Lyme Disease & Co-Infections

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CLASS: M240 - Manual for Test

The topic of Lyme disease is important for natural health professionals because: (1) There are many cases of Lyme and Lyme-like diseases in the U.S. (2) Lyme is under-diagnosed as well as misdiagnosed. (3) The internet is full of ineffective promises and magic products for Lyme disease. (4) Many who do not recover from Lyme disease are actually experiencing the effects of co-infections or autoimmune disease.

As natural health professionals we do not diagnose and we do not “cure” Lyme disease. We do not “cure” any disease because the FDA law says only drugs cure diseases and therefore only drug companies can make such a claim! It is not what we do, it is what we say that can get us into trouble. So, what can we do? We can determine why the person has succumbed to the bacteria, virus, parasite, fungus, or mycoplasma. We can provide the necessary nutrients, homeopathics, and herbs to encourage homeostasis and provide the support needed for the body to heal itself.

Be very careful about how you use your words! NEVER SAY, “I think you have (or you have) Lyme disease.” or “You have Lyme disease.” Speech like this is considered diagnosis. If your client says that they have Lyme disease, AND it has been confirmed by a doctor, ONLY THEN can you use the term. Should a client say that they think they have Lyme disease you can ask them why and discuss how they are feeling and what they are experiencing. (For example: Do you have: aches, swellings, headaches, rashes, etc.?)

The natural health professional should not use the words: prevent, alleviate, diagnose(s), or cure regarding any disease or medical condition. We do not conduct examinations, treat, prescribe, or write prescriptions. Do not use the titles doctor or physician in any literature or allow your clients (or anyone!) to call you doctor. It is important that you correct them. Let your clients (not patients!) know that it is illegal for you to use the words cure, prevent, heal, (etc.) so they are aware of the issues that you face.

This manual was created for the students at Genesis School of Natural Health. It is not a research paper. It is a guide for understanding Lyme disease and the response of the body to the infection. While all research is subject to change, Lyme disease studies have changed considerably in the last three years.

The recommendations in this manual are not intended to replace medical advice. If your client has a probable acute case of Lyme disease, they need to take antibiotics in addition to the support you provide through the use of herbs, supplements, homeopathics, diet changes, etc.

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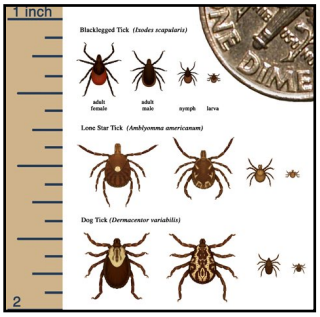
What Is Lyme Disease?

Lyme disease is a complex, multi-system inflammatory disease and the result of the most common vector-borne infection in the United States. The infection is transmitted to humans via tick bites from infected hard-bodied ticks of the genus Ixodes. It is believed that the transmission of *B. burgdorferi* requires at least 24–48 hours of tick attachment.[28] *Ixodes scapularis* is the blacklegged tick (deer tick) in the East and Midwest and *Ixodes pacificus* is the western blacklegged tick found on the Pacific Coast.[24]



The tick's life cycle consists of four stages: egg, larva, nymph, and adult. The tick larvae and nymphs become infected with *Borrelia burgdorferi* when they feed on infected animals, particularly the white-footed mouse. The *Borrelia* bacteria resides in the tick as it transforms from larva to nymph or nymph to adult, enabling it to continually transmit the bacteria to animals. While adult ticks prefer to attach, feed, and mate primarily on the white-tailed deer, they may also be found on dogs, horses, and other domesticated animals.

The *Ixodes* tick larva is about the size of a pinhead, which makes them almost impossible to find on your body. Larval ticks are not born infected with *Borrelia* so they are not able to transmit Lyme disease to animal or human hosts.

The nymph is the size of a poppy seed and responsible for the majority of spirochete infections in people. They are most active in the late spring and summer. Their very small size and painless bite allows them to attach unnoticed. Even the adult ticks are difficult to find as they are approximately the size of a sesame seed with a flat shape. After feeding, most ticks will drop off to prepare for the next life stage. At its next feeding, the tick can then transmit an acquired disease to the new host. There are many species of ticks that are vectors (carriers) for viruses, bacteria, and other infectious organisms.

The ticks *Ixodes scapularis and Ixodes pacificus* carry the spirochetes responsible for causing Lyme disease in the U.S. According to the CDC, only the infection caused by *Borrelia burgdorferi* or *Borrelia mayonii* results in Lyme disease. The CDC added *Borrelia mayonii* as a cause of Lyme disease in 2016.

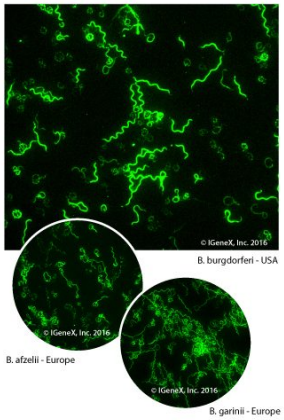
In Europe and Asia the taiga tick, *Ixodes persulcatus,* is the common vector for *Borrelia afzelii*, *B. garinii,* and *B burgdorferi*, all of which may cause Lyme disease.[3] According to the Infectious Diseases Society of America, the most common cause of Lyme neuroborreliosis in Europe is *Borrelia garinii,* followed by *Borrelia afzelii. Borrelia bissettii* is a species that does not officially cause Lyme disease; however, it has been found in heart tissue. The Czech Republic confirmed the presence of *B. bissettii* in cardiac valve tissue from a patient diagnosed with endocarditis and aortic valve stenosis.[4] The *Journal of Clinical Microbiology* states that *Borrelia bissettii* has been identified in "widely dispersed geographical regions" including California, Colorado, New York, Georgia, and Florida. "It is therefore possible that some cases of Lyme disease in the United States may be caused by *B. bissettii*."[5]

Another species that causes Lyme disease in Europe and Asia but is not recognized by the CDC as a cause of Lyme disease in the U.S. is *Borrelia garinii*. “The association of *B. garinii* with seabirds is thought to facilitate this species' wide geographic distribution in the coastal regions on both southern and the northern hemispheres, and as far as the eastern coast of North America.”(6) In Europe *Borrelia garinii,* is associated with treatment-resistant Lyme arthritis.

Not all *Borrelia* species cause Lyme disease. An example of a species that does not cause Lyme disease is *Borrelia recurrentis* which causes relapsing fever. While the relapsing fever is unique, some of the other symptoms are consistent with Lyme disease and include: headache 94%, myalgia 92%, nausea 76%, arthralgia 73%, vomiting 71%, meningitis 2%, eye pain 26%, neck pain 24%, and more.(9)

What is *Borrelia burgdorferi*?

Scientific Classification
Kingdom: Prokaryote
Domain: Bacteria (three major: spiral bacteria**,** rod-shaped bacilli and spherical cocci.)
Phylum: Spirochaetes **Order:** Spirochaetales **Family:** Spirochaetaceae
Genus: *Borrelia* **Species:** *burgdorferi* (sensu stricto and sensu lato)



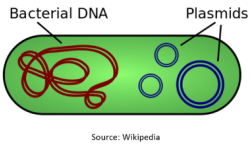
The *Borrelia* genus contains more than 30 species of arthropod vector-borne spirochetes which can be classified into two major groups. The first group of spirochetes contains up to 19 *Borrelia* species and are collectively referred to as ***Borrelia burgdorferi* sensu lato**. Sensu lato = in the wide or broad sense because there are various strains of the species. A strain is a genetic variant or subtype of a micro-organism. Of these, at least four species have been identified in North America: *B. burgdorferi* sensu stricto, *Borrelia andersonii, Borrelia bissettii,* and *Borrelia mayonii.* This group of spirochetes are transmitted by the hard-bodied ticks in the genus of *Ixodes* and are linked to Lyme disease.(29)

The second group of spirochetes in the *Borrelia* genus includes up to 25 *Borrelia* species transmitted primarily by the soft-bodied ticks in the genus of *Argasidae* . *Argasidae* exceptions include the louse-borne *Borrelia. recurrentis* and hard tick-borne *Borrelia miyamotoi* and *Borrelia lonestari*.(29)

There is a wide range of genetic diversity within each species of *Borrelia.* It is now known that *B. burgdorferi* can genetically recombine to create **different strains that behave differently inside the human body.** Some strains seem to remain in the skin, while others are more likely to invade the nervous system or heart. Some strains are also more commonly found in certain parts of the country. This could explain why Lyme patients report diverse symptoms and have different outcomes with antibiotic treatment.“ According to the Journal of Microbiology, “Approximately 90% of Borrelia plasmid genes show little similarity to genes of other bacteria.It is possible that these linear plasmids are in a phase of rapid evolution and undergo antigenic variation because of immune selection.”(31)

Borrelia burgdorferi

- *B. burgdorferi* is an anaerobic, motile spirochete with 7 to 11 bundled flagella set at each end that allow the bacterium to move in both low and high-viscosity mediums such as blood, lymph, and tissue. It has a high virulence factor (ability to invade the tissues of the host).
- *B. burgdorferi* is an extracellular and an intracellular pathogen It binds strongly to the extracellular matrix and cells of the connective tissue and the extracellular matrix appears to provide a protective niche.
- *B. burgdorferi,* like all bacteria, have cell walls that contain peptidoglycan. It was recently discovered that the Borrelia's peptidoglycan has a unique chemical structure. The structure results in the shedding of the peptidoglycan into the extracellular spaces of the host instead of being recycled back into the cell when they multiply. Peptidoglycan evokes an inflammatory response and it can be detected in the synovial fluid of patients with the symptoms of Lyme arthritis.(76)
- *B. burgdorferi* has the ability to change shapes, assume atypical morphologies such as round bodies/cysts, spherical shapes, blebs, and detaching granules or pearls. In microbiology, pleomorphism is the ability of some micro-organisms to alter their shape or size in response to environmental conditions.
- *B. burgdorferi* is one of the largest spirochetes (0.25 microns x 50 microns). It is as long as a fine strand of hair is thick. Most spirochetes cannot be viewed using conventional light microscopy. Dark-field microscopy uses a special condenser which directs light toward an object at an angle, instead of from the bottom.
- *B. burgdorferi* can share/transfer DNA among each other. According to The National Academy of Sciences, "*B. burgdorferi* undergoes genome-wide genetic exchange, including plasmid transfers…Frequent recombination implies a potential for rapid adaptive evolution and a possible polygenic basis of *B. burgdorferi* pathogenicity."(25) A plasmid is a small DNA molecule within a cell that is separated from chromosomal DNA and can replicate independently. Plasmids often carry the genetic instructions for antibiotic resistance and a host of other functions.



- *B. burgdorferi* is one of the few pathogenic bacteria that can survive without iron. Instead of iron-sulfur cluster enzymes they have enzymes that use manganese and zinc (26). This eliminates the problem many pathogenic bacteria face in obtaining iron.

Identification of *Borrelia*

B. burgdorferi is difficult to identify, even in untreated people with acute Lyme disease. The spirochetes do not stay in the blood for long periods of time which results in a low number of spirochetes in the blood. In addition, it is almost impossible to isolate and grow/culture *B. burgdorferi* from blood samples. An exception is *Borrelia. mayonii*, it proliferates in the blood for as yet unknown reasons.(8) Identification depends on the ability of lab technicians to see the spirochete, which often exist in low numbers. To complicate matters, *B. burgdorferi* is able to change shapes, and assume atypical morphologies. The "round bodies" described below are also known as cysts.

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“Here, we present a comprehensive analysis of *B. burgdorferi* pleomorphic formation in different culturing conditions at physiological temperature. Interestingly, human serum induced the bacterium to change its morphology to round bodies (RBs). In addition, biofilm-like colonies in suspension were found to be part of *B. burgdorferi*’s normal *in vitro* growth. Further studies provided evidence that spherical RBs had an intact and flexible cell envelope, demonstrating that they are not cell wall deficient, or degenerative as previously implied…. In addition to the typical spirochaete, *B. burgdorferi* is seen also as **small spherical shapes, blebs, detaching granules or pearls, and agglomerations of spirochaetes into biofilm-like (BFL) colonies**.”(10)

Lyme neuroborreliosis/neuroinflammation is likely the result of atypical, pleomorphic and cystic forms of *Borrelia burgdorferi*. These persistent and resistant forms within the neurons and glial cells may explain the long latent stage of infection. Up to 15% of the untreated *B. burgdorferi* infections result in neurologic involvement.(7)

Syphilis is another spirochete (*Treponema pallidum)* that has several clinical manifestations, atypical cystic and granular forms, and no single optimal laboratory test. It also has a long latent stage followed by chronic central nervous system infection and inflammation. “The similarity of clinical and pathological manifestations of syphilis caused by *Treponema pallidum* and Lyme disease caused by *B. burgdorferi* is well established.”(11)

The spirochetes that cause syphilis and Lyme disease have superior penetrating abilities compared to almost any other organism. Spirochetes can penetrate basement membranes (a membrane separating an epithelium from underlying tissue), the linings of organs like intestines, and the blood-brain barrier to reach the central nervous system. Syphilis can invade the placenta and infect an unborn child.(32) Because there are limited studies on Lyme disease during pregnancy, the CDC states that "Lyme disease might be dangerous to your fetus. With prompt treatment, complications can be prevented”. The studies do not rule out the possibility that *B. burgdorferi* has the ability cross the placenta and infect the unborn child. Studies strongly suggest that there are fewer adverse birth outcomes (including death) when the pregnant mother is promptly treated for Lyme disease.

Infection Rates & Immunity

According to the CDC approximately 30,000 cases of Lyme disease are reported every year. However, only a fraction of actual cases are reported. The number of people diagnosed with Lyme disease each year in the U.S. is around 300,000.(1) Children between the ages of 5 and 10 are nearly twice as likely to get Lyme disease, due to increased time outside, when compared to adults. Some researchers have reported that 30 percent of all Lyme diseases occur in children.

Researcher, Eugene D. Shapiro, MD, believes the 300,000 estimate is too high and that the “true incidence of the disease is complicated by reliance on passive reporting of cases and the high frequency of misdiagnosis and false-positive serologic test results.”(24) While not everyone agrees with the estimated number of cases and how many children vs adults it affects, it is clear that the number of yearly Lyme disease cases continue to increase.

Some Lyme cases are the result of reinfection. There are up to 19 different strains of *Borrelia burgdorferi,* and it appears that the immune system, after infection, only recognizes the antibodies of the strain that caused the initial infection.(33) The significance of the one strain one resistance model is that a previous *Borrelia* infection will not protect people from reinfection if the spirochete is one of the 18 other strains.

While a person should take precautions and be aware of the dangers of infection, not everyone who gets infected with *Borrelia* spirochetes will develop Lyme disease. In some people, the immune system destroys the bacteria before they can do any damage.(27) One theory is that the cytokines, a signaling molecule in the immune system, varies. According to the Radboud University Nijmegen Medical Centre, "Production of the cytokine IL-22 deceases with age, reducing the immune system's defense against the Borrelia bacteria."(69)

One of the immune responses involves the formation of a phagosome, a pocket in the membrane of a human cell which entraps the spirochete so it can be destroyed. Formation of the phagosome provides cooperation between other receptors. While there are many cascading immune events in response to the infection, Salazar says that some people may be at increased risk of Lyme infection because of a genetic deficiency in these receptors.(34) The National Institutes of Health states, "The risk of certain complications of the condition **may be influenced** by inherited genetic factors, but the inheritance pattern is **unknown**."

When it comes to the development of diagnostic tools and drugs, most of the research is invested in genetic abnormalities and the immune system. Like most diseases, the role of vitamins, minerals, phytochemicals, and general cell health is mostly ignored by the medical community. *Borrelia* and other infectious organisms need a non-hostile environment to gain control and resistance. Many adults and children have several sub-clinical health issues and nutritional deficiencies, making them vulnerable to bacterial and viral infections.

Prevention methods on medical/pharmaceutical websites include: cover up when in wooded or grassy areas, wear shoes, long pants tucked into your socks, a long-sleeved shirt, a hat and gloves. Try to stick to trails and avoid walking through low bushes and long grass. Check for and carefully remove ticks. Shower soon after being outside. Use insect repellents like DEET. Prevention should include healthy eating and lifestyle habits so the immune system is strong enough to stop the infection from turning into a disease.

According to the International Journal of Immunopathology and Pharmacology: "Many studies have reported that vitamins have been found to protect the integrity of cells and stimulate the production and function of the immune cells and play an important role in the maintenance of a healthy immune system. **Even a slight vitamin deficiency can compromise the body's ability to fight infections."**(39) "One of the best antibacterial, antifungal and antiviral agents still considered is **iodine**, due to its rapid penetration of phospholipid membranes and its oxidative damage to bacterial proteins, nucleotides and fatty acids".(40)

Iodine, baicalein and luteolin, rosmarinic acid, vitamin D3 and vitamin C were evaluated to determine if they would enhance the effectiveness of doxycycline. Doxycycline is the most prescribed antibiotic for Lyme disease. A combination of doxycycline with flavones baicalein and luteolin exhibited additive effects against all morphological forms of Borrelia species. **Doxycycline combined with iodine produced additive effects against spirochetes and biofilm. Additive anti-spirochetal effects were also observed when doxycycline was used with rosmarinic acid, vitamin D3 and vitamin C.**(37)

In 2017, thirty-one percent of the U.S. population was at risk of at least one vitamin deficiency or anemia. Vitamins A, C, D, E, folate, calcium, and magnesium are under-consumed relative to the Estimated Average Requirement (EAR) and iron is under-consumed by adolescent, adult, and pregnant females. "Pregnant and breastfeeding women were more likely to have a deficient status of vitamin B6 (35%) or be anemic (18%). Most people did not meet the EAR for vitamin E (89% inadequate), and approximately half the population did not meet the EAR for vitamins A (52% inadequate) and C (48% inadequate)…**Our estimate that nearly one third of U.S. adults is at risk of deficiency in at least one vitamin or has anemia is conservative** and does not reflect the full scale of micronutrient deficiencies, as the number of micronutrients analyzed was limited to those with biochemical measures…The most common deficiency was vitamin B6."(41)

Signs & Symptoms of Lyme Disease or Infection

Around 70 to 80 percent of **children** with Lyme disease develop a rash that is pink in the center and a deeper red on the surrounding skin. The rash may be mistaken for hives, eczema, sunburn, poison ivy and flea bites. Remember that 20-30 percent do NOT develop a rash.

"The presence of erythema migrans in 89% of children significantly aids the clinical diagnosis. It is speculated that the CNS lesions in children represent a **spirochete-triggered autoimmune process**. Headache is the most frequent neurologic symptom; the most common neurologic signs of pediatric LNB include facial nerve palsy (3%–5%) and meningitis (1%)."(28)

Lyme disease usually begins with the characteristic skin lesion, erythema migrans, at the site of the tick bite. Fever, chills, headache, fatigue, muscle and joint aches, and swollen lymph nodes may occur in the absence of rash. "Following hematogenous dissemination, neurologic, cardiac, and/or rheumatologic involvement may occur."(46)

Unlike *B. burgdorferi,* the *B. mayonii* appears to have the symptoms of nausea, fever, headache, neck pain, vomiting, a rash that is spread out (rather than a single bull's-eye rash), and neurological problems in the early stages of infection. Arthritis develops in later stages.(2)

Some rashes have bluish or red-blue coloring.

Early Signs & Symptoms: 3 to 30 Days After Tick Bite

- Fever, chills, headache, neck stiffness, fatigue, muscle and joint aches, and swollen lymph nodes with or without a rash. Many of the symptoms are flu-like.
- Erythema migrans (EM) rash
  - Occurs in approximately 70 to 80 percent of infected persons
  - Begins at the site of a tick bite but can take up to 30 days (average is 7 days)
  - Expands gradually over several days. Some rashes expand up to 12 inches across or more. As it enlarges **it may** develop a clearing which results in a target or “bull’s-eye” appearance
  - Some people develop this rash at more than one place on their bodies
  - It is typically not itchy or painful but might feel warm to the touch

Later Signs & Symptoms: Days to Months After Tick Bite

- Severe headaches and neck stiffness
- New or additional EM rashes on other areas of the body
- Facial palsy (loss of muscle tone or droop on one or both sides of the face)
- Arthritis with severe joint pain and swelling, especially the knees
- Intermittent or traveling pain in tendons, muscles, joints, and bones
- Heart palpitations or an irregular heart beat (Lyme carditis occurs when Lyme bacteria enters your heart tissue and disrupts the electrical system.
- Episodes of dizziness or shortness of breath
- Inflammation of the brain and spinal cord
- Nerve pain, shooting pains, numbness, or tingling in the hands or feet

MayoClinic.org: Diagnosis

Many signs and symptoms of Lyme disease are often found in other conditions, so diagnosis can be difficult. Additionally, ticks that transmit Lyme disease can also spread other diseases. If you don't have the characteristic Lyme disease rash, your doctor might ask about your medical history, including whether you've been outdoors in the summer where Lyme disease is common, and conduct a physical exam.

Lab tests to identify antibodies to the bacteria can help confirm or rule out the diagnosis. These tests are most reliable a few weeks after an infection, after your body has had time to develop antibodies. They include:

- **Enzyme-Linked Immunosorbent Assay (ELISA) test.** The test used most often to detect Lyme disease; ELISA detects antibodies to *B. burgdorferi, b*ut because it can sometimes provide false-positive results, it's not used as the sole basis for diagnosis. **This test might not be positive during the early stage of Lyme disease**, but the rash is distinctive enough to make the diagnosis without further testing in people who live in areas infested with ticks that transmit Lyme disease.
- **Western Blot Test.** If the ELISA test is positive, this test is usually done to confirm the diagnosis. In this two-step approach, the Western blot detects antibodies to several proteins of *B. burgdorferi*. **(end of MayoClinic.org - Diagnosis)**

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MayoClinic.org: Treatment

- **Oral Antibiotics.** These are the standard treatment for early-stage Lyme disease. These usually include doxycycline for adults and children older than eight, or amoxicillin or cefuroxime for adults, younger children, and pregnant or breast-feeding women. A 14- to 21-day course of antibiotics is usually recommended, but some studies suggest that courses lasting 10 to 14 days are equally effective.
- **Intravenous antibiotics**. If the disease involves the central nervous system, your doctor might recommend treatment with an intravenous antibiotic for 14 to 28 days. This is effective in eliminating infection, although it may take some time to recover from the symptoms. Intravenous antibiotics can cause various side effects, including a lower white blood cell count, mild to severe diarrhea, colonization or infection with other antibiotic-resistant organisms unrelated to Lyme. **(end of MayoClinic.org - Treatment)**

After treatment, some people still have some symptoms, such as persistent pain, muscle aches and fatigue. The cause of these continuing symptoms, known as Post Treatment Lyme disease Syndrome, is officially unknown. Multiple clinical trials have shown no benefit with additional IV antibiotic treatment in patients with Lyme disease, although the interpretation of those results have been challenged by some. Some experts believe that certain people who get Lyme disease are predisposed to develop an autoimmune response that contributes to their symptoms.

According to the National Institute of Allergy and Infectious Diseases, the term ‘chronic Lyme disease (CLD) is being used to describe symptoms in people who have no clinical or diagnostic evidence of a past or present *B. burgdorferi* infection in addition to those who have been diagnosed. “Experts” use the term Post Treatment Lyme Disease Syndrome (PTLDS).

One theory that remains in website literature to explain PTLDS is the presence of endotoxins. Bacteria produce two known types of toxins: endotoxins and exotoxins. Endotoxins are lipopolysaccharides found on the outer cell wall of Gram-negative bacteria that result in strong immune responses in animals. Exotoxins are secreted by some Gram-positive bacteria and a few strains of Gram-negative bacteria.

“Endotoxin is invariably associated with Gram-negative bacteria whether the organisms are pathogenic or not. Although the term "endotoxin" is occasionally used to refer to any cell-associated bacterial toxin, in bacteriology it is properly reserved to refer to the **lipopolysaccharide** complex associated with the outer membrane of Gram-negative pathogens such as *Escherichia coli*, *Salmonella*, *Shigella*, *Pseudomonas*, *Neisseria*, *Haemophilus influenzae*, *Bordetella pertussis* and *Vibrio cholerae*.”[50]

Newer research has determined that *B. burgdorferi* does not produce Lipid A and other chemical structures characteristic of endotoxins. “Clinical manifestations of Lyme disease are largely driven by the host immune response rather than toxin-mediated damage. *B. burgdorferi* does not produce lipopolysaccharides (endotoxin), and its genome does not appear to encode effectors that might act as toxins.”[30]

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Co-Infections

While some clinics recognize a need to test for multiple tick-borne diseases when they encounter a possible or probable Lyme disease diagnosis, most do not. There are also many studies designed to determine why a person would continue to have symptoms but do not even mention the possibility of co-infections.

CDC: “Why some patients experience PTLDS is not known. Some experts believe that *Borrelia burgdorferi* can trigger an “auto-immune” response causing symptoms that last well after the infection itself is gone. Other experts hypothesize that PTLDS results from a persistent but difficult to detect infection. Finally, some believe that the symptoms of PTLDS are due to other causes unrelated to the patient’s *Borrelia burgdorferi* infection.”

Most Common Tick-Borne Diseases (Besides Lyme) in the United States
Ixodes scapularis and *Ixodes pacificus* are the blacklegged ticks that carry Borrelia species that cause Lyme disease. You will see the same ticks listed for other diseases. **Important:** Not all of the ticks are found throughout the United States. Some are only found in specific areas.

- **Anaplasmosis** is transmitted to humans by tick bites primarily from the blacklegged tick (Ixodes scapularis) and blacklegged tick (Ixodes pacificus). Anaplasmosis is a disease caused by the bacterium *Anaplasma phagocytophilum*. Symptoms include fever, headache, chills, and muscle aches.
- **Babesiosis** is caused by the protozoan, *Babesia microti.* The microscopic parasites infect red blood cells and cause malaria-like symptoms. The onset is usually gradual with general discomfort, fever, chills, sweats, and pain. Nausea, vomiting, headache, and psychiatric problems have also been reported. Infection may lead to inflammation and enlargement of the spleen, anemia, thrombocytopenia, and a mild elevation of liver enzymes. Most cases are the result of tick bites from the blacklegged tick*, Ixodes scapularis.* Babesiosis can be transmitted via blood transfusions.
- **Ehrlichiosis** (air-lick-ee-OH-sis) is transmitted to humans by the lone star tick (*Ambylomma americanum*) and the blacklegged tick (Ixodes scapularis). Ehrlichiosis is the name used to describe diseases caused by the bacteria *Ehrlichia chaffeensis*, *E. ewingii*, or *E. muris eauclairensis.* The flu-like symptoms include fever, chills, headache, muscle aches, and sometimes upset stomach. Symptoms typically begin within 1-2 weeks after the bite of an infected tick.
- ***Borrelia miyamotoi*** infection has recently been described as a cause of illness in the U.S. It is transmitted by the blacklegged ticks *Ixodes scapularis* and *Ixodes pacificus.* Borrelia miyamotoi is a spirochete that is closely related to the bacteria that cause tickborn relapsing fever.
- ***Bartonella henselae* (Cat-scratch disease)** is a bacterial disease starting with a red mark that can become swollen and discolored or even look like stretchmarks/ striations. Symptoms include swollen lymph nodes, conjunctivitis, heart or spleen problems, bone lesions, hepatitis, and encephalitis (causing seizures and coma). There is indirect clinical evidence that *Bartonella* can co-infect a Lyme patient.

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- **Tickborne Relapsing Fever (TBRF)** is a bacterial infection transmitted through the bite of infected soft ticks. While it is a rare infection, it has been reported in 15 states: Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Texas, Utah, Washington, and Wyoming. TBRF is associated with sleeping in rustic cabins and vacation homes. The main symptoms of TBRF are high fever (e.g., 103° F), headache, and muscle and joint aches. Symptoms can reoccur with the telltale pattern of a fever lasting roughly three days, followed by seven days without fever, followed by another three days of fever. Without antibiotic treatment, this process can repeat several times. There are three types of relapsing fever: Tick-Borne Relapsing Fever; Louse-Borne Relapsing Fever; and *Borrelia miyamoto*i disease (sometimes called hard tick relapsing fever).
- **Rickettsiosis** refers to spotted fever diseases caused by the bacteria from the Rickettsia genus. **Rocky Mountain spotted fever** is the most serious and the most commonly reported. It is transmitted by the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and the brown dog tick (*Rhipicephalus sangunineus*). The **Pacific Coast tick fever**, is caused by *Rickettsia* species 364D. **Rickettsialpox** is caused by *Rickettsia akari* and ***Rickettsia parkeri* rickettsiosis** is caused by *R. parkeri.* Spotted fevers can range from mild to life-threatening. Most people who get sick with a spotted fever, other than Rocky Mountain spotted fever, will have a dark scab at the site of tick or mite bite, fever, headache, and rash.
- **STARI (Southern Tick-Associated Rash Illness)** is transmitted via bites from the lone star tick (*Ambylomma americanum*), found in the southeastern and eastern U.S. The cause is not known. It was thought that STARI was caused by a spirochete but so far, the research does not support the hypothesis. The symptoms include a Lyme-like rash, fever, headache, muscle and joint pains but has not been linked to arthritis, neurologic disease, or chronic symptoms.
- **Bourbon Virus** infection has been identified in a limited number patients. Because there have been only a few cases identified, a complete symptom profile is not available. Those diagnosed with the virus had symptoms including fever, tiredness, rash, headache, other body aches, nausea, and vomiting. They also had low blood counts for cells that fight infection and help prevent bleeding.
- **Colorado Tick Fever** is caused by a **virus** transmitted by the Rocky Mountain wood tick (*Dermacentor andersoni)*. The incubation period ranges from about one to 14 days. The most common symptoms are fever, chills, headache, body aches, and feeling tired. Some patients have sore throat, vomiting, abdominal pain, or skin rash. Almost half of those diagnosed experience a “biphasic” fever. This means they have several days of fever, feel better for several days, and then have a second short period of fever and illness.
- **Heartland Virus** cases have been identified in the midwestern and southern United States. Studies suggest that the lone star ticks transmit the virus. Common symptoms include fever, fatigue, decreased appetite, headache, nausea, diarrhea, and muscle or joint pain. Blood tests reveal lower than normal counts of white blood cells and platelets. Although most patients fully recovered, most were hospitalized and a few patients died.

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- **Powassan** is a **viral** disease transmitted by the blacklegged tick *Ixodes scapularis* and the groundhog tick *Ixodes cookei*. Many people infected with Powassan virus do not have symptoms. When symptoms do occur, they are initially fever, headache, vomiting, and weakness. The Powassan virus can cause severe diseases that include infection of the brain (encephalitis) or the membranes around the brain and spinal cord (meningitis). Symptoms of severe disease include: confusion, loss of coordination, difficulty speaking, and seizures. One out of 10 with severe infections die and almost half who survive the severe form of the disease have long-term health problems including loss of muscle mass and strength, recurring headaches, and memory problems.
- **Tularemia** is a rare infectious disease that typically attacks the skin, eyes, lymph nodes, and lungs. It is caused by the bacterium *Francisella tularensis* that infects the dog tick *(Dermacentor variabilis),* the wood tick *(Dermacentor andersoni),* and the lone star tick *(Amblyomma americanum).* **Ulceroglandular** is the most common form of tularemia and usually follows a tick or deer fly bite or after handing of an infected animal. A skin ulcer appears at the site where the bacteria entered the body and the lymph glands swell, especially in the armpit or groin.

In addition to the known microorganisms that reside in ticks, new research is detecting many new species. This does not mean that every organism found in a tick is able to cause disease in humans or contribute to the rate of Lyme disease co-infections.

The researchers that published *Evaluating polymicrobial immune responses in patients suffering from tick-borne diseases* found that 65 percent of the tick-born disease (TBD) patients in their study produced immune responses to various microbes. The study also indicated an 85 percent probability that a randomly selected TBD patient would have *Borrelia* and other related TBD microbes. They also stated that “Multiple microbial infections in TBD patients seem plausible because ticks can carry more than eight different microbes depending on tick species and geography. Moreover, Qiu and colleagues reported the presence of at least 18 bacterial genera shared among three different tick species and up to 127 bacterial genera in *Ixodes persulcatus*.”[42]

Co-infections that are considered clinically relevant include the *Bartonella* species, *Yersinia enterocolitica*, *Chlamydophila pneumoniae*, *Chlamydia trachomatis*, and *Mycoplasma pneumoniae*.[47] Mycoplasmas are the smallest known free-living organisms. *Mycoplasma* is a genus of bacteria that lack a cell wall around their cell membrane. Without a cell wall, common antibiotics are ineffective. Penicillin and other antibiotics target cell wall synthesis to kill or interfere with bacterial reproduction.

While co-infections are of great importance, the reactivation of latent microorganisms must also be considered. *Borrelia* infections initially trigger a strong immune response but research indicates that the bacteria invade and disrupt the structure and function of the germinal centers located in the lymph nodes. Germinal centers are clusters of B cells that respond to antigens. When germinal centers fail to induce memory B cells and long-lived antibody-producing plasma cells, the person is susceptible to reinfection.

“Researchers have found that following *Borrelia burgdorferi* infection, this process even prevented induction of strong immune responses to an influenza infection.”(12) The suppression of the immune system may result in a new infection, reinfection, or it may allow latent microorganisms (our bodies store/control many different viruses, bacteria, and other microoganisms) to reactivate.

B. burgdorferi persister cells are a dormant form of bacteria that can survive extended periods of time by inactivating metabolic activity. *Borrelia* persister cells, abnormal extra- and intracellular pleomorphic and cystic forms, are not affected by the standard antibiotics used for Lyme disease. Researchers are looking for a combination of antibiotics to combat dormat/persistant *Borrelia* cells. “Persisters are elusive, present in low numbers, morphologically heterogeneous, multi-drug-tolerant cells that can change with the environment.”(51)

CDC: “Although no cases of Lyme disease have been linked to blood transfusion, scientists have found that the **Lyme disease bacteria can live in blood that is stored for donation.** Individuals being treated for Lyme disease with an antibiotic should not donate blood. Individuals who have completed antibiotic treatment for Lyme disease may be considered as potential blood donors.”

Mosquitos & Lyme disease?

There are reports and research papers indicating that mosquitoes may be a vector for *Borrelia burgdorferi.* If mosquitoes are able to harbor and possibly transmit Borrelia it opens the door for other soft-bodied vectors like horseflies, additional species of ticks and other biting insects as possible vectors of Lyme disease.

“Lyme disease or Lyme borreliosis is a vector-borne infectious disease caused by spirochetes of the *Borrelia burgdorferi* sensu lato complex. Some stages of the Borrelial transmission cycle in ticks (transstadial, feeding and co-feeding) **can potentially occur also in insects, particularly in mosquitoes.** In the present study, adult as well as larval mosquitoes were collected at 42 different geographical locations throughout Germany. …the results show that DNA of *Borrelia afzelii*, *Borrelia bavariensis,* and *Borrelia garinii* could be detected in ten Culicidae species comprising four distinct genera (*Aedes*, *Culiseta*, *Culex*, and *Ochlerotatus*). Positive samples also include adult specimens raised in the laboratory from wild-caught larvae **indicating that transstadial and/or transovarial transmission might occur within a given mosquito population**.” - www.sciencedirect.com/science/article/pii/S1877959X15300327

A positive immunological reaction was detected in 16.6 percent of the adult forms and in 16.5 percent of the nymphs of *Ixodes ricinus*. “**Spirochetes were also detected in 1.7% of mosquito females, 3.2% of larvae and in 1.6% of pupae of *Culex pipiens pipiens*. The results of the present study confirm that contact with ticks constitutes the main risk of contracting Lyme disease, although mosquitoes play a role as vectors as well.”** - http://www.ncbi.nlm.nih.gov/pubmed/18274258

Inflammation & Oxidative Stress

When the body recognizes an infectious agent, it stimulates inflammation to help fight the infection and initiate tissue repair. This is crucial to the healing process. Chronic inflammation may lead to oxidative stress, excitotoxicity (neuron damage), changes in homocysteine levels (high levels damage arteries and lead to blood clots), mitochondrial dysfunction, decreased serotonin and increased quinolinic acid (neurotoxic), and more.

Inflammation is what causes the skin irritation, muscle and joint aches, neurological, cardiac, and other symptoms that are associated with Lyme disease. When there is an overactive, chronic immune response, it may result in Lyme arthritis/persistent Lyme arthritis. Both acute and chronic inflammation associated with Lyme disease needs prompt attention. Lyme neuroborreliosis affects both the peripheral and the central nervous systems. Peripheral Lyme neuroborreliosis results in **nerve root inflammation**, which can cause pain, sensory loss, and weakness.

Recent studies have shown that *Borrelia* enters the host cell and "triggers the activation of intracellular pathogen recognition receptors". These receptors alert the immune system of invasion but the result is excessive inflammation.(14) The excessive inflammation has been linked to peripheral and central nervous system dysfunction in at least 15 percent of Lyme disease patients. The symptoms may include radiating pain, headaches, sensory loss, and facial palsy that usually resolves after antibiotics. (44)

Like inflammation, oxidation is a normal and beneficial reaction when it is under control. Chronic infections often result in excess oxidative stress, which damage cell membranes and mitochondrial membrane phospholipids. The phospholipid molecules form the matrix of the cell membranes. When they are damaged by oxidation the membranes become "leaky" and small molecules are able to leak out of the cells and cellular organelles, including the mitochondria.

In Lyme disease patients, mitochondrial **superoxide levels were reported as very high** and **cytosolic ionized calcium levels were very low**. The result is oxidative stress and inadequate intracellular communication, both of which contribute to mitochondrial dysfunction in the immune cells.(17) "Calcium ions, both intracellular and extracellular, are critically important for many cellular processes: skeletal, cardiac, and vascular smooth muscle contraction; neural excitability; and stimulus-secretion coupling in all endocrine and exocrine tissues."(18)

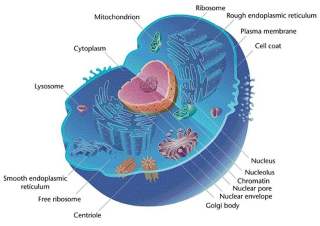


photo: biologydictionary.net

Mitochondria are very small organelles, found in every cell of the body except red blood cells. Large numbers of mitochondria are found in cells that require a lot of energy. In a heart muscle cell about 40 percent of the space is taken up by mitochondria. In liver cells almost 25 percent of the space is devoted to mitochondria. Mitochondria are known as the powerhouses of the cell because they convert energy from carbohydrates and fats to adenosine triphosphate (ATP). ATP is the form of energy used by cells and the conversion requires coenzyme Q (CoQ10). Low levels of Coenzyme Q10 are consistently associated with fatigue.

Mitochondrial cells contain their own set of DNA (mtDNA) and each mitochondrion contains dozens of copies of the mitochondrial genome likely because it has a high mutation rate compared to nuclear DNA. "**Subtle changes in mitochondrial function may cause a broad range of common metabolic and degenerative diseases.** The research shows that small changes in the ratio of mutant to normal mitochondrial DNA within the thousands of mitochondrial DNAs inside each cell can cause abrupt changes in the expression of numerous genes within the nuclear DNA."(16) According to Douglas C. Wallace, there is "strong support for the concept that common metabolic diseases such as diabetes and obesity, heart and muscle diseases, and neurodegenerative diseases have underpinnings in energy deficiencies from malfunctioning mitochondria."(16)

Lyme disease and other infections are not the only sources of inflammation. High calorie western diets cause systemic inflammation and "reprogram granulocyte monoctye precursor cells". The result is that fat cells/adipocytes behave as if they are "under attack by pathogens".(45) The chronic immune response causes the body to generate excessive inflammation.(15)

Research is also expanding to genetic explanations for excessive inflammation. The National Institutes of Health states that some of the genes **thought to be associated** with the development of antibiotic-refractory Lyme arthritis provide instructions for making proteins called Toll-like receptors. Other genes **implicated** in Lyme arthritis reside in the human leukocyte antigen (HLA) complex. The HLA complex helps the immune system tell the difference between the body's own proteins and proteins made by foreign invaders. **Some evidence suggests** that certain variations of HLA genes contribute to an inappropriate immune response that causes the body to react to one of its own normal proteins. The resulting inflammation may contribute to development of antibiotic-refractory Lyme arthritis. (35)

"Researchers identified a receptor on T cells that interacts with molecules on the surface of *B. burgdorferi.* Like a key fitting into a lock, the receptors join in a process resulting in bystander activation. This activation mechanism triggers the T cell to produce inflammatory molecules that accumulate around the joints and contribute to inflammation and arthritis**.** Some of the **newly 'turned-on' T cells** can interact with residual bacteria that persists long after the initial tick bite**,** producing a cascading cycle of inflammation that could lead to infection-induced autoimmunity."(36)

While we are unable to change our cellular DNA, we do have the ability to influence the expression of genes. Epigenetics, the study of heritable changes in gene expression that occur without alterations in the DNA sequence, can be altered by nutrients, organisms, and toxins. Known or suspected epigenetic modifiers include "heavy metals, pesticides, diesel exhaust, tobacco smoke, polycyclic aromatic hydrocarbons, hormones, radioactivity, viruses, bacteria, **and basic nutrients**."(43) Several studies have shown that environmental chemicals can alter epigenetic modifications, including histone modifications and DNA methylation. DNA methylation is when a methyl (CH_3) group is added to DNA to lock genes in the "off" position. This modifies the function of the genes.(48)

Folate (and many other nutrients) are involved in DNA methylation during early development and it continues throughout our lifespan. “Long-term supplementation with folic acid and vitamin B12 in elderly subjects with mildly elevated homocysteine levels resulted in changes in DNA methylation of several genes implicated in normal developmental processes and carcinogenesis.”[49] Vitamin D is a hormone that controls gene expression through genetic and epigenetic mechanisms that provide anti-cancer activities. Vitamin D influences DNA methylation and histone modifications that activate tumor suppressors and inhibit oncogenes. It also increases tumor suppressing activity. Vitamin D is frequently low in patients with Lyme disease.

Borrelia Targets: Tendons, Ligaments & Skin

Connective tissue is a common target of Borrelia spirochetes, but what is connective tissue? Even the simplified definition requires the following background.

- The human body is structurally organized: cells, tissues, organs, and the organ system.
- Cells are the smallest functional units of life.
- Tissues are groups of similar cells that have a common function.
- An organ is a structure that has at least two or more tissue types and performs a specific set of functions for the body.
- Many organs working together is called an organ system.

Each cell that is part of a tissue, organ, or system has space around it and that space contains fluid (interstitial fluid).The interstitial fluid that surrounds each cell contains nutrients, hormones, neurotransmitters, white blood cells and other substances. Each cell “takes” the substances it needs from the fluid and ”dumps” waste products and other unneeded substances back into the fluid. Fluid is always moving in the body and when the interstitial fluid (and all the waste and unused substances) moves into the lymph capillaries it is called lymphatic fluid.

If a tissue or organ consisted only of cells surrounded by fluid, it wouldn’t be able to hold a shape. It would lack structure and structure influences function. Structure of tissues and organs is provided by the extracellular matrix. This matrix is a complex meshwork that exists outside the cells in the interstitial fluid. The extracellular matrix is made up of proteoglycans, water, minerals, and fibrous proteins. A proteoglycan has a protein core surrounded by long chains of starch-like molecules called glycosaminoglycans.

The extracellular matrix of connective tissue is extensively studied because connective tissue is found throughout the body. One of the major functions of connective tissue is to connect tissues and organs. Tendons are bands of fibrous, non-elastic connective tissue that connect muscles to bones. Ligaments contain strong and flexible connective tissue and are found in the joints where they connect one bone to another bone. Connective tissue in tendons and ligaments are predominantly comprised of collagen. After *Borrelia* spirochetes have entered the body they need to find a place to reside and reproduce. A prime location for these activities is within the connective tissue of the skin, heart, joints, and central nervous system. *Borrelia* have been detected in the connective tissue of the aorta, the atria, and the ventricles of the heart.[19].

Borrelia spirochetes are able to break down the soluble and the insoluble components within the extracellular matrix. The spirochetes activate a group of enzymes called metalloproteases which **cause collagen to dissolve.** They also **inhibit the regeneration of collagen** that delays the healing process or prevents it completely. Borrelia may also interact with the hyaluronic acid which will initially decrease the swelling in the tendons. However, ultimately the ligament fibers will dry out. Dry ligament fibers and damage to collagen fibers increase the risk of ruptured tendons.

Borrelia infections are also responsible for structural changes in the collagen and elastic fibers of the skin. Several skin conditions have been associated with Lyme disease. The three main conditions are erythema chronicum migrans (the class and initial rash caused by Lyme disease), borrelial lymphocytoma (small, bluish-red nodule or plaque that usually appears on the earlobe or scrotum), and acrodermatitis chronica atrophicans (a fibrosing skin process). Other skin conditions include morphea, lichen sclerosus and B-cell lymphoma.(19)

Several other conditions may also occur with Lyme disease: dislocation of vertebrae, prolapsed intervertebral discs, ossification of tendon insertions, carpal tunnel, diverticulitis in the colon, conjunctivitis, inflammation of the optic nerve and structures in the eyes, and many more.

Morgellons disease (MD) is a dermopathy caused by spirochetes. The most distinguishing symptom of Morgellons is the presence of colored filaments beneath the skin, protruding from the skin, or within open lesions on the skin. The filaments contain keratin and collagen. *Borrelia burgdorferi* sensu stricto (most common cause), *Borrelia garinii*, *Borrelia miyamotoi*, and *Borrelia hermsii* have been detected in skin specimens taken from MD disease patients. The optimal treatment for MD has not been determined.(52) The disease is painful and often debilitating. Until recently, Morgellons disease was widely believed by the medical community to be a delusional illness.

Is it Lyme Disease or Something Else?

It is not uncommon for someone with Lyme to receive multiple negative test results before achieving a proper diagnosis. This leaves thousands of undiagnosed patients spending months or even many years going from doctor to doctor, trying to find out what is wrong with them. Lyme disease has many of the same symptoms as other diseases. It suppresses the immune system, possibly leading to reactivation of pathogens residing in the patient. In addition, the patient may have persistent *Borrelia* cell forms after successfully overcoming a *Borrelia* infection that reactivated after another infection (lowering the immune resistance). It may not be possible to know exactly which organism was responsible for the initial immune reaction or infection.

As you read about the following diseases, you will notice the some of the same pathogens that are listed as co-infections, mimic Lyme diseases symptoms, or are able to persist in the body. Understanding the roles of pathogens will provide keys to prevention and or proper natural protocols.

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic inflammatory autoimmune disease. While the immune system primarily attacks the lining of joints, the inflammation cascade can affect many organs and systems. The inflammation causes the tissue lining the inside of joints (the synovium) to thicken which results in swelling and pain in and around the joints. If the inflammation caused by RA is not reduced it can damage cartilage (the elastic tissue that covers the ends of bones in a joint) as well as the bones themselves. In Lyme disease the tendons and ligaments around the joints are a prime location for *Borrelia* reproduction, however, the spirochetes have also been found in the synovium. *Borrelia* damages the cartilage and elastic tissues by releasing enzymes that cause the collagen to dissolve.

Lyme disease is a risk factor for later developing RA and other types of inflammatory arthritis, such as psoriatic arthritis or peripheral spondyloarthritis. In a 2016 study almost one-third of the participants who had Lyme arthritis later developed inflammatory arthritis. Patients with mycoplasma pneumonia also have an increased risk of developing rheumatoid arthritis. One mechanism that may be responsible for risk is molecular mimicry. The result is that immune system antibodies may target "substances such as myosin, keratin, fibrinogen, brain, liver, kidney, smooth muscle, and lung tissues."(53)

Mycoplasma pneumoniae is not limited to just causing rashes, low-grade fevers, walking pneumonia and respiratory illnesses. It is associated with a wide range of central nervous system diseases, including childhood encephalitis. ***Mycoplasma pneumoniae* is also considered a clinically relevant co-infection in Lyme disease and it is often associated with rheumatoid arthritis.**

"Mycoplasma pneumoniae was found in the synovial fluid of 19/24 (79%) of rheumatoid arthritis patients, 6/6 (100%) of patients with nonrheumatoid inflammatory arthritis, and 8/10 (80%) of osteoarthritis patients attending the rheumatology clinic for drainage of joint effusions."(54)

Gastrointestinal Illness Connection with Arthritis

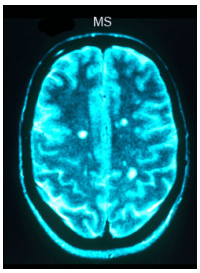
A study in Sweden, that included 71 patients, found that 45 percent of the patients with new-onset arthritis (arthritis occurred within the last three months) had a recent infection prior to arthritis. Laboratory tests for the 45 percent revealed that *Campylobacter jejuni* was the dominant infection. The occurrence of recent infections with *Borrelia burgdorferi, Chlamydia trachomatis,*(**relevant Lyme disease co-infection**) *Chlamydia pneumoniae* (**relevant Lyme disease co-infection**), and Parvovirus B19 were low compared to *C. jejuni* but they were implicated in the arthritis of the patients studied.(55)

Campylobacter jejuni is one of the most common causes of gastroenteritis. Undercooked or poorly handled poultry is the most common cause of infection. "*C. jejuni* is distinct from other causes of dysentery in its association with postinfectious complications such as Guillain–Barré syndrome, reactive arthritis, and postinfectious irritable bowel syndrome."(56)

C. jejuni infections in developed countries are usually asymptomatic. This is likely the result of frequent and early exposure to the bacteria which can provide immunity. The downside is that *C. jejuni* infections trigger both innate and adaptive immune responses that result in **long-term inflammation**. This subclinical inflammation is connected to enteric dysfunction (EED), which **reduces both absorption of nutrients and barrier function** (increases intestinal permeability/leaky gut) in the small intestine. Reactive arthritis is joint pain and swelling triggered by an infection in another part of the body - most often the intestines, genitals, or urinary tract.(56)

Multiple Sclerosis

Multiple Sclerosis (MS) is a chronic disease that attacks the central nervous system (brain, spinal cord and optic nerves). The nerve fibers are surrounded by myelin, which protects the nerve and helps conduct the electrical signals. The nerve fibers in MS patients have scar tissue/sclerosis where the myelin has “disappeared”. This is termed demyelination. The areas on nerve fibers where there is either not enough or no myelin are called plaques or lesions. As the lesions get worse the nerve fiber can break or become damaged.



In Lyme neuroborreliosis (encephalomyelitis) there may be no imaging abnormality, or findings that suggest neuritis, meningitis, myelitis, or encephalitis. White matter lesions are not a prominent feature of Lyme Encephaloyelitis and it is also uncommon to have oligoclonal bands in the cerebrospinal fluid of patients with Lyme disease although this is commonly seen in MS patients. Oligoclonal bands are proteins called immunoglobulins. The presence of these proteins indicates inflammation of the central nervous system.(20)

An interesting hypothesis: “MS prevalence parallels the distribution of the Lyme disease pathogen *Borrelia (B.) burgdorferi*, and in America and Europe, the birth excesses of those individuals who later in life develop MS exactly mirror the seasonal distributions of *Borrelia* transmitting *Ixodes* ticks. In addition to known acute infections, no other disease exhibits equally marked epidemiological clusters by season and locality, nurturing the hope that prevention might ultimately be attainable. As minocycline, tinidazole and hydroxychloroquine are reportedly capable of destroying both the spirochaetal and cystic L-form of *B. burgdorferi* found in MS brains, there emerges also new hope for those already afflicted.” (Med Hypotheses. 2005;64(3):438-48.)

Gastrointestinal Illness Connection with MS

Clostridium perfringens is a gram-positive, rod-shaped, anaerobic, spore-forming pathogenic bacterium and one of the most common causes of foodborne illness in the United States. *Clostridium perfringens* is able to weaken the brain-blood barrier and start disease development. **Epsilon toxin** is a substance produced by certain strains of the foodborne bacteria, including *Clostridium perfringens.* Dr. Jennifer Linden, a researcher at Weill Cornell Medical College said, “We believe we have very convincing data that supports this theory that epsilon toxin causes MS,” and "We provide evidence that supports epsilon toxin's ability to cause BBB permeability and show that epsilon toxin kills the brain's myelin producing cells, oligodendrocytes; the same cells that die in MS lesions.”(21)

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People infected with *C. perfringens* develop diarrhea and abdominal cramps (without fever or vomiting) within 6 to 24 hours; the illness typically lasts for less than 24 hours. Cooking kills the *C. perfringens* cells that cause food poisoning, but not necessarily the spores that can grow into new cells. If cooked food is allowed to sit at room temperature for long, the spores can grow and produce new cells.

Alzheimer's Disease

While the cause, or causes, of the vast majority of Alzheimer's disease cases are unknown, a number of contributing factors have been suggested, including infection. The spirochete *Treponema pallidum*, which causes syphilis, can cause dementia, chronic inflammation, cortical atrophy and amyloid deposition. Spirochetes of unidentified types and strains have been observed in the blood, cerebrospinal fluid, and brain of some Alzheimer's disease patients.

"In three of these AD cases spirochetes were grown in a medium selective for *Borrelia burgdorferi*… Positive identification of the agent as *Borrelia burgdorferi* sensu stricto was based on genetic and molecular analyses. *Borrelia* antigens and genes were co-localized with beta-amyloid deposits in these AD cases. The data indicate that *Borrelia burgdorferi* may persist in the brain and be associated with amyloid plaques in AD. They suggest that these spirochetes, perhaps in an analogous fashion to *Treponema pallidum*, may contribute to dementia, cortical atrophy and amyloid deposition…"(57)

Mental Disorders

The Medical Academy in Bialystok conducted a study in 2000 with 174 patients. Seventy-seven of these patients were diagnosed with arthritis, 20 with neuroborreliosis, 26 with skin manifestation-erythrema migrans and 51 with tick-borne encephalitis. The majority of patients with neuroborreliosis and tick-borne encephalitis experienced psychiatric problems in the acute and late phase (3-6 months after infection) of the disease. **"**The most common psychiatric manifestations were depressive disorders - episodes of depression or organic mood disorders, and cognitive deficits which manifest themselves as mild cognitive disorder or dementia."(58)

"A broad range of psychiatric reactions have been associated with Lyme disease (when it invades the CNS) including paranoia, dementia, schizophrenia, bipolar disorder, panic attacks, major depression, anorexia nervosa, and obsessive-compulsive disorder. Depressive states among patients with late Lyme disease are fairly common, ranging across studies from 26% to 66%…Psychiatrists who work in endemic areas need to include Lyme disease in the differential diagnosis of any atypical psychiatric disorder."(59)

It is important to remember that association doesn't mean cause. We are exposed to thousands of viruses, parasites, and bacteria throughout our life. Schizophrenia has been associated with various infectious organisms with *Toxoplasma gondii* as the primary culprit. *T gondii* is also implicated in bipolar disorders, autism, ADHD, Asperger syndrome, and general anxiety disorder. In addition, a variety of viral infections have been implicated in the development of psychiatric disturbances in adults.(60)

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“There is no question that the high rate of tick-borne illness found in this case series of Pediatric Bipolar Disorder (PBD) patients is provocative. Seventy-four percent or 20/27 youth with PBD were positive for tick-borne illnesses by both laboratory testing and clinician assessment…Mean age at PBD diagnosis was 7.3 years. Exposure to one or more pathogens was found in 24/27 (89%) of the patients. Frequency of positive serology included: Babesia (n=16), Mycoplasma pneumoniae (n=11), Bartonella (N=8), and Lyme (n=6). Twenty-two of these 24 agreed to clinical evaluation and 92% (20/22) were diagnosed with tick-borne illness.’[60]

Chronic Fatigue

Fatigue is a common symptom during acute infections and becomes more pronounced in chronic diseases and when the liver is inflamed. Like most diseases and disorders, there are several paths to the same symptoms. The most common nutritional deficiencies associated with extreme, ongoing fatigue are: Iron, B12, B6, CoQ10, iodine, water-soluble vitamin C, and fat-soluble vitamins A, D, E, and K. The most common systems that contribute to ongoing fatigue include the hypothalamic-pituitary-adrenal axis (HPA axis), thyroid function and the liver. Liver inflammation affects the HPA axis and controls the energy substrates required for various tissues in the body.

What has not been found is a direct connection between Lyme disease and clinically diagnosed chronic fatigue. Indirectly, Lyme disease may be linked to chronic fatigue through immune suppression (leading to reactivation of latent and persistent organisms like the Epstein Barr Virus) or the result of insufficient energy substrates produced by the liver. Lyme disease patients often have low iron, vitamin D, and CoQ10 levels.

Viruses, especially the Epstein Barr Virus (EBV/herpesvirus 4), have been implicated in many chronic fatigue cases. EBV establishes a persistent infection in more than 90 percent of adults and may be reactivated when a person’s immune system is suppressed. During the primary infection, EBV may cause acute hepatitis (inflammation of the liver). Research is also revealing that EBV is a trigger agent for autoimmune hepatitis.[61] Lyme disease also causes a mild form of hepatitis in up to 60 percent of patients.[13] EBV causes mononucleosis and the initial symptoms, including blood work, are similar to what a doctor would see with Lyme disease. Some cases of Lyme disease are misdiagnosed as mononucleosis and some EBV cases are misdiagnosed as Lyme disease.

The liver has a vital role as part of the immune system. The Kupffer cells (hepatic macrophages) in the liver are considered the first line of defense against blood-borne organisms, including *B. burgdorferi.* A lack of Kupffer cells increases the chances that the spirochetes will gain access into the extravascular spaces.[13] *Borrelia* isn’t the only tick-borne infection that results in liver inflammation. According to the CDC.gov website, there were more than 1,640 *Ehrlichia chaffeensis* (a relevant Lyme co-infection) infections reported in 2107 and they often result in cholestasis (impaired bile flow from the liver) and jaundice (when the liver is not able to keep up with the filtering of bilirubin as the red cells die).[62]

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Hormones During Acute & Chronic Inflammation Diseases

During an acute systemic infection (physical stress) the appetite is reduced and energy-rich molecules are released to supply the demands of the immune system. Energy-rich molecules include glucose, free fatty acids, amino acids, calcium, phosphorus, and other substances. As a metabolic organ, it is the liver that produces, stores and releases many of the required energy-rich molecules.(74) If an acute infection becomes a chronic disease, the energy release continues and may result in insulin resistance, low androgen levels, low vitamin levels, increased cortisol levels, and increased activity of the sympathetic nervous system.(70) The sympathetic nervous system stimulates the release of hormones in response to dangerous or stressful situations.

The stress-response system is usually limited/acute. Have you experienced your car sliding instead of stopping at an icy intersection? The hypothalamus, located at the base of your brain, sets off an alarm system in body that alerts the adrenal glands to the danger. The adrenals release adrenaline which increases your heart rate, blood pressure, and energy rich molecules. The adrenals also release the primary stress hormone, cortisol. Cortisol increases blood glucose levels, enhances the brain's ability to use glucose, and increases the production of substances that are used repair tissues. It also slows the functions that are nonessential (digestion, immune system, reproductive system, etc.) during the emergency or perceived threat. Once the danger has passed your hormone levels of adrenaline and cortisol drop, your heart rate and blood pressure return to normal, and other systems resume their normal activities.

Both chronic infection, pain or fever (physical stress), and chronic emotional stress result in the ongoing release of cortisol and other steroidal glucocorticoids. Prolonged exposure to glucocorticoids can disrupt the interactions between the hypothalamus, pituitary gland, and adrenal glands (HPA axis). The HPA axis is a neuroendocrine system that regulates digestion, the immune system, energy storage and expenditure, and influences our mood and emotions. HPA axis dysfunction increases the risk of depression, anxiety, digestive and sleep problems, headaches, weight gain or loss, and heart disease. Fatigue, muscular weakness, excessive free radicals, mitochondrial dysfunction and increased levels of pro-inflammatory cytokines are also associated with HPA axis dysfunction.

During chronic inflammation, which is common in Lyme disease, the HPA axis function is suppressed.(74) When the HPA axis function is suppressed it in turn suppresses the immune system. The use of immune stimulating herbs, without addressing the nutritional needs of the hypothalamus, pituitary, thyroid, and adrenals, is not an effective strategy. Always supply the raw materials, the nutrients required for the organs and systems to function as intended, before trying to stimulate them to do more.

Vitamin A deficiency has multiple effects on the pituitary-thyroid axis. It has a role in regulating thyroid gland metabolism, metabolism of thyroid hormone in peripheral tissues, and the production of thyroid stimulating hormone (TSH) in the pituitary. The pituitary gland is referred to as the 'master gland' because it controls the activity of most other hormone-secreting glands. **Vitamin E** and **selenium** are required for the proper conversion of T4 to T3 and **iodine** is required to make T4 and T3.

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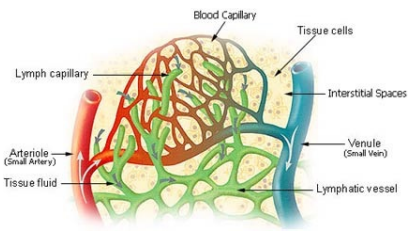
The adrenal glands secrete almost 50 hormones, including adrenalin, cortisol, estrogen, and testosterone. Most natural health professionals recognize that adrenal support should include a **B vitamin complex** that includes 30-50 mg of B6, increased **vitamin C**, and that all possible nutrient shortages should be corrected. A low sugar, low carbohydrate diet that includes abundant fiber (vegetables and fruits), adequate protein, and increased **omega-3 fatty acids** will aid in overcoming “adrenal fatigue”. There are several herbal adaptogens that support the stress-response action of the adrenals. Herbs used with nutritional supplements and diet changes will be more effective if the client is not deficient.

Drug Note: Prednisone, a synthetic steroid similar to cortisol, is used often by medical doctors. Withdrawal will occur if a person stops taking it abruptly or reduces the dose too quickly. Withdrawals occur because the body is unable to immediately produce enough cortisol to make up for the missing drug. It may take several days or weeks before cortisol production levels return to normal. Withdrawal symptoms include: body aches, mood swings, and extreme fatigue. Prednisone is prescribed for diseases that decrease cortisone production but it is also used for inflammation, swelling, and severe itching and redness. Common conditions that are treated with prednisone include: arthritis, asthma, severe allergies, skin conditions, bowel problems, and multiple sclerosis flares. It reduces the symptoms by suppressing the immune system which increases the threat of severe infections. If a person is harboring various latent viruses and bacteria (including *Borrelia*) or fungus, it may create a life-threatening situation.

The Lymphatic System and *B. burgdorferi*

Lyme disease recovery often evades natural health practitioners. The primary reasons for this failure are due to:

- Not understanding how the body functions as a whole (physiology).
- Not taking all infectious agents/co-infections into consideration
- Relying on a “miracle” herb or substance instead of using a combination of herbs and homeopathics in a strategic, layer by layer attack.
- Not understanding that Lyme disease is a multi-system inflammatory disease.
- Not targeting the lymphatic system and interstitial spaces where spirochetes are able to travel and reside.



Humans have two vascular systems: the blood vascular system and lymphatic system. The lymphatic vascular system is a complex network of vessels and lymph nodes and is often referred to as a drainage system. The lymphatic system regulates tissue pressure and fluid status, provides a pathway for immune surveillance, transports nutrients and other substances from the small intestine, and is connected to every cell in the body.

Blood carries the oxygen, proteins, fats, vitamins, minerals, hormones, enzymes, viruses, bacteria, various toxins, and other components to the interstitial fluid that surrounds every cell in the body. The components enter the interstitial spaces through the very small blood capillaries. Since the blood capillaries are too small for the red cells to pass, the interstitial fluid has a milky white color. In addition to the components that passed through the blood capillaries, the interstitial fluid also contains the metabolic waste products released by the cells. One of the main functions of the lymphatic system is to move this fluid, and all the components not used or needed by the cells, through the lymph nodes for processing and return the fluid back to blood system.

When this interstitial fluid enters the lymphatic system is called lymph. Before the lymphatic system returns the lymph back to the blood system it passes through at least one lymph node. There are over 500 lymph nodes in the human body and each lymph node contains dendritic cells, macrophages, and T and B immune cells to remove and neutralize potentially harmful components (viruses, bacteria, etc.). Lymph nodes also contain specialized blood vessels to direct the passage of proteins, cells, and fluid.

When the lymph fluid is not returned to the blood system at the same rate as it leaves a person may develop edema, which is lymphatic congestion. Edema is **protein-rich** interstitial fluid building up in the tissues. This buildup triggers inflammation, swelling, fibrosis (scarring from tissue damage), and increases the risk of soft-tissue infections.(71) *Borrelia* spirochetes disrupt the function of the lymphatic nodes, cause node swelling, and are associated with joint edema and myositis (inflammation of the muscle).

Before the *B. burgdorferi* spirochetes enter the lymphatic system, they must first leave the tick host. When the tick begins to feed on a human host the spirochetes replicate in the midgut, migrate into the salivary glands of the tick, and then are released into the human's bloodstream. The bloodstream carries the spirochetes to various tissues, organs, interstitial spaces, and the lymphatic system. When they reach tissues and organs, they attach to the host cell with molecules known to function as adhesions.

After adhesion the spirochetes become increasingly coiled and move deeper into cells using their flagella. While *B. burgdorferi* does infect various tissues, the bacterial load is very small. The spirochetes also leave the blood system quickly, which is why it is so difficult to detect. The primary destination of *B. burgdorferi* is the lymphatic system where they accumulate in the lymph nodes. Lymphadenopathy, swollen lymph nodes, is a common sign of an acute infection with *B. burgdorferi.* Sometimes the nodes are very large and look like huge bumps under the skin (not lipomas which are fatty tissue).

When the spirochetes enter the lymph nodes, the nodes start producing large numbers of antibody-producing cells (B cells). Normally this action would produce a memory of the bacteria (which is a long-term antibody response resulting in immunity to reinfection). However, this initial strong response to *Borrelia* does not result in immunity because the spirochetes destroy/alter the germinal centers in the lymph nodes they infect. The human body has over 500 lymph nodes and not all of them are affected but, they do distort enough of them to hinder the immune system. This distortion is responsible for *Borrelia's* ability to re-infect the body (new tick bite) or reactivate (latent forms residing in the body). The altered immune function even hinders the immune system's response to other infectious organisms, including the flu virus.

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Lymphatic vessels and nodes are not the only part of the lymphatic system that protects the body from infection. The spleen is the largest lymphatic organ in the body and it has multiple functions. It filters the blood and allows healthy red blood cells to pass but white blood cells in the spleen break down the damaged blood cells. While filtering the blood, it also captures bacteria, viruses, and other foreign particles. When the spleen detects potentially dangerous bacteria, viruses, or other microorganisms in the blood it, along with your lymph nodes, creates lymphocytes. Lymphocytes (T cells and B cells) are a type of white blood cell that produce antibodies. Antibodies and white blood cells stop infections from spreading through the body by trapping and destroying them. Half of all monocytes in the body are stored in the spleen. Monocytes are a type of white blood cell that can engulf a solid particle (bacteria, viruses, nutrients, etc.).

The gastrointestinal tract also contains lymphoid tissue. It is called gut-associated lymphoid tissue or GALT and includes the appendix, Peyer's patches, and lymphoid follicles. The Peyer's patches in the small intestine are specialized lymphoid follicles that are similar to lymph nodes and contain B lymphocytes. Smaller lymphoid nodules can be found throughout the intestinal tract. The mucosa that lines the small intestine is covered with fingerlike projections called villi. There are blood capillaries and special lymph capillaries, called lacteals, in the center of each villus. While the blood capillaries absorb most nutrients, it is the lacteals that absorb the fats and fat-soluble vitamins and deliver them to the bloodstream.

Organ and System Support

The blood supply of the liver is unique among all organs of the body. This is due to the hepatic portal vein system. Blood traveling to the spleen, stomach, pancreas, gall-bladder, and intestines pass through capillaries in these organs and is then collected into the hepatic portal vein. The collected blood is delivered to the liver where it is processed before being passed on to the rest of the body. While the liver has many functions and is well-known as a detoxification organ, it should also be regarded as an immune organ.

The Kupffer cells of the liver are a type of macrophage that capture and break down old, worn out red blood cells. They also capture bacteria and contain neutrophils to clear bacteria from the bloodstream. Most bacteria that enter the bloodstream are taken up and eliminated within the liver, including *Borrelia* spirochetes. The vitamin D nuclear receptors located in the Kupffer cells are involved in mineral ion homeostasis, immunity control, inflammation control, and detoxification of xenobiotics**.** Lyme disease patients are frequently clinically low in **vitamin D**. Kupffer cells also contain hepatic retinoids (precursors or derivatives of **vitamin A**).

As mentioned before, mitochondrial cells take up almost 25 percent of the space in the liver and supply the energy needed for the liver cells. The production of energy (ATP) requires coenzyme Q (CoQ10). **CoQ10** also increases the activity of antioxidant enzymes. Supplementing CoQ10 may help reduce the high mitochondrial superoxide (free radical) levels in Lyme disease patients.

The intracellular antioxidant network includes free radical scavengers and enzymes that degrade superoxide and hydroperoxides. **Vitamin C** maintains the intracellular antioxidant network, which mainly consists of **glutathione** and **vitamin E** but, it also requires **vitamin A**. Vitamin C is also considered an anti-inflammatory molecule. It reduces the reactive oxygen species (proper name for free radicals) that induce proinflammatory cytokines in several inflammatory diseases.(64)

Selenium has antioxidant properties and reduces inflammation in the liver which help protect the liver as it works to remove toxins. The main antioxidant enzymes include dismutases such as superoxide dismutases (**SOD**), catalases, and **selenium-dependent** glutathione peroxidases. All reducing components of the antioxidant network, are regenerated at the expense of NADPH. A clinical trial with Chronic Fatigue Syndrome patients found that supplementing **CoQ10** (200 mg/day) and **NADH** (20 mg/day) resulted in a significant improvement of fatigue.(65)

Nicotinamide adenine dinucleotide, or NAD, is in all living cells, where it functions as a coenzyme. It exists in either an oxidized form, NAD+, or a reduced form, NADH. Nicotinamide adenine dinucleotide phosphate, or NADP+, is a similar molecule with a similar function, differing from NAD+ in that it contains an additional phosphate group. “Broadly speaking, NAD is primarily engaged in regulating energy-producing catabolic processes, whilst NADP may be involved in both antioxidant defense and free radical generation. Defects in the balance of these pathways are associated with numerous diseases, from diabetes and neurodegenerative disease to heart disease and cancer.”(66)

Focusing on the liver, in the event of any disease, is prudent. Both clinical and subclinical liver disease and nutrient deficiencies are common. Some of the liver’s functions:

- Processes blood before passing it to the other organs.
- Breaks down the nutrients into forms that are used by the rest of the body.
- Regulates the levels of most chemicals in your blood.
- Creates bile, which contains waste products and starts the breakdown of fat.
- Produces the many proteins needed for blood plasma.
- Produces cholesterol and special proteins to help carry fat and fat-soluble vitamins to cells throughout the body.
- Converts excess glucose into glycogen for storage (glycogen is converted back to glucose for energy as needed).
- Regulates the blood levels of amino acids, the building blocks of proteins.
- Processes hemoglobin and recaptures its iron content.
- Converts ammonia to urea and clears the blood of drugs and other substances.
- Produces immune factors and removes bacteria from the blood stream
- Stores key vitamins and minerals and delivers them to cells throughout the body.

Do not assume that your client, adult or child, has a perfectly functioning liver. “Many people eating a common American diet are developing extensive hepatic fibrosis, or scarring of their liver, which can **r**educe its capacity to function, and sometimes lead to cancer,” said Donald Jump, a professor in the OSU College of Public Health and Human Sciences.”(67)

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According to the LiverFoundation.org, over 35 million Americans, or **1 in every 10, are or have been affected with liver and biliary disease.** This includes nonalcoholic fatty liver disease, hepatitis B and C, alcoholic liver disease, and others. Approximately 15,000 children are hospitalized every year in the U.S. with pediatric liver disease or disorders.

Non-alcoholic fatty liver disease (NAFLD) is the most common chronic liver disease in the U.S. Approximately 40 percent of adults and over 10 percent of children and adolescents (six million children!) have NAFLD and up to 50 percent **have no symptoms or vague symptoms like fatigue, lethargy, and occasionally itching.** Essentially, NAFLD is excessive fat deposition in the liver and it is strongly associated hepatic manifestation of insulin resistance. **Decreased hepatic vitamin A levels are to be expected**. There is an association between liver **vitamin A and vitamin D** levels and the severity of NAFLD.(63) **Vitamin C** insufficiency is closely related with the development or progression of inflammatory liver disease.

Liver sulfation is the primary pathway for eliminating excess neurotransmitters, several drugs and environmental toxins, some food additives, and toxins from intestinal bacteria. **Non-steroidal anti-inflammatory drugs inhibit sulfation**. NSAIDs are among the most commonly used drugs worldwide, and are taken by more than 30 million people every day.

Liver Support is Whole Body Support

The same minerals and vitamins specifically required by the liver to carry out its functions are also required by most of the cells throughout the human body. Clients that have a chronic disease, long-term low nutrition/processed food diets, or long-term inadequate intestinal absorption, would benefit greatly by taking the liver support supplements listed below.

A person may need all of the items below. It depends on their diet (the last 2-3 years), general health (diet, alcohol, body fat, antibiotic, and prescription drug use…), vitality and physical activity. Dosage should always be adjusted for the individual: age, sensitivities, digestion/indigestion, and medical history.

Vitamins, minerals, and herbs should be taken immediately before or after eating. Stomach acid and other digestive elements are needed for absorption. A few tablets will not stimulate digestion to the extent needed.

- **Food-based multivitamin/mineral that includes iodine** - Read labels and see if you can find one that covers a few of the recommendations listed below. Sometimes the antioxidant blend may serve as a multivitamin.
- **Additional B-complex** (choose the formula based on the complex containing 30-50 mg of B6 and natural folate - not folic acid). Don't forget to add up the mg of B6 from the other supplements. Adding a B-complex may not be needed.
- **Herbal tincture** of Alfalfa, Nettles, Dandelion root, and Bladderwrack (equal portions - 30 drops 2x per day) for additional minerals and whole system support.

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- **Vitamin A as retinol, retinoic acid (not beta carotene)** - The best source is from fish liver. 10,000-25,000 mcg for 1-2 months. Do not use if pregnant!
- **High doses of vitamin C and flavonoids** (500 mg - 1,000 mg 2x per day minimum)
- **Vitamin D** (cholecalciferol-D3) (1,000-2,000 IU) - it may be part of the multivitamin and should be taken with fat/fish oil supplement because it is a fat-soluble vitamin. D3 is cheap to make and clients should not be paying more than $15 for a two to three-month supply. Don't fall for marketing hype!
- **DHA/EPA** - From fish oil. Some brands, like Nordic Naturals, have DHA/EPA fish supplements with 100 mg of CoQ10 in 2 capsules (one with breakfast and one with supper).
- **Antioxidant Blend(s) or Singles to include:** Zinc, selenium, trans-resveratrol (see note below), quercetin (100-250 mg), CoQ10 (50-100 mg twice per day), NAD/NADH is an important molecule involved in the process of generating cellular energy (10 mg twice per day), NAC (see below) - There are many other antioxidants but these are necessary. These should be taken in addition to high-dose vitamin C with flavonoids. Vitamin C cannot be replaced by another molecule/antioxidant in the body.
- **N-acetyl-cysteine** (NAC)(250-500 mg twice per day) This is a precursor to glutathione and is very useful as a supplement for chemical exposures. NAC supplementation should only be used in conjunction with high levels of vitamin C and flavonoids (1,000 mg of ascorbic acid and at least 500 mg of flavonoids). **Hesperidin and rutin are essential flavonoids and accessory nutrients to form a vitamin C complex**.
- **Milk thistle** should be used throughout the balancing process even if it takes 2 years. It helps prevent the depletion of glutathione in the liver and it is a strong antioxidant. Glutathione conjugation in the liver helps to detoxify and eliminate poisons in the liver, lungs, intestines and kidneys. Milk thistle works better than supplementing glutathione. **Use a supplement standardized to include 250-500 mg silymarin flavonoids.** Silymarin protects new liver cells from being destroyed by toxins and also reduces liver inflammation (hepatitis).

Note: CoQ10 in any form, as long as it is taken with a meal/fats, has many health benefits. I did find some research supporting a specific CoQ10 supplement, MitoQ. MitoQ received positive results in preclinical studies for its enhanced ability to enter cell walls. While it is unnecessary for general conditions, it may be the best choice when a client is experiencing excessive inflammation due to an infection.[68]

Note: Resveratrol occurs in two isoforms: cis and trans. Trans-resveratrol is more biologically active. Resveratrol in any form is quickly metabolized which leads to low levels in the blood in a short time after entering the body. It would be best to take smaller doses 2-3 times per day rather than one large dose.

Note: Clients that are chemically sensitive, have strong seasonal allergies, or are very sensitive to drugs and/or herbs may have inefficient acetylation (liver detoxification pathway). A deficiency in B2/riboflavin, B5/pantothenic acid, vitamin C, L-Carnitine, or CoQ10 will inhibit acetylation.

How to minimize the number of tablets to meet the antioxidant supplement goals
First, do not be fooled by label names and marketing. Read the labels! When choosing herbal products, it is extremely important to choose a company that has strict quality control measures. Herbs lose potency when over-dried, old, powdered, or are exposed to oxygen and heat. When you are choosing vitamins, minerals, phytochemical isolates (quercetin, NAD, etc.) stay with well-established companies with proper labs and quality control. Most companies in the U.S. have good manufacturing standards as required by law, you are getting what they say, which is fine for vitamins and minerals.

That said, let's look at the ingredients in Occudyne II by Allergy Research Group. It is not found under the category "antioxidants". It is found under the category of "eye health". As you can see it is better than most multivitamin/mineral supplements however, it does NOT have adequate iodine, vitamin D, and a few other items. It would cut down on the number of bottles and tablets needed meet the needs of all cells when working with a chronic disease. While the pre-formed vitamin A (not beta-carotene) is only 1500 IU it is absolutely safe for long-term use and if pregnant. You do not need to use this product, it is an example.

Occudyne II Supplement Facts (Serving Size: 4 capsules, Servings Per Container:50)

Vitamin A (as 4500 IU of Beta-Carotene and **1500 IU of Retinyl Palmitate**): 120% RDA
Vitamin C (as Ascorbic Acid): 200 mg, 333% RDA
Vitamin D3 (as 200 IU of Cholecalciferol): 5 mcg, 50% RDA
Vitamin E (as d-Alpha-Tocopherol, Mixed Tocopherols andTocotrienols): 67mg, 333% RDA
Thiamin (as Thiamin Hydrochloride): 10 mg, 667% RDA
Riboflavin: 12.5 mg, 735% RDA
Niacin (as 83% Niacinamide and 17% Niacin): 30 mg, 150% RDA
Vitamin B6 (as Pyridoxine Hydrochloride): 15 mg, 750% RDA
Folate (5-Methyltetrahydrofolate [6S]-5-Methyltetrahydrofolic acid,): 400 mcg, 100% RDA
Vitamin B12 (as Methylcobalamin): 28 mcg, 467% RDA
Pantothenic Acid (as Calcium Pantothenate): 50 mg, 500% RDA
Calcium (as Calcium Citrate): 50 mg, 5% RDA
Iodine (as Potassium Iodide): 12 mcg, 8% RDA
Magnesium (as Magnesium Citrate): 125 mg, 31% RDA
Zinc (as Zinc Citrate): 25 mg, 167% RDA
Selenium (as 50% Sodium Selenite and 50% Selenomethionine): 100 mcg, 143% RDA
Copper (as Copper Bisglycinate): 1.5 mg, 75% RDA
Manganese (as Manganese Citrate): 5 mg, 250% RDA
Chromium (as Chromium Picolinate): 100 mcg, 83% RDA
Molybdenum (as Sodium Molybdate): 60 mcg, 80% RDA
Potassium (as Potassium Chloride): 49.5 mg, 1% RDA
Boron (as Boric Acid): 300 mcg - daily value not established
N-Acetyl-L-Cysteine: 100 mg - daily value not established
Glycine; 25 mg - daily value not established
L-Methionine: 100 mg - daily value not established
Taurine: 250 mg - daily value not established
L-Glutamic Acid: 25 mg - daily value not established
Lutein (as 10% FloraGLO® Lutein 10% CWS beadlet): 10 mg - daily value not established
Zeaxanthin; 600 mcg - daily value not established
Quercetin; 150 mg - daily value not established
Horsetail (Stem) Extract: 5 mg - daily value not established
Ginkgo Extract (standardized to 24% **Flavonglycosides** and 6% Terpene Lactones): 30 mg
Bilberry (Berries) Extract (standardized to 25% **Anthocyanosides**): 20 mg
Alpha-Lipoic Acid: 75 mg - daily value not established
Lycopene: 2.5 mg - daily value not established

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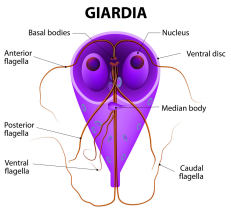
Intestinal/Bowel Support

In addition to our liver, we need well-functioning and microbe-balanced intestines. Gut-associated lymphoid tissue (GALT) is the gastrointestinal mucosa that is made up of several types of lymphoid tissue that contain immune cells such as B and T cells. This tissue is responsible for the immunity to bacteria, viruses, and parasites within the intestines. When an invader enters, the T and B cells are supposed to attack the invader and destroy them. The GALT cells are not as effective without help from a healthy microbiome.

The human gut is a host for a multitude of microorganisms (bacteria, yeasts, eukaryotes and helminth parasites, viruses, and more). The microbiome helps develop the immunity, the resistance, and stimulates your innate immune response. An altered microbiome can lead to illness and disease. Food choices, nutrients, antibiotics environmental toxins, various drugs, and stress factors can alter the microbiome. Recent studies suggest that the microbiome also influences emotional responses and behavior.

Inflammation in the intestines will inhibit absorption of vitamins and minerals. Common causes of intestinal inflammation include bacterial overgrowth, fungus/yeast, parasites, food sensitivities, lowered good bacterial species, low nutrients, and low fiber.
For intestinal function it is important to address any constipation or diarrhea issues, food sensitivities, excess parasite/bacteria/candida/fungus, and the natural flora. Asking someone if they are constipated is not enough. Some believe that if they have a bowel movement once a week they are not constipated because the doctor said it was normal. Ask them if they have at least one bowel movement per day. If they have one per day ask them if the “poop” is formed and stays formed or if it is loose. If constipated they will need a supplement/herbs to move the bowels while you remove the root cause(s).



Clients, regardless of constipation or diarrhea, should receive probiotics, a parasite/bacteria/candida/fungus formula, and usually digestive enzymes/proteases. We need most of the microorganisms in our intestines. It is the over-abundance, overgrowth of “bad” organisms that should be addressed. A healthy body holds small populations of “bad” organisms in check.

The most common food allergens and food sensitivities in the U.S. are soy, milk/dairy, wheat, corn, eggs, tree nuts and peanuts, fish and crustacean shellfish. Researchers estimate that 32 million Americans (5.6 million under the age of 18) have food allergies and about 40 percent of children with food allergies are allergic to more than one food. The Centers for Disease Control & Prevention (CDC) stated that food allergy in children increased by 50 percent between 1997 and 2011. (https://www.foodallergy.org/life-with-food-allergies/food-allergy-101/facts-and-statistics)

Increased intestinal permeability is one of root causes of food allergies and it also increases a person’s susceptibility to autoimmune disorders. Increased intestinal permeability (leaky gut) is most often caused by inflammation and tissue damage from excess *Candida*, bacterial overgrowth, parasites, food allergies and/or sensitivities, antibiotics/drugs, chemicals in tap water, and poor nutrition.

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Chronic inflammation in the intestines from consuming the reactive foods will slowly damage the intestinal walls and increase the permeability (leaky guts). The result is that endotoxins from microorganisms, bacterial translocation, and other molecules may pass through the “gaps” in the intestinal walls. The molecules that were not supposed to leave the intestines and enter the lymphatic and blood system are considered foreign to the immune surveillance team. Systemic inflammation and the role the “escaped” molecules play in various diseases is gaining more attention in the medical field.

Inflammation Reduction

Chronic inflammation is both common and dangerous. It can start many diseases, exasperate symptoms, and dramatically increase pain. Inflammation is usually the result of high sugar, oxidized fats, improper ratio of fatty acids, mineral and vitamin deficiencies, and toxicity. Virus, bacteria, mycoplasmas, and parasites may also lead to chronic inflammation. Acute and chronic Lyme disease is well-known for causing an excessive inflammation reaction.

Reducing the excessive inflammation induced by *Borrelia* can be accomplished by the same nutrients and supplements for liver support and diet changes. If you do not address the diet you may manage to lower the inflammation temporarily but you will not adjust the environment that made them susceptible to Lyme disease and or co-infections. The changes will also create an environment resistant to additional chronic diseases and infections.

In addition to eliminating the top allergens for at least six months (eliminate unfermented and GMO soy forever), a diet very low in grains and sugars with adequate protein and fats will be necessary. What is adequate depends on physical activity and individual digestion and metabolism. Some people do very well on a diet that is high fat with no grains at all, others do well with small amounts of grains. There is no perfect diet to meet the needs of everyone. Some “diets” are great while healing but are not necessarily needed or desirable for years. Remember that a variety of colorful vegetables and fruits should be consumed everyday regardless of the amount of protein, fat, and grains.

Fat is vital for a healthy body but… the type and amount of fat consumed is very important. Fatty acids will either support or hinder your efforts to recover from pathogens, including *Borrellia*. Omega-3 and omega-6 fatty acids are important in the normal functioning of all tissues of the body.

Linoleic acid, an essential omega-6 fatty acid, is required by the human body in small amounts. It is one of two fatty acids that humans cannot produce themselves (must obtain it from food sources). Nuts, seeds, deep green leafy vegetables like kale and spinach, and vegetable oils contain omega-6. Omega-3 fatty acids help reduce inflammation, and some omega-6 fatty acids (soy, corn, safflower, cottonseed) tend to promote inflammation when the ratio of ingestion favors omega-6. The typical American diet tends to contain 14 to 25 times more omega-6 fatty acids than omega-3 fatty acids. Ideally, the ratio of omega-6 to omega-3 fatty acids should be between 1:1 and 4:1.

Research supports the use of omega-3 fatty acids for the treatment of NAFLD. However, the continued overuse of omega-6 fatty acids can interfere with recovery. Additionally, omega-3 fatty acids have beneficial effects in regulating adipose tissue function, and inflammation. Inflammation in the body is also driven by low or deficient vitamins and minerals.

“Increased awareness of obesity has led to a dietary shift toward "heart-friendly" vegetable oils containing omega-6 polyunsaturated fatty acid (omega-6 PUFA). In addition to its beneficial effects, omega-6 PUFA also exhibits **proinflammatory and prooxidative** properties… Our study, for the first time, demonstrates that consumption of a high fat diet rich in omega-6 PUFA for only 4 weeks instigates **mitochondrial nitrosative damage** and causes cardiac dysfunction at high afterloads.” - http://www.ncbi.nlm.nih.gov/pubmed/17023268

Increasing omega-3 fatty acids while decreasing omega-6 fatty acids through food choices, and taking a fish oil supplement, are important steps for reducing inflammation. Protecting the body from the oxidization of the fats in the body is just as important. When the consumption of fish oil and other beneficial fats increases, the need for vitamin E also increases. Increasing vitamin E is also protective when the body is experiencing oxidative stress from infections like Lyme disease.

Vitamin E prevents the oxidation of fats inside the body and it is a common vitamin deficiency. One of the highest vitamin E oils is wheat germ oil. If a person is not celiac or allergic to wheat this is a wonderful oil. Wheat germ oil does not contain more than trace amounts of proteins (like gluten). This applies to butter also as it contains only trace amounts of the proteins and sugars that are responsible for milk allergies and sensitivities. Greens like kale, spinach, swiss chard, raw nuts and seeds, olive oil and avocados are also excellent sources of vitamin E.

Carnitine, derived from the amino acid lysine, is found in nearly all cells of the body where it plays a critical role in energy production by transporting long-chain fatty acids into the mitochondria so they can be oxidized to produce energy. It also transports toxic compounds out of the mitochondria. All amino acids may be low if a person is unable to break down proteins efficiently, has absorption issues from intestinal inflammation, or if they do not consume enough protein to meet their daily requirements.

Low protein consumption, insufficient protein digestion, obesity, and a vegetarian diet may also result in low B12. While B12 will be included in most multivitamin supplements, it is usually not enough. Supplementing with a separate **sublingual METHYL B12** is recommended.

If your client needs additional calcium, use the negatively charged organic molecules (lactate, citrate, malate, fumarate, or gluconate). Calcium lactate is highly soluble and it is highly recommended. I do not recommend the inorganic calcium molecules (carbonates, phosphates, and chlorides). Calcium carbonate has the most elemental calcium but, it is not absorbed as easily and may cause constipation and acid reflux rebound.

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“Potentially harmful phosphate-based products derived from the wet acid digestion of phosphate rock represent one of the most serious problems facing the phosphate industry. This is particularly true for **dicalcium phosphate** (DCP), a food additive produced from either sulphuric acid or hydrochloric acid digestion of raw rock material. This study determined the **natural occurring radionuclide concentrations** of 12 DCP samples and 4 tricalcium phosphate (TCP) samples used for animal and human consumption, respectively…High radionuclide concentrations in some DCP samples may be of concern due to **direct or indirect radiological exposure via ingestion.”**- J Hazard Mater. 2009 Oct 30;170(2-3):814-23. doi: 10.1016/j.jhazmat.2009.05.037.

Systemic Enzymes

Proteolytic enzymes (proteases) are used throughout the body, not just for the digestion of food. In the blood, proteases break down proteins, cellular debris, toxins, harmful substances produced at sites of injury or inflammation and play an important role in preventing and eliminating blood clots and reducing edema. Proteases are also effective against bacteria, fungi, and parasites because they are comprised of protein. Even the capsid that protects the genome of a virus is made of protein.

A protease deficiency compromises the immune system and can lead to edema (fluid retention) anywhere in the body. Protease supplements can be taken with meals to increase digestion of protein but **they must be taken on an empty stomach** if the purpose is to have them reach the blood system. Before bed or at least two hours before eating seems to work best for most clients. Proteases/proteolytic enzymes that are vital during inflammatory conditions include **chymotrypsin, trypsin, bromelain, papain and pancreatin. Serrapeptase and Nattokinase are excellent but do not rely on one enzyme to do all the work.**

In 2001, researchers demonstrated that some surface proteins of *B. burgdorferi* were **resistant to some proteases.**(72) In 2018, the research paper entitled, *The Emerging Role of Microbial Biofilm in Lyme Neuroborreliosis* stated: “Recent evidences suggest that the antibiotic resistance and the reoccurrence of Lyme Borreliosis are associated with biofilm-like aggregates, which allow *Borrelia spp*. to resist adverse environmental conditions.”(73) Taken together, research supports the use of proteases to help with biofilms and may help breakdown parts of the spirochete’s outer membrane.

Research does not support the claim that proteases will cure Lyme disease. Proteases do offer excellent immune support, reduce inflammation, **work with NAC** to disrupt biofilm formations, help clear clot-forming fibrin, and reduce edema. **Protease supplements for Lyme disease should include at least Serrapeptase, chymotrypsin, trypsin, and bromelain.**

“The complex of proteolytic enzyme and anti-protease induces increased plasma concentrations of anti-proteases and elimination of anti-protease-complexes and cytokines. …Oral administration of enteric coated tablets containing proteolytic enzymes of plant and animal origin may stabilize or probably enhance a variety of physiological and immunological processes even in healthy consumers.” - www.ncbi.nlm.nih.gov/pmc/articles/PMC3312459/

Silver: Colloidal Silver

Colloidal silver is defined as a mixture of silver **ions and** silver **nanoparticles** suspended in an aqueous medium. They are usually synthesized by electrolysis using a set of silver cathodes. Silver is not used in the human body and must be excreted. The estimate is that 90-99 percent of ingested silver is eliminated through the feces and urine. Silver absorption through the skin is extremely low due to the sulphydryl groups belonging to the keratin and phospholipids in the skin. The sulphydryl groups bind to the free silver particles like other metals. Recent studies show that silver is probably a low risk xenobiotic metal for humans.

Prolonged ingestion or inhalation of silver may result in permanent silver deposits in the skin that appear bluish (argyria). The estimated amount of silver concentrated in the body to produce argyria is between 3.8 and 5 grams. “Silver should not be regarded as a cumulative poison. Only in cases of chronic systemic silver overload situations where excretory mechanisms become saturated, does silver deposit in an inert fashion in lysosomal or intercellular sites, unrelated to tissue damage. In these situations, selenium serves as a major protective factor in precipitating the silver in a highly insoluble and hence inert form of silver selenide.”(38)

Silver is not a magic bullet cure for Lyme disease! If you choose to add colloidal silver to your client’s protocol, choose colloidal silver products that contain 3 to 30 ppm of ionic silver which should not cause argyria. Do not consume more than the recommended dose.

Essential Oils

Note: The study below was done in a petri-dish and does not reflect the action of metabolism when essential oils are ingested. What the study shows is that some essential oils, when applied directly to the bacteria in a dish, have “strong killing activity”(76). I recommend using the **essential oils topically (diluted with a carrier oil)** as part of a Lyme Disease protocol. I would apply the oils at the groin (inside upper thigh area) and the armpit to target the lymphatic system as a carrier.

“The study, published October 16 in the journal *Antibiotics*, included **lab-dish tests** of 35 essential oils…The Bloomberg School researchers found that 10 of these, including oils from garlic cloves, myrrh trees, thyme leaves, cinnamon bark, allspice berries and cumin seeds, showed strong killing activity against dormant and slow-growing "persister" forms of the Lyme disease bacterium. …In the new study Zhang and his team extended their **lab-dish testing** to include 35 other essential oils, and found 10 that show significant killing activity against stationary phase Lyme bacteria cultures at concentrations of just one part per thousand. At this concentration, five of these oils, derived respectively from **garlic bulbs, allspice berries, myrrh trees, spiked ginger lily blossoms and may chang fruit** successfully killed all stationary phase Lyme bacteria in their culture dishes in seven days, so no bacteria grew back in 21 days. … Oils from **thyme leaves, cumin seeds and amyris wood also performed well**, as did **cinnamaldehyde**, the fragrant main ingredient of cinnamon bark oil.”(76)

Note: Do not use essential oils as a substitute for the whole herbal tinctures recommended in parasite or Candida protocols. The essential oil within a plant are a small part of the whole and are not responsible for all the actions.

Probiotics - Short Note

"A safe probiotic needs to be of human origin, devoid of intrinsic and transmissible antibiotic resistance genes. The functional requirements of a probiotic include acid and bile tolerances, adequate adherence and colonization on epithelial surfaces, immuno-stimulation, and antagonistic activity against pathogens." - https://academic.oup.com/cid/article/62/9/1143/1745140

Bacillus coagulans, Lactobacillus rhamnosus, Lactobacillus reuteri Lactobacillus casei, Lactobacillus plantarum, Lactobacillus acidophilus, Lactobacillus fermentum, Lactobacillus. bulgaricus, Bifidobacterium breve, Bifidobacterium infantis, Bifidobacterium bifidum (most body's most common probiotic bacteria), *Saccharomyces boulardii,* and *Streptococcus thermophilus* are some of the best probiotic strains for *Candida* and bacterial overgrowth protocols. It is not necessary to have them all or all at once. It is important to switch brands/formulations to provide a variety of species.

SEE NEXT PAGE FOR PROTOCOLS

The following pages of protocols are for adults. They are suitable for children, if at least 5 years old and they do not have other serious health conditions in addition to a *Borrelia* infection. One-ounce bottles of both herbs and homeopathics are usually sufficient for young children (5 to 10 years old). The health of the child from birth, age, weight, and sensitivities need to be considered when choosing the types of herbs and the dose.

If the child has many health issues do not use "detoxifying" types of herbs and homeopathics until they have improved through diet changes, proper nutritional supplements, and nutritive herbs.

Children will need a liquid or chewable vitamin. If the only liquid or chewable vitamin you can find includes some things you would not normally give for ongoing health maintenance, do not (unless it is something like Nutrasweet or sucralose/Splenda) skip having the support.

Example: The liquid antioxidant or vitamin/mineral formula has a great profile of ingredients but it also has a preservative and/or folic acid instead of folate. Sometimes we need to settle for the best we can find based on the needs of the client and budget. This is the same as saying it is better to eat conventional veggies than to skip them because organic ones are not available. I know I will take some criticism for this statement but, I would rather give a high-powered antioxidant blend with a preservative added to lower excessive inflammation than allow the inflammation to continue to destroy tissues in the body.

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Acute Lyme Disease & Co-Infection Protocols

I am going to define Acute Lyme Disease as a diagnosed (positive lab test and/or absolute bulls eye markings) event that has happened within the past 3-6 months. If a child or adult is diagnosed with Lyme Disease they should absolutely take the antibiotics!

PHASE ONE: Protocol While Taking Antibiotics (Also, if antibiotics were not prescribed but a *Borrelia* infection is likely)

- **Full-spectrum multivitamin** (dose depending on diet over the past 2 years)
- **Fish oil omega-3 fatty acids** (DHA and EPA)
- **Full-spectrum antioxidant blend** (see liver/whole body support for specific antioxidant information, however, an acute case may not need the "heavy" support)
- **Vitamin C** (500-1,000 mg twice per day) if not included in the antioxidant blend
- **Vitamin D:** 500 IU (children)-1,000 IU (adults) if not included in the multivitamin
- **Adaptogenic/adrenal herbal combination:** Acute and chronic Lyme disease clients often need adaptogenic/adrenal herbs to support the HPA-axis.
- **Herbal Tincture Blend #4**: *Rhodiola rosea, Eleutherococcus senticosus, Schisandra chinensis, and Withania somnifera***

****Withania is* contraindicated for hyperthyroid and nightshade allergies.**
Replace *Withania* with Lemon Balm (*Melissa officinalis*) if client has a hyper-thyroid
Replace *Withania* with Holy Basil (*Ocimum sanctum*) or Milky Oat Tops (*Avena sativa*) if the client has a nightshade allergy

Use equal amounts of each herb (15 ml each, 2 oz. bottle) **Dosage:** 30-60 drops with breakfast and again at lunch. Using these herbs late in the day may interfere with sleep.

- **Herbal Tincture Blend #1**: Echinacea, Burdock Root & Seed, and Nettles. Use equal amounts of each herb, 20 ml each, in a 2 oz. bottle. **Dosage:** 20-30 drops three times per day for lymphatic drainage and immune support while taking the Tick Pathogen nosode homeopathic and/or herbal tincture blends that are anti-bacterial or anti-fungal.

- **If your client likely has an acute case of Lyme infection but no antibiotics were prescribed, start the Lyme disease specific Herbal Tincture Blend #2 in phase one instead of phase two:**

  Herbal Tincture Blend #2: Cat's Claw/*Uncaria tomentosa*, Banderol/*Otoba parvifolia*, and *Andrographis paniculat.* Use equal amounts of each herb, 20 ml each, 2 oz. bottle. Dosage: 20-30 drops two to three times per day. The adult client should finish two 2 oz. bottles and children should use one 1 oz. bottle.

- **Homeopathic:** Use Tick Pathogen Nosode from Professional Formulas if your client was diagnosed with Lyme disease or very likely has Lyme disease/*Borrelia* infection Dosage: 10 drops under the tongue two to three times per day. **Use one bottle - it should last 4-6 weeks**.

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PHASE TWO: Protocol When Client has Completed Antibiotics and/or the Homeopathic Nosode from the first visit:

- **Continue phase one choices** (3-6 months): Full-spectrum multivitamin, Omega 3 fish oils, Full-spectrum antioxidant blend , Vitamin C, Vitamin D, Adaptogenic/adrenal herbal combination
- **Add probiotics** (3-6 months),
- **Add a systemic enzyme** blend for those who can swallow the pills, bromelain (chewable for kids)
- **Herbal Tincture Blend #1**: Echinacea, Burdock Root & Seed, and Nettles. Use equal amounts of each herb, 20 ml each, in a 2 oz. bottle. **Dosage:** 20-30 drops three times per day for lymphatic drainage and immune support while taking the Tick Pathogen nosode homeopathic and/or herbal tincture blends that are anti-bacterial or anti-fungal.
- **Herbal Tincture Blend #2 (2 oz/60 ml): If an adult started this blend in phase one this would be their second and last bottle.**

  Herbal Tincture Blend #2: Cat's Claw/*Uncaria tomentosa*, Banderol/*Otoba parvifolia*, and *Andrographis paniculat.* Use equal amounts of each herb, 20 ml each, 2 oz. bottle. Dosage: 20-30 drops two to three times per day. The adult client should finish two 2 oz. bottles and children should use one 1 oz. bottle (two bottles if symptoms persist).

When your client has finished two bottles of Herbal Tincture Blend #2 they may start, if needed, the Candida/fungus/yeast herbs.

Herbal Tincture Blend #3 for *Candida/fungus/yeast:* Pau d'Arco, Thyme, Oregano and *Cymbopogon citratus*, (Lemon Grass). Use equal amounts of each herb, 15 ml each in a 2 oz bottle. Dosage: Use 30 drops twice per day until the bottle is gone.

The *Candida* herbal blend listed above will "play well" with the Lyme & Co-infection herbs and homeopathics but, if they experience headaches (strong or most of the day) or diarrhea (more than just in morning or once per day) or another strong reaction, reduce the *Candida* herbs and the Lyme herbs by half. **If they are very sensitive**, finish the *Candida* herbs (#3) and start the Lyme herbs (#2) and homeopathics as a Phase Three*.

***Remember to have all the supportive supplements from Phase Two if you start a Phase Three to address the Candida and/or sensitivity issues.**

If your client does not improve significantly or totally please re-read the manual and read the next pages of protocols to determine what may be holding your client back from recovery.

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Chronic, Post Treatment, or Reactivated Lyme Disease in Adults

Your client may need less or more depending on their current state of health! There are supplements mentioned previously in this manual that are not found below (example: Methyl B12).

PHASE ONE (First Appointment)

- **Whole Body & Liver Support:** Provide for the nutritional needs of all organs & systems in the body and reduce excess inflammation and free radicals (p. 27-28 liver/whole body support supplements. Don't forget the liver specific standardized milk thistle).

Use the supplements/herbs during entire protocol. Continue to use as many items as necessary depending on the client's state of health and eliminating viruses, mycoplasmas, etc. that have been reactivated.

- **Adaptogenic/adrenal herbal combination (Herbal Tincture Blend #4):** Acute and chronic Lyme disease clients often need adaptogenic/adrenal herbs to support the HPA-axis.

Herbal Tincture Blend #4: *Rhodiola rosea, Eleutherococcus senticosus, Schisandra chinensis, and Withania somnifera***

****Withania is* contraindicated for hyperthyroid and nightshade allergies.**
Replace *Withania* with Lemon Balm (*Melissa officinalis*) if client has a hyper-thyroid
Replace *Withania* with Holy Basil (*Ocimum sanctum*) or Milky Oat Tops (*Avena sativa*) if the client has a nightshade allergy

Use equal amounts of each herb (15 ml each, 2 oz. bottle) **Dosage:** 30-60 drops with breakfast and again at lunch. Using these herbs late in the day may interfere with sleep.

- **Bacteria/Parasite formula (one 2 oz. bottle):** Reduce the intestinal over growth of bacteria/yeasts/parasites:

There are several formulas to clear the intestines of excess parasites and bacteria but, the best ones will be **alcohol-based tinctures that include at least** Wormwood (*Artemisia absinthium*), Black Walnut Hulls (*Juglans nigra*), and Clove (*Syzygium aromaticum*) or Pumpkin Seed (*Cucurbita pepo*). A pre-made formula like Core Artemisia from Energetix is a great bacteria/parasite formula. Typical dosage is 30 drops, two to three times per day.

If your client has had food poisoning in the past, has IBS (or other bowel symptoms), or usually "throws up" when sick, consider using both a **parasite tincture and a homeopathic nosode** that targets a variety of bacteria and parasites. Here is an example of homeopathic nosode for various bowel parasite: Bowel Pathogen Nosode from Professional Formulas. **If choosing only one, use the herbal tincture**. **Probiotics** should be used for at least one month after a bacteria/parasite or anti-fungal herbal blend.

- **Diet:** Make any needed dietary changes (including common food allergens).

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- **Consider:** If they have any arthritis symptoms add 100% - 200% RDA magnesium (any form except oxide), consider 20% - 30% RDA calcium lactate or citrate, and if any toe or muscle cramping or occasional “missed heart beats” get a potassium (99 mg - plus magnesium, if possible, to cut down on how many tablets). Do not use calcium carbonate.
- **Consider:** Supply digestive enzymes, if needed, for bloating, gas, reflux, heartburn, etc.
- **Consider:** Use an herbal formula for constipation if it is chronic, or doesn’t resolve with diet changes and the bacteria/parasite formula.

Note: When starting a protocol for any **chronic illness**, it is a common mistake to use herbs and homeopathics to target the removal of systemic toxins and organisms as the first step. **Phase One** should be used to make diet changes, supply all the necessary vitamins, minerals, fatty acids, antioxidants, and enzymes needed by the organs and systems to function correctly and to reduce inflammation. Because nutrient absorption is hindered by intestinal inflammation, phase one includes clearing excess organisms and eliminating common food sensitivities and inflammatory foods.

Note: There are several supplements, herbal formulas, and homeopathics that I am recommending and it will be expensive. Try to get as many as possible in a combination and do not overpay based on marketing hype. The best way to absorb, digest, metabolize all of the supplements and herbs is by taking them with food that includes fat as part of the meal. A meal will stimulate the digestive system to provide stomach acid, bile, and digestive enzymes to break down and make the supplements useable. Homeopathics and systemic enzymes must be taken away from food. A good rule of thumb is to take systemic enzymes before bed or two hours before or after food.

Note: If your client has an overgrowth of *Candida,* the bacteria/parasite formula will clear a path for a more effective “attack” on the very resilient *Candida* in **Phase Two**. You should suspect *Candida* overgrowth if they have ever had 2 or 3 antibiotics in a row (this includes childhood ear infections, strep throat, etc.) or have experienced a yeast infection. Long-term food choices that include fake sugars, corn syrup, fast food, hydrogenated oils, and other SAD foods may also result in *Candida* overgrowth.

Note: There are many natural health professionals who expect a strong **Herxheimer reaction** when working with clients that have Lyme disease, *Candida*, and other chronic conditions. It is my philosophy that the reaction is mostly due to not preparing the key organs before the “attack”, not providing adequate support, and/or using a dosage that is too high so that the liver and bowels are unable to keep up with the “waste” products. Experiencing a small reaction is normal but, strong reactions should be a sign that protocol adjustments are needed.

Schedule the Phase 2 appointment for 4-6 weeks after the first visit and remind them to pick up or call to have supplements mailed if they will run out of any supplements.

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PHASE TWO (Second Appointment)
The second appointment should occur 4-6 weeks after the first appointment. The client should have had enough time to make at least some of the diet changes, finish the bacteria/parasite formula, and had at least 30 days of nutritional building with the supplements.

- **Continue Whole Body & Liver Support:** to provide the nutritional needs of all organs & systems in the body and reduce excess inflammation and free radicals

- **Reduce *Candida* species if it is a likely issue**

Herbal Tincture Blend #3 for *Candida/fungus/yeast:* Pau d'Arco, Thyme, Oregano and *Cymbopogon citratus*, (Lemon Grass). Use equal amounts of each herb, 15 ml each in a 2 oz bottle. Dosage: Use 30 drops twice per day until the bottle is gone.

The *Candida* herbal blend listed above will "play well" with the Lyme & Co-infection herbs and homeopathics but, if they experience headaches (strong or most of the day) or diarrhea (more than just in morning or once per day) or another strong reaction, reduce the *Candida* herbs and the Lyme herbs by half. **If they are very sensitive**, finish the *Candida* herbs (blend #3) and start the Lyme herbs (blend #2) and homeopathics in Phase Three. This will create a Phase Four where you need to continue the supportive supplements and herbs.

- **Continue** to make any needed dietary changes
- **Continue** to supply sufficient digestive enzymes, if needed, for bloating, gas, reflux, heartburn, etc. Use an herbal formula for constipation if it is still an issue.
- **Continue** calcium, magnesium, and potassium if they started the items at the first appointment.
- **Add Probiotics**
- **Add Lyme & Co-infection Herbs**

Herbal Tincture Blend #2: Cat's Claw/*Uncaria tomentosa*, Banderol/*Otoba parvifolia*, and *Andrographis paniculat.* Use equal amounts of each herb, 20 ml each, 2 oz. bottle. Dosage: 20-30 drops two to three times per day. The adult client should finish two 2 oz. bottles and children should use one 1 oz. bottle (two bottles if symptoms persist).

- **Add Lyme & Co-infection Homeopathic Nosode**

Choosing between Lyme Nosode Drops and Tick Pathogen Nosode from Professional Formulas

If your client would be described as weak, sensitive to foods or chemicals, or has taken many pharmaceuticals, use Lyme Nosode Drops (5-10 drops under the tongue, two times per day). Also choose Lyme Nosode Drops if your client most likely had Lyme disease but a co-infection may be hindering recovery.

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If a client is still experiencing symptoms after finishing a bottle of Lyme Nosode have them take the Tick Pathogen Nosode Drops as a next step (include Herbal Tincture Blend #2 and either Hoxey-like formula or Herbal Tincture Blend #5).

Use Tick Pathogen Nosode if your client was diagnosed with Lyme disease or very likely has Lyme disease/*Borrelia* infection. Dosage: 5-10 drops under the tongue two to three times per day. **Use one bottle - it should last 4-6 weeks**.

Professional Formulas: Tick Pathogen Nosode 2 oz
Borrelia burgdorferi, Borrelia andersonii, Borrelia atzelii, Borrelia garinii, Borrelia japonica, Babesia microti, Ehrlichia chaffeensis, Bartonella henselae, Anaplasma phagocytophilium, Mycoplasma fermentans, Rickettsia rickettsia, Tularemia, Herpes virus #6, Colorado tick fever, Rocky Mountain Spotted Fever 30X, 60X, purified water, 20% alcohol.

Professional Formulas: Lyme Nosode Drops 2 oz.
Active Ingredients: Angelica archangelica 2X, Du huo 2X, Shujin chin 2X, Magnesia phosphorica 2X, 3X, 6X, Hydrastis canadensis 3X, Kali muriaticum 3X, Manganum metallicum 3X, Yucca filamentosa 3X, Cartilage 3X, 6X, 12X, Phytolacca dacandra 3X, 12X, 30X, Rhus toxicodendron 6X, Causticum 6X, 12X, 30X, Hordeum vulgare 8X, Oxalicum acidum 8X, 12X, Arnica montana 8X, 100X, 1000X, Latrodectus mactans 10X, **Lyme nosode** 12X, 30X, 60X, **Ticks** 12X, 30X, 60X, **Rocky mountain spotted fever** 12X, 30X, 60X, **Babesia microti** 12X, 30X, 60X, **Ehrlichia chaffeenis** 12X, 30X, 60X.

- **Add lymphatic drainage and blood "cleanser" herbs** to support the safe use of the Lyme & Co-infection herbs and homeopathics: **Choose One**

Adults: Hoxey-like formula from Professional Formulas (it is a 4 oz. bottle for adults at 30-60 drops, two or three times per day.)

Children or Adults: Herbal Tincture Blend #1: Echinacea, Burdock Root & Seed, and Nettles. Use equal amounts of each herb, 20 ml each, in a 2 oz. bottle. **Dosage:** 20-30 drops three times per day for lymphatic drainage and immune support while taking the Tick Pathogen nosode homeopathic and/or herbal tincture blends that are anti-bacterial or anti-fungal. Be sure to use child-appropriate dose for children.

Children or Adults (stronger formula): Herbal Tincture Blend #5: Poke root, Echinacea, Burdock root & seed, Red Clover. Use equal amounts of each herb, 15 ml each, in a 2 oz. bottle. 20-30 drops two to three times per day for lymphatic drainage and immune support while taking nosode homeopathics and/or herbal tincture blends that are anti-bacterial or anti-fungal. Be sure to use child-appropriate dose for children.

- **Add systemic enzymes** (chymotrypsin, trypsin, and bromelain are the most important)
- **Consider** adding 2 to 3 specific essential oils to use topically (see page 34)

Schedule the Phase Three appointment for 6 weeks after the second visit and remind them to pick up or call to have supplements mailed if they will run out of any supplements.

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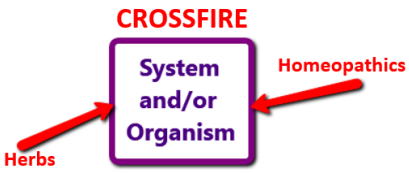
PHASE THREE (Third Appointment and Beyond!)

The third appointment should occur about 6 weeks after the second appointment. At this point have them fill out a new symptom form (like the one completed at first visit) while they are seated with you for the appointment. You will need to determine what has resolved, what has improved, and what is still lingering. This requires that you talk about the symptoms in detail and take notes and ask many questions to get specifics.

What they need will depend on which symptoms are left, how they responded and reacted to past homeopathics and herbs, their state of health before starting the Lyme disease protocols, and possible reactivated organisms. Re-read this manual!

Common reactivated organisms:

- Viruses in the herpes family (including EBV) which often cause great fatigue, sluggish liver issues, and nerve pain symptoms.
- Systemic mycoplasmas and bacteria (joint pain and/or swelling.)
- Liver parasites (need to use homeopathic nosode specific for flukes and other parasitic organisms - VER from DesBio would be a good choice.)
- If they have a medical history of strep throat, pneumonia, bronchitis, sinus infections, or other bacterial issues you will need to address food sensitivities and bacterial overgrowth in the bowels or systemic parasites (amoeba and protozoa).



- Remember the crossfire action for best results. Use a homeopathic and herbal formula aimed at the same system and/or organism.
- Never forget lymphatic drainage and blood cleansing herbs.
- Always support the liver and/or bowels.
- Heavy Metals should never be a first target as they are usually stored outside the liver. Clear the liver and bowels, and build up nutritional status before stimulating the release of metals. Provide sufficient antioxidants and drainage during your protocol.

Specific Formulas used in the protocols:

Herbal Tincture Blend #1 for gentle blood and lymphatic support and movement: Echinacea, Burdock Root & Seed, and Nettles. Use equal amounts of each herb.

Herbal Tincture Blend #2 is specific for *Borrelia* and other bacteria: Cat's Claw/*Uncaria tomentosa*, Banderol/*Otoba parvifolia*, and *Andrographis paniculat.* Use equal amounts of each herb.

Herbal Tincture Blend #3 for *Candida/fungus/yeast:* Pau d'Arco, Thyme, Oregano and *Cymbopogon citratus*, (Lemon Grass). Use equal amounts of each herb.

Herbal Tincture Blend #4: *Rhodiola rosea, Eleutherococcus senticosus, Schisandra chinensis, and Withania somnifera*** *Withania is* contraindicated for hyperthyroid and nightshade allergies. Replace *Withania* with Lemon Balm (*Melissa officinalis*) if client has a hyper-thyroid. Replace *Withania* with Holy Basil (*Ocimum sanctum*) or Milky Oat Tops (*Avena sativa*) if the client has a nightshade allergy. Use equal amounts of each herb.

Herbal Tincture Blend #5 for a stronger blood and lymphatic support and movement (not as "aggressive" as Hoxey-like formula by PF): Poke Root, Echinacea, Burdock Root & Seed, Red Clover. Use equal amounts of each herb.

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Examples of Great Products Listed Below:
Always check new labels before ordering. DesBio has changed some formulas (removed nosodes) but didn't rename the products.

During EDS testing I found that most of Energetix homeopathics did not test or test as well as those from Professional Formulas and DesBio. The Energetix herbal combinations tested well.

PF = Professional Formulas

Homeopathic Nosodes - Primarily Bacteria & Mycoplasma
Lyme Nosode Drops (PF)
Tick Pathogen Nosode (wide range) (PF)
Rheumatoid Arthritis Nosode (wide range - ignore the label name!) (DesBio)
Lyme Plus (wide range) (DesBio)
Bacteria Plus (wide range) (DesBio)
Borrelia Series (10 vials) (DesBio)
Borrelia-Babesia Series (10 vials) (DesBio)
Mycobacter/Mycoplasma (PF)

Homeopathic Nosodes - Primarily Parasites
Bowel Pathogen Nosode (wide range) (PF)
Parasites/Amoeba/Protozoan Nosode (PF) - excellent for children also (1 oz.)
Food Poisoning Detox (wide range) (PF)
Colo-Chord (amebas/ parasites) (Energetix)
VER (liver is primary target) (DesBio)

Homeopathic Nosodes - Fungus/Mold/ Candida
Toxic Fungi-Mold Nosode (PF)
Mycosis Nosode Drops (PF)
Mycocan-Chord (candida/fungus) (Energetix)

Homeopathic Nosodes - Viruses (involved in chronic diseases)
Virus Nosode Drops (PF)
Vaccinosis Nosode Drops (PF)
Childhood Immunizations Detox (PF)
Herpetic Nosode Formula (PF)
EBV/CFS Plus (DesBio)
Virus Plus (fatigue generating) (DesBio)

Homeopathic: Xenobiotic Detoxification
Food Additive Detox (PF)
Lawn and Garden Detox (PF) pesticides etc.
Industriox (PF) and many other formulas

Herbal Formulas: Parasites/Bacteria/ Candida/Fungus
Parasite Complex (parasites) (DesBio)
CoreArtemisia Blend (parasites/bacteria) (Energetix)
Para-A (parasites/bacteria) (Marco Pharma)
Core Pau d'Arco Blend (Candida/Fungus) (Energetix)

Herbal & Homeopathic (HO) Formulas for Blood/Lymph/
Hoxsey-Like Formula 4 oz (blood/lymph) (PF)
Lappa #30 (blood/lymph) (Marco)
PhytoChemo 4 oz (cell destruction) (PF)
Scolopendrium (spleen) (Marco)
Core Scrofulara (lymph/spleen) (Energetix)
HO: Lymph Drainage (DesBio)
HO: Systemic Drainage (DesBio)
HO: Lymphonest #10 (Marco)
HO: Drainage-Tone (lymph) (Energetix)

Metals (Always use with blood/lymph/ kidney/liver support)
Cilantro tablets (Marco)
Nepro-Rella (Marco)
Viscum #3 (Marco)
Core Cilantro Blend (with liver/kidney support - Energetix)

There are various homeopathics to crossfire with the herbs depending on whether the client has "silver" fillings or other metals (screws…)

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