Chemical & Physical Sciences
UNIVERSITY OF TORONTO
MISSISSAUGA

Colloquium Seminar Series
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3:30PM in CC3150

SYNTHETIC BIOLOGY SENSING SYSTEMS FOR TACKLING GLOBAL CHALLENGES

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Antimicrobial resistance is a rapidly increasing and deadly global health threat that is undermining progress towards achieving UN Sustainable Development Goals related to health, food and water security, and economic growth. Often, antimicrobial medications are prescribed based on symptoms, without a definitive diagnosis of the pathogen. This approach results in avoidable mortality and misallocation of limited healthcare resources due to ineffective and/or unnecessary treatment regimens. Moreover, inappropriate use of medication can lead to the emergence of antimicrobial resistant pathogens that are increasingly difficult to treat with existing drugs. We urgently need accurate, accessible, and rapid diagnostics that can be used in diverse healthcare settings to guide antimicrobial use and prevent the further emergence and spread of multidrug resistant pathogens.

Research in the Weckman Lab invents new diagnostic sensors at the interface of cell-free synthetic biology, next generation microscale and nanoscale sensing systems, and engineering design for clinical and commercial translation. We use state-of-the-art synthetic biology techniques like isothermal cell-free lyophilized reactions and CRISPR/Cas detection for the rapid identification and quantification of multidrug resistant pathogens like the deadly fungal pathogen, Candida auris. We develop low-cost sample-to-result analysis protocols with a focus on design for usability and commercial translation of point-of-care diagnostics. We also integrate our synthetic biology circuits with highly multiplexed micro and nanoscale sensing systems like single molecule nanopore sensors and microelectromechanical systems (MEMS) to enable rapid and accurate quantification of diverse biomarkers concurrently. The convergence of these research fields will open the door to next-generation, ultra-sensitive, and digitally linked diagnostic sensors capable of guarding against antimicrobial resistance, while increasing the equity, efficiency, and quality of healthcare systems around the world.