Identification of a Crucial Legionnaire’s Disease Virulence Factor: The Transmembrane Permease Lpg0730 Is Integral to the Ability of Legionella pneumophila to Infect Protozoan Host Cells

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The intracellular bacterial pathogen Legionella pneumophila causes a severe pneumonia, Legionnaire’s disease. Legionella grow ubiquitously in freshwater environments, such as ponds and streams. However, the development of certain technological advances, such as air-conditioning systems, has allowed the bacterium to become an opportunistic human pathogen. Humans inhale Legionella contaminated water droplets and the bacteria are engulfed by macrophages as part of the innate immune response. Upon phagocytosis, the bacteria establish a replicative position inside of an endoplasmic reticulum (ER) compartment and use the compartment to replicate. Using the Dot/Icm Type IV Secretion system (T4SS), the bacteria deliver hundreds of ‘effector’ proteins to the cytosol of the host cell. These proteins collectively work to disrupt host cell processes in order to produce an ER compartment suitable for Legionella replication. Recently the transmembrane permease Lpg0730 has been proposed and annotated as a quorum sensing receptor. This protein rests on the membrane Legionella and likely regulates the transport of specific molecules in or out of the cells. This study aimed to define the role this protein plays in the basic cellular operations of Legionella. Through a “trial and error”-style experimental design, it was found that the protein is not involved in Legionella quorum sensing; rather it is a virulence determinant in its T4SS. An in vivo intracellular growth assay revealed that the transposon mutant strain of Lpg0730 did not infect host cells. These findings can be translated into the development of new antibiotic treatments that target Lpg0730 specifically.

Awards Won:
Second Award of $2,000