Scientists Resolve Decades-old Mystery of ‘Chlamydial Anomaly’

Bethesda, Md -- A 50-year-old mystery surrounding the existence of a cell wall in the bacterial pathogen Chlamydia trachomatis, or chlamydia, has been solved by researchers at the F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences (USU). Chlamydia is the leading cause of sexually transmitted infections worldwide, infecting nearly 1.5 million Americans each year. It can cause sterility in men and women, Pelvic Inflammatory Disease, and ectopic pregnancy and is also the leading cause of preventable blindness. Other types of chlamydia cause a variety of diseases in humans and animals, including two strains of the bacterium that are threatening survival of the koala population in Australia.

Since the 1960s, scientists have tried to solve the ‘chlamydial anomaly.’ All chlamydial species are sensitive to antibiotics that target the bacterial cell wall, or peptidoglycan, but no one has ever been able to show that peptidoglycan exists in chlamydia until now.

In an article published in the Dec. 11 issue of Nature, study lead co-author Dr. George Liechti, a postdoctoral fellow in the laboratory of Dr. Anthony Maurelli at USU, along with a scientific team from Maurelli’s lab and collaborators from Indiana University (IU) in Bloomington, Ind., outlines their discovery of the presence of a peptidoglycan in chlamydia.

Using novel chemical probes designed by researchers in the laboratories of IU scientists Drs. Yves Brun and Michael Van Nieuwenhze, Liechti was able to visualize the cell wall of chlamydia for the first time since these paradoxical observations were initially described 50 years ago. Maurelli’s team, working closely with the IU researchers, produced images that revealed a cell wall architecture never before seen in bacteria: a ring-like structure that appears to cut across each growing microbe at its center line.

Additional experiments carried out by Liechti and IU researcher Erkin Kuru confirmed that the label is specific for the bacterial cell wall and suggests that chlamydia generates its unique cell wall the same way as many other microbes, such as E. coli, do.

The demonstration by Maurelli’s team that chlamydia possess peptidoglycan will help other researchers study how infection with these organisms produces an inflammatory response in its human host.

In addition, peptidoglycan almost certainly plays a role in chlamydial cell division, says Liechti. “We know almost nothing about how chlamydia divide,” he said, “but the unusual labeling pattern of the peptidoglycan that we observed suggests some very testable models that we plan to pursue in our lab.”

In addition to solving a decades-old mystery, this study suggests new and powerful applications of this innovative labeling technique developed by Maurelli’s IU collaborators. This breakthrough in labeling technology has the potential to revolutionize the study of the microbial cell wall with potential applications in visualization of the cell wall by electron microscopy and the eventual capture and purification of peptidoglycan components.
Learning to Care for Those in Harm's Way

“I am thrilled that we were able to resolve the chlamydial anomaly,” said Maurelli. “Now that we have shown that chlamydia have a typical bacterial cell wall, scientists can focus on key questions such as how the peptidoglycan of chlamydia contributes to the severe inflammation that is typically seen in chlamydia infections of the eye and the genital tract. We can also get a better understanding of how certain antibiotics work against these organisms.” The discovery could eventually lead to the development of new therapeutic approaches for treatment of chlamydial infection.

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About the F. Edward Hébert School of Medicine, USU:

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