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Rapid detection of bacterial resistance to β-lactam antibiotics using liquid chromatography – tandem mass spectrometry

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Antibiotic susceptibility testing (AST) can involve automated platforms that produce results in 10 hours following bacterial colony growth. However, AST may require 10-72 hours before definitive, individualized treatment can begin. An assay was developed for the detection of bacterial resistance due to enzymatic degradation of β-lactam antibiotics with the goal of designing a liquid chromatography – tandem mass spectrometry acquisition method capable of performing AST at an accelerated rate in comparison to the current standards. The assay consisted of a one-hour bacterial incubation with a multiplexed panel of ampicillin, cefazolin, cefotaxime, and imipenem at 0.5 µg/mL, and a concurrent incubation of cefoxitin at 2 µg/mL. The assay used the extent of antibiotic hydrolysis as a means of measuring resistance quantitatively. Hydrolysis percentages were obtained by chromatographic peak area integration. The assay could differentiate between three types of β-lactamase enzymes: carbapenemases, Class A β-lactamases and Class C Amp C β-lactamases. An antibiotic resistance profile for a single clinical isolate could be obtained in 2 hours and 35 minutes following bacterial colony growth.

Speaker Biography

Michael Thompson has obtained his undergraduate degree from the University of Wales, UK and his PhD in Analytical Chemistry from McMaster University. Following a period as Science Research Council PDF at Swansea University, he was appointed as Lecturer in Instrumental Analysis at Loughborough University. He then moved to the University of Toronto where he is now Professor of Bioanalytical Chemistry. He has held a number of distinguished research posts including the Leverhulme Fellowship at the University of Durham and the Science Foundation Ireland E.T.S Walton Research Fellowship at the Tyndall National Institute, Cork City. He is recognized internationally for his pioneering work over many years in the area of research into new biosensor technologies and the surface chemistry of biochemical and biological entities. He has made major contributions to the label-free detection of immunochemical and nucleic acid interactions and surface behavior of cells using ultra high frequency acoustic wave physics. He has served on the Editorial Boards of a number of major international journals including Analytical Chemistry and The Analyst and is currently Editor-in-Chief of the monograph series "Detection Science" for the Royal Society of Chemistry, UK. He has been awarded many prestigious international prizes for his research including The Robert Boyle Gold Medal of the Royal Society of Chemistry and the E.W.R. Steacie Award of the Chemical Society of Canada. He was made a Fellow of the Royal Society of Canada in 1999.

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