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Detection of 16s RNA from *Legionella pneumophila* using impedance spectroscopy on microfluidic devices

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Legionellosis is a life threatening disease caused by pathogenic Legionella pneumophila. *L. pneumophila* is found in natural and engineered water systems where it is in symbiosis with amoebas and is a serious threat even in developed countries. Detection of Legionella RNA is a viable method, since RNA degrades rapidly after microbe death and hence correlates with microbe activity. Ribosomal 16s RNA is abundant, highly conserved between bacterial species and has been used for species identification. Impedance spectroscopy provides a rapid and simple method to detect the presence of *L. pneumophila* through detection of 16s RNA. We present a microfluidic device with microfabricated interdigitated electrodes to perform impedance spectroscopy detection of *L. pneumophila* rRNA. During device operation, 16s rRNA is captured on DNA functionalized impedance spectroscopy electrodes. Subsequently, the signal from the captured rRNA is amplified by binding with near infrared quantum dots. By applying impedance spectra to equivalent circuit models, the double layer capacitance can be extracted as a useful parameter for rRNA detection. Increases in double layer capacitance correlate with binding of *L. pneumophila* rRNA and quantum dots. We can sense 10 mM of rRNA and are currently investigating the system limit of detection. This project builds on previous work in our lab with sensing *L. pneumophila* 16s rRNA using surface plasmon resonance. The impedance spectroscopy microfluidic system can provide a simpler and cheaper rRNA detection method than surface plasmon resonance platforms.

Biography

Khalil Heileman graduated from the University of Toronto in 2010 with a Bachelor's degree in Mechanical Engineering. In 2011, he started his Master's degree in Biomedical Engineering at McGill University. He is currently a PhD candidate at McGill University after fast tracking from the Master's program. His research interests lie in combining impedance spectroscopy, microfluidics, and microfabrication to develop biosensors for biomarkers and cells. His research has a special emphasis on DNA/RNA probes and evaluating pancreatic islet functionality.

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