



Welcome to the 2019

**Chemistry**

**Student**

**Research**

**Presentations**

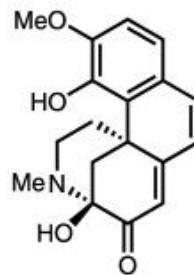
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# The Navarro Lab

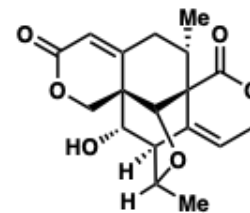


# Research Overview

1. Biologically active natural products

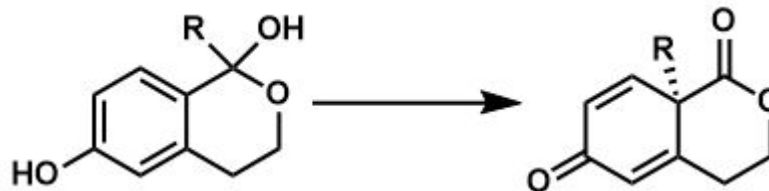


8-demethoxyrunanine



swerilactone A

1. New synthetic methods



# Total Synthesis of Swerilactone A

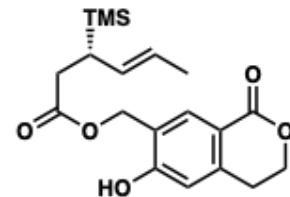
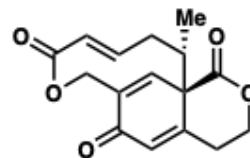
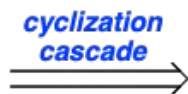
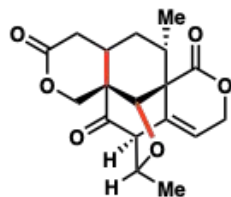
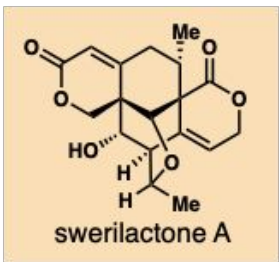
- First isolated from *Swertia mileensis* in 2008
- Cytotoxic activity against hepatitis B virus-infected cells
- No reported total syntheses
- Why organic chemistry?



Allen Li

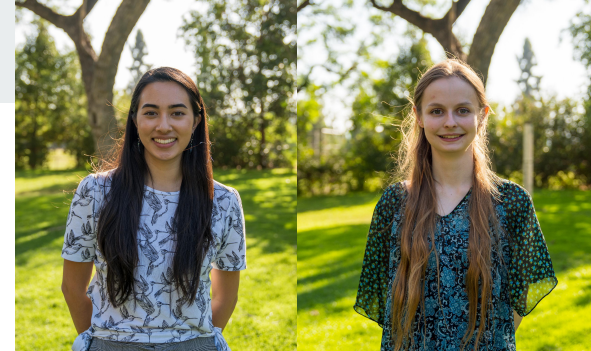
Connor  
Saldares

+ Tim McClure  
+ Jillian Kuo





# Methods Research

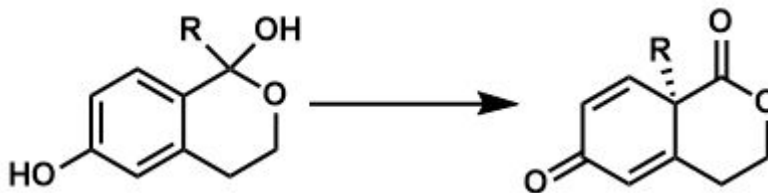


Cheyenne  
Orozco

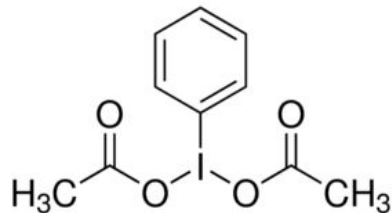
Caroline  
Arnall

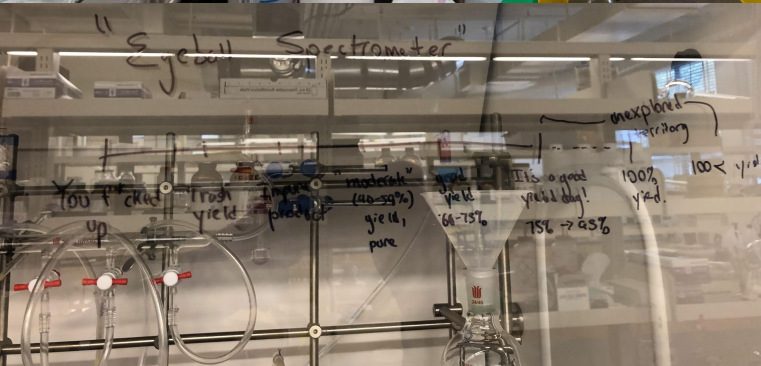
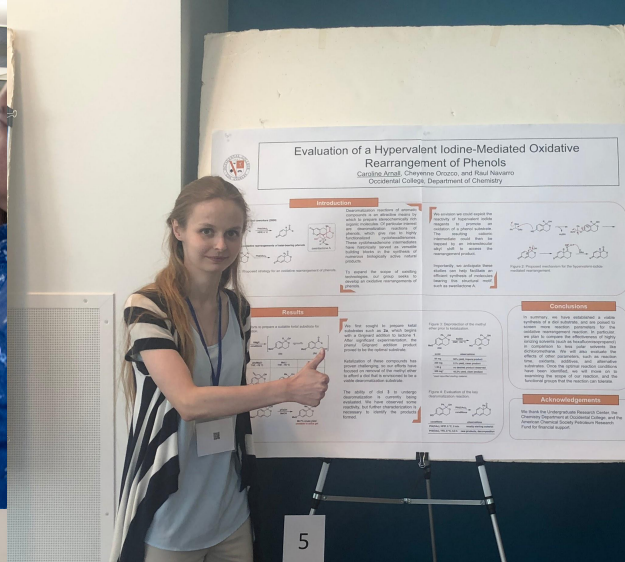
Developing new methods helps find new ways to access motifs, assists in synthesis efficiency, expands general knowledge on the reactivity of organic molecules

Reaction we are investigating currently



Hypervalent Iodine-Mediated  
Oxidative Rearrangement









## Contact Info

Professor Navarro: [rnavarro@oxy.edu](mailto:rnavarro@oxy.edu)

Total Synthesis:

- Allen Li: [ali2@oxy.edu](mailto:ali2@oxy.edu)

Methods:

- Caroline Arnall: [carnall@oxy.edu](mailto:carnall@oxy.edu)

Website: [www.navarro.oxycreates.org](http://www.navarro.oxycreates.org)

Instagram: @totalsynthbros



SRP Conference, Summer '19

A large red square with a white border, centered on a white background. The text "Cannon Lab" is written in white, bold, sans-serif font in the center of the square.

**Cannon Lab**

# The Cannon Lab

PI: Dr. Jeff Scott Cannon

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Presenters:

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Kayla Rose Steinke

[ksteinke@oxy.edu](mailto:ksteinke@oxy.edu)

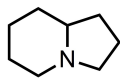
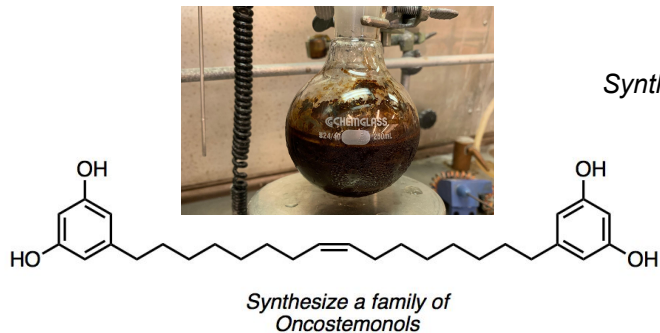


Summer 2019

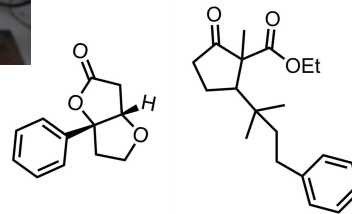
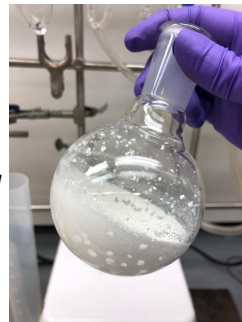
# What do we do?

Method Development: Devising new synthetic methods to obtain useful products or carry out key reactions with the intent of being able to apply these newfound techniques broadly

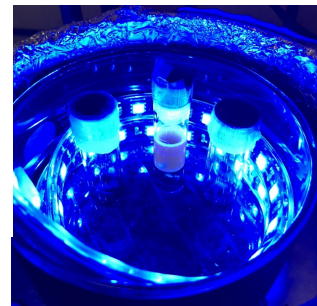
Computational Analysis: Using *in silico* models to predict or analyze chemical behavior and subsequently inform practices



Synthesis of functionalized indolizidines

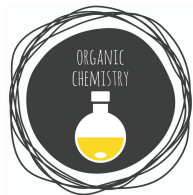


Photoredox radical chemistry





# Why Ochem?



## Motivations:

- Develop pathways to generate unique biologically relevant molecules
- Design functionally and geometrically complex compounds
- Use innovative methods and strategies
- Synthetic targets may see use in pharma/biotech, etc.

## Perks:

- *Applying* techniques of 220 and 221 Labs
- *Gaining* experience with important instrumentation (NMR, IR, GC)
- *Simulating* graduate labs and project ownership
- *Giving* academic & professional presentations
- *Attending* local & national conferences
- *Making* friends!!!!!!

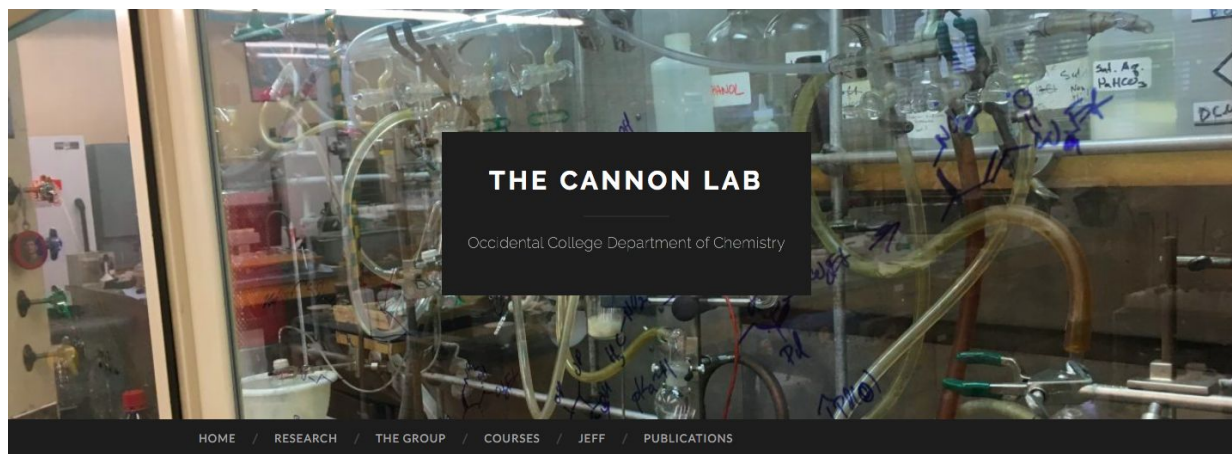




# Find Us !!

Insta: @thecannonlab

Website: cannonchem.com



## 2019 UC Irvine SoCal Undergraduate Research Symposium

AUGUST 9, 2019 / THECANNONLAB / LEAVE A COMMENT



# The Hill Lab



# Electromechanical Reshaping (EMR) of Cartilage

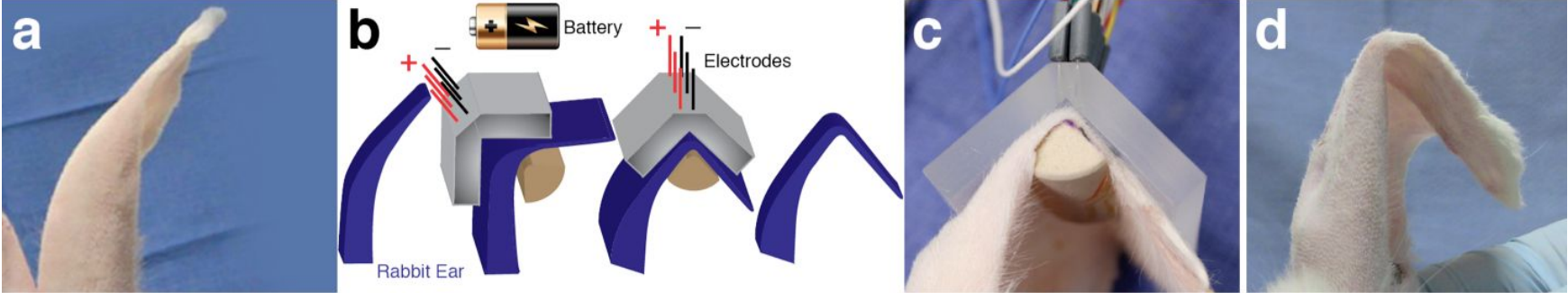
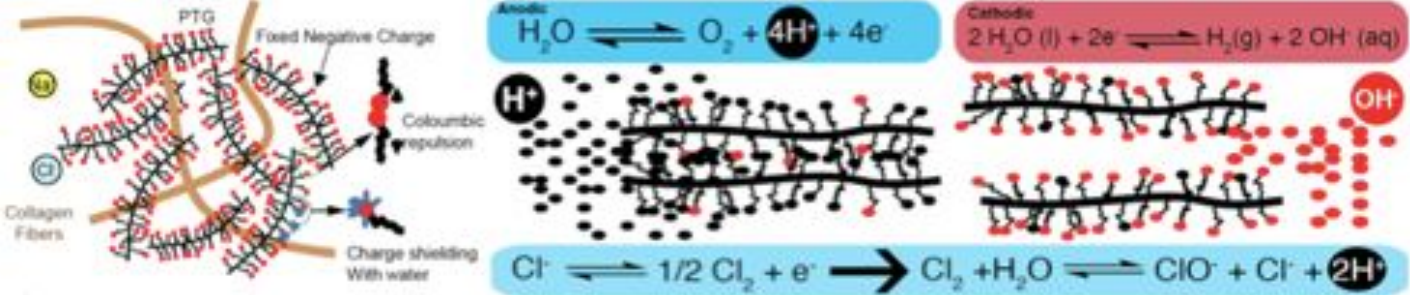


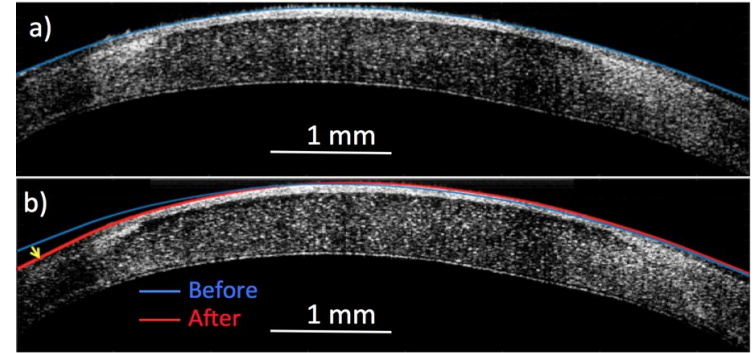
Figure 1: Electromechanical Reshaping of rabbit ear (in vivo) using DC power supply (battery), platinum needles, and acrylic jig.

*At the molecular level...*



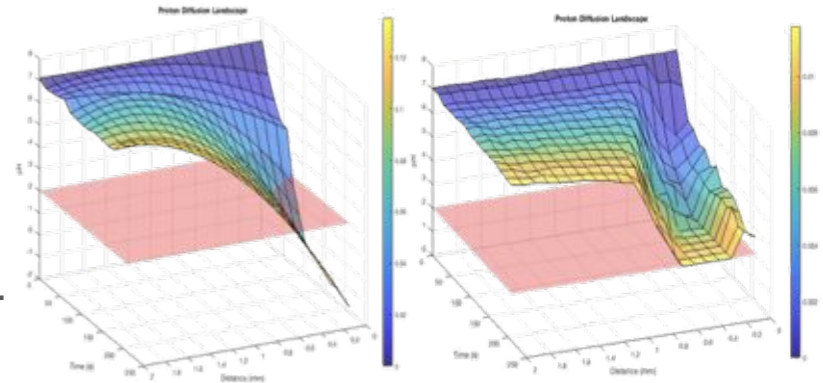
# More Applications of EMR and Future Aims

- Electrochemical Cornea Reshaping
- Tendon lengthening (contractures)
- Cornea Clearing (base injury)



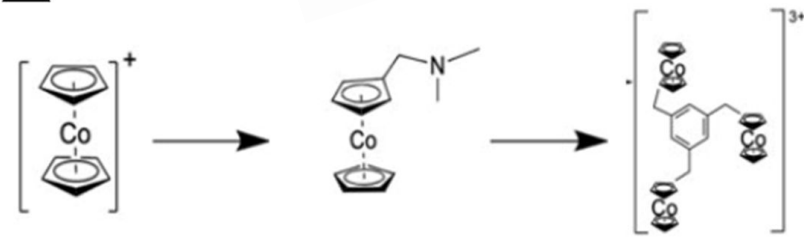
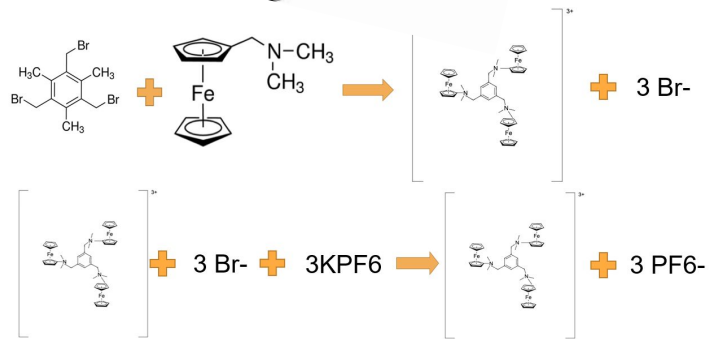
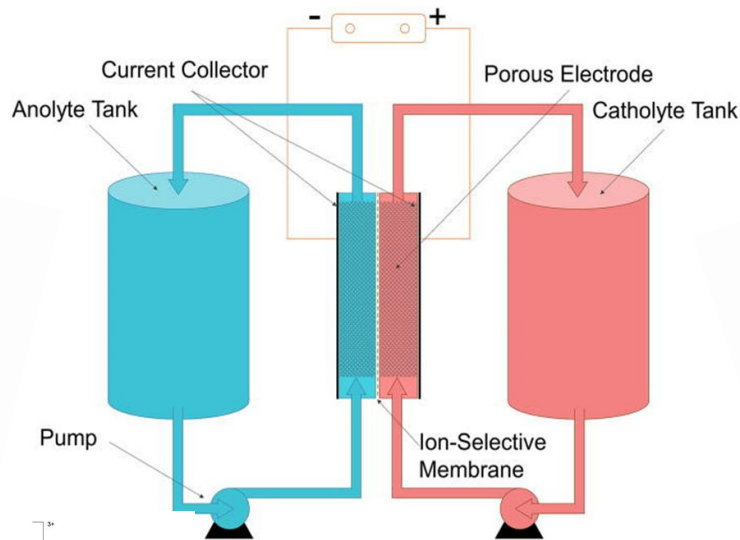
- Dosimetry and pH profile to prevent tissue death

Empirical pH diffusion landscape.

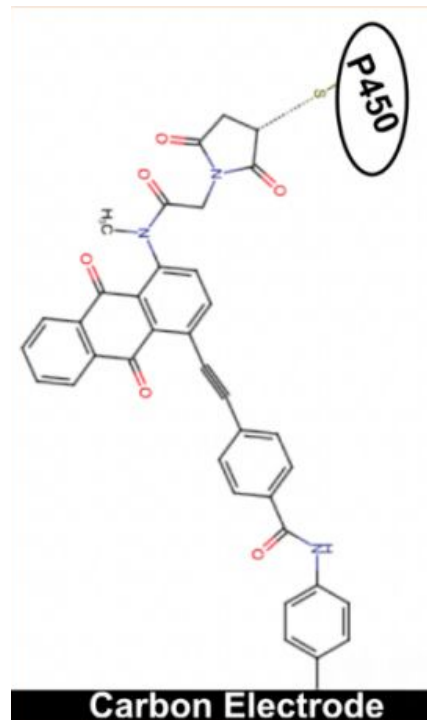
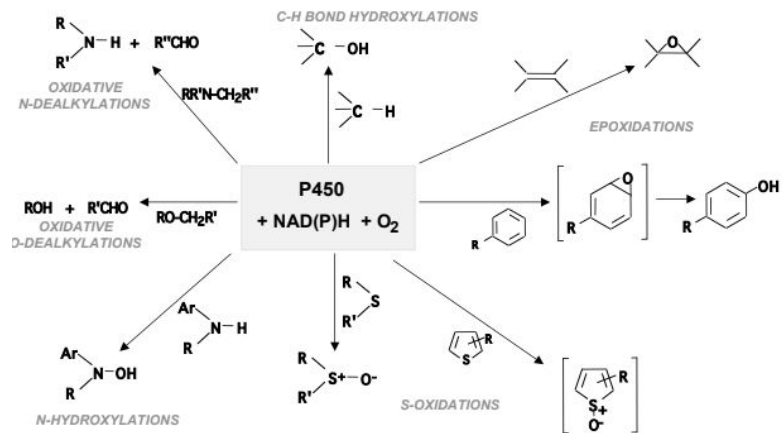




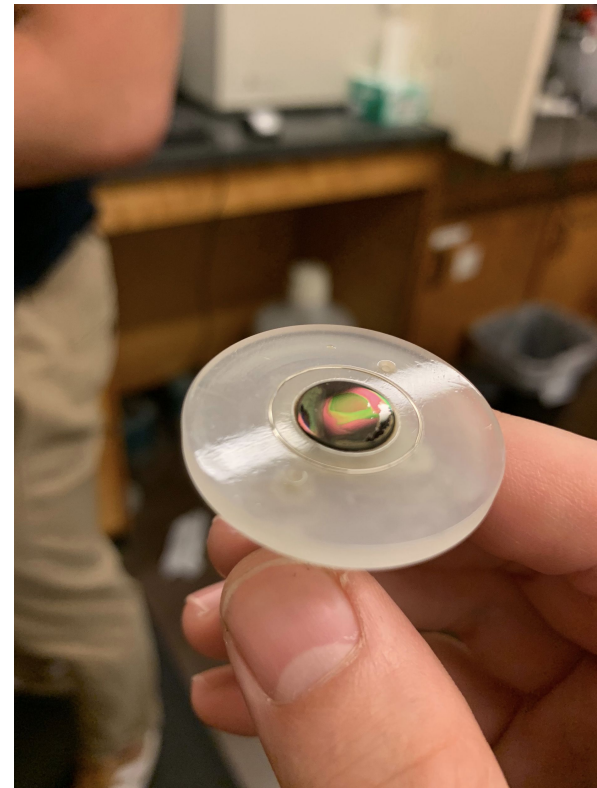
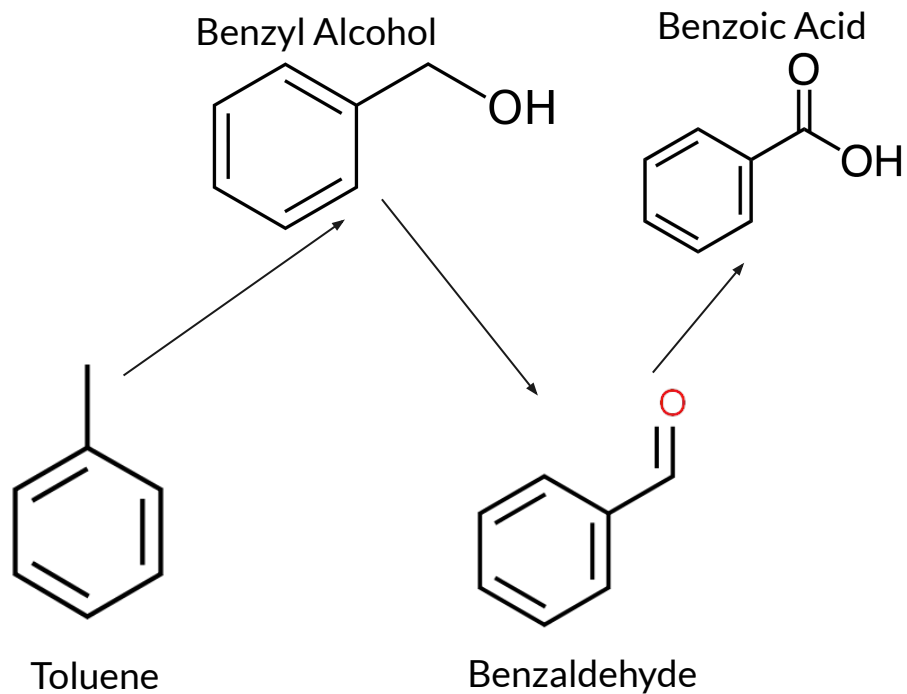
# Organometallic Synthesis for Redox Flow-batteries



# Electrochemical Characterization of a P450



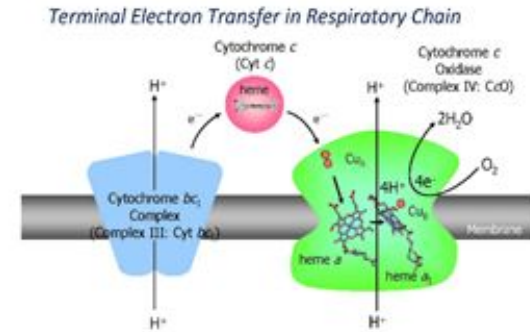
# Organic Oxidation with a Ni/Fe Hydroxide Catalyst





# Thermodynamics of the Electron Transfer Reaction between Cytochrome C and the CuA Domain on CytC Oxidase

- This is an e- transfer reaction at the end of the electron transport chain (ETC), the **mechanism behind aerobic respiration**
- **Current data is not consistent** with the kinetic rate of this reaction needed to **sustain living organisms**?!!!!!!?
- Investigate **conformational change when proteins dock** (thiol ligand bridge, see figure), this would make energy level (reduction potential) gap between the proteins consistent with a much faster rate!
- But **how** do you investigate this????



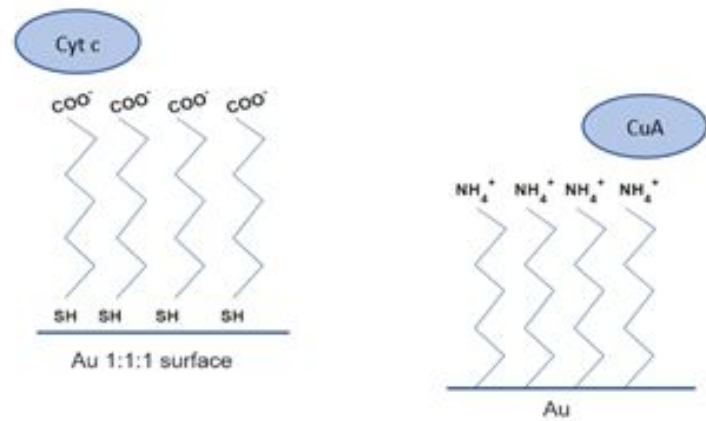
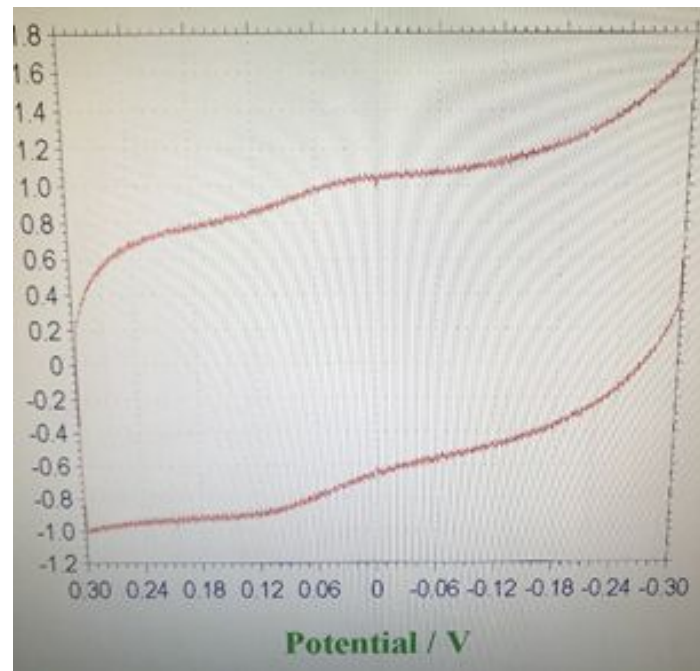


Fig. 2 SAMs on gold electrode surface



# Some cool lab skills I have learned in my research experience in the Hill Lab and with Prof. Muren:

## CuA

- how to transform bacteria
- how to run DNA and protein gels
- how to run a column (size exclusion, ion exchange, FPLC, TLC, you name it!!)
- how to whip up any kind of buffer I might need (just give me the pH and concentration and you got it)
- how to use 90% of the centrifuges on campus (not always as easy as it may seem!)
- how to use the Nanodrop as well as the other, far less exciting, cuvette-using spectrometers
- how to use a potentiostat
- several techniques in cleaning electrodes, and attaching/orienting my thiol layer onto my electrodes
- how to run cyclic voltammetry studies
- how to analyze those CV studies into thermodynamic data!

## P450

- how to synthesize new compounds!
- how to use a schlenk line
- how to reflux stuff
- how to run an NMR on my synthesized compounds for the P450 project
- how to use the rotovap

## ***Electrochemistry!!!!!!!***

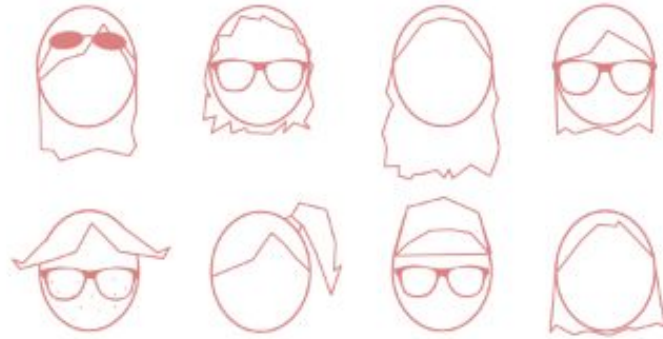
## ***Inorganic synthesis***

## ***Animal dissection and ex/in vivo experiments (UC Irvine collaboration)***

## ***Biochemistry/Molecular Biology***



# SP<sub>1</sub>IN LABOR<sub>1</sub>TORY

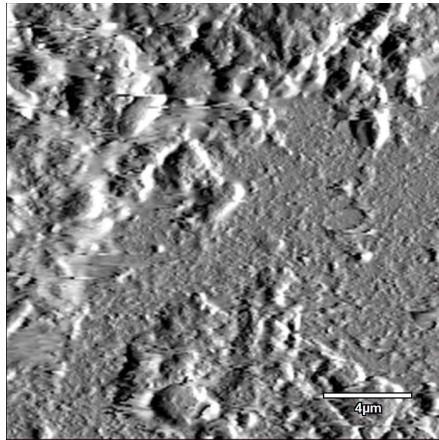
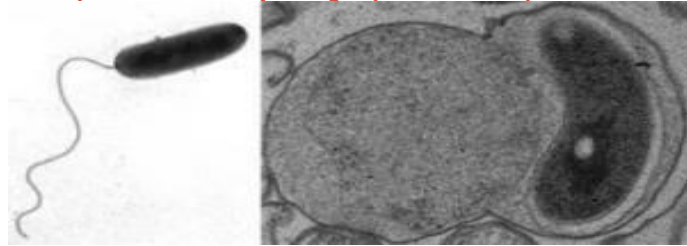
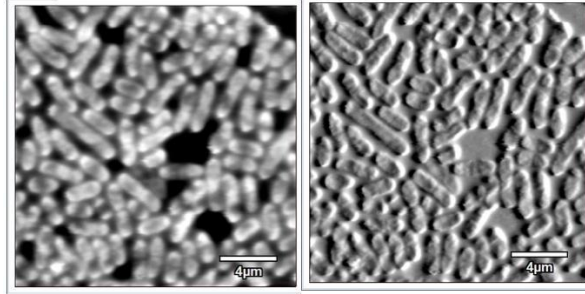


Interdisciplinary - Chemistry of Bacterial Predator-Prey Interactions

Biochemistry, Biophysics,  
Physical Chemistry and Computational Chemistry

# WHO - Infectious Disease a Critical Human Health Issue

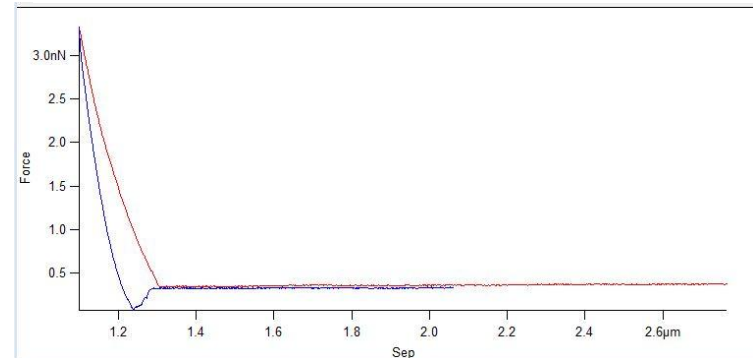
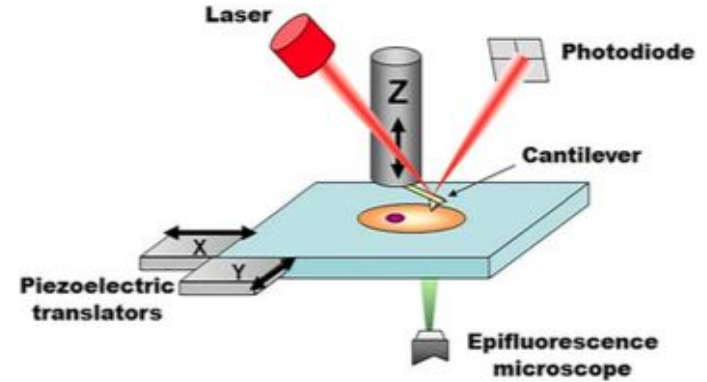
## Surface Interactions of a Bacterial Predator (*Bdellovibrio bacteriovorus*) and its prey (*E. Coli*)



- Sought to understand chemical and physical properties of *Bdellovibrio* at surfaces with and without prey cells
- Understand how *Bdellovibrio* sense surfaces and *how they identify their prey as edible*

# Atomic Force Microscopy (AFM)

- We use atomic force microscope to image *E. coli* and *Bdellovibrio*, and measure their adhesive forces
- This instrument allows us to take quantitative force measurements of cell membrane





# Contact Info

Professor Spain

[emspain@oxy.edu](mailto:emspain@oxy.edu)

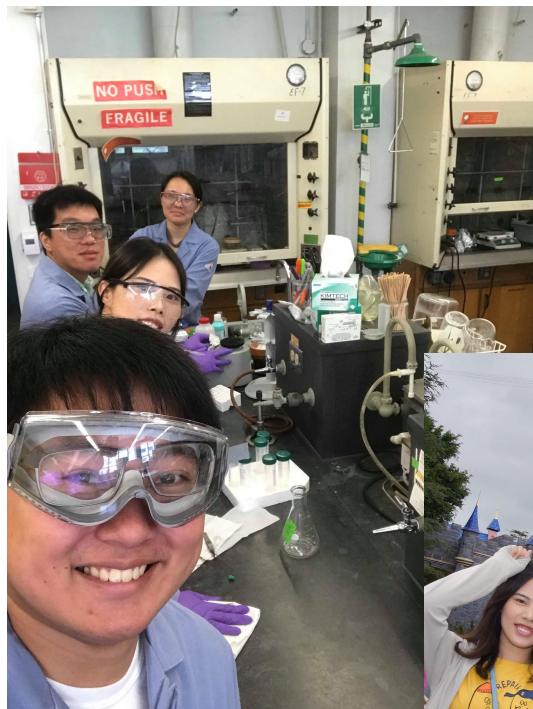
NC 307

Russell Uyemura

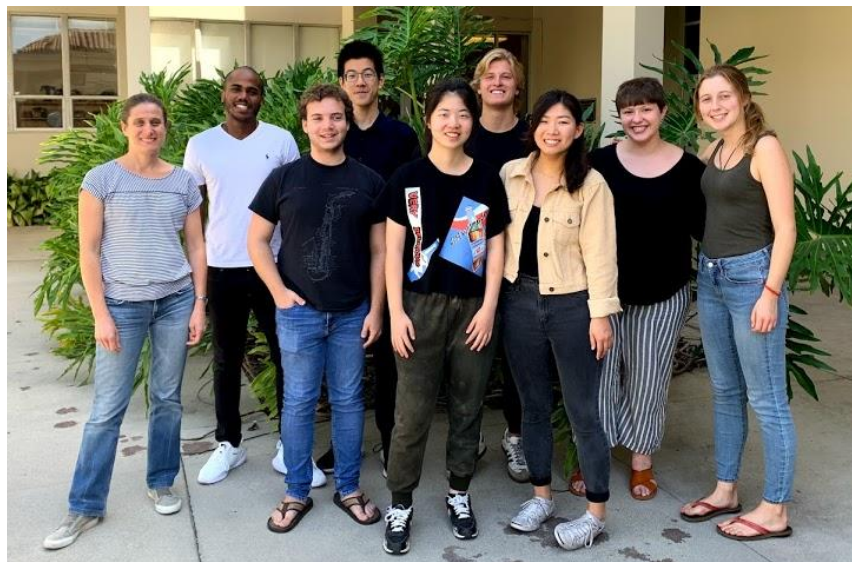
[ruyemura@oxy.edu](mailto:ruyemura@oxy.edu)

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[jwu2@oxy.edu](mailto:jwu2@oxy.edu)

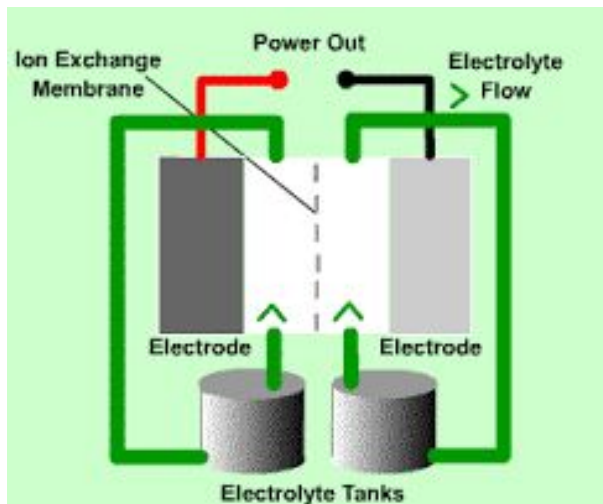


# DESPAGNET-AYOUB GROUP

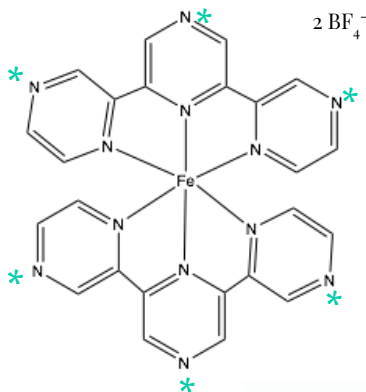


# FLOW BATTERY – BRANDON

- Develop metal complexes with outer sphere Lewis acids to allow selective electrochemical shifts

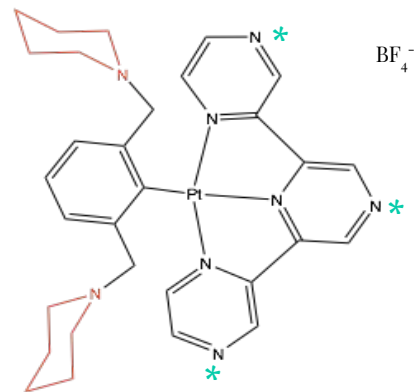


## Iron Complex



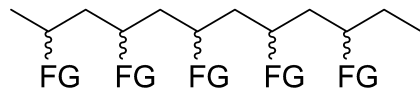
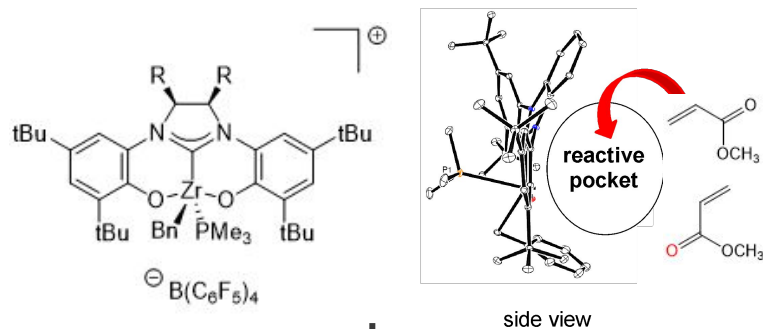
\*N indicates potential coordination spots for  $\text{B}(\text{C}_6\text{F}_5)_3$

## Platinum Complex



- Both complexes are being tested as electroactive species for redox flow batteries to enhance energy storage/transfer

# POLYMERIZATION – SERENA, MOLLY, MCKENNA



FG: Functional group  
(-CO<sub>2</sub>Me, -OCOMe, -CH<sub>2</sub>OH, -CH<sub>2</sub>NHR...)

- Early Transition Metal Catalyst: NHC Phosphine Zirconium Complexes
- Directing approach of functionalized olefin
  - No interaction between polar functional group and metal center





# CONTACT US!

FOLLOW US @EDACHEMLAB

EMAIL US IF YOU HAVE ANY QUESTIONS!

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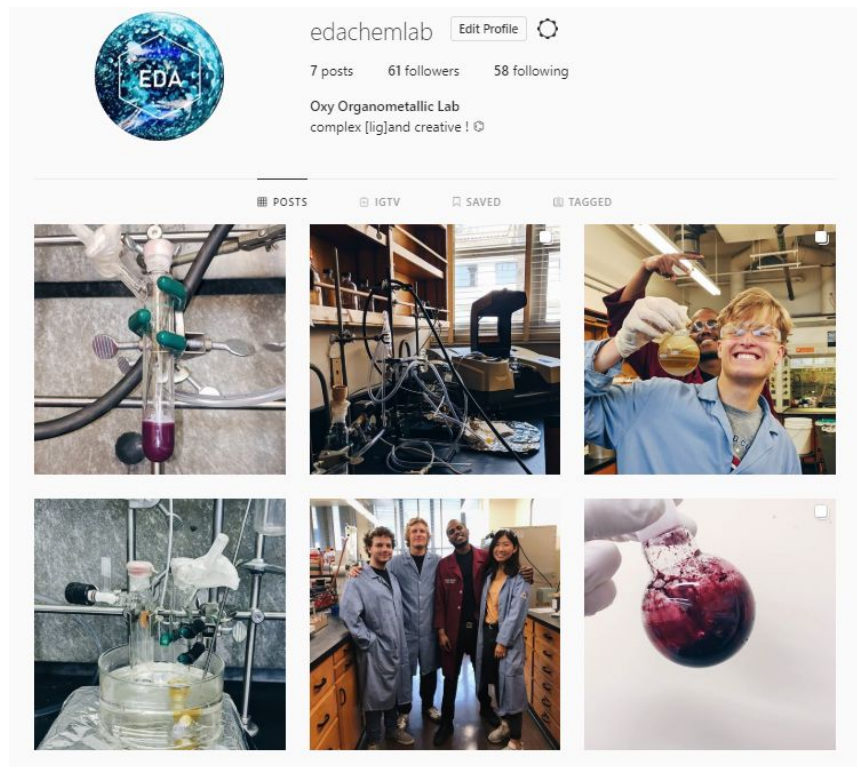
**Damien:** [dbissessar@oxy.edu](mailto:dbissessar@oxy.edu)

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Molly ('21): [mdavis2@oxy.edu](mailto:mdavis2@oxy.edu)

McKenna ('21): [simsm@oxy.edu](mailto:simsm@oxy.edu)



# AKU RESEARCH LAB

## Presenters:

**Morgan Crotta '21**    [mcrotta@oxy.edu](mailto:mcrotta@oxy.edu)

**Lauren Chin '20**    [lchin@oxy.edu](mailto:lchin@oxy.edu)



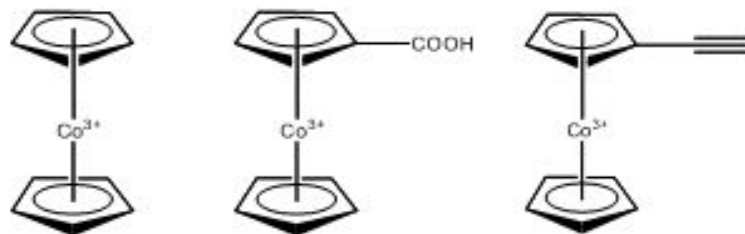
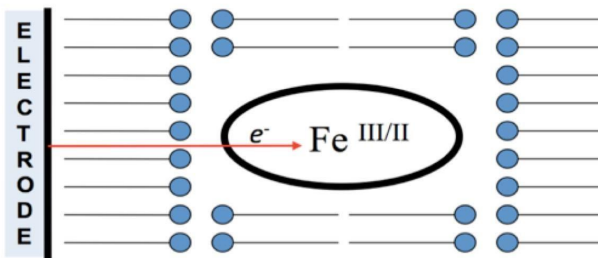
# Cytochrome P450

Ayanna Lynch, Warren Zhang, Morgan Crotta, Crystal Liang, Wesley Hsiao, Zachary Schuman, Parag Kalay

- Hormone biosynthesis
- Human P450s metabolize > 90% of drugs

## Goals:

- Develop a biocatalyst system
- Use electrode as an inexpensive and industrial friendly alternative for NADPH



## What do we do in lab?

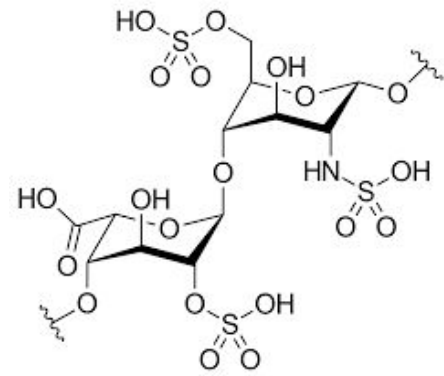
- Synthesis of viable P450 mutants
- Understanding enzyme-electrode interactions
- Synthesis of cobalt compounds for electron transfer to P450



# Heparin

Lauren Chin, Andrew Park, Atnasia Dessalegn

- Expressed by most animal cells, varied function
  - Affects growth factors, Inflammation, Immune response
  - Coagulation**
- Therapeutic heparin used to prevent postoperative thrombosis, **\$4B / yr**



## Problems with Heparin

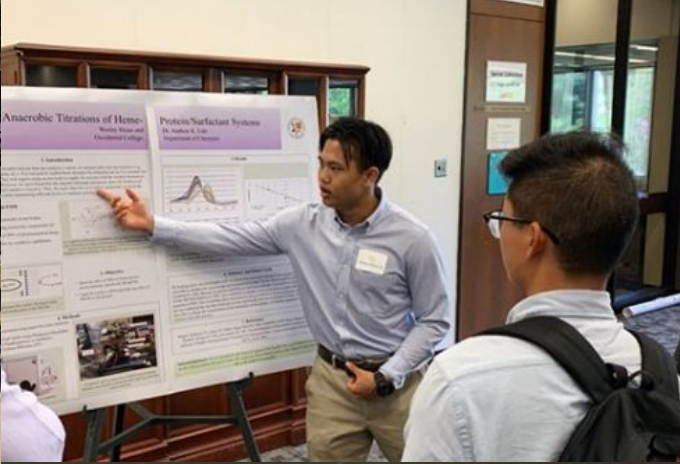
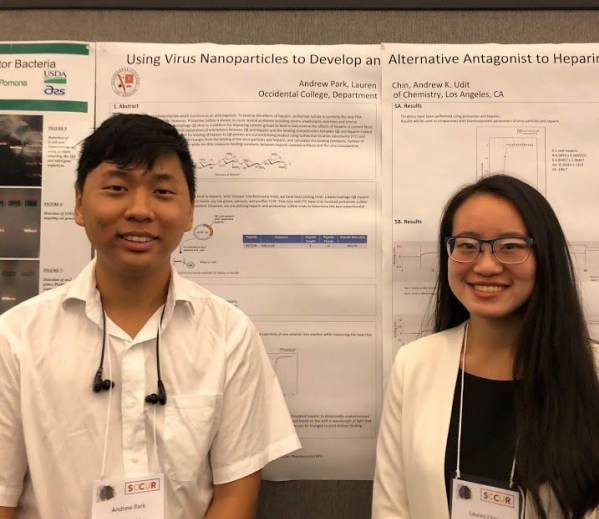
- Heterogeneous
- Toxic Antidote (Protamine)
- Overdose

## Goals

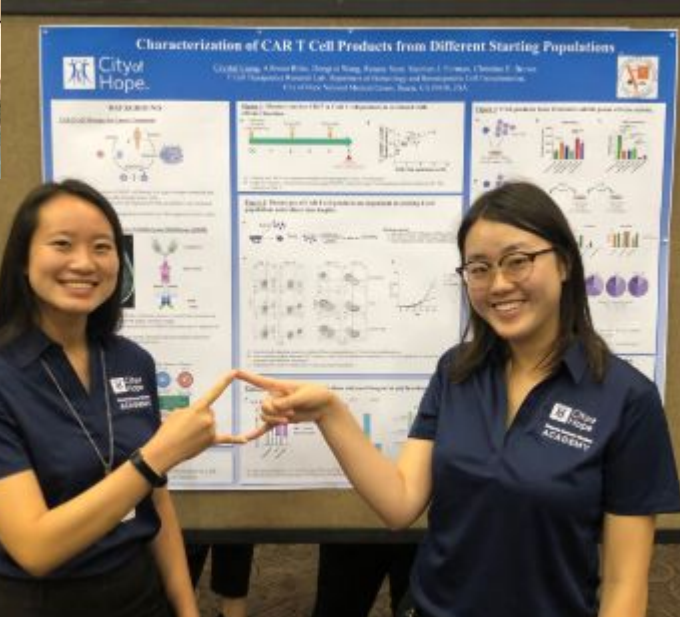
**Design alternative antidote**

### What do we do in lab?

- Grow cells to produce nanoparticles
- Purify and test proteins
- Isothermal titration calorimetry
- Biolayer interferometry



Join the  
Udit Lab!





GETTY MUI INTERNSHIP

**Ayanna  
Lynch**



## OVERVIEW

- Getty Marrow Undergraduate Internship
- 10 weeks (June 17<sup>th</sup> - August 23<sup>rd</sup>)
- Getty Research Institute with Mark Benson
- Getty Conservation Institute with Vincent Beltran



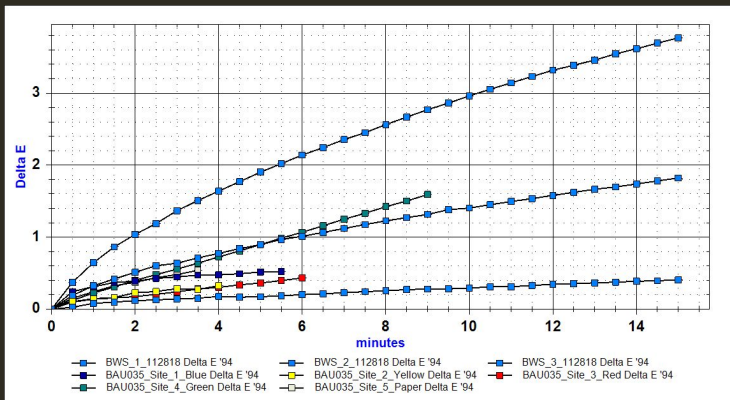
MFT AT GCI

- Training on the Microfading Tester
- Protocol development
- Blue Wool Standard testing
- Meetings with Academy Museum of Motion Pictures and American Museum of Natural History



## MFT AT GRI

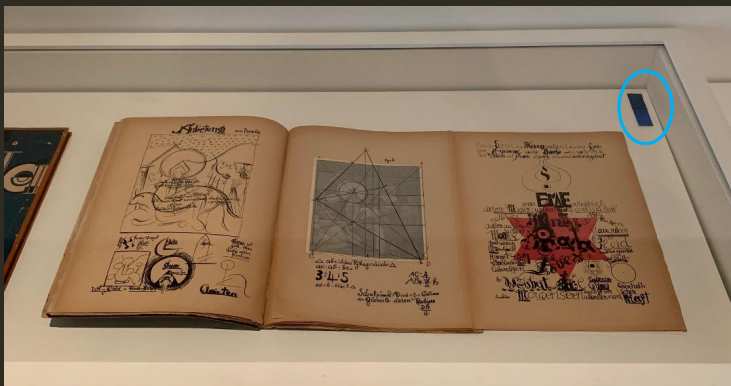
- MFT testing of works for gallery exhibitions and pieces intended to go on loan
- Blue wool equivalencies
- Lighting recommendations
  - Lighting level
  - Display duration





## BAUHAUS BEGINNINGS

- Color and light monitoring in the GRI galleries
- Specific gallery challenges due to architecture



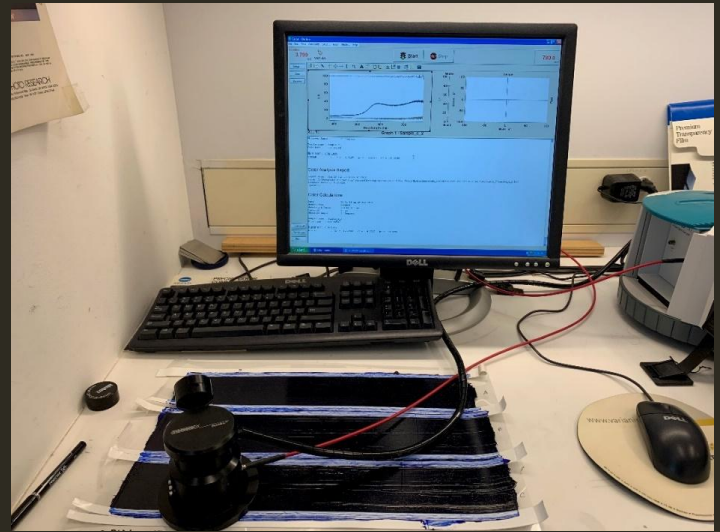
## LIGHT BOX STUDIES

- Range of sample types with varying light sensitivity
- Reciprocity between simulated “gallery” fading and MFT predictions
- Supplementary visual survey of “Just Noticeable Difference”
  - Weekly surveys taken to determine how much color difference is visible to the human eye



# OTHER PROJECTS

- Paint films
  - Data collection
  - Protocol Development
- Environmental Data analysis
  - Excel tool testing and protocol editing
  - Environmental tool testing
- Architectural Model Conservation
  - Dry cleaning
  - Condition reports
  - Pest Treatment



## MOVING FORWARD

- Graduation in May 2020
- PhD in Chemistry
  - Material Science????
  - Physical Chemistry????
  - ????????????



THANKS!

- Getty Foundation

- Getty Conservation Institute, Science Department

- Getty Research Institute

- Mark and Vincent



**Dr. Lasater's  
Cookies!!!**

**More cookies!!!**



**Tea!!!**

**Charcuterie!!!**

**Finger  
Sandwiches!!!**

**Lemon Bars!!!**