THE UNIVERSITY OF ARIZONA
COLLEGE OF ENGINEERING

Biomedical Engineering

BME IS PROUD TO ANNOUNCE THE DOCTORAL DEFENSE OF

MATTHEW BILLS

BME PhD Candidate

"Portable Optical Biosensors for the Rapid Classification of Clinical and Field Samples"

Abstract: Three novel biosensors will be discussed.

The first sensor aims to reduce the cost and complexity typically associated with obtaining an accurate white blood cell and differential count. For our biosensor, a drop of blood is obtained via fingerpick from a subject. The sample is diluted, and the white blood cells are separated and fluorescent stained while flowing through a custom paper microfluidic chip. We than obtain a partial-differential and total WBC count using a using a smartphone and smartphone microscope attachment. This rapid classification could see use in resource poor settings as well as in modern settings where a partial differential WBC is sufficient.

The second sensor uses an angular photodiode array to capture Mie scatter to rapidly diagnose cancer from a tissue surface. This is achieved by illuminating a tissue sample at several different angles and measuring the scattered light intensity from several discrete angles that is attenuated and amplified based on the variation in the size, abundance, and refractive indices of several cellular and tissue structural elements. Small changes in these parameters result in observable variation in optical scattering from a tissue sample. We predict and model Mie scatter from several different structural elements. The observed optical scattering obtained from rat and human tissue sets is consistent with our simulated findings, supporting our premise and for future testing. A device such as this could be a useful aid for clinicians diagnosing cancer by using it to detect cancer earlier.

Our third device aims to meet the need of the South Korean coast guard to rapidly identify ocean oil spill samples in order to hold the guilty parties accountable. We were tasked with designing a portable, lightweight, easy to use device to identify and classify oil spill samples. We designed a Raspberry-Pi based UV-Fluorometer to measure fluorescence from three UVA light sources (365nm, 375nm, and 385nm). The device is able to accurately (94% correct classification) classify samples into one of 4 broad categories (crude oil, heavy fuel oil, light fuel oil, and lubricant oil) as well as provide an estimation of the samples' physiochemical makeup in the form of the sample's percent saturate, aromatic, resin, and asphaltene contents.

Please join us on
FRIDAY, NOVEMBER 15TH, 2019
KEATING 103
3:00 PM
HOST: DR. JEONG-YEOL YOON

Persons with a disability may request a reasonable accommodation by contacting the Disability Resource Center at 621-3268 (V/TTY).