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Q: Talk about connection between animal and human health.

A: [1.59] Absolutely, the concept of one medicine has been around for many, many years but has only intermittently been embraced by veterinary and human medicine. Historically, many of the infectious diseases that can infect an animal can also infect a human being and more recently people have quantitated those infections to the point of 75 percent of all recently discovered – or what are referred to as emerging infectious diseases – are now known to induce disease in animals and humans or be carried by an animal and ultimately induce disease in a person.

Q: [2:45] So, if I can find a disease in an animal and treat a disease in an animal, will that, in some cases, help me find and treat diseases in humans?

A: [2.58] It's very clear that if you're looking for new and emerging pathogens, you're probably going to be more successful in finding these organisms that were previously undiscovered by studying animals. Animals have far more environmental contact, particularly with vectors or insects that transmit infectious agents, than does the average person.

[3:25] If the same organism causes disease in an animal and a human and it's more likely to find it in the animal, you can then extrapolate to the human and try to determine whether you can find that same organism in a person that you found in an animal. [3.41]

Q: Tell me about Bartonella. It's not an emerging pathogen, but perhaps our understanding of it is emerging.

A: [4.01] A very new genus of bacteria to a great extent, or one that literally has been rediscovered, is the genus Bartonella. Historically, if we go back to 1992, only two Bartonella species were known to exist and they actually had different names at that point in time: one in south America, Bartonella bacilliformis, and the other caused trench fever, Bartonella quintana. Now, we as scientists have discovered 26 different Bartonella species so we've gone from just a couple to a large number. And there's two really important facts relative to the Bartonellas. One is many animals carry these organisms without showing obvious signs of disease, and two, the number of insect vectors that can transmit Bartonellas continues to grow as research and our understanding of these organism increases. [5.06]

Q: You're talking about fleas, right?

A: [5.10] The vectors that are definitively know to transmit Bartonella include lice, so the human body louse would be one example. For the trench fever agent, fleas which can transmit Bartonella amongst rodents and cats, and that work has been well established. And other vectors, such as ticks and biting flies, wingless flies, have all been recently implicated as being able to transmit these organisms among various animals populations throughout the world. [5.48]

Q: Why should I worry about Bartonella?

A: [5.50] Well, our knowledge of this genus of bacteria is really changing very, very rapidly and one of the major changes that has evolved from our research here at North Carolina State University where historically it was only thought that someone who was immuno-compromised with AIDS or some other severe suppression of the immune system could develop a Bartonella infection. And these organisms infect the bloodstream and the cells lining the blood vessels – the endothelial cells.[6.69] What we know now as a result of research from our laboratory is that Bartonella infects a lot of people, it infects immuno-competent people and that in an immuno-competent individual, these bacteria are much, much more difficult to detect. [6.47]

[6.47] I think as our knowledge has improved, it's pretty obvious that most people may not get through life without being exposed to one or more Bartonella species. In many cases the immune system probably eliminates that infection once an exposure's occurred. But in some instances, outwardly and seemingly healthy individuals develop a chronic infection of the bloodstream that ultimately can manifest in a variety of ways, including infection of the heart valve, abnormal electrical activity in the heart, and based on more recent observations that need to be confirmed with future studies, rheumatologic diseases and neurologic diseases. [7.40]

[7.47] About a year ago I was contact by a mother who related the history that she, her husband and her son had all been sick for at least a decade. The boy was 10 years old and both parents were ill for several years prior to their children being born. The medical situation was quite unique in as much as the son had a twin sister who died shortly after birth and the twin sister had a congenital heart defect so we initially started by doing blood cultures on the members of the family and found that the boy and the mother were infected with two Bartonella species and they happened to be infected with the same Bartonella species, the same subspecies and the same strains.[8.47] So as well as we can tell with these organisms it was pretty likely that they had infection with the same organisms. Through cooperation with the mother and the attending pathologist, we were able to obtain tissues samples from the child that died at nine days of age and we found the same two Bartonella species in the tissues from the child, suggesting that the child was most likely infected in utero although the children were born by Caesarian section so the manuscript is entitled perinatal transmission of Bartonella henselae and Bartonella vinsonii subsp. Berkhoffii of two children.

Q: So the infection could have been spread during birth, rather than prior to birth?

A: [9.32] The little girl had multiple blood transfusions and it is possible that during the surgical procedure, if there was contamination between the mother's blood and the children in some way, that transmission could have occurred at that point in time, versus in utero where that would not have been the case. [10.00]

Q: But it sounds like you think it occurred before the children were born?

[10.07] I think it's very likely that it was in utero infection and one of the reasons I believe that is that now we've identified a couple of other families in which multiple individuals within the family are sick,

including the children. So I believe that we are going to find that not only are Bartonellas transmitted by bites and scratches from animals, by a spectrum of insect vectors but also perhaps during in utero transmission. [10.41]

[10.57] we have historically blamed transmission on bites or scratches from animals, transmission by insects biting someone and now there is the possibility that transmission is occurring from the mother to the child. [11.21]

Q: What are the implications for the family? Are they getting treated?

A: [11.41] The implications of our finding for the family have yet to be determined. One of the difficulties of highly adapted intravascular organisms is trying to prove the extent to which these bacteria cause disease. [12.00] And disease causation cannot be established through a case report or a case series. For this particular family who had sought care from numerous physicians, numerous specialists and historically had been evaluated for many different disease processes, there was never anything identified or any treatment that had been attempted that had benefited members of the family. So they are currently being evaluated by physicians in the area in which they live for treatment for Bartonellosis. 12.44

[12.50] Clearly other manuscripts that we've published in which people had an accurate diagnosis of having Bartonella in their blood and were treated appropriately, have resulted in a complete therapeutic response and total resolution of disease manifestations. [13.12]

[13.25] Based on our experiences over the past two years it seems highly likely that Bartonella can be a cause or a co-factor in some chronic illnesses. It is really important that the veterinary medical profession and the human medical profession begin to sort out what these bacteria are actually doing in our respective patient populations, better understand how they are being transmitted and what the risk is for exposure and infection with these organisms. [14.09]

Q: So are thousand of people are now being tested?

A: [14.31] The difficulty that I've come to appreciate in the past few years is when a new genus of bacteria is discovered – and perhaps we could use Lyme disease as an example – it takes many, many decades, numerous studies and probably a lot of controversy before it is clearly determined what those organisms are doing, how they're transmitted, what type disease manifestations they're actually capable of inducing in a patient or patient population. I've had tremendous difficulties in finding researchers, collaborators, and supporters either on the veterinary medical side or more importantly on the human medical side to take Bartonella seriously as a genus of bacteria and to come up with the resources that are clearly going to be necessary to sort out the medical importance of this genus of bacteria. [15.41]

Q: For example, your most recent paper was not accepted for publication by the New England Journal of Medicine.

A: [15.49] The manuscript that will be published in the Journal of Clinical Microbiology was initially submitted to the New England Journal of Medicine and had relatively positive reviews with questions and concerns that were readily addressable. However, it was decided (and the New England Journal of Medicine is a highly prestigious journal that rejects many, many more manuscripts than it accepts) that the manuscript would not be published there. Again, I think, because this genus of bacteria is not yet perceived to be important and because describing case series or case reports is not as scientifically valid in regard to evidence of causation is the reason that it was not accepted in a medical journal versus a microbiological journal where we emphasize our enhanced ability to detect these bacteria. [16.53]

Q: How do you handle the time commitment?

A: [17:15] Well, if you ask my wife I don't handle the time commitment very good. I went from working 12-hour days to 14- or 16-hour days, but I've decided that at this stage of my life and this stage of my career what I'm doing is far more important than anything I ever thought I would do, either as a veterinarian, a clinician or a researcher and therefore the time commitment, the emotional commitment is justified, at least as long as I can keep up with it. [17.48]

Q: How do you get the word out to the medical community?

A: [18.40] In regard to Bartonella and the diseases that this organism causes, there's going to be a very rapid evolution in the clinical literature and hopefully the scientific literature related to this genus of bacteria. I don't think that the manuscripts that we've published where repeatedly we can demonstrate the presence of this organism, particularly in veterinarians and veterinary professionals who are at an occupational risk for exposure to two very important Bartonellas that are carried by cats and dogs, can be ignored. [19.31]

The types of illness are very subtle, very chronic and could lead a person to potentially see a neurologist, a cardiologist, a rheumatologist, and what it's going to take in the future are very structured studies that ask very defined questions relative to specific patient populations to be able to provide the overall evidence that's needed to establish how important these bacteria really are as a cause of human illness. [20.10]

If I'm correct, they are extremely important, they were historically not known to exist. If we go back into the early 90s there's been a rapid expansion in species, a rapid expansion in known vectors and a rapid expansion in reservoir hosts – essentially those animals walking around out there in nature carrying Bartonella. [20.36]

For example, one of the newest named Bartonellas is Bartonella australis which you can find in a kangaroo in Australia. If you look at flying squirrels, ground squirrels and groundhogs in the southeast United States, each of those Bartonellas have their own specific Bartonella species that they carry in their blood. People, as we have become more comfortable or more inclined to become close to nature, particularly if it's in our backyard, can get scratched or bitten by a squirrel or a groundhog or another animal pretty easily. [21.19]

So I think from our limited view of what we see in regard to these bacteria right now, I think they are going to be of tremendous medical importance. Proving that is yet to be done.

Q: Where do you go from here?

A: [21.49] We've been carrying this work forward in a couple of ways. Several years ago I approached industry representatives, both in human medicine and veterinary medicine, many of whom were good personal friends that I've known for decades, in an effort to try to find someone or some company that would undertake the development or the adaptation of the diagnostic testing platform that we had developed here at NC State. I was very unsuccessful in this endeavor and for a variety of reasons ended up helping to start a company that now exists in the Research Triangle Park that's called Galaxy Diagnostics. [22.33] Galaxy Diagnostics launched animal testing in the fall and launched human testing three weeks ago so one thing that will help generate information for veterinary clinicians and human physicians as to whether these bacteria are in their patients or not is a newly formed company.

What Galaxy will also do for me as a researcher is take some of the pressure off from the daily e-mails and phone calls I get from people with chronic illness and allow us now to back up and refocus on some of these very specific studies that we believe need to be done. [23.11] In addition, in collaboration with Duke University Medical Center and a rheumatologist in the Washington area, we've done two very large studies looking at different patient populations and we're in the process of putting that data together. So although it's not a prospective, case-controlled study, it will be two very large case series that should give us a much better idea of what these bacteria are doing and will again, I hope, energize research at the federal level to better address this genus of bacteria. [23.56]