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### **Inflammation in Lyme Disease**

**Historically, the defining features of inflammation include: rubor (redness), calor (warmth), tumor (swelling), and dolor (pain) and there is a distinction between acute and chronic inflammation. Acute inflammation compromises the early response to an injurious agent and is a defensive response that paves the way for repair of the damaged site. Chronic inflammation results from stimuli that are persistently damaging to tissues. Inflammation is a way in which the body reacts to infection, irritation or other injury and is considered a nonspecific immune response. The inflammatory response directs immune cells to the site of injury or infection and is manifest by an increased blood supply and vascular permeability. Microorganisms are then engulfed by neutrophils and macrophages (types of white blood cells) in an attempt to contain the infection to a small tissue space.**

**However, Lyme Disease can involve multiorgan systems and therefore inflammation becomes a more generalized condition. This may occur in joints, muscles, the intestine, the heart, and the brain where spirochetes bury themselves deep within tissues to avoid being detected by the immune system.**

**Inflammation becomes particularly concerning when the brain is involved. Microglial cells (immune cells of the brain) become activated in response to an insult or injury and cause localized inflammation. When spirochetes reach the brain, an immune response is activated and inflammation occurs. Patient's may experience the feeling of "swelling" in their head or eyes or pressure in their head. This may also be the result of increased intracranial pressure secondary to inflammation.**

**When the microglial cells of the brain become activated, a particular brain biochemical pathway known as the "kynurenine pathway" becomes involved and the production of a highly toxic molecule known as "quinolinic acid" results from the metabolism of the amino acid tryptophan. Quinolinic acid can be thought of as the equivalent to "battery acid" in the brain where it literally causes neuronal destruction through increased free radical production as is observed in multiple sclerosis, Parkinson disease, Alzheimer's diseases and ALS.**

**In summary, chronic microglial cell activation in the brain from an infection causes activation of a specific biochemical pathway known as the "kynurenine" pathway. Utilization of tryptophan in the kynurenine pathway produces a highly toxic**

**molecule known as “quinolinic acid” which essentially degrades neurons in the brain and may cause cell death. In other words, the brain becomes toxic from quinolinic acid and free radical production and cell destruction occurs.**

**There are natural therapies that can help minimize the effects of quinolinic acid and decrease brain inflammation and toxicity. This will result in decreased brain fog, confusion, a recovery of memory function and greater mood stability. I have been working with this paradigm for quite some time with great success. The idea is to DECREASE inflammation so that tissue damage is minimized and nutritive healing can occur.**