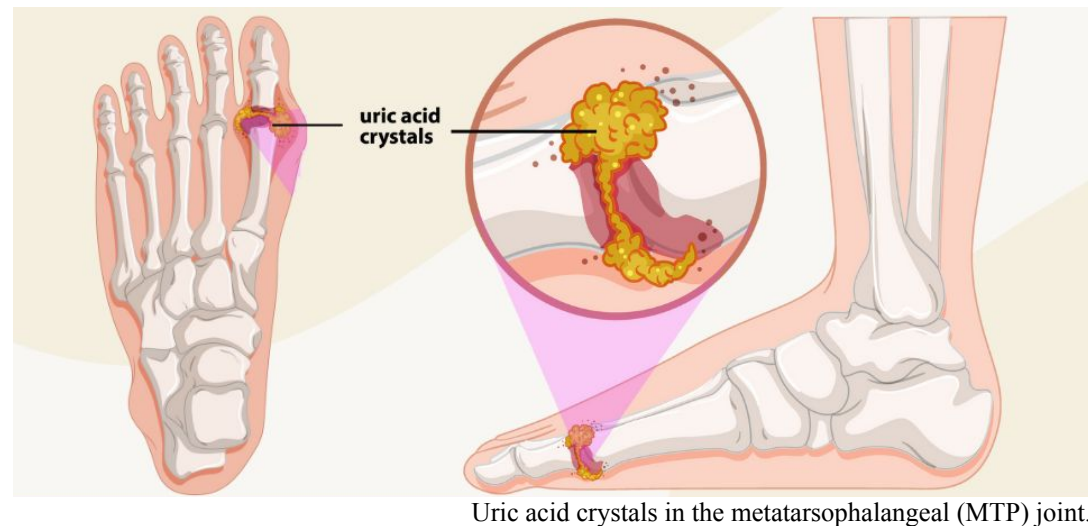


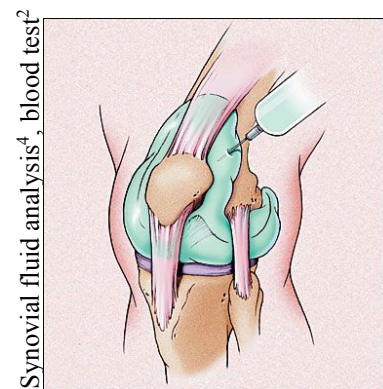
## Introduction

**Gout** is inflammatory joint arthritis that affects **9.2 million Americans<sup>1</sup>** and is caused by uric acid (UA) levels greater than **6 or 7 mg/dL<sup>2</sup>** and the resultant formation of urate crystal deposits.



- **Increased risk:** older males, obese, high diet of purine-rich foods, excessive drinking
- **Diagnosis:** synovial fluid analysis, blood tests, urine tests, X- rays
- **Treatment:** lifestyle changes, medication

### Current limitations:



**Invasive**  
**Expensive**  
**Time-consuming**  
**Inconvenient**

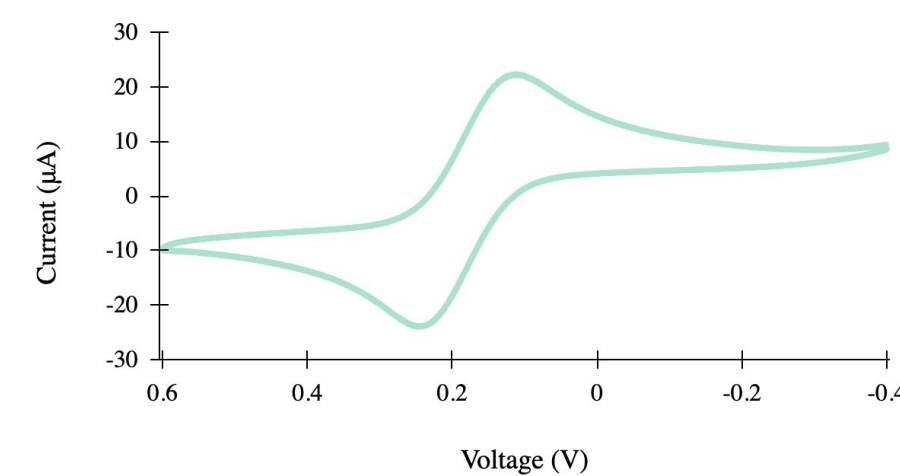
### Proposed improvement:

Monitor uric acid levels in wearable fashion to make reliable decisions for further treatment

- ✓ **Rapid**
- ✓ **Convenient**
- ✓ **Affordable**
- ✓ **Non-invasive**

## Results

### Electrode Characterization



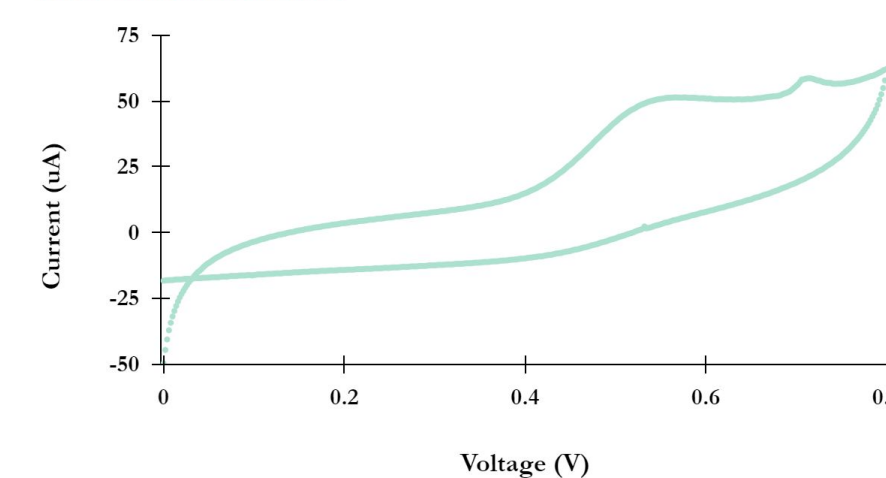
### Cyclic Voltammetry

- Scan rate: 100 mV/s
- $E_{Ox}$  : 247 mV
- $E_{Red}$  : 112 mV
- $I_{Ox}$  : 26  $\mu A$
- $I_{Red}$  : 22  $\mu A$

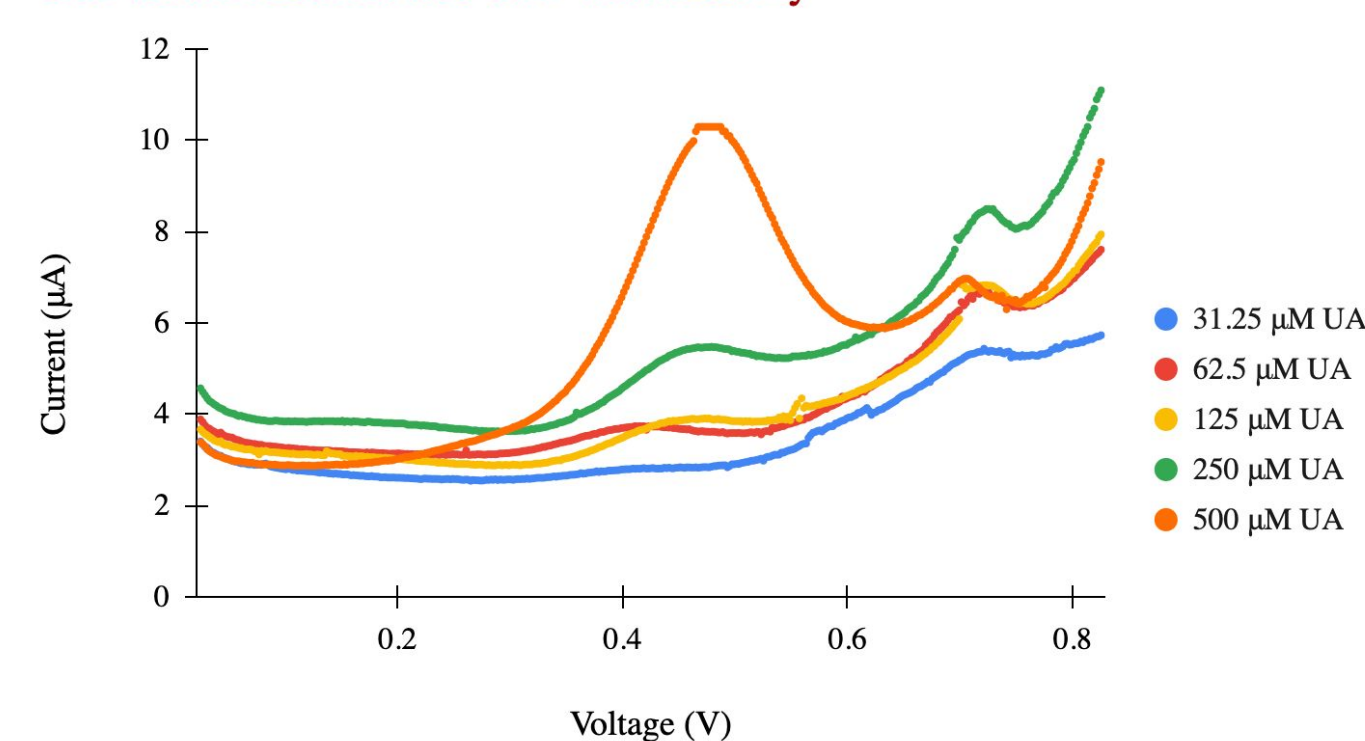
### Cyclic Voltammetry

- Scan rate: 100 mV/s
- $E_{Ox}$  : 586 mV
- $I_{Ox}$  : 51.23  $\mu A$

### Uric Acid Detection



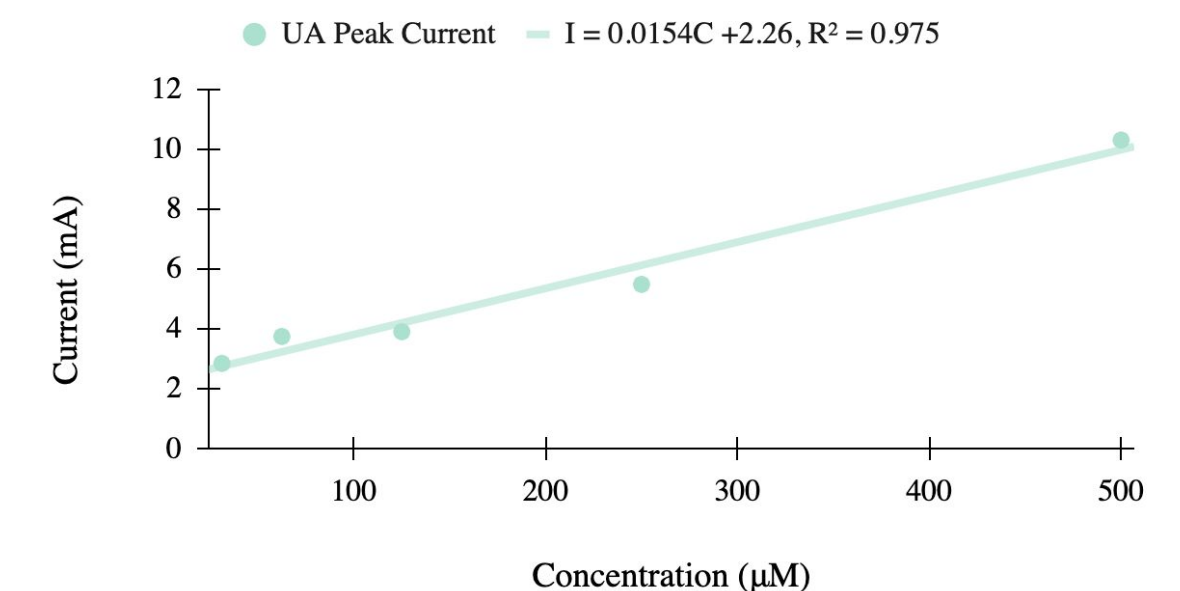
### Uric Acid Differential Pulse Voltammetry



## Conclusion

- Fabricated fiber-based electrode successfully detected uric acid concentration in therapeutic range
- CV and DPV show accurate detection of uric acid concentration in phosphate buffer solution with adjusted pH to optimize sensitivity

### Calibration Curve



## Future Work

Future work includes the incorporation of a fabricated patch in a wearable device with real-time mobile interface. We will optimize testing for patient samples and improve the limit of detection to enhance accuracy and efficiency for uric acid detection.



## SHINE Reflection

I have had the chance to not only be exposed to research and to fall in love with it but also to be part of a motivated community at the Mousavi lab. I have learned much about voltammetry techniques, electrochemistry, and biosensors.

## Acknowledgements

Thank you Dr. Katie Mills and the USC Viterbi's SHINE program for this research opportunity. Thank you Dr. Maral Mousavi, Farbod, and Victor for being supportive mentors and the rest of the MAD lab for establishing a welcoming and kind learning environment.

## References

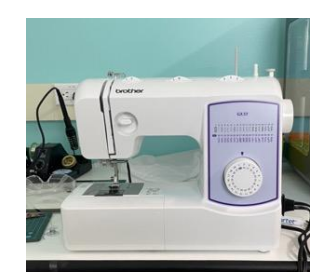
- <sup>1</sup>Yip, K., & Berman, J. (2021, December 28). What is Gout? JAMA. Retrieved July 11, 2022, from <https://jamanetwork.com/journals/jama/fullarticle/2787544#:~:text=How%20Common%20Is%20Gout%3F,in%20men%20and%20older%20people>.
- <sup>2</sup>Gabbey, A. E., & Nall, R. (2020, August 19). Uric acid test (blood analysis). Healthline. Retrieved July 11, 2022, from <https://www.healthline.com/health/uric-acid-blood#test-results>
- <sup>3</sup>Herbals, A. (2022, February 17). Gout Attack- Turn to Ayurveda. Aryan Herbals UK. Retrieved July 11, 2022, from <https://www.aryanherbals.com/uk/blog/ayurveda-for-gout/>
- <sup>4</sup>Zuber, T. J. (2002, October 15). Knee Joint Aspiration and Injection. American Family Physician. Retrieved July 11, 2022, from <https://www.aafp.org/pubs/afp/issues/2002/1015/p1497.html>

## Fabrication

Fiber Substrate



Sewing Fiber-based Electrodes

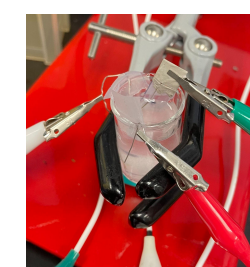


Electrode Fabrication



Data Analysis

Uric Acid Detection



Electrode Characterization

