Blood Vessel Penetration

Here are some things we know: The pathogen that causes Lyme disease is *Borrelia burgdorferi* and it is a highly motile spirochete that belongs to a genus of bacteria that are notorious for giving rise to variant strains. But it is equally known for the ability to penetrate blood vessels.

Inside the Tick: *Borrelia burgdorferi* enters the human bloodstream through the bite of infected tick. When the bacteria was in the gut of the tick the bacteria adapted to a cold environment and had no immune system to worry about evading. The bacteria intermingled unharmed inside the tick. What this means is that the bacteria are not geared up to do battle with the host's immune system while safe and sound inside the tick. So it goes into a state that best helps the bacteria adapt to a cold environment. But this changes when your blood starts entering the tick's belly.

When a tick bites:

- The tick injects an anesthetic to stop pain
- The tick saliva has an antihistamine to inhibit itching
- The tick saliva has an anticoagulant to keep blood flowing
- The tick saliva has a immunosuppressive to reduce WBC attacks
- The tick injects a glue and glue's its head in place in your skin
- The tick releases an enzyme that dissolves the glue in seconds

(This is a highly evolved critter!)

It is believed that ticks act as a mixing pot for different Borrelia species and share genetic information between themselves.

While inside the tick there is no need for the Lyme-bacteria to use its extensive defensive mechanisms, but the bacteria are equipped and ready for the next step which happens when it comes in contact with human blood.

Blood Vessel Adhesion: When the tick feeds on a human the warm blood enters the tick. Proteins in human blood immediately begin to prime the bacteria to become ready. As tissue plasminogen and other blood factors bind to the spirochetes, the bacteria get ready to express surface proteins for blood vessel adhesion. With each new division, the bacteria will begin to

express new surface proteins designed to let them evade the immune system, exit the bloodstream and enter other tissues and organs.

This means: As the tick feeds on your blood, the bacteria inside the tick are becoming primed to survive and thrive inside the human bloodstream.

When this highly motile bacterium enters the blood, every beat of the host's heart sends the bacteria to every part of the body. The host's body heat and the new found warmth also triggers the expression of a new set of Outer Surface Proteins (OSPs), some of which like Decorin Binding Protein and OSP-C help the Lyme spirochete to attach to the inside lining of the blood vessels. The attached bacteria then rocks back and forth along the endothelial cells of the blood vessel.

The host responds by releasing a mixture of inflammatory factors that lead to a cascade of enzymes and blood proteins to the site of the irritation. Tissue plasminogen is converted to plasmin, basement membrane laminase, hyaluronidase, histamines, vasoactive amines and other proteases are activated including metalo matrix protease 9 MMP-9 a substance that helps erode collagen and plays a key role in brain invasion. This leads to the breakdown of the blood vessel extracellular matrix and soon holes appear in the blood vessels exactly where the bacteria have attached.

> **Lyme Bacteria Factoid:** The Lyme spirochete can travel 100 times faster than our fastest immune cells.

The Lyme spirochete has also learned how to attract white blood cells to assist in this process. Normally white blood cells like neutrophils and macrophage's and killer T-cells are a bad thing for bacteria, but the Lyme pathogen then triggers these cells to approach the attachment site and release substances that actually help create holes in the blood vessels.

Ironically, the very immune cells that should be killing the bacteria, are helping them escape!

However the Lyme spirochete even has more tricks up its sleeve.

The bacteria can penetrate blood-vessel-endothelial cells and live inside them. They can penetrate, survive inside, and even kill human B-cells; the cells that usually produce antibodies.

The bacteria can also penetrate skin cells and live inside skin fibroblast cells unharmed and undetected, and in the test tube antibiotics cannot penetrate and kill the Lyme spirochetes that are inside these cells!

Isn't it amazing that within hours of entering the human body that the bacteria can immediately use the very first cells it comes in contact with to hide inside them completely safe and sound away from the immune system! It is a good argument for evolution.

Another blow to your defenses can come when the tick is co-infected with Anaplasmosis which can lower your neutrophil count in days to the point that you have compromised immunity.

How long does it take for the Lyme bacteria to penetrate a blood vessel? In a real-time film, researchers from Canada have shown it takes mere minutes to attach, penetrate, and forever disappear into deeper tissues. .

(See spirochetes unwound video at http://spirochetesunwound.blogspot.com/)

Let's examine this aspect for a minute. Aren't we told by Yale that the ticks have to be attached 36-48 hours to transmit Lyme? Aren't we told that tick bites should be treated with only one day of doxycycline? Aren't we told that it takes 6 weeks for the immune system to make measurable levels of antibodies? Aren't we told that physicians should not treat until two antibody based blood tests are positive?

To wait for a rash and two positive blood tests takes about eight weeks and possibly longer if a doctor is reluctant. We know the bacteria can hide inside human cells in mere minutes of entering the blood stream? If I were a parent I would be a little concerned about the cavalier attitude of not treating this disease with more respect.

Maybe early endothelial cell invasion was something they should have reexamined in 1982 when we knew Lyme was caused by a spirochete known to be intracellular and enter the brain and become incurable.

Ma Y, Sturrock A, Weiss JJ. Intracellular localization of *Borrelia burgdorferi* within human endothelial cells. *Infect Immunol* 1991;59:671-8

By 1982 there was over seventy years of readily-available evidence that Borrelia species quickly penetrated the blood vessels and entered the brain. This evidence was ignored.

In Dr. Allen Barbour's *"The Biology of Borrelia Species"* and other references, it is suggested **that using dilutions of culture that are diluted to the point that just a few bacteria are present, was still enough to transmit active Lyme Disease to animals.**

Even if the risk is low that a few bacteria are found in the tick's salivary glands when it bites, it seems that the fact that just a few is all it takes should make us take pause at not treating tick bite from endemic areas.

Remember the argument that only Ixodes dammini ticks transmit Lyme disease because they regurgitate blood from their midgut back into the host. Remember this takes 36-48 hours into tick feeding. Remember that the Deer tick doesn't transmit Lyme faster because the bacteria is not in the tick saliva which is injected immediately? Well the same OSP-C surface protein that helps the bacteria transit blood vessels also helps the bacteria enter the tick's salivary glands. So we know the bacteria is trying to get to us quicker, and evidence now supports that they do!

> **OspC facilitates Borrelia burgdorferi invasion of Ixodes scapularis salivary glands**
> Utpal Pal, Xiaofeng Yang,Manchuan Chen, Bockenstedt, J. F. Anderson
>
> . These studies conclusively demonstrate the importance of OspC in the invasion of tick salivary glands by*B. burgdorferi*, a critical step in the transmission of spirochetes from the arthropod vector to the mammalian host.
>
> ***J. Clin. Invest.* 113:220–230 (2004). doi:10.1172/JCI200419894.**

Considering the seriousness of this disease perhaps our "*medical-experts"* should be a little more aggressive in treating tick bites?

Before dismissing any tick bite please read Dr. Elizabeth Maloney's position paper on prophylactic treatment of tick bites in endemic areas.

The Management of Ixodes scapularis Bites in the Upper Midwest

Elizabeth L. Maloney, MD

Wisconsin Medical Journal volume 110 • no. 2 79

Also how do the current guidelines that advocate not treating tick bites of less than 36 hours of attachment account for improper removal of ticks?

What about undetected ticks under the scalp?

Relapsing Fever *Borrelia recurrentis* is transmitted when you scratch your head infected with lice and the bacteria enters your bloody scalp.

Children are especially prone to squeezing ticks attached to them. Yet everyday children are told to wait and see if they get a Lyme rash instead of being given an antibiotic. The reason for this isn't that your doctor doesn't want to treat, but he or she knows it throws up a red-flag to medical review boards and clinic administrations as being an antibiotic "over-prescriber".

In a reply to a patient's letter to the editor Dr. Johann Bakken MD used his authority to reassert that it takes 36-48 hours for an infected tick to infect a patient.

[Duluth News Tribune November 26th, 2010]

Dr Johann Bakken MD

…it takes 36 to 48 hours before the spirochetes are passed <u>efficiently</u> into the host. It therefore follows that a daily inspection of all skin areas after exposure in tick endemic areas, followed by prompt removal of attached ticks, markedly reduces the chance of acquiring Lyme disease.

Dr. Johan S. Bakken is a consultant in infectious diseases at St. Luke's Hospital, Duluth, is co-author of the IDSA Treatment Guidelines for Lyme Disease, 2006, and is a member of the IDSA board of directors.

Dr Johan Bakken took part in writing the now infamous 2006 IDSA guidelines which advocates two tiered testing for Lyme. But here is what Bakken had to say about two tiered testing before signing off on the 2006 guidelines that advocate for two tiered testing.

Commercially available FDA-approved kits are only 36-70% sensitive… the ELISA assay does not have adequate sensitivity to be part of a two tiered approach to diagnosis.

Johan S. Bakken Journal of Clinical Microbiology, 1997 [35(3): 537-543] IDSA Lyme Disease Guidelines

(No relation to Dr. Lorie Bakken PhD)

More Contrary data on 2-Tiered Testing:

NY Dept Health 1996:
We found CDC 2-tiered testing missed 82% positive Lyme cases. Dept of Health report to the CDC

April 15, 1996

Johns Hopkins study 2005: found CDC 2-tiered testing missed 75% of positive Lyme cases IDSA Lyme Disease Guidelines

The next two studies by Dr. Lorie Bakken PhD shows that when blinded identical samples were sent to over 500 laboratories across the USA; that the ELISA screening test only had about a 50 % accuracy and nowhere near the false positive rate that was being touted by the “Lyme Experts”!

I’m sorry but data from blinded studies funded by a college trumps the comments and claims of test accuracy from people who hold patents on Lyme tests, and then telling us how good their tests are!

Bakken LL, Callister SM, Wand PJ, Schell RF. Interlaboratory Comparison of Test Results for the Detection of Lyme Disease by 516 Participants in the Wisconsin State Lab of Hygiene/College of American Pathologists Proficiency Testing Program. *J Clin Microbiol* 1997; Vol 35, No 3:537-543

Bakken LL, Case KL, Callister SM et al. Performance of 45 Laboratories participating in a proficiency testing program for Lyme disease serology. *JAMA* 1992;268:891-895

So my question is: If we are not to treat tick bites, and wait 8 weeks or longer for two tiered tests to come back, and the screening test is 36-70 % accurate: Aren't we asking patients to risk severe infections of deep tissues? This sounds like a recipe for medical disaster.

The patient who wrote the letter that Dr. Johan Bakken referred to, was already infected and relapsed. So this information on tick bites seems a bit useless and moot to her, but then do you see the word *"efficiently"* ? Didn't Dr. Allen Barbour just say that a mere few bacteria are needed to cause an infection, and live animal studies show it takes mere minutes to attach and penetrate a blood vessel. Doesn't it follow that even an inefficient infected tick might transmit a low number of bacteria that could be so low as to evade the immune system?

Now let's look at this ability to penetrate blood vessels more closely. What if the vessel we are talking about is in the human knee joint? Isn't that a place the bacteria thrive? Swollen knees are often seen in Lyme disease. After all, the connective tissue located there is a food source for the bacteria.

A place often not talked about is the male testes. This organ is a "Blood-Protected" area meaning it has a blood-testes-barrier similar to the Blood Brain Barrier. In the early literature we often heard of swollen and painful testes in men. Now this is rarely mentioned, but my point being: How did the Lyme infection get into the testes? It was by breaking down the blood vessel integrity. In a young man this has the potential to affect fertility. One of my first graduate projects was detecting antibody coated sperm in infertile men in 1977. Antibodies can only attack sperm if the sperm comes in contact with white blood cells long enough to attack the hosts' own body namely the sperm cells. Perhaps Lyme disease played an unknown role in this phenomena?

But what if that blood vessel that the Lyme spirochete attaches to is the umbilical cord and placenta? Could the bacteria enter the fetus?

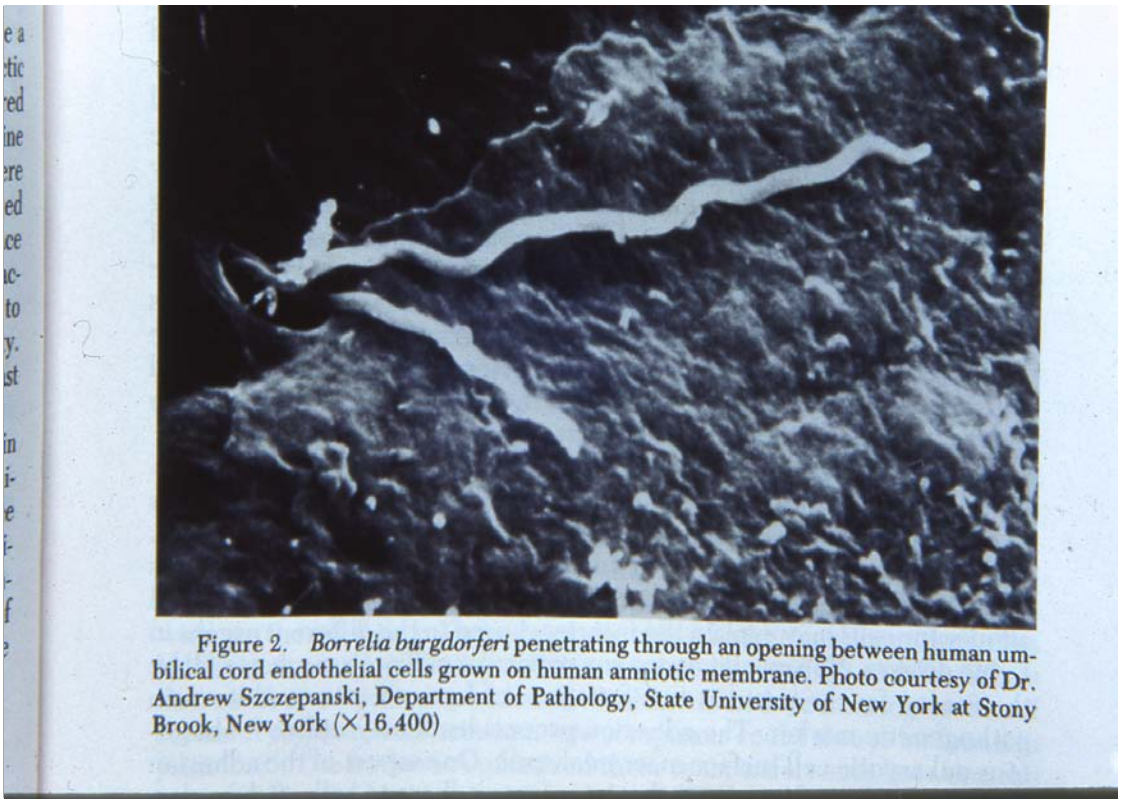

Figure 2. *Borrelia burgdorferi* penetrating through an opening between human umbilical cord endothelial cells grown on human amniotic membrane. Photo courtesy of Dr. Andrew Szczepanski, Department of Pathology, State University of New York at Stony Brook, New York (×16,400)

What if the blood vessels the bacteria attach to are the ones surrounding the brain of a small child? In 1985, Allen Steere documented that Lyme could be transmitted to the fetus.
(http://www.canlyme.com/Schlesinger_1985.pdf)

In 1992 the Pediatric Neurologist Dorothy Pietrucha documented that children that were bitten by ticks were exceptionally prone to head aches, pressure in the head, and aseptic encephalitis.

It didn't take long before desperate parents from across the country were clamoring to New Jersey to see Dr. Pietrucha. But it wasn't long before her peers were upset that she was successfully treating all of their treatment failures.

One of Dr Pietrucha's patients included an 11 year-old girl with MS-like lesions in the brain reported that the lesions disappear with six months of antibiotics. *(This is something we were told could not happen because the brain does not make new brain cells)* Is this another absolutely true medical factoid proven wrong in the 21st century?

Soon the New Jersey Medical review board came knocking on her door. Dr. Pietrucha, a serious no nonsense researcher who suffered no fools was essentially forbidden to treat children aggressively with antibiotics. It was not her choice but the medical experts in charge had spoken. One of our greatest minds and voices was censured by her peers before her work was ever appreciated or understood.

I implore you to go back and look at some of the Lyme Disease Conference videos of Dorothy Pietrucha's lectures. You would be hard pressed to find flaws in her data, her methods, or find fault in her clarity on the neurologic aggressiveness of this bacterium.

Two Case Histories to consider:

Case History: A California woman living in a low endemic area had a clinical diagnosis of Lyme with a multitude of late stage symptoms. She was seronegative for Lyme at YALE *Medical Center. She gave birth to a still born. Live*

Borrelia burgdorferi was cultured from the fetal brain. *1987 ArthritisRheum Vol 30 No. 4 Lavoie P, Lattner BP, Durray PH, Barbour AG, Johnson HC.*

Case History: 24 year old woman, positive CDC serology but negative by Yale ELISA. She gave birth to a stillborn. Live Borrelia burgdorferi was cultured from, liver, adrenal, brain, heart and placenta. *Rheum Dis Clinics of North America 1989: 15 Alan Macdonald*

Borrelia are bacteria that are associated with dozens of tick and louse-borne Relapsing Fevers that are found throughout the world. These related illnesses range in symptoms from cases of mild fevers to rapidly fatal encephalitides. The hallmark attribute that almost all Borrelia bacteria have in common is their ability to adapt and change in order to infect host animals that in turn infect many species of ticks and lice.

(The one Borrelia species that don't have genetic variation when it divides is the laboratory strain B-31. This man-enhanced strain was altered by taking away plasmids *(chromosomes)* that cause gene insertions that lead to genetic variation. In other words, Borrelia was originally designed by nature to easily create new strains to survive in animals, but man altered the Lyme bacterium to create a stable product to create Lyme tests for profit.)

We know for example that if you rank all the known Borrelia pathogens in a phylogenetic tree based on related genetics, you will find that many disease causing pathogens that cause similar symptoms will often end up close together in related groups on the phylogenetic family-tree.

Borrelia burgdorferi, Borrelia afzellii and Borrelia garinii that cause Lyme disease in America and Europe have some specific clusters of genes that are similar to each other and have similar tick vectors, meaning they probably bumped up against each other inside ticks not too long ago. It is believed that they are closely related and variations occurred as separate tick populations over thousands of years migrated with animal populations and the bacteria became isolated from each other. Of course now we have airplanes and modern commerce to speed up this process of dissemination for all diseases.

At one time all Borrelia had a common ancestor. Exactly how long ago we don't know, but the evidence of common ancestry is in their related and similar genes. More genetic evidence suggest that many thousands of years ago, Lyme disease had a common ancestry with the Syphilis spirochete. In truth many symptoms and pathologies we see in Syphilis we see variations of in Lyme disease. Syphilis was once called the great imitator of other diseases, but now that crown has been bequeathed to Lyme disease.

> **What we need to understand is that these bacteria will always evolve and change and we will continue to find in ticks many more Lyme-like Borrelia, so without a doubt it is time to stop calling it *"LYME DISEASE"* and simply call it Borreliosis.**

When the genomic sequence of *Borrelia burgdorferi* was determined, it came as quite a shock that most of the genes in this large bacterium had no known counterparts or similarities to other known bacterial genes. **This means**: the function of the majority of the genes in the Borrelia species has yet to be determined. Also, as far as "bacterial intelligence" goes, it had always been thought that Syphilis was king and master. Once called the "The Great Imitator," Syphilis was known for mimicking many diseases including Alzheimer's, arthritis, blindness, and Heart Disease. But the Lyme spirochete has more than three times the functional genes of Syphilis. This puts Lyme at the head of the class in the Mensa society of bacteria !

“The Lyme spirochete has more than three times the functional genes of Syphilis. This puts Lyme at the head of the class in the Mensa society of bacteria !”

What we don’t know: The Lyme bacteria *Borrelia burgdorferi* likes to preferentially express certain genes and suppress others. This allows the bacteria to adapt to new environments.

What does it take for *Borrelia burgdorferi* to express one of the suppressed genes of the Relapsing Fevers from which it came?

Borrelia burgdorferi like all Borrelia, have genes that are latent but intact.

If Borrelia genes are expressed or triggered by the environment they are in; then could pathogen-host interactions based on patient genetic markers explain why some Lyme patients have persisting symptoms? In simpler terms: Are some patients genetically prone to have chronic Lyme disease? Will only certain strains of *Borrelia burgdorferi* cause chronic Lyme?