

Department of Electrical and Computer Engineering Seminar Biobatteries and Diagnostic Platforms for Point-of-Care Testing Needs

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Location: ECE221 3:00 PM to 4:00 PM January 28, 2022

Zoom Meeting:

https://texastech.zoom.us/j/98445783357?pwd=bWJXL0VnNVZWTTFIVVFhZFNKNDJOdz09 Meeting ID: 984 4578 3357, Passcode: 895224



Biography:

Dr. Arwa Fraiwan is a Senior Research Associate in the Biomanufacturing and Microfabrication Laboratory in the Mechanical and Aerospace Engineering Department at Case Western Reserve University. She received her PhD in Electrical Engineering from Binghamton University. To date, she has co-authored 42 publications in high-impact peer-reviewed journals and refereed conference proceedings. She is a co-inventor on two US patents and with two more pending. Her research interests include biofuel cells, BioMEMS, biosensors, POC diagnostics and mHealth.

Abstract:

Disposable lab-on-a-chip (LOC) devices have recently emerged as a new paradigm for clinical diagnostics and monitoring disease status. The devices incorporate advanced micro-sized biosensors and microfluidics, which require only small reagent volume, reduced size, and minimized power consumption. Additionally, they offer many other advantages including short reaction time, versatile designs, multifunctional system integration with small footprints, thereby enabling portability and mobility for effective and rapid point-ofcare (POC) testing even in challenging field conditions where laboratory infrastructure, equipment and highly skilled personnel are in short supply. Recent advances in LOC devices have greatly enhanced POC diagnostic performance and many technologies have been successfully introduced into the market. However, there has been a significant challenge in realizing a truly stand-alone and self-sustainable diagnostic platform. A key challenge is to develop a miniaturized power source for powering those POC devices. Power autonomy is critical for POC diagnostics to operate in resource-limited settings where a stable electrical supply is not readily available.

In the upcoming seminar, I will present my main research projects to date in two parts. First, I will overview several paper-based bacteria-powered batteries that I have developed during my doctoral studies as part of our effort to develop efficient paper-based batteries. These batteries are built using micro-sized microbial fuel cells (MFCs). MFCs are an emerging renewable energy technology that can transform the chemical energy of biodegradable organic matter into electrical power catalyzed by bacterial metabolism. In the second part of my presentation, I will introduce the design, development, manufacturing, and clinical testing of a novel POC hemoglobin test, HemeChip. HemeChip is a paper-based, microchip electrophoresis technology that enables the diagnosis of hemoglobin disorders in resource-limited settings. The technology has been developed at Case Western Reserve University, and is commercialized under the product name "GazelleTM" by Hemex Health Inc. It has been extensively validated in the US, Africa, India and South East Asia, with a focus on hemoglobinopathies, including sickle cell disease and beta thalassemia. The technology is undergoing further development to include more tests for anemia, diabetes and COVID. Finally, I will describe my future research and teaching visions.