Laboratory Induced Heartland Virus from Asian Longhorn Ticks

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Meghan Hermance, an assistant professor of microbiology and immunology at the University of South Alabama. We'll be discussing infection and transmission of Heartland virus in ticks in a lab.

Welcome, Dr. Hermance.

[Meghan Hermance] Well, thank you. I'm happy to be here to chat with you.

[Sarah Gregory] Let's start off with you telling us what Heartland virus is?

[Meghan Hermance] Sure. Heartland virus is an emerging virus that's transmitted by ticks. This virus is found in North America, originally in Missouri, and because that's part of the "heartland of the country", that's where its name is derived. But technically, Heartland virus is related to other types of viruses known as bandaviruses, which are also transmitted by ticks.

[Sarah Gregory] When was it first discovered?

[Meghan Hermance] This was back in 2009, Heartland virus was isolated from two men in Northwestern Missouri. These individuals were admitted to a hospital with a febrile disease, and ultimately, both of these individuals recalled being bitten by ticks about five to seven days before their illness began. And then while they were hospitalized, these two people had blood samples taken and virus was ultimately isolated from those blood samples, and then they characterized the virus and named it Heartland virus.

[Sarah Gregory] How many people in the United States have been infected with it that we know of?

[Meghan Hermance] Well, we estimate that it's over 50. There are over 50 documented cases of Heartland virus as of last year in 2001. And these cases have been identified in people living in several midwestern and southern states.

[Sarah Gregory] So it's still relatively rare then, right?

[Meghan Hermance] It is, yes. This is a rare—pretty emerging, but rare—tickborne virus.

[Sarah Gregory] Can we expect an increase in the future?

[Meghan Hermance] That's something that we're certainly tracking. And I think with increased surveillance—and we'll talk some about that, I'd love to chat about that today—but increased tick surveillance in the field, as well as increased patient or physician awareness of this disease, will probably result in increased cases in years to come.

[Sarah Gregory] Okay. So what are the signs and symptoms?

[Meghan Hermance] There aren't too many cases described in the literature for Heartland virus. But of those Heartland virus cases that are described, we see that these people infected with Heartland virus usually have fever. They also have thrombocytopenia, which is a low blood platelet count, and the platelets are what help clot. Individuals tend to have leukopenia, which is a low white blood cell count, and then they often display fatigue. And then some of the other side effects can range from anything like headaches to reduced appetite, nausea, diarrhea, muscle

pains, and then pain in the joint as well. And usually, but not always, individuals will recall having a tick bite within about two weeks of the onset of their illness.

And what's interesting, and also tricky, is that the symptoms of Heartland virus disease are similar to those of other tickborne diseases, such as ehrlichiosis and anaplasmosis. So when we have patients that are being treated for ehrlichiosis, for instance, who don't respond quickly to a treatment with an antibiotic (like doxycycline), Heartland virus disease should be considered in those patients. And another challenge is that we don't have commercially available tests for Heartland virus.

[Sarah Gregory] Okay. So some of those symptoms sound pretty serious. Is it fatal? Can it be fatal?

[Meghan Hermance] It can be. So Heartland virus causes a serious febrile illness, and most of the recorded cases have involved hospitalization of patients. And that's usually because the patients need IV fluids, or they need treatment for fever or pain or other related problems. And then there has been some fatalities in Heartland virus patients, and those are usually related to situations where the patient has comorbidities or is older in age.

[Sarah Gregory] And comorbidity is having another physical complication, like diabetes or something already, right?

[Meghan Hermance] Exactly, yup.

[Sarah Gregory] What is this invasive Asian tick mentioned in your study?

[Meghan Hermance] Yeah. This is...was the focus of our study. This is the invasive Asian longhorned tick, which is the common name for the tick species *Haemaphysalis longicornis*, which is quite a mouthful. This Asian longhorned tick gets its common name from these little spurs dorsally on its mouthparts, and these are the distinguishing feature that allow us to distinguish the invasive Asian longhorned tick from native *Haemaphysalis* species of ticks in North America. Because this Asian longhorned tick, as the name would suggest, is native to Eastern Asia, and it wasn't until 2017 that this tick was first detected in the United States outside of a port of entry. And then since then, we've seen established populations of the Asian longhorned tick documented in 17 different states, and these are along the east coast, and then some northeastern, southern, and midwestern states as well.

It's tricky because this Asian longhorned tick has a wide host range, and it is known to be able to adapt to a range of climates. And both of these factors, we expect, will contribute to the longhorned tick's geographic range expansion in North America in the coming years. And the additional complicating factor is that all of the Asian longhorned tick populations that we've detected in the United States to date reproduce by parthenogenesis or asexual reproduction. So that's where a single engorged female tick can complete her lifecycle and she can reproduce without mating (so without fertilization). And this is concerning...this form of reproduction in the tick is concerning because it can contribute to these really dense tick populations that can establish pretty rapidly in new locations, and that's what we're seeing happen in the United States.

[Sarah Gregory] Sounds like something from a horror movie.

How is the Asian one different than the indigenous one that's already in the United States—or was already in the United States?

[Meghan Hermance] Yeah, that's a good point. This Asian longhorned tick, like we talked about, it's not native to the US but to Eastern Asia. But we do have two native tick species that are relatives of *Haemaphysalis* species of ticks in the United States. One of these is *Haemaphysalis leporispalustris*, but we'll just call it the rabbit tick. And then, another species is *Haemaphysalis chordeilis*, or the bird tick. And these are different because neither of these two native *Haemaphysalis* tick species are known to cause any human disease. They're not known to transmit any pathogens that cause disease in humans.

[Sarah Gregory] Oh, okay. So how is this invasive tick getting a virus from the middle of the United States?

[Meghan Hermance] So at this time, there aren't any reports of field-collected Asian longhorned ticks being infected with Heartland virus. But this is because studies that screen these Asian longhorned ticks collected from the field, screening those ticks for pathogens are still ramping up. And so, there's a lot more work to be done with those field-collected longhorned ticks.

Of the few studies that have screened the field-collected Asian longhorned ticks for pathogens, most of these have focused on testing the ticks for tickborne bacteria and parasites—and an example of that would be the Lyme disease bacteria—but these studies haven't screened the Asian longhorned ticks collected in the field for viruses. So, the purpose of our study was to test whether this invasive Asian longhorned tick species is even capable of maintaining and transmitting Heartland virus within a very controlled setting of a laboratory.

[Sarah Gregory] I see. Alright, so there's actually not cases of it on the street yet, but potentially, like, how dangerous is it? Is it more or less serious than any of the others?

[Meghan Hermance] Yeah. The invasive Asian longhorned tick is a public health threat, while those two other native longhorned tick species that I mentioned above, they're not public health threats. But the invasive species (the Asian longhorned tick) is known to transmit several pathogens that cause human disease in its native region in Asia. So namely, the Asian longhorned tick is the main transmission vector—this is a mouthful—the main transmission vector of severe fever with thrombocytopenia syndrome virus, which is also known as Dabie bandavirus. And this virus was isolated in China the same year that Heartland virus was detected in the United States in 2009. And what's interesting is that SFTSV or Dabie bandavirus and Heartland virus are genetically very closely related, and SFTSV have caused thousands of cases in China (disease cases in China) and other parts of Asia. And it causes a very similar disease to Heartland virus, with the added risk that SFTSV can be transmitted human to human by contact with infected blood, and that's in addition to its natural transmission by the Asian longhorned tick. So we do see these links here, and that's why we consider, yes, this invasive population of Asian longhorned ticks now established in North America are a public health threat.

[Sarah Gregory] That's actually terrifying, because any other tickborne virus is just from tick to the person. But you're saying that these could...so human to human, once a person has...there's blood share for some reason, then somebody...another person can get it from that person, right? That's what you just said?

[Meghan Hermance] Yes, that's correct. And that's been shown for SFTSV virus in Asia in hospital settings, healthcare settings. And we haven't seen that form of human to human via blood transmission happening with Heartland virus in North America, but they are very similar viruses. They're closely related.

[Sarah Gregory] Just stepping back from the transmission for a second, you said it started these....it became apparent in port cities, this tick. How does that happen? Are they carried on animals? On people? I mean, how do the ticks get here in the first place?

[Meghan Hermance] Yeah, typically...so what we've...we expect happened with these Asian longhorned ticks that first appeared at ports of entry, so within quarantine in the past decade, those were typically seen on imported livestock—a lot of those types of animals are the preferred host for the adult life stage of the longhorned tick. And then more recently in 2017, that was the first time where we had documented Asian longhorned ticks outside of a port of entry and just established on a sheep farm in New Jersey. And from there, you can see the spreading of populations from that point.

[Sarah Gregory] Okay, back to your study now. You infected ticks in a lab. How did you do that?

[Meghan Hermance] Yeah, that's a fun concept to talk about. We infected adult female Asian longhorned ticks with Heartland virus by injecting a specific amount of Heartland virus through the tick's anal pore. So we used very fine glass needles to do this, because regular needles, even insulin syringe-type needles, would still be too big and would damage or kill the tick if we tried using regular needles. So we injected our ticks with these fine glass micropipette needles, and we injected Heartland virus into the tick's anal pore. And what this does is it allows us to deliver virus directly to the tick's digestive tract. And when you think about how ticks acquire virus in nature, this happens when a tick feeds on a vertebrate host, and then virus is ingested by that feeding tick and the first organ system that the virus would contact inside the tick is the digestive system. So all of that's really to say that although the anal pore microinjections are not how ticks would become infected with virus in nature, this lab approach allowed us to deliver Heartland virus to a biologically relevant organ system of the tick. And by doing this type of microinjection of Heartland virus through the tick's anal pore, we also are able to deliver a very specific, controlled amount of virus to each tick in our study. So we wanted to deliver equal amounts of virus to every tick. And again, in nature, this is something that's not really possible to generate ticks infected with equal amounts of virus when those ticks are infected naturally by feeding on vertebrate hosts. So there were some advantages to doing this form of infection in our laboratory study.

[Sarah Gregory] This is absolutely fascinating. I understand about the microneedle (the glass microneedle), but, I mean, it still seems amazing.

So how did you, essentially, physically do it? I mean, it seems so difficult.

[Meghan Hermance] Yeah. I mean, we have to have a steady hand first. But the ticks are turned upside down, so they are stuck to a piece of tape on their back. And then their anal pore, which is kind of on the stomach (the ventral side of the tick), is accessible to us. And they wave their legs around (they're stuck to a piece of tape), and then we...under a microscope, very steadily and carefully, inject that fine glass needle into the pore of the tick. So it's one of those procedures you tend to want to cut yourself off of caffeine beforehand so you don't have jittery hands.

[Sarah Gregory] I think that's amazing, there's no way that I could possible do that, caffeinated or not.

How did you figure this out? Has this kind of thing been done before? I mean, the process of infecting the tick.

[Meghan Hermance] Yeah it has, and that was really helpful for us. This method of infecting ticks by the anal pore microinjection has been performed by several research groups, specifically groups that infected ticks with virus, have done this in recent years in Japan and China. This is actually how some of the researchers in China showed that the Asian longhorned tick is capable of transmitting that virus that's closely related to Heartland virus (the SFTSV virus), and they used this same method. So it has been published on, and we had very accessible methodology to pull from the literature that helped us do this ourselves.

[Sarah Gregory] I have to ask, was there a test? I mean, that you were capable of having that steady a hand?

[Meghan Hermance] A lot of practice. We did this...some trial runs ahead of time with just ticks being injected with media. And so we could understand if we were causing damage to the ticks. We didn't want to see a lot of die-offs. And we practiced. We got, you know, pretty good at it to the point where we didn't see any die-offs from our ticks that were injected with media, like the control ticks or the ticks injected with virus. So practice did make perfect, in that case.

[Sarah Gregory] Well, well done. Your study showed transovarial transmission to ticks. Tell us about transovarial transmission.

[Meghan Hermance] Sure. Transovarial transmission means, "through the ovum or egg". So specifically, transovarial transmission is where a pathogen or a germ is transmitted from a parent to its offspring by infection of the developing egg. So this is a form...transovarial transmission is a form of vertical transmission, where we're tracking pathogen or germ presence, in this case, in the female adult tick and then screening whether that is passed to the tick's progeny (the eggs and larvae).

[Sarah Gregory] Okay. So how does this relate to the ticks that you studied?

[Meghan Hermance] In our study, we tested whether the adult Asian longhorned tick females that we microinjected with Heartland virus were capable of passing Heartland virus to their offspring (so that would be the resulting tick eggs and larvae). So in order for a tick to lay eggs, this female tick must first feed for several days in a row on a vertebrate host. So we took some of our adult female ticks that we microinjected with Heartland virus, and about a month after microinjection, we fed them on mice, allowed the fed female ticks to lay eggs, and then we tested the eggs for Heartland virus. We also allowed some of the tick eggs to hatch to larvae, and then we tested the larvae for Heartland virus as well.

[Sarah Gregory] Okay. So overall, what did you find from this experiment—the whole thing?

[Meghan Hermance] Yeah. Overall, we showed that the adult female Asian longhorned tick was capable of maintaining viral RNA (and that's the genetic material of the virus), and the adult female tick that was microinjected with virus was capable of maintaining infectious Heartland virus in their bodies for over four weeks after microinjection. And then when we fed these microinjected female ticks on mice—and we only had put one tick on each mouse (the 1:1 ratio)—we showed that four out of the five mice...that 80% of the mice seroconverted. And by that, by seroconversion, I mean that the mice displayed antibodies that are specific to Heartland virus after they had been exposed to the Heartland virus-injected ticks. So this seroconversion suggests that the Asian longhorned tick is capable of transmitting Heartland virus to vertebrate hosts in a form of transmission known as horizontal transmission.

Our data clearly shows that the Heartland virus-injected ticks that fed on mice ultimately laid eggs that were positive for the genetic material of the virus (the Heartland virus RNA). And then when we allowed some of those eggs to hatch to larvae, we also showed that the larvae were positive for the viral RNA as well as infectious Heartland virus. So this was very clearly demonstrating the transovarial transmission from the microinjected adult female to her progeny.

[Sarah Gregory] Okay, let's help the listeners and me understand this. So no Asian ticks (longhorned ticks) have shown to have Heartland virus yet, but you did infect these lab ones. So do you think this can be replicated in a real lie infection?

[Meghan Hermance] That's a really good question, and I have to start that by saying that's a yes and no type of answer, and I'll explain why. Our laboratory model shows that the Asian longhorned ticks can transmit Heartland virus transovarially. And this occurred with a very high efficiency. In other words, we showed in our study that 100% of the microinjected fed female ticks passed Heartland virus to their eggs and larvae. So given the correct environmental conditions for these natural populations of Asian longhorned ticks in the United States, the physiological ability of the Asian longhorned ticks to transovarially transmit Heartland virus should translate to nature. That's because the ticks we used in our study were the same strain of the parthenogenetic ticks found in nature in the United States.

What's unlikely to translate to real life tick infections is this high rate of transovarial transmission of Heartland virus that we detected in our laboratory tick samples. And that goes back to the method of how we infected our ticks. We used that artificial method of anal pore microinjection in the ticks, which was reproducible, and it was highly effective at generating those uniformly infected adult female ticks. It also resulted in 100% of our virus-injected females being positive for Heartland virus.

So I have to point out that's not usually the situation in nature. Every tick in a natural population is not going to be positive for virus. And from field surveillance studies that have been conducted in several states, we see that Heartland virus infection rates of the lone star tick, which is currently a native...it's the known vector species of Heartland virus in North America (the native tick species to North America), and these field surveillance studies have shown that Heartland virus infection rates in that lone star tick species are quite low. And this is similar for the related virus (SFTSV virus) in Asia, where we see very low infection rates in ticks in Asia.

So the point is that the transovarial transmission rate of Heartland virus is expected to be much lower in nature than what we see in our laboratory controlled experiment. And this is largely because of the expected infection rate of the adult female Asian longhorned ticks would be much, much lower in nature. So going back to your question, yes, the Asian longhorned ticks appear to be capable of transovarial transmission of Heartland virus, so it could occur in nature given the right conditions. But no, our lab infection rates would not be replicated in nature.

[Sarah Gregory] Would infection from the Asian virus comingle with the US virus, creating a super strain? Or would they always remain a different strain?

[Meghan Hermance] So it’s possible. But for this to happen, the Asian virus (what we've been referring to as the SFTSV virus) and then its North American relative (Heartland virus), both of these viruses would need to circulate in the same geographic region where they could infect the same species of hosts. And there is certainly the possibility of SFTSV (the Asian virus) infected

longhorned ticks being imported into North America. So that's why increased levels of field surveillance that test Asian longhorned ticks for Heartland virus and SFTSV would be very important going forward.

But back to your question, if these viruses comingle, could they create a super strain? And the answer to that is yes, it could occur, and the concept is known as reassortment. Heartland virus and SFTSV (the Asian virus relative), these are very closely related tickborne bandaviruses. And these are viruses that are single-strand RNA viruses, and they have genomes that are segmented. And so, what that really boils down to is that if two related bandaviruses like Heartland virus and SFTSV (the Asian virus), if these two related viruses infect the same susceptible host cell at the same time, their genome segments could reassort and then they could result in progeny viruses that could contain genome segments derived from both of the parent bandaviruses. And we see this happening with other types of viruses, like influenza as an example of reassortment. It's a possibility for this group of viruses that are tickborne as well.

[Sarah Gregory] What does all this mean, everything you discovered...what does this mean for future cases? Do you think there will be more, or this will increase? It's emerging, so we're kind of at the beginning, but what are your thoughts?

[Meghan Hermance] Yeah. If such a reassortment event were to occur, we don’t know whether or not this would result in more human cases. And that’s because we don’t know whether the resulting reassortant virus strain would have what we call altered phenotypic traits. An example of that would be, the reassortant virus strain could include different genome segments that may be more efficiently transmitted by the Asian longhorned tick. Or the reassortment virus could be a phenotype that's not as efficiently transmitted by the Asian longhorned tick, and then in that situation, fewer human cases. So it's something we just don't know yet, but there are ways to study that going forward, certainly.

[Sarah Gregory] Are there ways to stop this—to interrupt this process?

[Meghan Hermance] Yeah. I'm glad you asked, because with all of these tickborne diseases (and Heartland virus disease is one of them), prevention of the tick bite is very important for avoiding infection. And that's what we really have to highlight, is preventing tick bites, that individuals know where they're going to expect ticks. And in the case of the Asian longhorned tick, people need to be aware of the ticks in tall, grassy areas, meadows, shrubby-type vegetation, and tall pasture. And then, it's important that people treat their clothing and gear with products...the CDC recommends products like 0.5% permethrin. And especially during your outdoor activities (going with this idea of tick prevention), it's important to do these simple tasks like tucking your pantlegs into socks, wearing closed toed shoes and light-colored clothing (the light-colored clothing lets you see, with good contrast, any ticks that may be on you). You want to conduct these very frequent tick checks during activity outdoors, try to walk in the middle of the trail so you can avoid leaf litter and high grass. And then, of course, use repellents—that would be EPA-approved ones would include repellents like DEET, picaridin, oil of lemon eucalyptus, for example. And once you're done with all of your outdoor activities, it's very important that individuals check yourself for ticks. You need to shower, examine your gear and pets, and pay special attention to areas like your ears and hairline, under arms, between your legs, back of knees, and ankles. So a very thorough tick check is necessary, but that is the best way to stop transmission of tickborne diseases is to be very cautious of any ticks and preventing tick bites on yourself.

[Sarah Gregory] Makes you kind of just not want to go outside.

You mentioned doxycycline, I know that's what is used for Lyme disease. Is there any treatment for this?

[Meghan Hermance] Unfortunately, no. So many tickborne diseases that people often think of (like Lyme disease or Rocky Mountain spotted fever), those diseases are caused by bacteria transmitted by ticks. So in those cases, antibiotics can be used to treat those types of tickborne diseases. But since we've been talking about Heartland virus, this virus is not treatable by antibiotics, the antibiotics aren't effective. So there aren't any specific medications to prevent or treat Heartland virus disease. And when people get infected with Heartland virus, some patients may need hospitalization so they can receive supportive care. And that can be administered in the form of fluids (IV fluids), medications for fever, pain, and problems along those lines.

[Sarah Gregory] And I guess there's no vaccine?

[Meghan Hermance] That's correct. Yeah, there's no vaccine for Heartland virus. And, like we talked about a couple minutes ago, it's just...the best way to avoid contracting this disease is to prevent tick bites in the first place.

[Sarah Gregory] And why did you do this study?

[Meghan Hermance] We conducted this study so that we could gain insight into whether this invasive Asian longhorned tick species poses a public health threat for transmitting a North American tickborne virus, specifically Heartland virus.

[Sarah Gregory] Were there any surprises?

[Meghan Hermance] Well, having worked with tickborne viruses for a number of years and having conducted many other studies where we've modeled transmission of virus from tick to host, transmission of virus from host to tick, and then within the tick body, nothing really surprises you anymore. But this was our group's first study that used the anal pore microinjection method that we talked about earlier. And we were very pleased to find out how reproducible this procedure was for delivering specific quantities of virus to each of the ticks in our study. And then, you know, as I've talked with your earlier, it just wasn't an easy procedure. So that didn't come as a surprise to us, you know, doing those microinjections on live ticks while dealing with some of the challenges with the BSL3 (the biosafety level 3) laboratory containment and arthropod facility. They weren't surprising to us, but they were challenges that we had to deal with.

[Sarah Gregory] Were there any other challenges beyond those?

[Meghan Hermance] Well, this BSL3 (the biosafety level 3) research with infected ticks requires you to account for every tick, because these are infectious...this is infectious material. So this includes all of the ticks that we feed on an animal in the biosafety level 3 facility. So we can't just let the ticks feed wherever they want to on the body of the mouse and then drop off after they're done feeding. We have to use these tick feeding capsules that we glue to the backs of mice, and those capsules contain the ticks on a very specific part of the mouse's back. And like I mentioned, in this study, we just put an individual...a single adult female tick on each mouse. So it was a very nice 1:1 ratio for accounting purposes.

But as you can probably imagine, screening tick progeny from the Heartland virus-injected fed female ticks, this had some challenges. For instance, when we're counting out potentially

infectious tick larvae in the biosafety level 3 facility, we have to use additional protocols and containment procedures so that we make sure all of those tick larvae are accounted for.

[Sarah Gregory] Good heavens. And they're teeny tiny, right?

[Meghan Hermance] They are, yeah. They're quite small. We used a lot of light-colored material. It's a facility that's designed specifically for infectious work with arthropods, and arthropods is a catch-all for ticks as well as insects, like fleas and mosquitoes. We do all of that type of work in our arthropod BSL3 facility.

[Sarah Gregory] What do you think are the kinds of future studies needed?

[Meghan Hermance] Yeah. For future studies, we really need to investigate whether the Asian longhorned tick can acquire Heartland virus when they co-feed in close proximity on the same host animal with ticks that are already infected with Heartland virus. This is a concept known as co-feeding transmission, and it has been shown to occur for several other types of tickborne viruses. We need to know if the Asian longhorned ticks can acquire and transmit Heartland virus when they co-feed on the same host with other Asian longhorned ticks.

And we also need to see if Asian longhorned ticks can acquire and transmit Heartland virus when they co-feed on the same host with ticks that are native to North America—an example of those ticks would be the lone star tick (the *Amblyomma americanum*). So that would be an example of inter-species co-feeding transmission. And in that type of scenario, Asian longhorned ticks could increase Heartland virus infection rates in the lone star tick populations, which could in turn increase the risk of human infection because the lone star tick really likes to feed on humans. It's a very aggressive feeder towards humans. So overall, future studies are underway, and we need others to conduct these as well with, you know, different questions in mind where we're investigating whether co-feeding transmission occurs in relation to Asian longhorned ticks transmitting North American viruses.

We also...we'll need to confirm the presence of infectious virus in the saliva of adult ticks that we microinject with Heartland virus. And if we can detect infectious Heartland virus in the tick saliva, that would allow us to rule out the possibility that the mice in our study seroconverted or generated those antibodies specific to Heartland virus just because they were exposed to high levels of noninfectious virus, or you could call it "dead" virus, during the Asian longhorn tick feeding. So that's why screening virus from the tick saliva and confirming that it is infectious would be an important future study as well.

[Sarah Gregory] Are any of these studies on your plate? Are you in the process of setting them up?

[Meghan Hermance] Yes. Yeah, they are underway. We are actively working on these co-feeding transmission studies where we're co-feeding Asian longhorned ticks on the same animal as other Asian longhorned ticks, where some are infected, and others are not. And then we have...we'll be setting up soon...next month we'll be looking at inter-feeding or co-feeding transmission between different species—so, inter-species co-feeding transmission. So that's where we're ramping up our other tick species (the number of lone star ticks) that we can co-feed with infected longhorned ticks. So it's all underway and stay tuned.

[Sarah Gregory] Okay. Well, hopefully EID will get them, and maybe we'll get to do another podcast.

What's the main public health lesson from your study?

[Meghan Hermance] Our data show that the Asian longhorned tick is capable of transovarially transmitting Heartland virus to its progeny. And since reports of all of the Asian longhorned tick populations collected in the field in the United States have been limited to the ticks that have reproduction by parthenogenesis and not bisexual ticks. This means that a single female tick can lay hundreds of eggs without mating. So the evidence that this invasive tick species can transmit Heartland virus in the transovarial mode without the need for a mate...this is worrisome. It highlights the need for continued Asian longhorned tick surveillance, and this includes testing the field-collected ticks for tickborne viruses, including Heartland virus as well as other viruses, like Powassan virus and Bourbon virus.

[Sarah Gregory] Tell us about your job—it's a pretty, I think, unique niche—and how did you get into it, how did you get interested in it, what led you to it?

[Meghan Hermance] Yeah, of course. I've been interested in vectorborne diseases as far back as high school, doing field surveillance projects for mosquito species in the greater Houston area, going that far back. But, you know, through my graduate studies at University of Texas Medical Branch and just really diving into the field of tickborne virus transmission, I ultimately landed here in a position that I'm in now where I'm continuing that type of work. My current research program is investigating tick-virus-host interactions. And ultimately, we seek to discover where there are biological weak links in transmission cycles that we can target for novel tickborne disease control strategies.

And then, in my current position, this involves training and mentoring graduate students. Our team includes undergraduate student researchers and research technologists, as well. I'm just...I'm lucky to be able to work with this amazing group of colleagues, the other trainees and faculty in the department of microbiology and immunology. These people are very brilliant and hardworking, but we also have that unique environment where we're able to have fun together, as well.

And specific to my job, I get to perform a variety of activities. You know, no two days are the same for me, and I love that. In addition to assisting with lab experiments and mentoring and training researchers, I get to spend time in my office writing papers and grants. I serve on committees within the university and overall contribute to graduate student education through a variety of activities. So it's a fun place to be at this point in my career. I'm just fortunate to be in this group of individuals.

[Sarah Gregory] Tell us a little bit about your private life. You live in Alabama. What do you do there in your leisure time?

[Meghan Hermance] Yeah. Alabama...so I'm in Mobile, Alabama. And this is a beautiful, old port city. I didn't realize until I moved here how old it really is. So I've enjoyed learning about culture and history of this city. I guess one example of that is that Mardi Gras actually originates in Mobile, so not in New Orleans. We are very proud to claim that Mardi Gras is originally from Mobile. And so, there's a huge culture for that here, and much of the city of Mobile participates in one way or another every year during Mardi Gras. And even my house is a little piece of history, since it's turn of the century. And I guess, you know, as you'd expect with an old house comes both the charm and then the projects, too. So that keeps me busy, which is fun. And, you know, we're just positioned...this city is positioned along the coast. So Alabama and Northwest

Florida have beautiful beaches, and they're not far. Some of them are under an hour away. So I've really enjoyed exploring that part of the Gulf, as well. I'm originally from Houston, Texas, but this is a different part of the country, and it has been a great place to work and live.

[Sarah Gregory] Well, thank you so much for taking the time to talk with me today, Dr. Hermance.

[Meghan Hermance] Thank you so much for the invitation, Sarah. I really enjoyed chatting with you about these topics.

[Sarah Gregory] And thanks for joining us out there. You can read the March 2022 article, Transovarial Transmission of Heartland Virus by Invasive Asian Longhorned Ticks under Laboratory Conditions, online at cdc.gov/eid.

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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