Scientists identify potential key to Lyme disease

February 9 2009

Researchers at UT Southwestern Medical Center have identified a protein that may help give Lyme disease its bite. The findings suggest that the bacterial protein, which aids in transporting the metal manganese, is essential for the bacterium that causes Lyme disease to become virulent.

"We believe our findings provide a foundation for further defining metal homeostasis in this human pathogen and may lead to new strategies for thwarting Lyme disease," said Dr. Michael Norgard, chairman of microbiology at UT Southwestern and senior author of a study now online and in an upcoming issue of the *Proceedings of the National Academy of Sciences.*

Lyme disease, discovered in 1977, is the most prevalent tick-borne infection in the U.S. Borrelia burgdorfei, the bacterium that causes Lyme disease, lives in infected mammals and in the midgut of ticks. When an infected tick bites an animal or a human, the bacteria are transmitted to the new host. Infection causes fever, malaise, fatigue, headache, muscle and joint aches, and a characteristic "bull's-eye" rash that surrounds the site of infection.

To establish infection, however, the bacterium also must acquire a number of essential nutrients, including metals like manganese from its mammalian and tick hosts. Until now, no metal transporter responsible for this acquisition had been identified in this bacterium.

In the current study, microbiologists examined whether bacteria genetically engineered to lack this manganese transporter, called BmtA, transmitted Lyme disease to ticks and mice. The bacterium lacking the transporter, Dr. Norgard said, grows a bit more slowly in the test tube but is not dramatically different from the normal version.

"When you try to grow it in a mouse, however, it can't grow," he said. "The fact that the bacterium without this particular manganese transporter can't grow in a mouse raises important questions about what aspects of physiology and metabolism contribute to the pathogenicity of the organism."

Lead author Dr. Zhiming Ouyang, postdoctoral researcher in microbiology at UT Southwestern, said another newly discovered characteristic about the bacterium that causes Lyme disease is that it doesn't seem to require iron to function, something most other pathogens need to survive.

"Out of the thousands of bacteria known, the Lyme disease agent and only one or two other bacterial species do not require iron for growth," Dr. Ouyang said. "That raises the question as to what other metal co-factors the Lyme disease bacterium depends on to carry out the work that iron does for all these other biological systems. Our research suggests that manganese is a really important one."

The next step is to understand the exact mechanism of how manganese functions in the organism.

"I really think that there's also something to the notion that manganese may regulate the expression of other virulence factors," Dr. Norgard said. "It could be that manganese has more of an indirect effect, but more research is needed to determine what must happen for Borrelia burgdorfei to become virulent."

Source: UT Southwestern Medical Center