Department of
Biomedical Engineering
UNIVERSITY OF WISCONSIN-MADISON

Spring 2018 Seminar Series

Translational Immunoengineering Biosensors for Personalized Disease Theranostics at the Point-of-Care

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Infectious diseases remain the leading cause of mortality around the world. Diagnosing disease at its onset will have a critical impact in timely administering the therapeutic interventions that could result in saving patients' life. The availability of Point-of-Care (PoC) diagnostic sensors can have a significant impact for early patient stratification.In this talk, I will discuss my research work on development of PoC biosensing technologies and their integration with the patients' clinical data to develop personalized disease prognostics systems.

First, I will present the differential immuno-capture technology that I developed for specific leukocyte counting (CD4+/CD8+ T cells) for AIDS diagnostics from a drop of blood. Clinical testing of the biosensor is done using blood samples collected from HIV infected donors at Champaign-Urbana Public Health District and Carle Hospital.

Second, I will discuss the development of the individualized stratification system for Sepsis (a disease with highest mortality rate in critical care settings worldwide). The Sepsis diagnostic system combines PoC testing of biomarkers including CD64 neutrophil expression, total leukocyte count and its subtypes from whole blood (10μL) in less than 20 min. The sepsis PoC sensor is integrated with the patient EMR information to develop more accurate prediction of patients' diagnosis and prognosis. The longitudinal clinical studies were done using the developed biosensor to monitor the individual patient's disease progression and the recovery outcome of administered therapeutic interventions.

I will conclude the talk with the discussion on the emerging challenges in infectious disease diagnostics and therapeutics in particular the roles of immuno-engineering, antibiotic resistance and precision pharmacotherapy in patients' stratification. PoC technologies for personalized theranostics of infectious diseases could drastically reduce the time to appropriate treatment, dramatically increase survival rates, and save healthcare systems billions of dollars around the world. Theranostics enabled by advancements in microfluidics and micro-nano sensing technologies and their integration with clinical data to develop predictive computational systems for individualized patient stratification can be an important part of the solution.

ABOUT the SPEAKER

Umer Hassan is a Postdoctoral Research Associate in Department of Bioengineering at University of Illinois Urbana-Champaign (UIUC) with a Research Affiliate appointment at Carle Foundation Hospital, Urbana. He completed Ph.D. in Electrical and Computer Engineering with emphasis on biosensing and nanotechnology from UIUC in 2015. Umer's research has been focused on developing point-of-care (PoC) translational biosensors for disease diagnostic and therapeutic applications. He is the recipient of Baxter Young Investigator Award (2016), Emerging Engineer Award (2015), Cozad New Venture Competition Award (2014), NSF I-Corps Fellowship (2014) and Our Common Future Fellowship (2010).

Wednesday, March 7, 2018
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