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Endotoxin detection in full blood plasma in a theranostic approach to combat sepsis

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Annually, an estimated 750,000 individuals are affected by sepsis in the United States (similar incidence is reported in Europe and around the world), with approximately 200,000 casualties. The pathogenesis of sepsis are relatively well known, one of the most potent immuno-activators being bacterial lipopolysaccharide (LPS) also known as 'endotoxin' – which is a major constituent of the outer membrane of Gram-negative bacteria. Clinical tests, such as the 'Limulus amoebocyte lysate' (LAL) assay or the more recent 'endotoxin activity assay' (EAA), are available to detect endotoxin. However, these methods are expensive, relatively fastidious to implement and (may) require reporter molecules. In the present paper, we introduce a biosensor-based approach for detection of LPS in blood plasma. A qualitative, cut-off (mid pg mL⁻¹) biosensor assay alternative for bacterial endotoxin is described. Detection is based on the acoustic wave physics of the highly sensitive, ultra-high frequency 'electromagnetic piezoelectric acoustic sensor' (EMPAS) transducing device. The biosensing platform features dual-functional, binary organosiloxane adlayer surface chemistry (on quartz resonator discs) combining high binding affinity for the target analyte with pronounced antifouling properties against biological matrix sample interference. Unlike current clinical tests, measurements are performed in a realtime and label-free advanced fashion, using full human blood plasma microsamples (50 µL). Another highlight of this work is the rapidity with which analysis is completed (approximately 35 min per replicate). Underway is an attempt to validate this assay with a statistically relevant number of blood sources. Next in line is the actual assessment of clinical testing performance with real-life samples drawn from hospitalized patient donors.

Biography

Michael Thompson has obtained his PhD from McMaster University in Hamilton, Ontario. He is Professor of Bioanalytical Chemistry in both the Department of Chemistry and Institute for Biomedical Engineering at the University of Toronto. He has published close to 300 papers in international journals and has received many prestigious awards for his research. He served on the Editorial Boards of major journals and is currently Editor in Chief of the Royal Society of Chemistry book series on Detection Science. He was made a Fellow of the Royal Society of Canada in 1999.

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