Molecular Surveillance of Clinically Important β-Lactamase Genes: A Requirement for One Health

Antibiotic resistance is a global problem that affects not only human health, but animal and environmental health as well. The One Health Approach is defined as ‘the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals and our environment…’. Both Gram-negative and Gram-positive organisms have developed a multitude of antibiotic resistance mechanisms both plasmid and chromosomally mediated. Difficult resistance mechanisms to detect in the clinical laboratory are mechanisms that confer resistance to β-lactam antibiotics. There are over 2,000 different β-lactamases that can confer resistance to β-lactam antibiotics. Many Gram-negative organisms produce multiple enzymes simultaneously in addition to other mechanisms of resistance making these organisms multi-drug resistant. This seminar will introduce 1) the global problem and One Health Approach to antibiotic resistance, 2) how the production of β-lactamases by Gram-negative pathogens can exclude the use of all β-lactam treatment for both human and animal patients, and 3) introduce new PCR-based detection methods for β-lactamase genes. Implementation of these PCR-based technologies can help control the spread of β-lactamase producing pathogens, direct antibiotic stewardship programs, and guide therapy.
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Bio-summary:

Dr. Nancy D. Hanson is Professor and Director of the Center for Research in Anti-Infectives and Biotechnology in the Department of Medical Microbiology and Immunology at Creighton University. Dr. Hanson received her Ph.D. in Medical Microbiology from the University of Nebraska Medical Center in 1991. She joined the faculty of Creighton University in 1995. Her area of expertise is the study of molecular mechanisms of antibiotic resistance in Gram-negative organisms such as *E. coli*, *K. pneumoniae*, *Salmonella* spp. and *Pseudomonas aeruginosa*. Her research explores many aspects of antibiotic resistance mechanisms including: 1) identification of the selective pressures required for the emergence of resistance, 2) regulation of gene and protein expression involved in resistant phenotypes, and 3) the development of PCR-based diagnostic tests that can be used by laboratories to detect resistance genes in clinical isolates. Dr. Hanson has published over 75 journal articles and holds 8 patents regarding molecular diagnostics. In 2007, Dr. Hanson was awarded researcher of the year by the Nebraska Chapter of the Cystic Fibrosis Foundation for her work on *P. aeruginosa*. In 2008, Dr. Hanson was part of an international colloquium for the American Academy of Microbiology on Antibiotic Resistance in Annecy France. In 2013, Dr. Hanson received the Distinguished Research Career Award from Creighton University School of Medicine. Dr. Hanson was also selected as an American Society of Microbiology Distinguished Lecturer for academic years 2014-2016. In June 2016, Dr Hanson was invited to the Opening of the Australian Center for Antimicrobial Resistance Ecology as a Keynote Speaker.