

The Lyme Bacterium (*Borrelia burgdorferi*)



Habitat: Called an endoparasite, this bacterium can only live inside of another organism. Remarkably, *B. burgdorferi* can survive in a range of temperatures, from the hemolymph of insects to the warm blood of mammals.

Diet: *B. burgdorferi* obtains nutrients and energy from the blood of a host.

Life Cycle/Reproduction: *B. burgdorferi* reproduces asexually, making identical copies of itself with each duplication. They can reproduce rapidly, and one scientific study found an average of 2,735 bacteria/tick 15 days after the tick had fed. Although the scientists found that recently molted nymphs had only 300 bacteria/nymph, within 75 days, these nymphs had an average of 61,275 bacteria! The tick serves as the vector for the bacteria, moving it from one "holding place" or "reservoir" to another host, which may even be a human. Small rodents, especially mice, act as good reservoirs. If a larva bites an infected mouse, that tick will likely become infected itself. The tick vector can then bite another host and transmit the bacteria, propagating itself.

Dispersal: There are two types of dispersal associated with this bacterium. First, there is dispersal of individual bacteria. For example within the tick, the bacteria attach to the mid-gut to avoid being digested by the tick. When the tick attaches to a vertebrate host, the bacteria detach from the mid-gut and migrate to the salivary glands, where they can then be transmitted to the vertebrate host. Secondly, there is dispersal of the entire population of bacteria. This type of dispersal requires that the bacteria successfully "move" from a reservoir to a host with the help of a vector.

Biotic interactions: The biotic interactions associated with *B. burgdorferi* have been discussed above. The bacteria need hosts, vectors, and reservoirs. The most effective reservoir is the white-footed mouse, and the most effective vector is the black-legged tick. One susceptible host is the human, which, if infected and untreated, can become very sick. Using the term loosely, competitors of the bacteria would be those host cells that compete with the bacteria for accessing food and nutrients. Animals that pick off the tick before it can attach for 48 hours (and before the bacteria can migrate from the gut to the saliva), act as "predators". Other "predators" include the immune system of some animals that can fight the infection and destroy the bacteria.

References:

<http://www.ajtmh.org/cgi/content/abstract/42/4/352>

<http://www.afpmb.org/pubs/tims/tg26/References/169235.pdf>

Based on the fact sheet, what resources and conditions would favor the growth of a population of bacteria? What resources and conditions would benefit an individual bacterium?

Organism	Resources	Conditions
<i>Borrelia burgdorferi</i> (Lyme-causing bacteria)	<i>Nutrients and energy obtained from feeding within the host</i>	Biotic Conditions <i>Competition</i>
	-depends on host susceptibility and availability	-must be able to successfully enter host which requires that the tick be attached for 24 hours
		<i>Predation/Death</i>
		-must be able to avoid predators (host immune system)
		<i>Dispersal</i>
		-individual level: requires proteins to attach to the tick's gut (to avoid digestion) and to be able to migrate from the gut to the tick's salivary glands to be dispersed
		-population level: requires vectors to be available in which to reproduce and to be dispersed to other hosts
		Abiotic Conditions
		-can survive range of host temperatures