New methods for infectious diseases research developed

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Infectious diseases researchers at Umeå University in Sweden are studying the properties of bacteria with the same methods that materials scientists use to research surfaces. Studies of the outermost parts of the cell walls of bacteria yield new information about the chemical composition of structures that are key to the capacity of bacteria to infect organisms.

The findings are now being reported in the prestigious *Journal of Biological Chemistry*.

When bacteria infect a host organism, they usually attach to tissue cells. Infectious diseases scientists at Umeå are studying structural details of the outermost layer of bacteria cells in order to find new substances that can prevent bacterial infections. In collaboration with materials researchers at the Department of Chemistry, they describe new methods that facilitate and speed up their studies.

Optimal for equipment in health care

Chemist Madeleine Ramstedt is pursuing research on a material with new properties that prevent bacteria from attaching to its surface. The new material would be optimal for equipment in health care, where biofilms of bacteria can be a source of infection. In her research, Madeleine Ramstedt uses spectroscopic methods, among others, that she is now making available to her colleagues in the research consortium

Umeå Centre for Microbial Research, UCMR.

Microbiologists Sun Nyunt Wai, Ryoma Nakao, and Bernt Eric Uhlin, together with chemists Jean-François Boily and Madeleine Ramstedt, were investigating whether new physiochemical analysis methods could also be used for microbial studies. The scientists combined so-called cryo-x-ray photoelectron spectroscopy with multivariate analysis. This analysis yields specific patterns of intensity curves depending on the chemical composition of the surface of the material being studied.

Can affect the infection capacity

“We’ve succeeded also in analyzing the cell surfaces of bacteria with our x-ray spectroscopy. We found strong patterns that we could clearly relate to various consistencies in lipids, sugar, protein, and the polymer peptidoglycan in the cell wall of the bacterium that can affect the capacity of a bacterium to infect an organism,” explains Madeleine Ramstedt.

“The method makes it possible to analyze the very outermost layer, about 10 nanometers from the surface.”

“Our method is relatively simple in comparison with other methods where you first have to extract various cell components. This means that with our method you are examining the surface under more natural conditions in an intact bacterium cell.”

Shock frozen bacteria

X-ray photoelectron spectroscopy has previously been used to study bacteria, but only to a limited extent. The Umeå scientists have managed to optimize the method.

"We shock freeze the bacteria and keep them frozen throughout the analysis. This allows us to assume that they do not change during the examination. Now it's possible to compare the cell walls in similar bacteria that have been treated in different ways or that have changed, for example by developing resistance. With our method we can now compare structures in cell walls in pathogenic bacteria with those of non-pathogenic bacteria, all on a larger scale. Hopefully this new method of analysis will yield more rapid results and provide infectious diseases researchers with new clues for finding new antibiotics," says Madeleine Ramstedt.

More information: Madeleine Ramstedt, et al: Monitoring surface chemical changes in the bacterial cell wall – multivariate analysis of cryo-x-ray photoelectronspectroscopy data. *The Journal of Biological Chemistry* (On-line 17 February 2011).

Provided by Umea University