PHYSICS AND ASTRONOMY
COLLOQUIUM

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"Nanomechanical Response of Bacteria to Antimicrobials: A Pressing Issue"

Abstract

Bacteria are microorganisms that have evolved over 3.5 billion years and are responsible for a wide range of phenomena in the world around us, ranging from causing diseases to helping to digest food to shaping the surface and sub-surface of the Earth. Despite great advances in the control of bacterial infections that have been achieved through the use of natural and synthetic antimicrobials, overuse of these compounds has allowed many bacteria to adapt, and this has led to the emergence of antimicrobial-resistant "superbugs". To counteract this, it is necessary to develop new compounds and new strategies, and a key component to this approach is learning how antimicrobials work. Although their effectiveness can be easily screened, their mechanism of action is more difficult to determine. Many compounds act by compromising the mechanical integrity of the bacterial cell envelope, and our study introduces an atomic force microscopy (AFM)-based creep deformation technique to evaluate changes in the time-dependent mechanical (viscoelastic) properties of Pseudomonas aeruginosa PAO1 bacterial cells upon exposure to two different but structurally related antimicrobial peptides. We observe a distinctive signature for the loss of integrity of the bacterial cell envelope following exposure to the peptides. Measurements performed before and after exposure, as well as time-resolved measurements and those performed at different concentrations, revealed large changes to all of the viscoelastic parameters that are consistent with differences in the way in which the peptides disrupt the cell membranes. The AFM creep deformation measurement provides new, unique insight into the kinetics and mechanism of action of antimicrobial peptides on bacteria, and is a promising tool for the evaluation of new candidate molecules.

Wednesday, January 15, 2014
3:30 p.m.
Bob Wright Centre
Room A104