DEPARTMENT OF BIOMEDICAL ENGINEERING SEMINAR SERIES

PRESENTS

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"Low-cost and portable smartphone-based medical diagnostic devices for skin microbiome classification and SARS-CoV-2 detection"

ABSTRACT: Rapid advances in technologies have enhanced the healthcare devices and scientific tools to become more and more powerful, allowing observation in micro/nanoscale with high precision and accuracy. Nevertheless, one of the biggest issues is that not all people can easily afford or have access to these tools. Many healthcare or diagnostic equipment can be very expensive, time-consuming, may need trained personnel, and require big space and laboratory setup. To overcome these limitations, my interest is to apply biosensing technologies to develop low-cost medical diagnostic devices that can be easily accessible, portable, and easy to use. These can be achieved by utilizing inexpensive materials, implemented with available sensors on the smartphone, and improved the efficacy by big data collection and machine learning algorithms. Two projects that will be covered are 1. A smartphone-based autofluorescence imaging device with multispectral light sources for skin microbiome classification, and 2. Paper-based microfluidic chip for SARS-CoV-2 detection using 2.1) a low-cost and portable smartphone-based fluorescence microscopic imaging device for a particle-counting method and 2.2) simple and automated flow-based analysis using a smartphone application.

AND

Sam Freitas

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"Worm Paparazzi: a new system for automated lifespan and healthspan measurement in individual C. elegans"

ABSTRACT: The study of aging is a rapidly expanding area of biology and is providing new insights into how late onset diseases impact our global health. The demographics of the world are increasingly becoming older, and thus incidence of diseases that share age as a primary risk factor (cancer, heart disease, immune dysfunction, etc.) are increasing. There are major efforts to identify interventions that can slow aging and extend lifespan; however, mammalian lifespan models become systematically impractical on a large scale. Maintaining large scale mammalian colonies has a much greater cost overhead than invertebrate model systems. *Caenorhabditis elegans* are easy to culture invertebrate who only live ~3 weeks on average, providing an inexpensive and rapid way to measure changes in an aging population. This becomes useful in screens of large-scale drug and genetic libraries who provide powerful upstream genetic tools for evolutionarily conserved mechanisms of aging. Although inexpensive, the standard method of measuring lifespan in *C. elegans* is inefficient and labor intensive, requiring a large investment in

skilled technician time to manually score individual animals for survival every few days. A second limitation is that animals are maintained in pooled populations of ~30-60 animals, which makes individualized tracking over time impossible. Additionally, human variation can result in a significant variability between technicians, providing inconsistent results in studies. We have built a fully autonomous, scalable, robotics system that can accurately calculate both the lifespan and healthspan of *C. elegans*, while removing the inherent variability that results when multiple human technicians are involved in a study. Worms are house in a custom-molded polydimethylsiloxane (PDMS) plate that segregates worms to single-wells, allowing characteristics of individual animals to be tracked across lifespan. The "Worm Paparazzi" (WP) is an in-house system unique to the solution of the current C. elegans research problems in both manual and other automated systems. The WP system is capable of high throughput and individual animal screening, whereas previous systems can either do high throughput or individual animal screens; making the WP system the most cost-effective solution in terms of time and money per animal. A unique advantage the WP system is the capacity of a single robotic system, each unique robot can process ~140,000 animals each year, pushing an unprecedented amount of data compared to a similar system.

In our preliminary validation studies, the system produces results that appear to be on par with both literature and in-house manual experiments. This system can and is currently being used for large-scale screens for chemical toxicity, anti-aging gene characterization (via RNA interference), and identification of novel anti-aging drugs. Future directions include expanding capacity with multiple robotic systems, improved user interfaces, and expanded analytical toolboxes beyond what humans are capable of measuring.

Please join us on
Monday, November 16th, 2020
12:00-12:50 pm, https://arizona.zoom.us/j/94765815841

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