Undergraduate Research at UMD's MSAL

Dylan Jesner (The undergrad)

College Park Scholars – Science & Global Change Program

Major: Bioengineering

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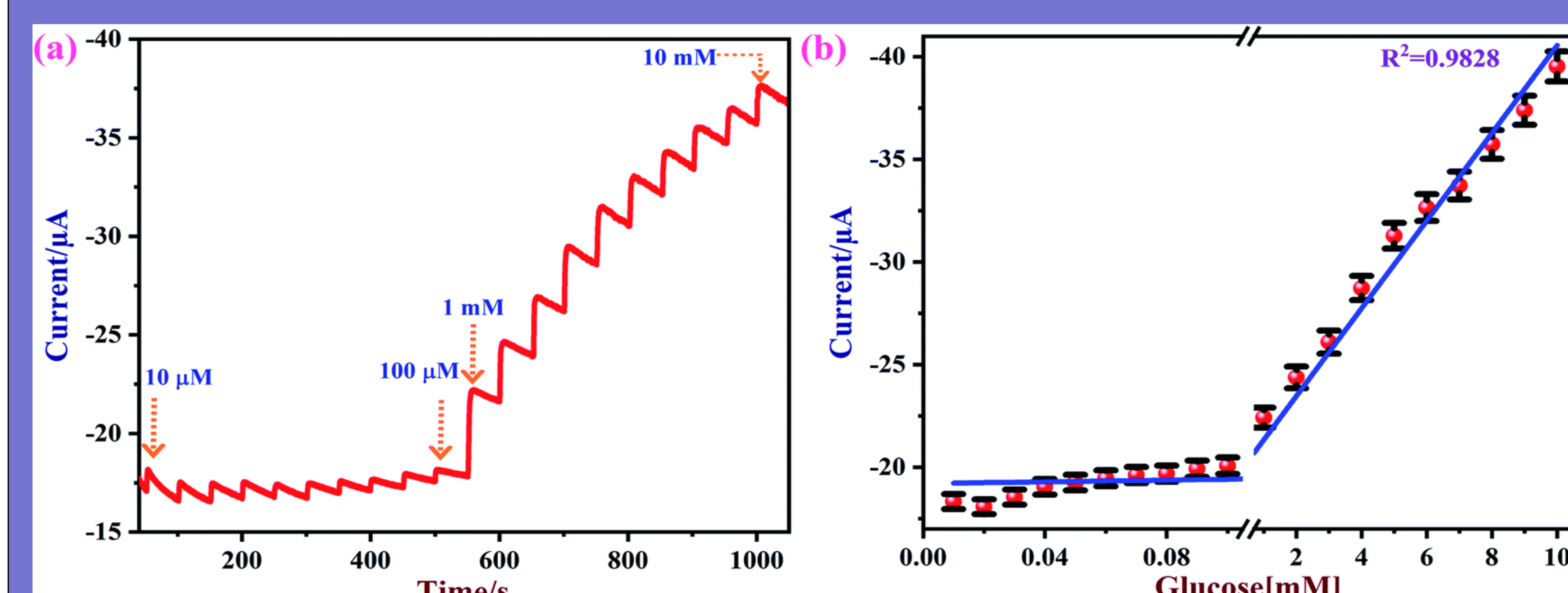
Introduction

I have been working for the MEMS Sensors and Actuators Lab (MSAL) at UMD for the last year. The majority of my research is ongoing and therefore not yet presentable, but I will give a summary of my own learning experience through the research.

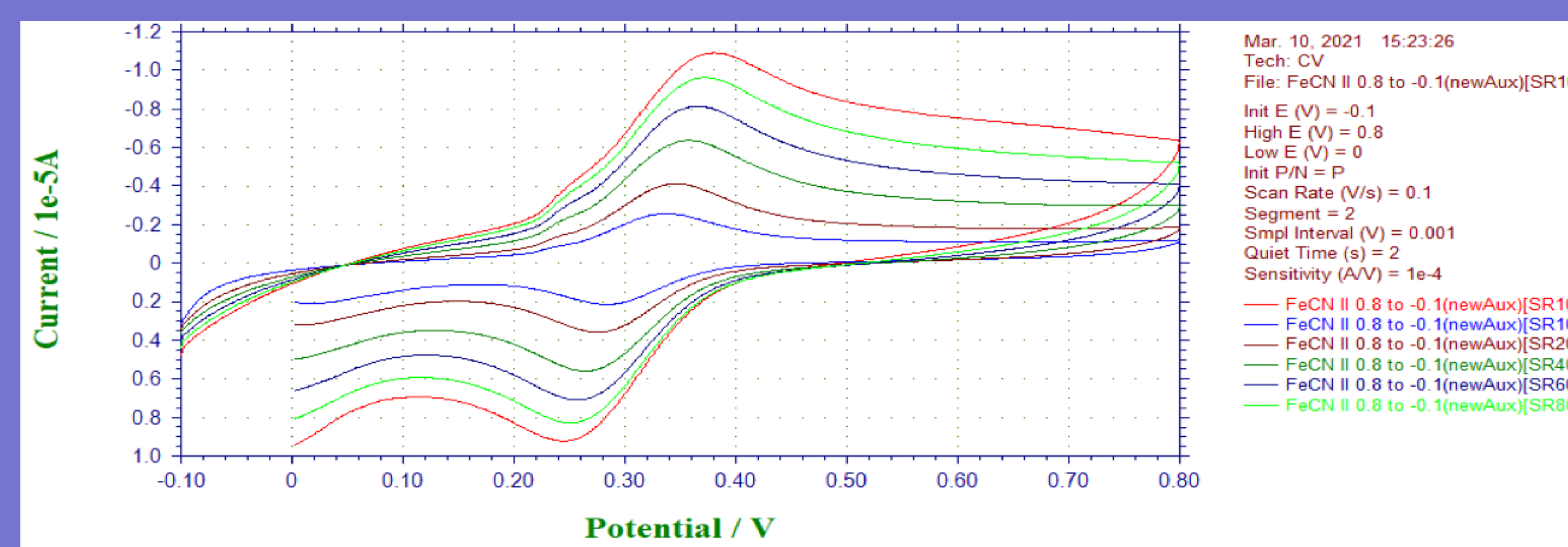
The focus of my work is to incorporate sensors into a pod/capsule design.

Activities:

- Extensive literature review in multiple fields
  - Sensor development, Biofilm prevention, Pod/Capsule-Based Sensors
- Electrochemistry experiments
- 3D Printing and material analysis



Sample chronoamperometry graph (i-t curve) and calibration curve: The calibration curve is made from the data in the i-t curve and used to extrapolate measurements made by a fabricated sensor.



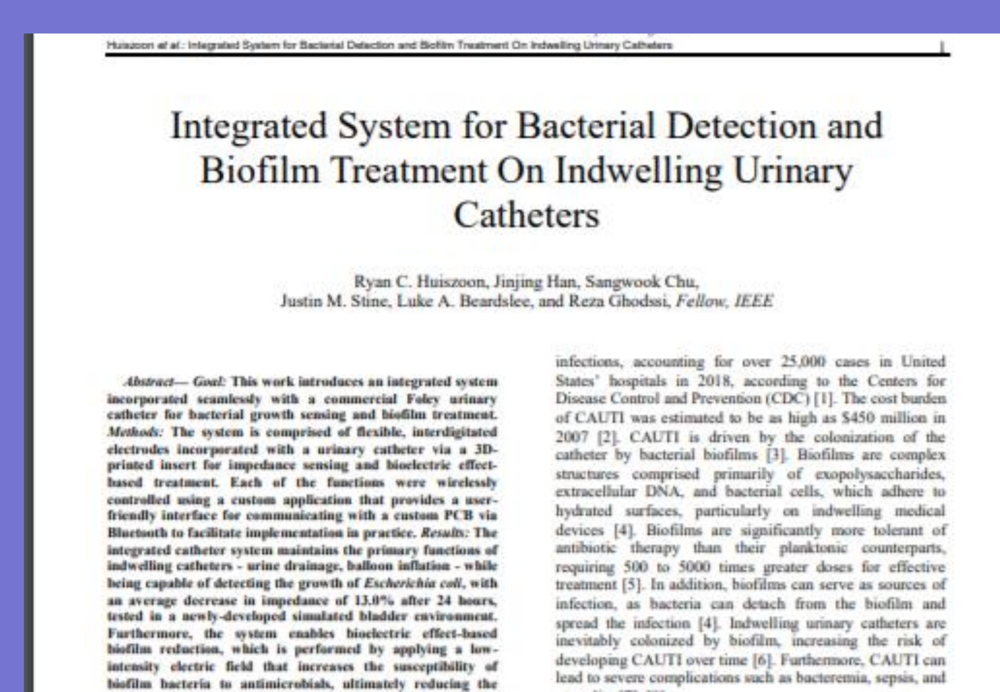
Cyclic voltammetry performed to evaluate the area of an electrode with the Randles-Sevcik Equation: $Ip = \pm 0.446nFAC\sqrt{(nFDv)/(RT)}$

Discussion:

Discussion of my results is currently not possible; however, I can discuss the work I have done personally.

I was able to learn details of electrochemical techniques typically taught in graduate-level classes, as well as developing my skill in reading academic papers, as they were required to learn these techniques as well as the data interpretation performed after the experiments.

I also was able to develop my abilities in Computer-Aided Design (CAD), as well as learning how to use and maintain a research-grade 3D printer to use those designs.



Huiszoon et al.: Integrated System for Bacterial Detection and Biofilm Treatment On Indwelling Urinary Catheters

Integrated System for Bacterial Detection and Biofilm Treatment On Indwelling Urinary Catheters

Ryan C. Huiszoon, Jinjing Han, Sangwook Chu, Justin M. Stine, Luke A. Beardslee, and Reza Ghodssi, *Fellow, IEEE*

Abstract— *Goal:* This work introduces an integrated system incorporated seamlessly with a commercial Foley urinary catheter for bacterial growth sensing and biofilm treatment. *Methods:* The system is comprised of flexible, interdigitated electrodes incorporated with a urinary catheter via a 3D-printed insert for impedance sensing and bioelectric effect-based treatment. Each of the functions were wirelessly controlled using a custom application that provides a user-friendly interface for communicating with a custom PCB via Bluetooth to facilitate implementation in practice. *Results:* The ...

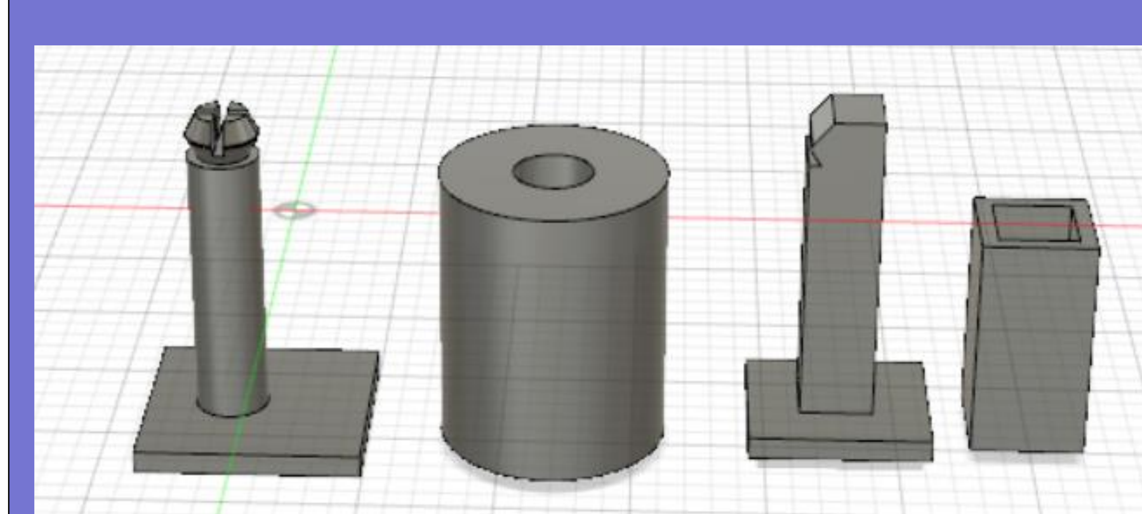
infections, accounting for over 25,000 cases in United States' hospitals in 2018, according to the Centers for Disease Control and Prevention (CDC) [1]. The cost burden of CAUTI was estimated to be as high as $450 million in 2007 [2]. CAUTI is driven by the colonization of the catheter by bacterial biofilms [3]. Biofilms are complex structures comprised primarily of exopolysaccharides, extracellular DNA, and bacterial cells, which adhere to hydrated surfaces, particularly on indwelling medical devices [4]. Biofilms are significantly more tolerant of ...

The research that initially inspired me to reach out to MSAL for an undergraduate research position

Future Work:

I plan to continue my work with MSAL on this project in the future. A goal of this project is to have published work within the year.

The project will continue to expand, including exploration of sensor components and materials, as well as the design of the module.



CAD design for (discarded) snap-fit posts for a sensor case

What I Learned (Non-Skill)

- The field of bioengineering: it overlaps with many other fields, to create a large swath of possible fields.
- I also learned the importance of professional communication, as one needs to be in communication constantly when working in a lab.
- I no longer know what field of bioengineering I want to pursue- but that I want to continue working in and exploring the options

Work Cited:
Jeevanandham, G., Jerome, R., Murugan, N., Preethika, M., Vediappan, K., & Sundramoorthy, A. K. (2020). Nickel oxide decorated MoS2 nanosheet-based non-enzymatic sensor for the selective detection of glucose [10.1039/C9RA09318D]. *RSC Advances*, *10*(2), 643-654.

QR code for my video testimonial:

Site Information:

Name of Site: MEMS Sensors and Actuators Laboratory

Address: 2201 J.M. Patterson Building. University of Maryland

Supervisor: Drs. Santiago Botasini & Reza Ghodssi

The particular goals of the site you were at: To develop sensors integrated into larger components

Acknowledgments:

Practicum Professors: Drs. Holtz & Merck

Lab PI: Dr. Reza Ghodssi

Site Supervisor: Dr. Santiago Botasini

- Taught me electrochemistry, lab practices

Additional Supervisor: Justin Stine

- Introduced me to my project

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MEMS SENSORS AND ACTUATORS LAB