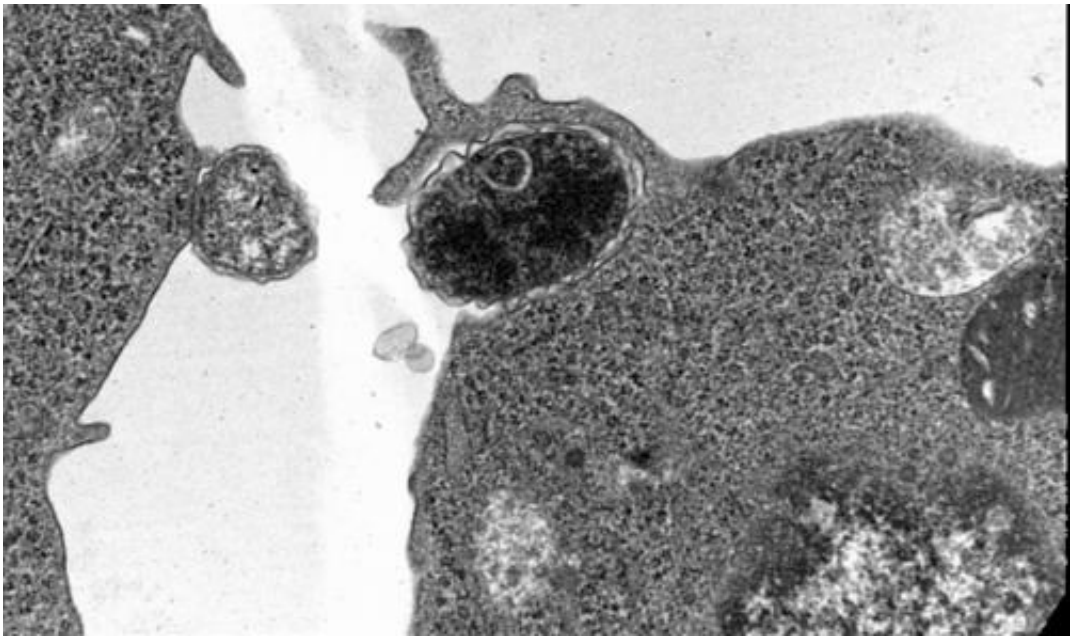
# Researchers uncover molecular basis of infection of tick-transmitted disease

October 12 2012



The image depicts two *Anaplasma phagocytophilum* bacteria (arrows) that are bound to the surfaces of host cells. The bacterium on the right (thick arrow) is invading its host cell by triggering its own uptake. A team of VCU researchers led by Jason Carlyon, Ph.D., has identified a key mechanism by which this pathogen invades host cells. Their findings provide a direction for developing a vaccine for protecting against *A. phagocytophilum* and related bacterial pathogens. Credit: Image courtesy of Jason Carlyon, Ph.D. and Matthew J. Troese, Ph.D./VCU.

Virginia Commonwealth University School of Medicine researchers

have identified the "keys" and "doors" of a bacterium responsible for a series of tick-transmitted diseases. These findings may point researchers toward the development of a single vaccine that protects against members of an entire family of bacteria that cause disease in humans, domestic animals and livestock.

Survival for many bacteria is dependent on their ability to invade human or animal cells. And it needs to be done in a very precise fashion. Bacteria use a specific set of "keys" on their surfaces to unlock specific "doors," or entryways into their host cells.

By understanding how these bacteria invade cells, researchers are able to identify potential targets to block the spread of infection, and from there, develop safe and effective vaccines.

In the study, now published online and appearing in the November (Volume 80, Issue 11) issue of the journal *Infection and Immunity*, a journal of the American Society for Microbiology, researchers reported that a protein called OmpA on the surface of *Anaplasma phagocytophilum* is important for invading host cells. *Anaplasma phagocytophilum* is an *Anaplasmataceae* bacterium that infects humans to cause granulocytic anaplasmosis. It is the second most common tick-transmitted disease after Lyme disease in the United States, and it also is found in Europe and Asia.

The team also identified the particular sugar residue on the surfaces of host cells to which OmpA binds.

"In other words, we identified both a key and door that together promote *Anaplasma phagocytophilum* infection," said lead investigator Jason A. Carlyon, Ph.D., associate professor and a George and Lavinia Blick Scholar in the Department of Microbiology and Immunology in the VCU School of Medicine.

"These findings are important because our data also establish a direction for development of a single vaccine that protects against members of an entire family of bacteria that cause disease in humans, domestic animals and livestock," he said.

According to Carlyon, the region of OmpA that mediates infection is shared among other *Anaplasmataceae* bacteria.

Experts have seen a steady rise in the incidence of human infections caused by tick-transmitted bacterial pathogens in the past several years. Many tick-transmitted bacterial pathogens are considered "emerging pathogens" because it was only recently discovered that they infect humans. Moreover, evidence suggests that many of these infections go unrecognized, signifying that the prevalence of human diseases caused by *Anaplasmataceae* pathogens is even higher, said Carlyon. Livestock infections carry a significant economic burden, costing the U.S. cattle industry $100 million per year, he added.

Researchers in Carlyon's lab are presently refining their understanding of how OmpA promotes infection and testing its efficacy in protecting against infection by *A. phagocytophilum* and other *Anaplasmataceae* members.

The findings of the VCU-led study were also highlighted in a commentary that appeared in the same issue of the journal, authored by two experts in the field, including Guy H. Palmer, DVM, Ph.D., director, Creighton chair and Regents professor in the Paul G. Allen School for Global Animal Health at the Washington State University College of Veterinary Medicine, and Susan M. Noh, Ph.D., also with Washington State University College of Veterinary Medicine.

For this work, VCU has filed a patent. At this time, U.S. and foreign rights are available, and the team is seeking commercial partners to

further develop this technology.

Provided by Virginia Commonwealth University