New findings could help target the bacteria that cause Lyme disease and syphilis (w/ Video)

November 19 2013

The bacterial pathogens that cause Lyme disease and syphilis are highly invasive. These pathogens, or spirochetes, can invade the central nervous system and, in the case of syphilis, enter the placenta, causing disease in the unborn child. In the November 19 issue of the *Biophysical Journal*, a Cell Press publication, researchers provide new insights into how these spirochetes penetrate tissue barriers. The findings might be used to develop new treatment strategies to help affected patients or even prevent infections.

"We are one of the few groups that are trying to understand the physical interactions with the environment that make spirochetes such successful pathogens," says senior author Dr. Charles Wolgemuth of the University of Arizona in Tucson. "We've previously understood very little about how these bacteria move through and into our organs, tissues, and central nervous system, but our work sheds light on these processes and could form the basis for novel therapeutics that target the bacterium's ability to invade."

Dr. Wolgemuth and his team, in collaboration with Dr. Justin Radolf at the University of Connecticut Health Center, found that the swimming speeds of the bacteria decrease with increases in the viscosity of their external environment, even though their motors—called flagella—are entirely intracellular. The team then used mathematical modeling to determine how these flagellar motors propel the undulating bacteria

forward through viscous fluids. Finally, they fit their simulated data to their experimental data to reveal how external forces affect the movement of the Lyme disease and syphilis spirochetes.

The researchers also showed that both types of spirochetes (syphilis's *Treponema pallidum* and Lyme disease's *Borrelia burgdorferi*) respond to changes in viscosity in a similar manner and can be explained by the same biophysical model. "Since the syphilis bacterium cannot be cultured in the lab, our results show that data derived from studying the Lyme disease bacterium is highly informative about the syphilis bacterium and can be used as a 'surrogate' for it," says Dr. Wolgemuth.

More information: *Biophysical Journal*, Castellano et al.: "Viscous Dynamics of Lyme Disease and Syphilis Spirochetes Reveal Flagellar Torque and Drag" dx.doi.org/10.1016/j.bpj.2013.10.004

Provided by Cell Press