species that were collected. And none of them seemed to be the clear culprit, although it did suggest that there was like, I think in a later collection, in a later paper, they found one instance of the virus in a mosquito. So they were like, okay, well. That doesn't rule it out, but it's clearly not mosquitoes

EAU: Right, right.

EW: Uh, they did also do antibody testing in some animals like primates, and they found that yes, some primates seem to have been exposed to this virus previously, and so this suggested that Oropouche virus was not uncommon in wildlife.

EAU: Also, they like developed an antibody test for it already. I'm amazed.

EW: I can't wait to tell you more. Okay. This was, I will say like, it's you, you're amazed, right? Like it's really cool to, to look at this beautiful, like, okay, logical next steps. You have the resources to look at this. You understand what you're looking for, all this stuff. This was not front page news, even in the world of viruses,

EAU: Oh, wow.

EW: Because it was, first of all, viruses are very diverse. The, there are so many undiscovered viruses out there, and this was one person. Who had recovered was, yeah, this was a handful of howler and capuchin monkeys that showed past infection, maybe an infected mosquito or two. I mean, this was one of an untold number of viruses circulating in wildlife that remained to be

EAU: It was like, who cares? Okay, so you found a new virus.

EW: It was like, thank you for recording that information. We'll add it to our list of thousands of viruses just like this. Yeah, and also, maybe it was a fluke. Maybe this was a one-time event that

EAU: happened

EW: and the next five years of silence that surrounded this virus seemed to suggest that that was actually the case until it popped up again in 1960. This time in an entirely different country, over a thousand miles away.

EAU: Ooh, not good.

EW: [00:35:00] Not good. Well, intriguing.

EAU: Mm-hmm.

EW: Uh, and not good. A three-toed sloth in Northern Brazil was found to be infected with the virus, in a way kind of foreshadowing the sizable epidemic that would occur in the region in the following year. So in 1961 an estimated 11,000 people were infected with Oropouche virus in the same region.

EAU: Oh wow.

EW: And so as it turned out, no. Yeah. That not only was that first 1955 case, not a one-off this epidemic would also be just the first in a series that occurred over the next decades the virus spread to much of Central and South America, and especially throughout Brazil.

EAU: So, but they were able to identify it as Oropouche virus because of the work of the people who identified it from the one guy in 1955. That's incredible.

EW: There's, yeah. Because of this work, because of this network of information, this was, this virus was able to be named, described, identified, and linked to an, an outbreak. It's pretty, it's pretty impressive.

EAU: very impressive.

EW: Yeah. And over the next decades, I'm kind of like squeezing a lot in here. Um, the numbers kept climbing. So between 1978 and 1981, an estimated 220,000 cases, uh, 30 outbreaks along the Amazon River, between 1961 and 1996 with an estimated half a million cases. And most of these are in Brazil. And it wasn't just the number of cases that kept growing, though, it was also the Virus's geographic distribution. First there was that case, that individual case as far as we knew in Trinidad. Then there was the outbreak in Northern Brazil, then all along the Amazon River, then in these non-endemic regions of Brazil.

Then in Panama, Peru, Ecuador, Bolivia, Venezuela, Haiti, Columbia, French Guiana, uh, you just like, yeah, Guatemala, Cuba, on and on,

EAU: All of these, all of these places, by the way, that don't all touch and are not all that close geographically necessarily,

EW: Some of these cases are, you know, whether or not this indicates local spread. I'll, I'll, I'll let you answer that later on.

But the increasing number of, of countries that are reporting this virus at all shows two things. It shows that the potential for increased geographic spread, and it also shows an increased awareness because detect better detection and awareness might be driving some of this because for decades, Oropouche virus cases were probably wrongly ascribed to dengue or outbreaks.

EAU: So like how many of the past dengue outbreaks were actually, Oropouche, could it have mix? This yeah. Or Zika or chikungunya, like they're all so

EW: they're all so kind of similar. Yeah. But there's, there is no doubt that this disease is on the move and it might actually be evolving to become more virulent, you know, some recent cases, or it has the potential to become more virulent. Given what you told us, Erin, about the virus's characteristics, you know, it's high mutation or recombination rate, multiple insect vector hosts and multiple vertebrate uh, reservoirs. This is not entirely surprising that we're seeing this kind of spread, but it is concerning and it begs a few questions. Where did this thing come from again, and how is it spreading so quickly? And why was anyone looking for viruses in sloths in the first

EAU: yeah. That's what I wanna know who, who tested that sloth and why were they testing that sloth. I can't

EW: wait. Okay, we're gonna answer the first two questions first, can do this pretty quickly. Oropouche Virus probably originated in Brazil, anywhere from, prepare yourself for a wide, wide range

EAU: range here.

EW: 80 to 360 years ago. Smaller than we have for a lot of other things.

EAU: wait, wait, wait. 80 to 360.

EW: Yeah,

EAU: Wow. So it's super new.

EW: it's super new.

EAU: Three. It's three. The oldest they think it is is in the hundreds of years.

EW: But here's, here's the thing that I, I kind of have questions about because we talked about how it has these different, like segmented genome with a lot of reassortment. so our existing data is like the diversity of these viruses is maybe not reflective of the overall history. I'm not sure, but I was thinking about how flu we have complete extinct viral lineages.

EAU: right, right, right.

EW: So

EAU: we have called those different viruses or would we Yeah, it is because the, the serogroup that Oropouche belongs to is called the Simbu serogroup. And I had a really hard time sorting through like, are these different genotypes? Are these different viruses? Are these different? And, and there are a number that they classify as different viruses, even though they are quite [00:40:00] similar. So yeah, it is, it is a confusing phylogeny of the, that whole group, including Oropouche virus. So that I guess makes sense in that way. So like the Simbu serogroup is probably much older, but Oropouche itself, who knows? I

EW: I don't know. I mean, I do think that it's like there are viruses that, that emerge or when, when does a new virus become a new virus, I is a, Hmm. For a virologist.

EAU: question too. No, just kidding.

EW: Philosopher. Sure. But I think that whenever it originated, it has seemed to expand relatively recently. Like only in the last few decades that it's expanded the most of South America and Central America. Why it has done so is because of humans. Bottom deforestation and widespread movement of humans created the perfect conditions for Oropouche virus spillover, and spread. As forests were cut down, that led to more opportunities for infected mosquitoes to bite the humans living on the forest edges. So like, think about the construction of that highway.

EAU: highway. Mm-hmm.

EW: And then increased movement, uh, for humans, both short scale, like from deforested region to city, and then long scale from one city to another region or another country drove the spread of this virus.

So consider, if you will, this sequence of events. Someone is working on the construction of a road through a newly deforested region of the Amazon, for instance, like the road that we discussed in our firsthand. One day they're bitten by a midge that's infected with Oropouche virus. A few days later, they take their day off to drive back to their nearby city to visit with some friends and family. There, a midge bites them, picks up the virus. That midge then bites someone else, infecting them, another midge bites that person and suddenly you've got an epidemic on your hands. This is how one spillover event can lead to sizable outbreaks. The story doesn't end there. So now let's say somebody else was in town during this outbreak, and they also happen to be working on road construction in a newly deforested area, but in another part of the country or another country entirely where Oropouche virus is not present. They get infected during this city outbreak, head back to their work site where another midge bites them, becomes infected, then bites a sloth or a howler monkey, another mi, another midge or a mosquito picks up the virus and then suddenly Oropouche is endemic in this new forested region.

EAU: Right.

EW: This is spillback.

EAU: Spillover into humans. Spillback into wildlife,

EW: spillback doesn't get talked about enough, I feel

EAU: No, it doesn't. It really doesn't. But yeah, it's an important part.

EW: It is a really important part and I wanted to mention before I forget that I'm wearing my spillover, I'm call it my spillover sweater today. It's got, um, if you're watching on YouTube, you can see this. It's got a woodpecker

EAU: very cute.

EW: and um, squirrels.

EAU: There you go. Show us that squirrel beep squirrels.

EW: They're very cute.

EAU: So cute.

EW: it's from now on. Anytime we do another,

EAU: Oh, I love it. a uniform. I've

EW: got it, I've got it. It cuts down on decision making.

EAU: It's Oh, fantastic.

EW: Um, spillover and spill back for Oropouche virus, they're not just like. Likely to happen, but they're, they have happened and they are likely to result in sustained transmission or turning an uninfected area into an endemic one. And this is for, for all the things that we've already talked about, right? The wide host range, the recombination, multiple potential different species of vectors we don't really know. I mean, this virus is like, has never heard of a dead end host

EAU: Mm-hmm. It's just what it seems like.

EW: that? it's all about those borders between humans and wildlife becoming more porous due to human activities like deforestation.

EAU: Yeah.

EW: In fact, deforestation in the Amazon rainforest in Brazil from the 1950s to the 1980s coincided with 200 arbovirus is being discovered in the region. So, Oropouche is not the exception, but it is rather the rule. In fact, roughly 75% of all emerging infectious diseases have an animal origin, and 70% of those come from wildlife.

EAU: Got I've got some good stats too, Erin. Yeah. Mm-hmm

EW: Uh, wildlife, like the sloth, who is the subject of our third question? Why were people looking at sloth viruses anyway?

EAU: I love that someone funded this, so give it to me.

EW: okay. Okay. So given what I just said about the high proportion of human pathogens that come from animals, maybe the answer is self-evident. Like why

someone was looking at a sloth. Well, because wildlife can carry viruses. But I wanna dig a bit deeper exploring not only why researchers were examining wildlife for new pathogens in the mid 20th century, but also the [00:45:00] infrastructure that allowed them to do so. Both the first described case of Oropouche virus, and this isolation from a three-toed sloth took place at two viral research institutes, one in Trinidad and one in Northern Brazil. Both of these institutes, the Trinidad Regional Virus Laboratory and the Belém Virus Laboratory were established and funded, at least in part by the Rockefeller Foundation in the mid 20th century.

EAU: Okay. Interesting.

EW: We've encountered the Rockefeller Foundation before on this podcast, uh, maybe most notably during our hookworm episode. The organization, which was started by one of the wealthiest people in history, it played a pivotal role in eliminating hookworm in the early 19 hundreds in, in the southern us. Or at least that if that part is controversial or up for debate, sure. I, that's, that's fine. What it did is it at least elucidated some of the factors that sustained its transmission, and over the following decades, the foundation broadened its goals beyond the us. Its mandate as set out in 1909, was "to promote the wellbeing and to advance the civilization of the peoples of the United States and its territories and possessions and of foreign lands in the acquisition and dissemination of knowledge in the prevention and relief of suffering and in the promotion of any and all of the elements of human progress." End quote.

EAU: Okay.

EW: It's a notable goal. I wish more billionaires would, philanthropy

EAU: instead of

EW: the other.

EAU: Alternatives. Mm-hmm.

EW: But I, I think it would be incomplete to view this foundation or the field of tropical medicine as a whole, as solely philanthropic, whether in intent or impact. Philanthropy was part of it, but it was not all of it. Right. Why were people trying to better understand how yellow fever was transmitted, or how to prevent leishmaniasis in

EAU: build the Panama Canal.

EW: Exactly. So imperialist powers like the US and England could install local governments without people dying of infection. Infectious disease in these regions became the first hurdle to overcome in, you know, settlement, whatever that meant.

EAU: right.

EW: Like, you must first conquer infectious diseases before you can conquer this

EAU: the land. Mm-hmm. Yeah.

EW: Scientific and medical knowledge may have benefited the populations under imperialism. It did not always. And if it did, it often came. Those benefits came much later on, and it came with tremendous costs. That knowledge was not freely shared, and in some cases it wasn't shared at all. The colonizers were often the only ones to benefit from that knowledge or have, or have the capacity to implement it. Oh, screens prevent mosquitoes, which could then prevent yellow fever. Let's put those screens in our houses.

EAU: Yeah. Yeah.

EW: Um, clean water, screens, bug spray, medications, stuff like that. That was not like, oh, and then now here it is, everyone not. In the age of imperialism from the late 18 hundreds to the early 19 hundreds, scientific progress was not democratized. And the concurrent rise of germ theory enabled the use of tropical medicine as a tool of imperialism. The Rockefeller Foundation, which emerged as this period was winding down as the imperialist, uh, the age of imperialism was winding down. It seemed, from my reading, less focused on conquer and more on capitalism, which is unsurprising. Given Rockefeller's prowess as a businessman. He saw progress, particularly economic progress, as viewed from a capitalistic western perspective, he saw this progress as being hindered by poor health. It wasn't just that life was being cut short, it was also labor and productivity, similar to how today we use the metric, disability adjusted life years to measure the impact of a disease.

EAU: right.

EW: Rockefeller saw that improving the overall health of a region through public health interventions would ultimately lead to greater economic prosperity, which was great if the region was under the control of the us. But if it wasn't, then that also meant more money to be pumped into like the global

capitalism machine, which predominantly benefited Western imperialist powers. So it's kind of a "yes, and" situation. Like, so the, the virus labs and other Rockefeller initiatives absolutely reduced the overall disease burden in certain areas, and they advanced scientific and medical knowledge and the US and probably Rockefeller and his descendants enjoyed some of the economic benefits from those efforts. Maybe that feels like a touch cynical or something.

EAU: I mean, but we've always said like how much money you save with public health and how investment in public health is like, it's just like that's a, it's a, a clear example of someone having enough money to do that, which is really interesting. if it's cynical.

EW: Right. And it's like, it's kind of one of these things where it's like, we're [00:50:00] money or public health is, is money saving? not revenue generating. And so investment in public health ultimately is like the smartest thing that you can do as an economic power,

EAU: Are billionaires listening.

EW: Right, right. And so it's like, okay, if we can't convince you to do this out of the good, you know, good for mankind just to have a leg leave a legacy that means something more than just consumer profiting off of pe, whatever, all of that, then let us convince you because it makes more financial sense

EAU: It will, it will eventually save us a lot of money. Yeah.

EW: But I, it still feels like. It still feels a little bit cynical. And, and so I, I also, I don't know, I, I wanted to also add that I think that the researchers and probably the, the organizers, the administrators of this foundation who were involved and wanted to take part in these efforts, I think that they probably, or possibly had good intentions, like the purest of intentions, maybe they went into this field to reduce human suffering, to devise new vaccines, to identify pathogens or simply just add to this body of knowledge to make the world a better

EAU: Well, and like a bunch of nerds getting to actually do this important science, like, are you kidding me?

EW: It's the dream.

EAU: Oh.

EW: And it's not like local populations where these labs were established were just like passive players. Many citizens and regional governments became directly involved in primary research as well as the application of that knowledge. And in funding it was often like meeting the funding need. Yeah.

EAU: right.

EW: From 1950 to 1970, the Rockefeller Foundation provided the Arbovirus program with \$30 million in funding, which is worth about \$230 million in today's money, and many local governments directly matched that funding. It's, it's kind of staggering when you think about what a force that must have been and how investment in basic research really has pays

EAU: It pays off. I just still can't get over the fact that they found this virus from one dude, and then within a couple of years, we're able to identify outbreaks that easily. I mean, how many times have you told a story on this podcast, Erin, where it's like, yes, someone found this virus and named it, but then decades later, someone else found this virus and they thought they were the first person ever to identify it. Like, that's usually how these stories go.

EW: It's usually how it goes. And I think, part of it has to do with when this, like the historical context of when this was happening. And so in a lot of those cases, there was not the technology or the scientific know-how to be like, this is a virus at

EAU: right. Or to be able to share that information widely and yeah. And

EW: so I think this was sort of a confluence of we have the equipment to do this, we have the interested minds to the funding and we have um, this, this network of information that can spread and the incentive to identify this like, Hey, here's this money. Find out what you can about, about Arboviruses,

EAU: so that's what they were doing with this sloth. They were like, we've got money to find viruses, and so we're gonna test a bunch of animals everywhere, over.

EW: Yeah.

EAU: But that was my dream job for time. So,

EW: Yeah, so these, these Rockefeller Foundation Virus laboratories were established initially to keep better track of the yellow fever virus, had caused

deadly outbreaks in Central and South America in the early decades of the 20th century, and had hindered the US progress in building the Panama Canal. Our yellow fever episode. It also had been in the US for a long time, blah, blah, blah. Anyway,

EAU: Hamilton.

EW: Hamilton. Field Laboratories were established not just in Trinidad and Brazil, but also Egypt, India, South Africa, Nigeria, and Columbia. And as researchers uncovered more information about the ecology of yellow fever, its mosquito vector, its vertebrate host, how climate induced its transmission. Two things happened at least. The first was that in their ecological studies of yellow fever, they were also finding other arthropod born viruses that had never been described. Y'know, test this mosquito screen, this monkey sloth, et cetera. Oh, that's something we haven't seen before. Let's dig a little bit deeper.

EAU: The second

EW: is that they were leveraging their knowledge about yellow fever to make meaningful, sustained progress in its control.

EAU: Mm-hmm.

EW: If you could make such headway against a long feared deadly disease, maybe you could do the same for these new viruses that you were finding. Identify the arthropod vectors. Figure out which vertebrates act as reservoir, host, measure, infect- infection against climatic or seasonal variables, and then use all that information to disrupt the chain of transmission and prevent disease even though it wasn't called that at the time. This embodies a One Health approach where animal, human, and environmental health are all taken into consideration. Historically, after the early years of germ theory and [00:55:00] epidemiology where animals and the environment were more likely to feature in studies alongside, uh, human disease, these different fields were often siloed. So like it was pre germ theory, it was like, oh, the weather has turned, this might lead to an outbreak of plague, you know, that kind of thing. It, once we found one bacteria, one disease, that sort of segmented segmenting, chopping up these diseases into discrete entities, that also meant that specialties were also segmented and siloed. Um, like a biomedical researcher wasn't necessarily inclined to observe a disease under natural conditions if lab environment and an experimental animal could

EAU: Mm-hmm. Mm-hmm.

EW: control the ecological noise much better that way. And collaborations between physicians and veterinarians dwindled as the fields grew more specialized. Who's got the time, or you would have to learn a lot more about like a horse's guts you were prepared to. One area though that resisted such rigid boundaries among disciplines was that of medical entomology and tropical medicine,

EAU: Oh, love Love

EW: these were the two areas in which the Rockefeller Foundation was heavily involved. How could you predict the movement of a mosquito-borne virus without considering the mosquito itself?

EAU: You cannot, and all the other things they're feeding on and their environment and where they're living how hot it is and how long it takes for their larva to develop and how long they live and

EW: It's environment, it's the wildlife, it's the domestic animals, it's humans. It's all of these things. And so the Rockefeller virus labs staffed as they were by researchers interested in cycles of infectious disease and natural environments. They were well positioned to ask and answer these questions of, what about the mosquito? What about the wildlife? What about the environment? What about the climate and the weather? And so hopefully that answers the question of why people were looking at sloth viruses in the first place.

EAU: Yeah.

EW: This one health approach is not just one lens through which to view a disease like Oropouche fever. It's the only lens that we should be looking at this, right? Fortunately, that is the framework that many researchers are using today to better understand what this virus might have in store for the future. Speaking of the future, Erin, could you tell me, uh, where we stand with Oropouche virus today?

EAU: I would love to, erin.

I have some stats to start you off with. Very similar to some of the ones that you hit us with, Erin. Uh, according to a paper from 2024 in the Lancet Infectious Diseases Vector-Borne Disease, specifically vector-borne diseases account for nearly 29% of all emerging infectious diseases. 30% of all emerging infectious disease are vector-borne and arboviruses specifically. So viral vector diseases

are 40% of all pathogenic viruses found in humans from the late 1800s through 2010.

EW: Yeah. I, yeah, feel like I'm, I feel like I'm doing a research for my, for my dissertation,

EAU: know and it is, it is bringing me back in a way that I didn't realize how much I missed this. The true burden of arboviral diseases is not known period. However, we do know that over the last several decades the global burden has been increasing, not decreasing and Oropouche virus. I am just so shocked that I did not know about this. Like when we were in grad school, I had not heard of Oropouche virus, which is so weird 'cause we were so deep in this world.

EW: Well, it, I think that it also just shows silos. Again, like, it, wasn't, directly applicable to our readings

EAU: and our So it is and has been considered one of the most prevalent arboviruses, where it's documented second only to dengue virus.

EW: it's

EAU: prevalent. It's very, very prevalent. We think that there has been at least half a million cases, at least 500,000 cases, and that is almost certainly an underestimate because of so much of what you talked about, Erin, that like we didn't know until we were able to identify this, we didn't know that it existed. How many times between then and before then and now has this been misidentified as malaria, as dengue, as Zika, as chikungunya, as so many other viral illnesses, but even as of 2017. The research, at least to that time, had suggested that it was only found in a few countries, which were not all geographically that close because by then in 2017 paper, it was like Panama, Brazil, Peru, Trinidad, and Tobago. [01:00:00] And that's not the entire, uh, the entirety of its range. And we know now from the most recent outbreaks that that is definitely not the entirety of its range. We also know from a few more recent outbreaks that the attack rate of this virus, so if it gets into a community, how many people is it likely to infect? Might be quite high.

EW: Seems like it.

EAU: It seems like it. There was an outbreak in 2020 in French Guiana where about 43% at least of a population was infected in one outbreak. And there haven't been that many sero prevalence studies, but the ones that have been done in Columbia and Brazil have found between 10 and 16% of people in the

regions that they've studied show evidence of prior infection with Oropouche virus.

EW: Wow.

EAU: I know, I know. But the biggest news with Oropouche virus, and the reason that we started getting email requests for this back in 2024. Is that there was a very, very large multi-country outbreak that spanned really, it started in like the end of 2023, um, but especially 2024 and 2025 that spread across at least 11 countries, including Bolivia, Brazil, Columbia, Cuba, Ecuador, Guiana, Panama per Peru, and with travel associated cases in the us, Canada, Cayman Islands, and multiple countries in Europe. By the end of 2024, there had been over 16,000 confirmed cases, 39,000 suspected cases, and that was not the end of the outbreak because in 2025, an additional 13,000 confirmed cases were reported across the Americas and another 17,000 suspected cases were identified that that year. And like we talked about in terms of the seasonality of this.

Um, the vast majority, like we saw several kind of outbreak waves. If you look at the graphs, the uh, Pan-American Health Organization, paho has a really great, uh, you can go in and look like month by month and look at these graphs, um, of all of these reported cases. But the vast majority of these cases were in the rainy seasons, which kind of do vary depending on where you are. This is a very large range geographically from like the MidCentral America and the Caribbean, all the way into South America. But the outbreak seem to kind of wane by June, July of 2025. And since then there have just been sort of sporadic reports. It seems like that particular outbreak is over, but was incredibly large.

EW: it won't be the last.

EAU: No, absolutely not. And in those two years, some really big changes also seemed to have happened with Oropouche, not just how much more widespread this was. Right. We saw it in countries like Cuba where we didn't even know that this vector species existed. It has now been found in Cuba, but when the first cases appeared, people were like, what the heck is vectoring it in Cuba? *Culicoides paraensis* doesn't exist there. Maybe it does, or maybe it was a different vector species. It's still a little bit unclear, but so the geographic spread was astonishing in that it was in so many places that we had not previously seen it. We also saw the first ever reported deaths from Oropouche virus in 2024. There were two deaths reported, both of them from Brazil, and the vast majority of these cases were in Brazil across both of these years, 2024 and 2025. In 2024, there were two deaths in Brazil, both in two, otherwise young women in their

twenties healthy with not any known conditions that would put them at high risk. And in 2025 there were six additional deaths. Five in Brazil and one in Panama. And that does not count the miscarriages or pregnancy losses and stillbirths, which we saw that we think were associated with Oropouche virus or the congenital malformations that we think might be associated. So microcephaly and the lack of brain development that we have seen in a handful of cases as well.

EW: Yeah.

EAU: So huge changes that we saw with Oropouche Virus in the last couple of years compared to anything that we had seen previously. Why? We don't really have great answers. Um, there was El Nino years during some of that time, and so we think that, you know, the seasonality and the increase in rainfall and things are likely associated with that particular outbreak and will be in the future.

EW: Just higher numbers of Midges, for

EAU: example. Exactly, and like I said there, there are still questions to be answered about what was different about this particular viral strain, but it does seem like the, almost all the cases in 20 24, 20 25, these large outbreaks were from this kind of novel reassortment where we saw a virus that looks quite different than Oropouche viruses that we have seen in the past. [01:05:00] And so that, and how big of a role that played. And what about this novel Reassortment made it so that this outbreak could happen? We still don't know, but it is very likely that that played at least part of a role in addition to the vectors and the rainfall and the climate and the, the deforestation and the travel and the globalization and all of the things play

EW: I, I feel like some, some things are, could be, if you're thinking about this in terms of like a fire, right? Some things are the matches and some things are the kindling. Yeah. And so it's like what the El Nino year is not the match, but it's the, the kindling, you know,

EAU: like right. Yeah.

EW: I'm curious for the, the genetic diversity of these viruses in that outbreak. Was it all the same?

EAU: As far as I could tell, it does seem to be kind of all this big novel reassortment that is quite different than any of the other, or Oropouche viruses that we've seen in the past.

EW: Okay.

We have covered a lot of mosquito borne and arboviruses on this podcast, and there are many, many, many more out there we have not covered. And I think sometimes the number, just like the sheer diversity of sort of like how I was like, well, this is not, the rule is not the exception. It's the rule. paradoxically make you go, oh, well then there are so many, like whatever. But Oropouche virus is, it is exceptional ways. It in its, uh, in its ability to spread in its vector, uh, prevalence and distribution and in the increasing frequency and just sort of also the fact that like, we're not, I worry that the, that we all have maybe a little bit of headline fatigue when it comes to things like this. And it's like this inclination to go, oh, it's just an exaggeration or whatever. But like, no, I really. things will continue to happen. Modern medicine won't prevent us if it's not, if it's not able to be accessed not shared equitably.

EAU: right.

EW: Yeah,

EAU: Yeah. And I mean, we still, from what I can tell, it's not like this has, uh, led to a huge boost in Oropouche funding and now we have all these vaccines on the horizon. There's not, there's none. There's nothing. There's nothing.

EW: don't see that happening with this administration,

EAU: No, definitely not. Um, yeah, no, it's, uh, I think Oropouche is, is another example of so, so many that we have seen of th these will just keep coming.

EW: Mm-hmm.

EAU: VI viruses will just keep coming. They will keep spilling over. We will keep seeing new ones and the end. The end.

EW: Great stuff.

EAU: Great yeah. We've got lots if people wanna read more about Oropouche virus.

EW: We do. Um, okay, so I, there was a paper from 2024 that I really liked it was by Tilston Lenel from 2024 Oropouche Virus an Emerging Orthobunyavirus. That was great. Um, there were a few more. There were, I honestly, I have a lot of, a lot of papers. If you're interested in reading more about sort of like the Rockefeller and Public health imperialism perspective, there's a paper from 1976 by Brown titled Public Health and Imperialism Early Rockefeller Programs at Home and Abroad. And then finally, I just wanna recommend these papers, 'cause it was really interesting to think about the One Health and where did this, where did this idea come from? Uh, from Ancheta et al, from 2021. There are two papers, the Origins and Lineage of One Health, part One and part two.

EAU: Love it. Out. I also had a number of papers, uh, one from 2017 by DeRosa et al from the American Journal of Tropical Medicine and Hygiene. I really liked that was called Aura Push Virus, clinical Epidemiological and Molecular Aspects of a Neglected Orthobunyavirus. Or Bunya virus. I don't know. Um, there was also a review from The Lancet Infectious Diseases from 2024 by Wesselman et al the, it was titled, yeah, that was a good one. Emergence of Oropouche Fever in Latin America, a narrative review. And then if you want more detail on this novel Reassortment, um, there was a Nature Medicine article from 2024 by Naveca or Naveca, et al, um, titled Human Outbreaks of a Novel Reassortment Oropouche Virus in the Brazilian Amazon region. And then I also wanna shout out one that was more focused on the vectors themselves, um, by Gallichote, I'm probably pronouncing that wrong and I'm really sorry. Um, and it was from plus Neglected Topical Diseases that was called Vector Competence for Oropouche Virus, A systematic review of pre 2024 experiments. Um, it was, it was a really good one. Uh, it was like, we know anything.

EW: I know. I mean, I feel like, despite the fact that we've kept saying, well, we don't, we don't know. It's understudy. It's underst study people. A lot of people have done a lot of great work on it,

EAU: Oh, totally. Totally. There's a lot. There is a lot there. We just, we still dunno, we comparative to other viral and arboviral illnesses. This has not gotten the attention or [01:10:00] recent, recent funding that it deserves. Okay.

EW: Okay. Um, thank you to Blood Mobile for providing the music for this episode in all of our episodes.

EAU: you to Tom and Lianna and Pete and everyone at Exactly right for everything you do to make this possible.

EW: Thank you, thank you, thank you to anyone who enjoys this podcast in any way, or participates or partakes or whatever.

EAU: Yeah, yeah. Thank you. And especially thank you to our patrons for your support over on Patreon. It really, really does mean a lot to

EW: Does it does, uh, until next time, wash your hands.

EAU: you filthy animals.