

Ticks and Lyme 101: an Interview With Dr. Peter Rand and Charles (Chuck) Lubelczyk in January 2018

Introductions

Peter: *I'm Doctor Pete Rand, and I'm one of the founders and an emeritus codirector of the Vector-Borne Disease lab at The Maine Medical Research Institute, and we've been involved in the research into the ecology of ticks and now more recently mosquitoes for the last 27 years.*

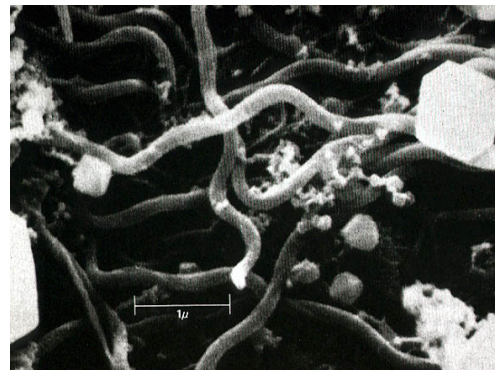
Chuck: *I'm Chuck Lubelczyk. I started out as a Wildlife Biologist, and now I've graduated to the title of Vector Ecologist which means I get to work with ticks and mosquitoes studying their distribution in abundance. A lot of our work on tick-borne disease research is focused on coastal and island communities since the mid 1990s and we have done extensive work on many of the islands tracking the tick population and their infection prevalence with different pathogens.*

What exactly is a vector-borne disease?

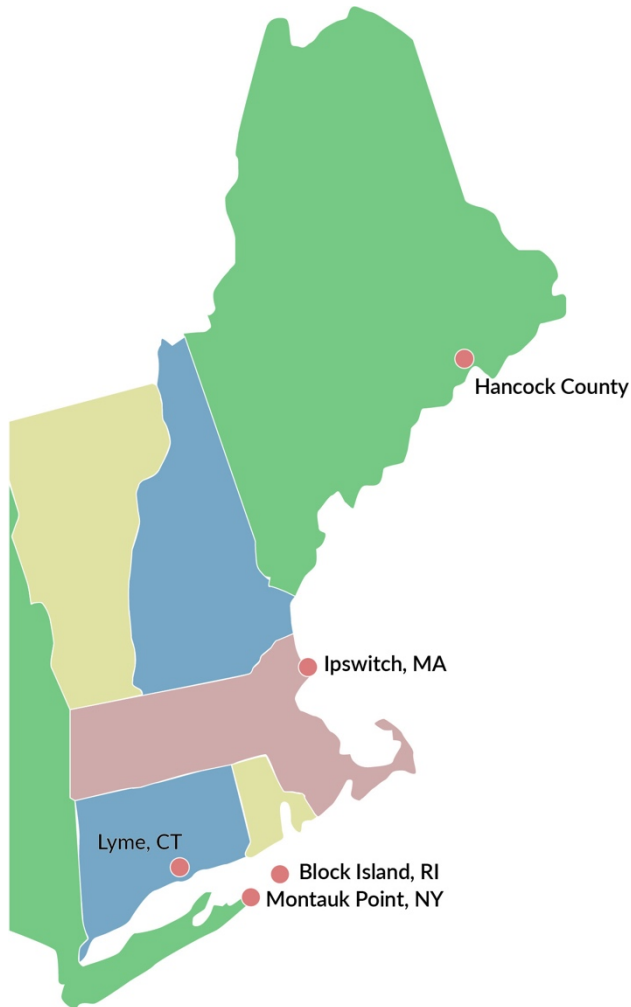
Chuck: *A vector-borne disease is a disease that will be of either public health or veterinary health implication. It is caused by the bite of an infected—usually arthropod—in our case ticks or mosquitoes that will transmit a disease agent to either people or animals.*

What is Lyme disease?

Peter: *Lyme disease has become in the United States the primary vector borne disease now. It is a disease which is caused by a spirochetes—spiral bacteria—that is transmitted by the tick when it bites people and transmits the bacteria and then it causes flu like symptoms usually within a week to two or three weeks after the bite—they may develop a rash—as a matter of fact about 80% of them do develop the rash, and the rash is a very specific type of rash. It's usually circular and sometimes it clears in the middle, so it looks like a target. But they may also develop neurological diseases: they may get palsy on one side of their face, they may get particularly joint symptoms with hot swollen joints, and this is the acute stage of the disease and it is almost completely curable given the right antibiotic for a period of time. Sometimes the disease is not treated, and it goes into a more chronic stage which is usually more arthritic but then also sometimes more neurologic over time. But usually—even then—treatment with antibiotics makes it curable.*



A microscopic view of the Lyme spirochetes



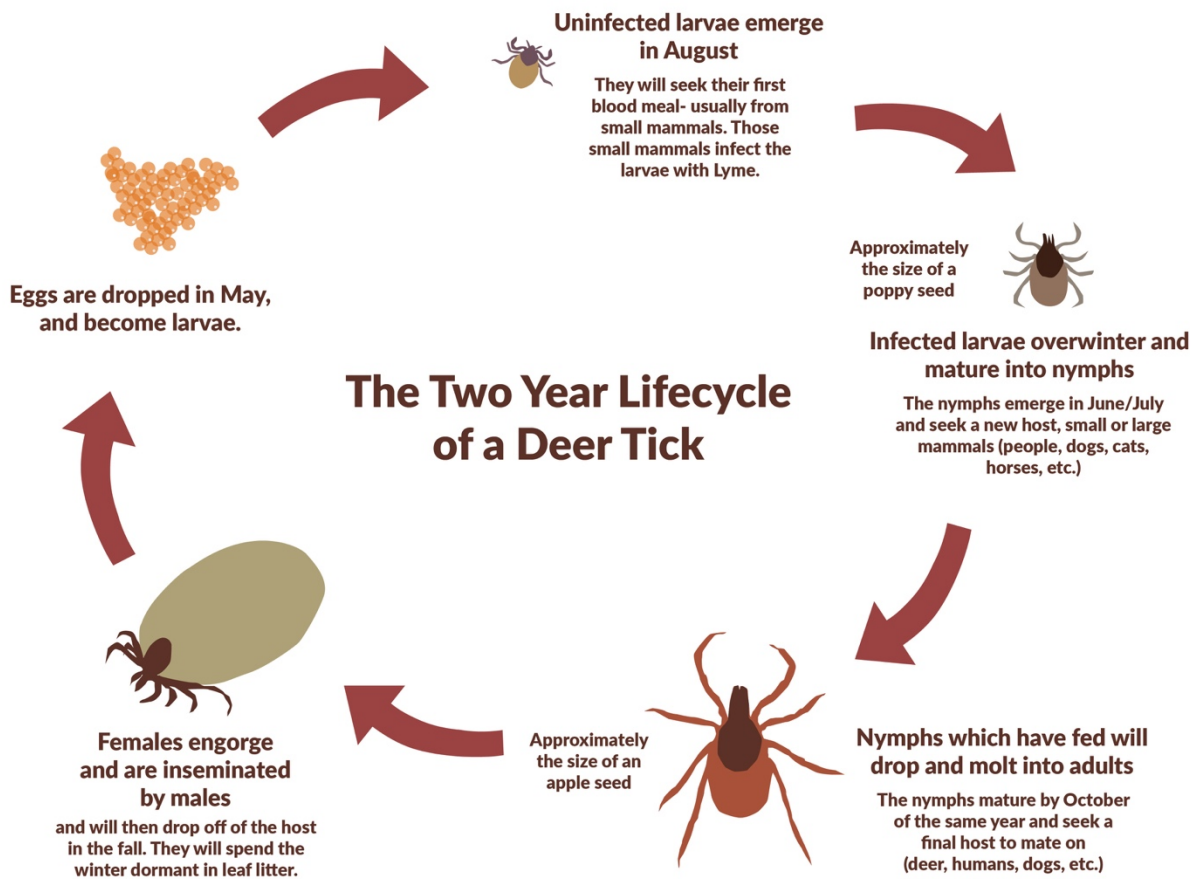
What is the history of Lyme disease?

Peter: *The disease was first recognized down in Connecticut in 1975 by Doctor Alan Steer. It was quite rampant on Block Island and Montauk Point in New York and then up the Connecticut coast. And it gradually moved northward along the coast until 1985.*

There was an outbreak of it down in Ipswich Massachusetts where a fairly high percentage of people living in the town infected with it. There was a large deer herd in the town. At that point we were concerned that it might be coming into Maine. And so at the Maine Medical Center Research Institute we established a lab to survey ticks in the state to see if the tick that was carrying the disease—the deer tick—was here and to have people identify ticks and send them in to us so we could watch the spread of the disease as it came into the state and try to figure out strategies that we might be able to develop to help control the tick.

Since then it has expanded as the disease has expanded throughout the state—primarily the southern part—but now in the middle part and a little bit in the northern part of the state. And as time has gone on, we have been examining such things as the role of birds in transmitting the tick to the state to bring the disease here.

Chuck: *In addition to Lyme, we have other pathogens as well now that we see, and Maine isn't any different from other states in the Northeast. We have—as far as we know—at least 5 tick borne diseases. Lyme disease is one of them, but we have other diseases such as anaplasmosis, babesiosis, a viral disease called Powassan virus, some of which have appeared on Maine islands and some of these are islands that are stretching up into Waldo and Hancock county, so they are certainly outside of what we could consider the longstanding hot areas of the state such as southwestern Maine.*



What are the hosts a deer tick seeks throughout its lifecycle?

Peter: The ticks primarily are interested in getting on deer. When the males get on deer they just stay there and keep inseminating the females. And the females will engorge, drop off, and then after they drop off—say in the late fall—they will overwinter, and then when they come out in the spring time, they will drop their eggs in May. And when they do that, the eggs will then develop into larvae. The larvae will emerge from those eggs in August. The larvae now are uninfected. And they will then seek a host—usually mice and small mammals. Originally it was thought that mice were the primary host—and they still are a major host—but also chipmunks, red squirrels, and other small mammals can also be host to the tick, and those animals maintain the infection within them. So, the uninfected larval tick will drink blood from the infected mouse then it will overwinter and in the next spring develop into a nymph which may be infected because the infection will carry over the molt. Those nymphs will go out and they will be interested in not only small mammals but also in people, dogs, horses, and other animals.

Those nymphs are the primary vectors for the disease in humans. The nymphs will come out in June and early July. We find that people start getting Lyme disease at about the same time—a couple weeks later. And the peak of Lyme disease in people will be some time around mid-summer. However, the nymphs that have fed will drop into the leaf litter and then later on the same year in October will molt into adults. Even though they are larger and even though they are frequently seen when they are on you and you can remove them—nevertheless they also transmit the disease to humans so there is a second bump in human and in canine infections at that point.

Chuck: To talk about size of the ticks—commonly when people are talking about the nymphal ticks they are the ones that are referred to as the size of the head of a pin. And if you want to use a food analogy you can think about them being about the size of a poppy seed—quite small. The adults that Peter mentioned that are out in the fall are going to be larger though. And they're about the size of an apple seed—so quite a bit larger and more noticeable. And one of the things we do here is that many people don't realize that deer ticks are larger in the fall—that physically they are bigger ticks because they are older. And we hear a lot of folks that will throw these large ticks away after the first of October because they don't realize that they're deer ticks, but people do need to realize that these adult deer ticks will be out in the fall and they will frequently emerge around the first week of October. If it's a mild winter, we can have them well past Christmas in southern coastal areas. If the temperatures stay above 40 with no snow, it's very possible to find them even towards the end of December in some areas. They're out, and people can encounter them in fairly substantial numbers close to Thanksgiving if the temperatures are mild enough.

Tell me more about ticks and the temperatures they can survive in.

Chuck: If we were in a January where we didn't have a lot of snow right now and we had our typical thaw of three or four days close to 40 degrees then we would have tick samples sent into our lab. People would find them out in the woods. Normally this time of year what encounters the deer ticks are going to be dogs. Because dogs will be out for a walk, and they will lay down on the ground for a few minutes and take a rest. Their body heat will actually activate the ticks under the leaf litter. And the ticks will come up to the surface, get on the dog, and then they're found. At this time of year not as many ticks will get on people because people aren't down close to the ground where the ticks are. But when we do have mild winters and very early springs—2012 is a good example where we had temperatures in late February in the 50 degree area (Fahrenheit). We certainly had a very early tick season and by the first or second week of March the ticks were out the gate like gangbusters. Because it was so mild out.

Peter: This winter has been rather extraordinary in one extent, in that the last couple of weeks have been bitterly cold. And the question is: does that cold impact the overwintering of the ticks- if it's very very cold will it kill the ticks so there will be less ticks for next year. We're in the middle of the third year of a study to examine that very fact. Out here in Cape Elizabeth

we have a number of what we call tick pots in which we have buried temperature monitors to see how much the cover over the tick will protect it.

Chuck: A lot of people may not realize that snow is actually a very good insulator. It's a really good protective cover for a lot of things that live close to the ground. And it acts as a real good buffer against these really frigid sub-zero temperatures that we've had. And I think that the data will probably play into a larger picture when we look at climate change- at impacts on different weather patterns. Certainly, the two years prior to this one (2015 and 2016) we've had pretty mild winters. We've had even early days in January where it's been close to 40 degrees with very little snow cover. And I think as our winters are changing—which I think they are to some extent—we can see a potential impact on the survival and perhaps spread of these ticks.