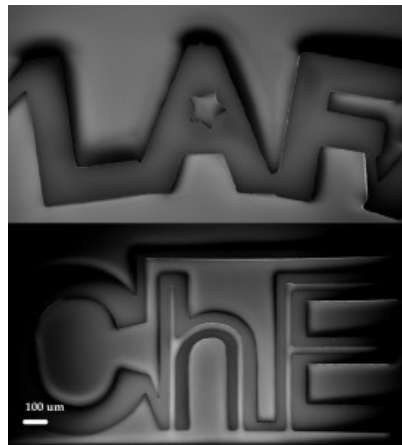
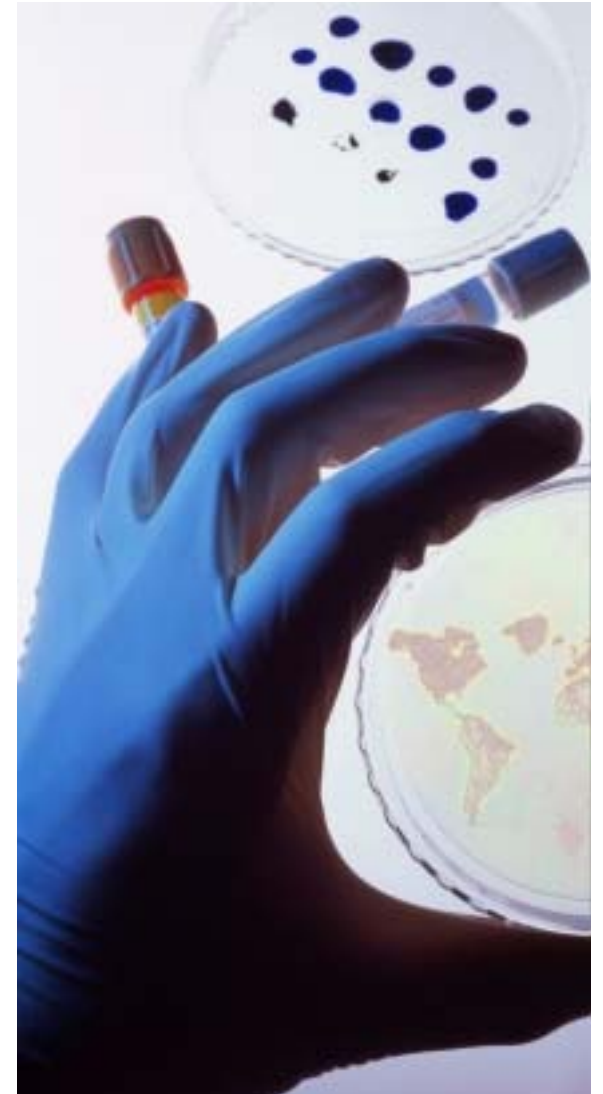


Have fun, get paid, and travel the world: Getting involved in research at Lafayette

Department of Chemical and Biomolecular Engineering



Lafayette College
February 2015



Have fun, get paid, and travel the world: Getting involved in research at Lafayette

Independent research: CHE 390/391



Independent Study in Chemical Engineering serves to provide a high quality student-faculty experience for a range of topics, from specialized technical coursework to independent hands-on research projects. CHE 390/391: Independent Study will focus on contemporary issues from primary literature and count as a Technical Elective in the Chemical Engineering course of study. The specific topic and goals of the Independent Study are to be determined by the Instructor and the student.

Course Hours: One hour per week meeting with Instructor (minimum)
 Ten hours per week laboratory or project work (minimum)

Have fun, **get paid**, and travel the world:
Getting involved in research at Lafayette

THE EXCEL SCHOLARS PROGRAM

Lafayette's EXCEL Scholars Program enables high-performing students to assist faculty members with their scholarship. The purpose of the EXCEL Program is to encourage collaboration in learning between faculty and students. The work of the student must, therefore, be research-oriented and not administrative in its primary emphasis. EXCEL Scholars may work part-time during the academic year or full-time during the Summer and the Interim Session.

Participation in the EXCEL Program is an honor reserved for those students who have achieved distinction in their academic program at Lafayette. To be eligible as an EXCEL Scholar, students should have completed their first year at Lafayette and should maintain a cumulative GPA of 3.25.



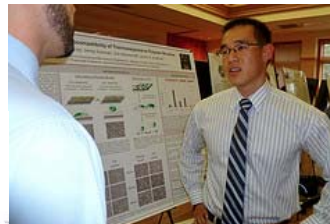
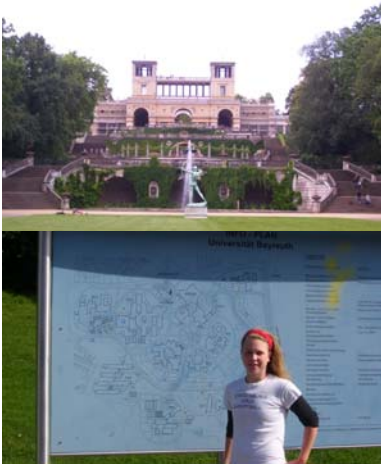
<http://researchsupport.lafayette.edu/research-by-students/>

Have fun, get paid, and **travel the world**: Getting involved in research at Lafayette

Honors thesis research: CHE 495/496

An Honors Thesis in Chemical Engineering serves to provide outstanding students with a high quality student-faculty research experience during the senior year. Candidates for honors must have and must maintain a cumulative GPA of 3.00 and ChBE Departmental GPA of 3.20. The specific research topic of the Honors Thesis should be discussed well in advance of the senior year with the Instructor.

Course Hours: One hour per week meeting with Instructor (minimum)
 Ten hours per week laboratory or project work (minimum)



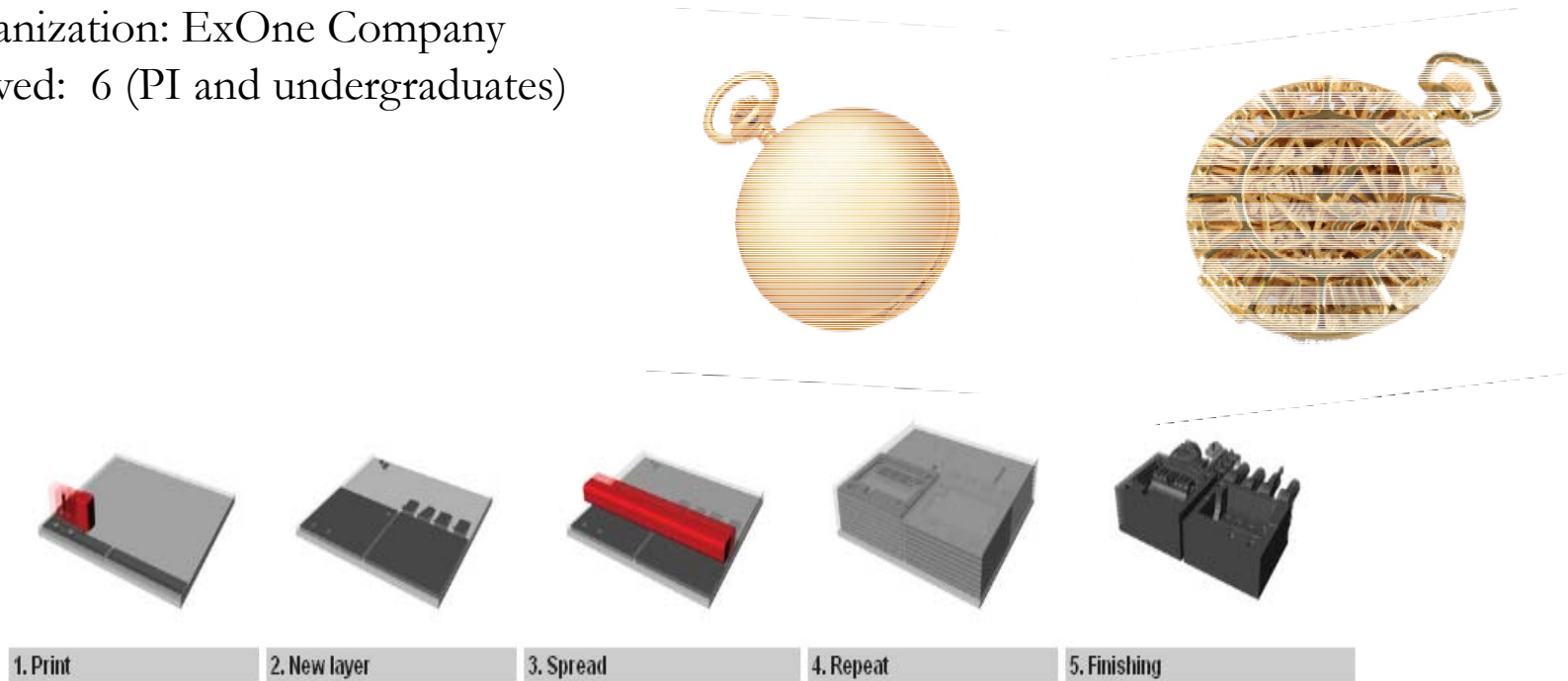
Getting involved: Ferri

Optimization of Voxel Resolutions in Materials Additive Manufacturing

Duration: 1 years; (with renewal upcoming)

Funding organization: ExOne Company

People involved: 6 (PI and undergraduates)



1. Print

Selectively dispense binder using inkjet printing technology

2. New layer

The build platform is lowered by a set increment.

3. Spread

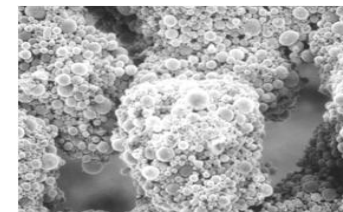
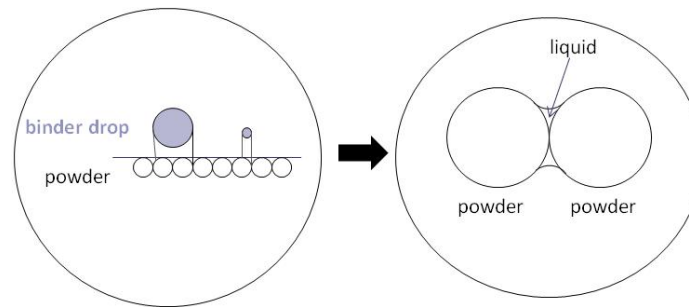
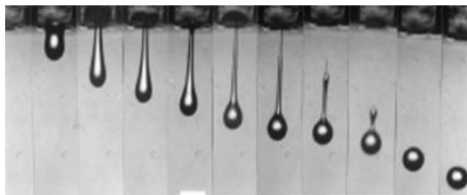
Spreads a new layer of powdered metal.

4. Repeat

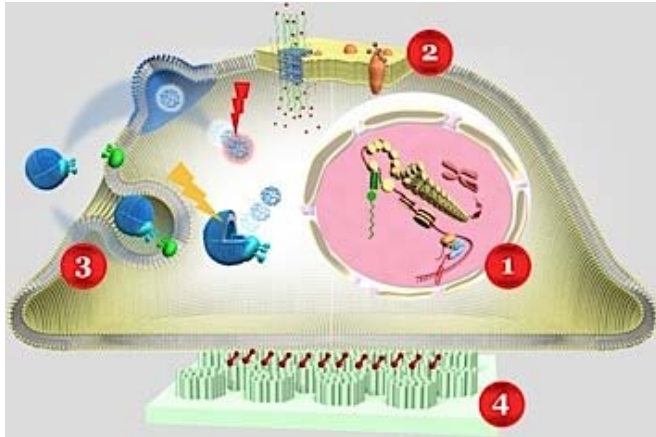
Repeat Steps 1-3, until the part is built.

5. Finishing

Unbound metal is removed. Metal parts are thermally processed.



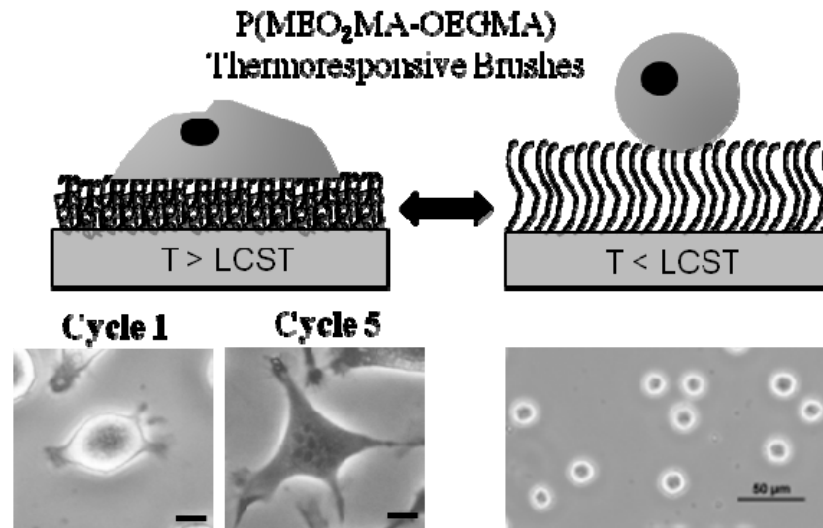
Engineering the cell-surface interaction



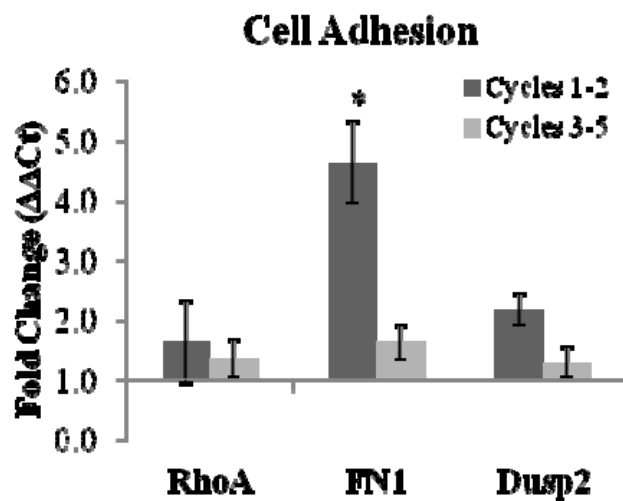
DNA → RNA →
PROTEIN

- **Overarching principle:** *Manipulate biomaterial properties, (bulk: modulus; surface: chemistry, topography), to selectively control the cell-material interaction.*
- For the relevant cell type, evaluate the following parameters on the biomaterial:
 - Cell morphology: microscopy, image analysis (spreading, circularity)
 - Cell adhesion: microscopy, immunofluorescence, adhesion assays
 - Cell differentiation: gene and protein expression, soluble signaling
 - Cell proliferation: DNA quantification
 - Cell-vitality: live/dead quantification using ViCell

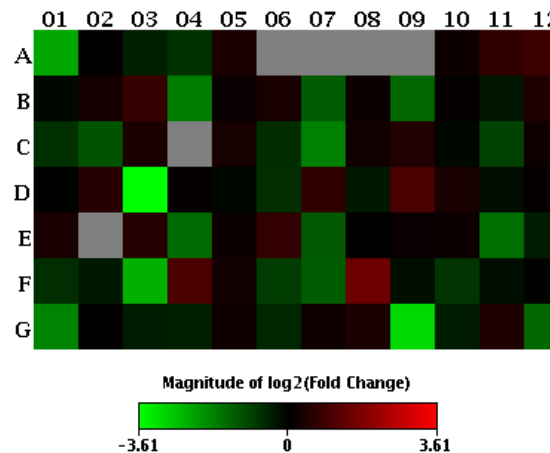
Thermoresponsive Polymer Brush Fabrication and Cell Culture



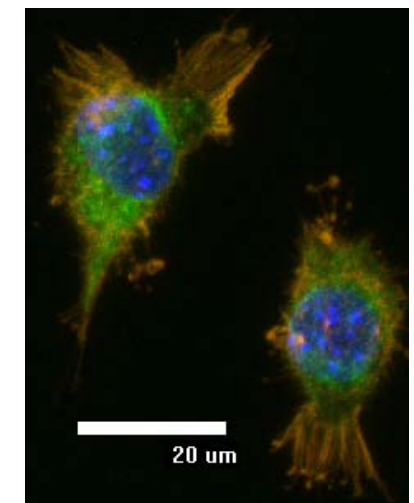
Gene Expression by Real-time RT-PCR



Mechanistic Cell Adhesion Analysis using mRNA Microarrays



Cell Morphology by Confocal Microscopy





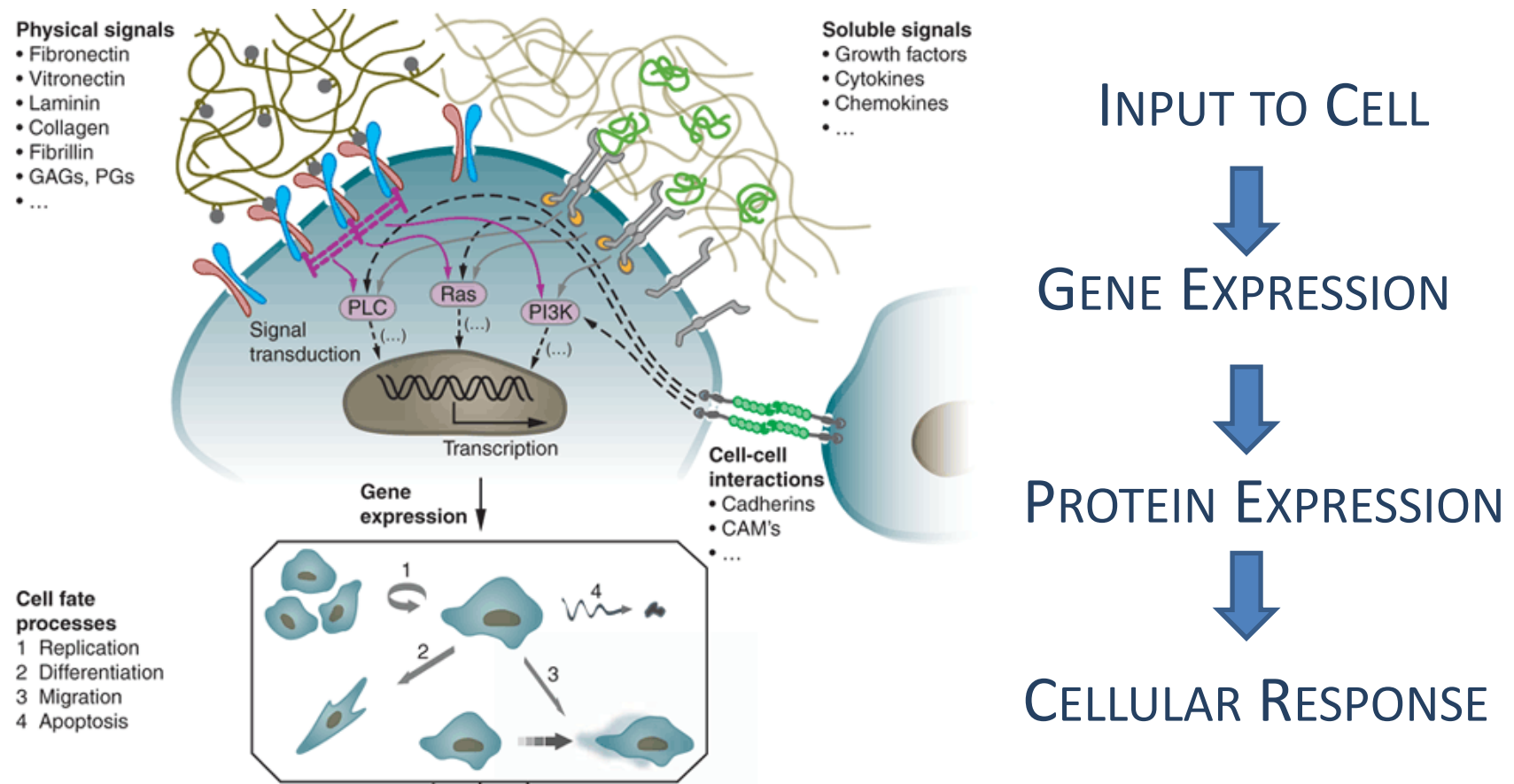
What skills will I learn?

- Sterile cell culture
- Real-time RT-PCR
- Microscopy (phase contrast, confocal)
- Polymer fabrication (nanofibers, microspheres, 2D films)
- UV-vis spectrophotometry

What positions are open?

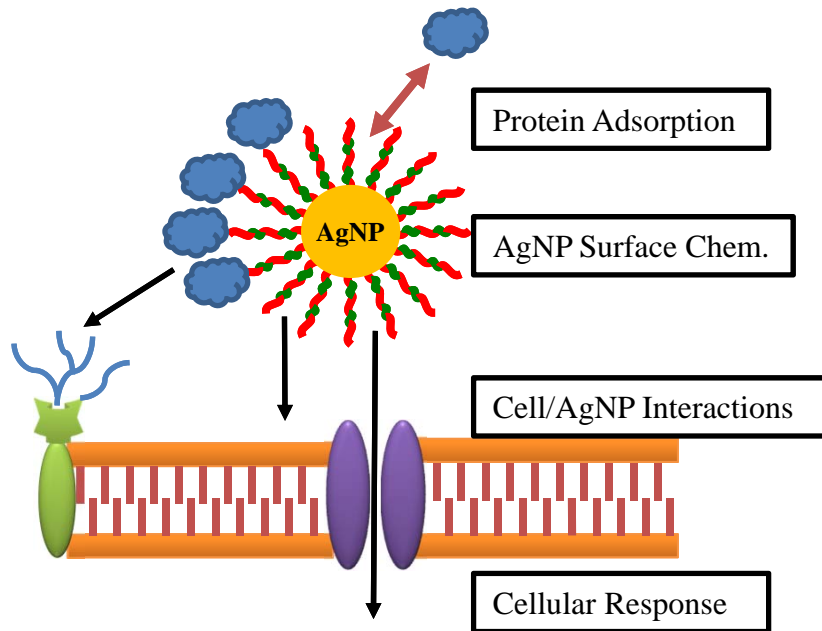
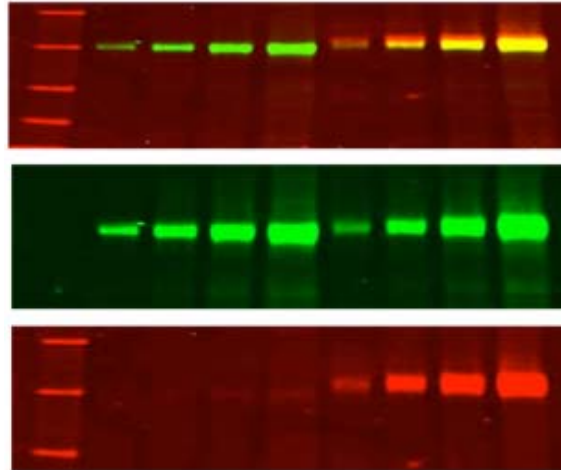
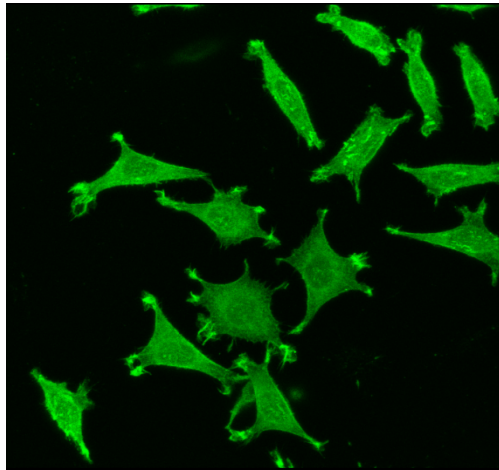
- EXCEL: Summer and AY 15-16
- Honors Thesis
- Independent Study

Investigation of protein expression and cell function in biomolecular engineering applications

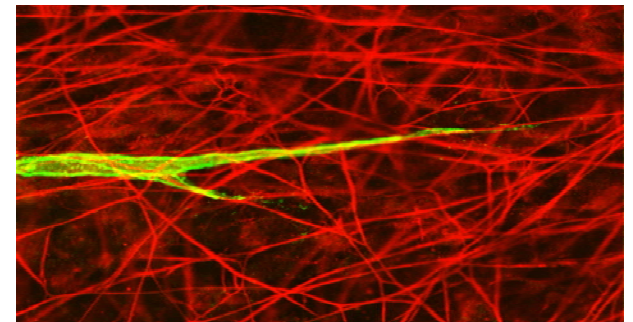
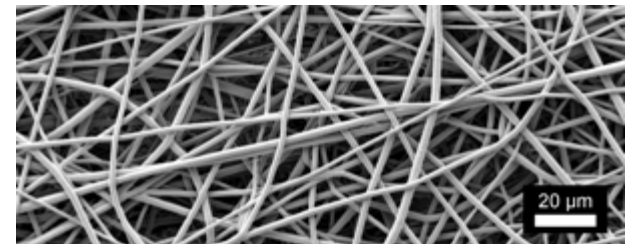
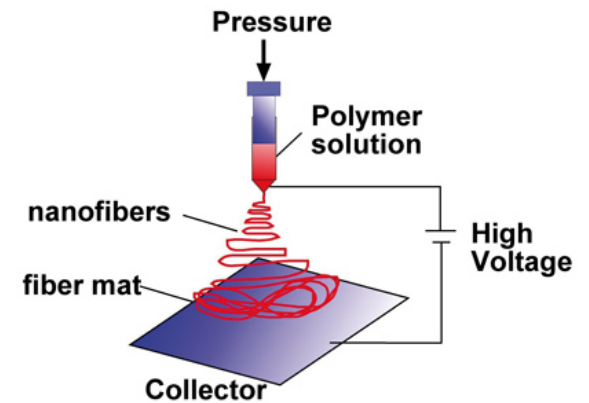


Central question: How does the regulation of cell protein expression affect cell function and inform the engineering of better materials?

Cellular and Proteomic Responses to Engineered Materials



Cell/Biomaterial Interactions



Experimental skills:

- Sterile cell culture
- Immunohistochemistry
- Confocal microscopy
- Protein electrophoresis and western blot
- Fluorescence spectroscopy
- In vitro cell function assays

Availability:

- Honors Thesis: AY 2015-2016 (Juniors)
- EXCEL: AY 2016-2016 (Sophomores and Juniors)

Polly R. Piergiovanni

Current Research Interests

- Development of experiential activities in food engineering
- Kinetics of dye – textile adsorption
- Developing engineering students' critical thinking skills

Independent Study Projects available for Fall 2015

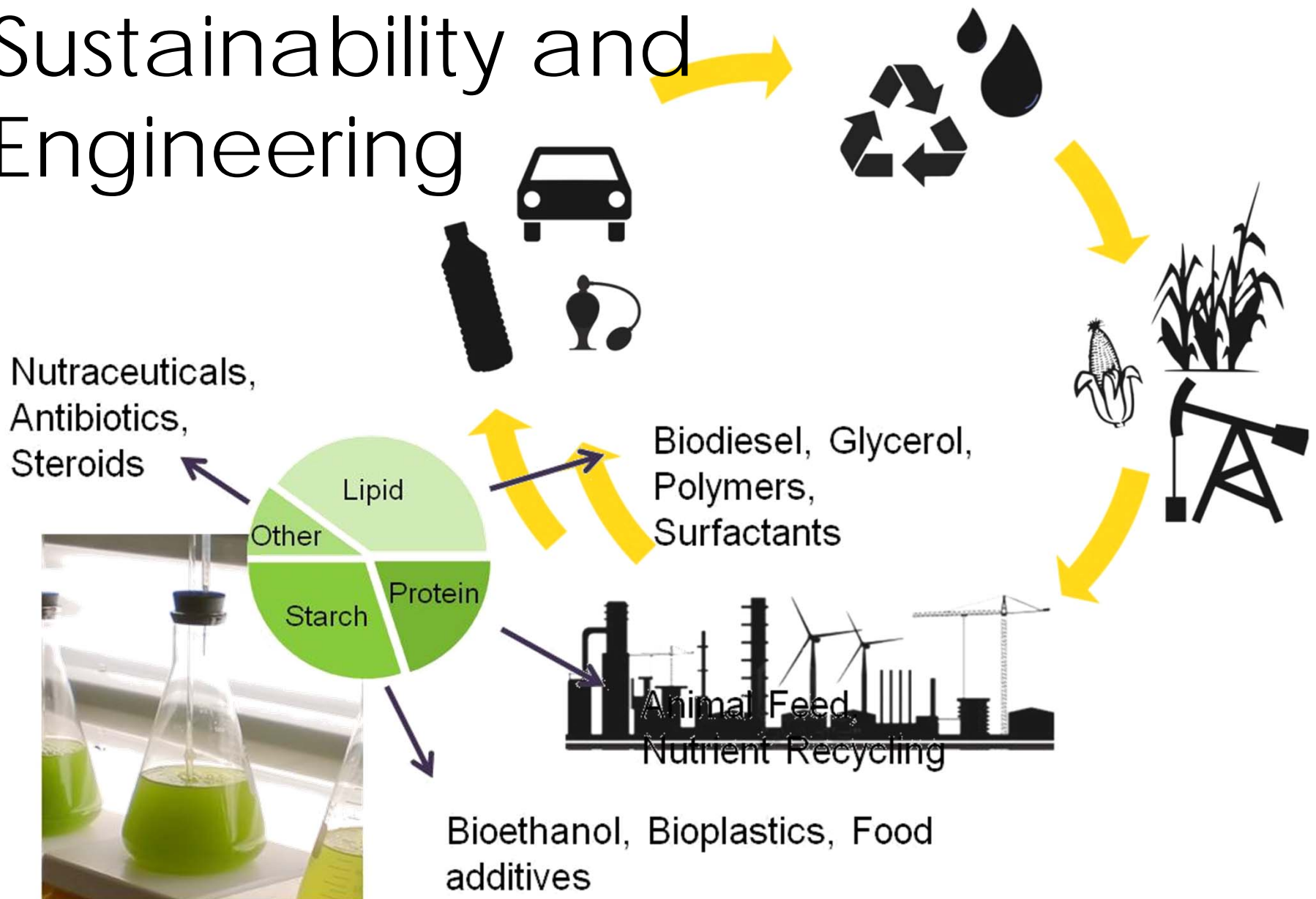
Research Interests

Polly R. Piergiovanni

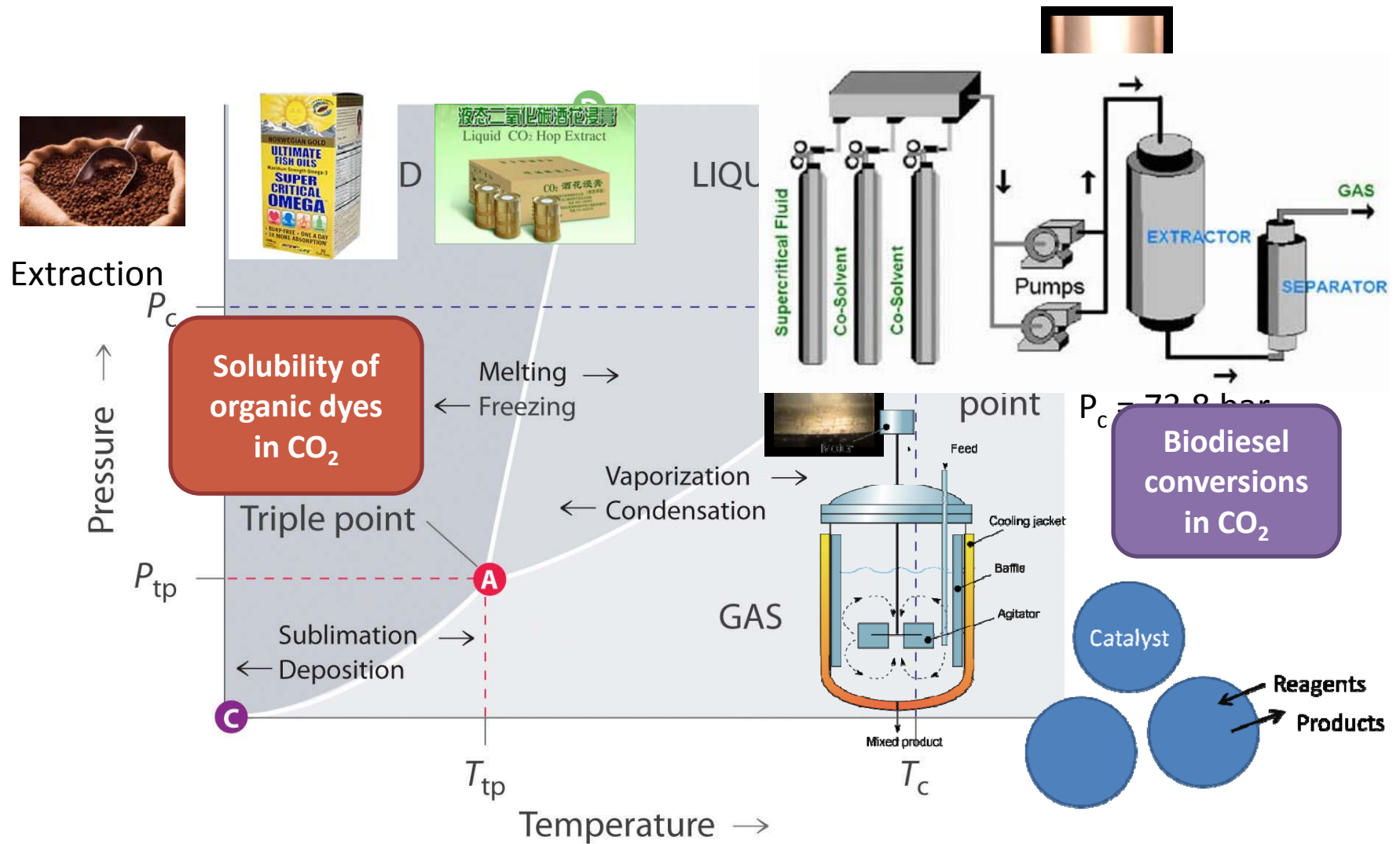
- Adsorption thermodynamics and kinetics



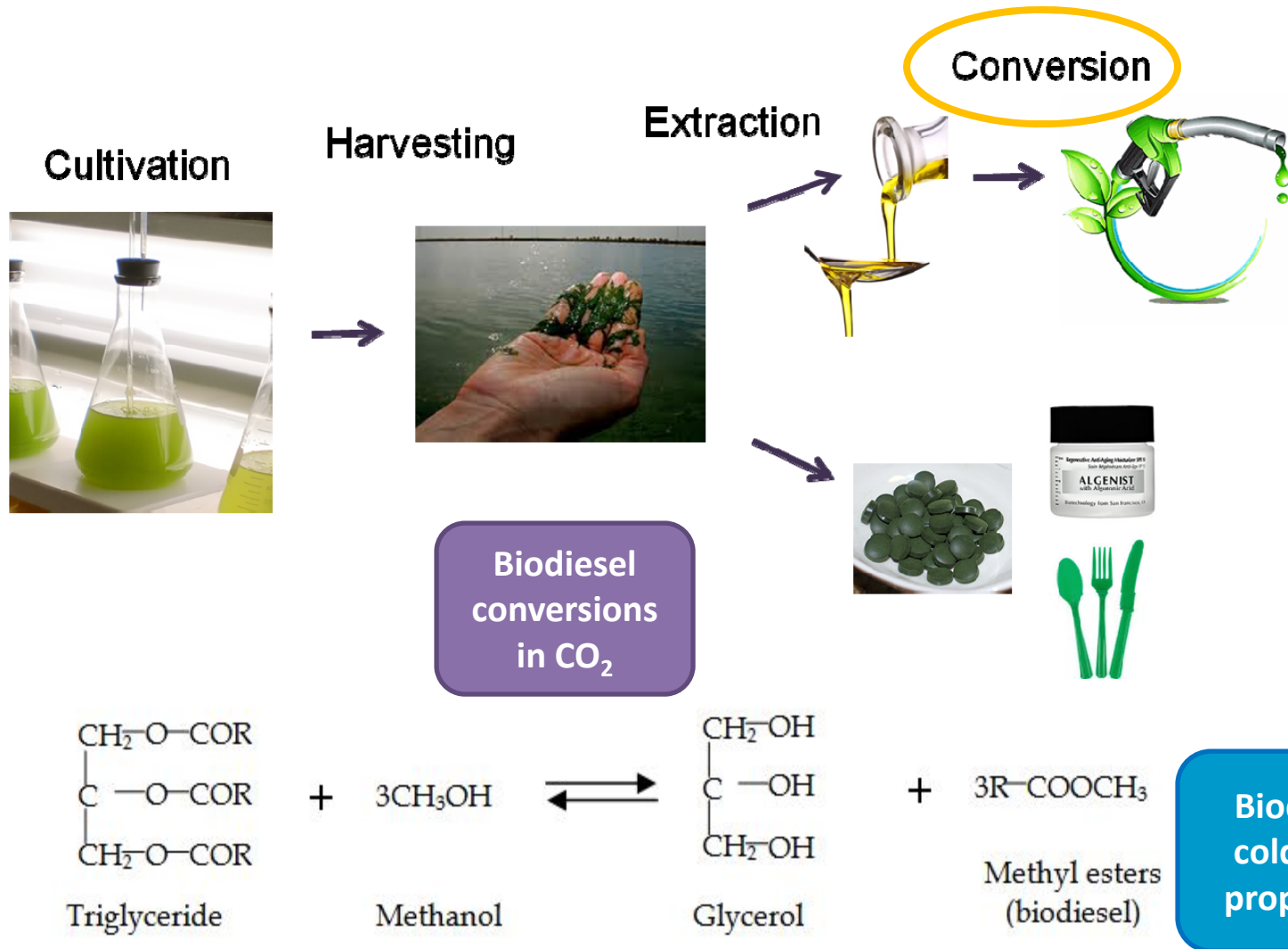
Sustainability and Engineering



CO₂ as a green solvent

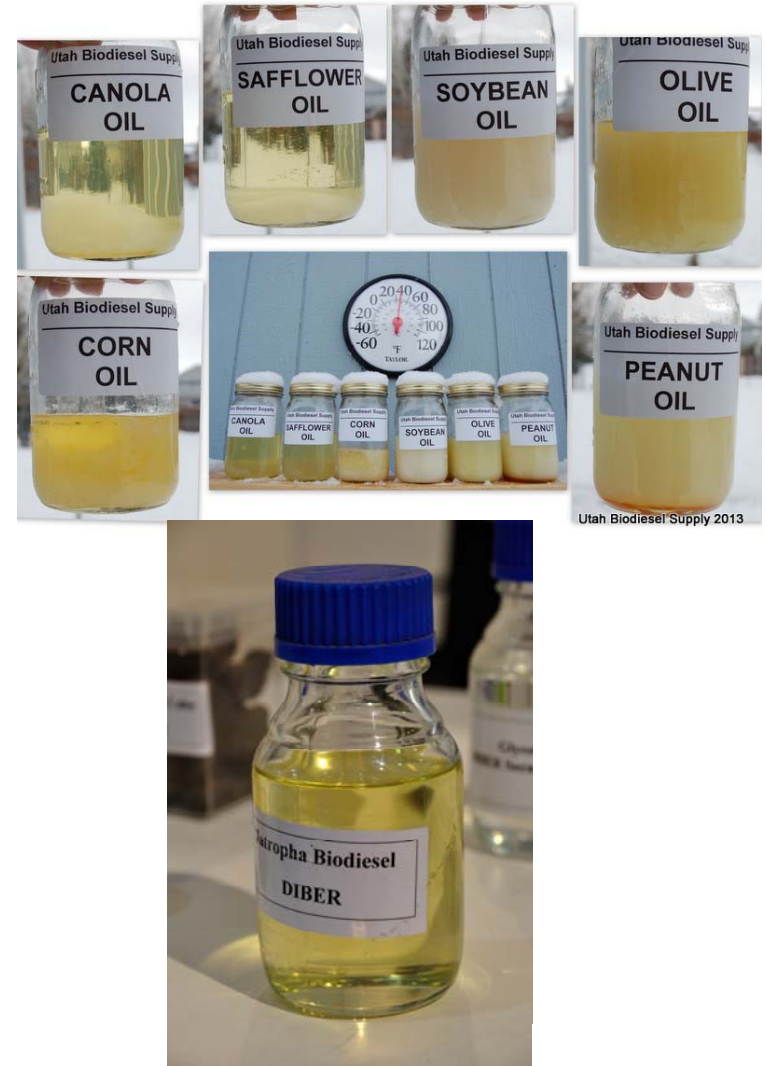


Biodiesel Production Process



Green Faculty Collaboration

- A major disadvantage of using biofuels is **cold flow properties**.
 - Impacts ability for engines to run
- Interested in how particular components of oils and additives influence cold flow properties.



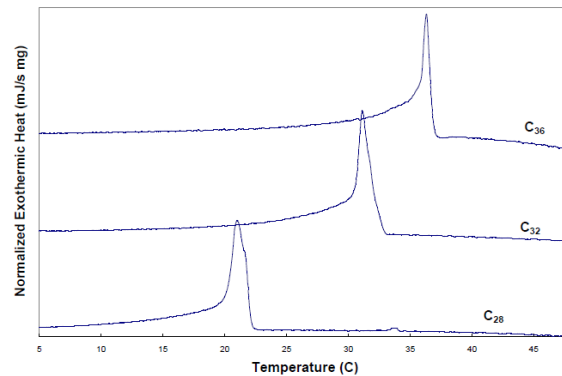
Keeping Things Flowing Under the Sea...



- Issue faced in petroleum transportation
 - Cold water temperatures → crystallization (cloud point) → deposition and gelation (pour/gel point)
 - Chief component of deposits: n-alkanes (waxes)
 - Impacted by presence of other materials

Equipment/Skills

- Conducting measurements of flow properties important in the energy industry.
- Rheometry
- Differential Scanning Calorimetry



Opportunities available:

EXCEL scholars (SU 15 and AY 15-16)

Honors Thesis and Independent Study (AY 15-16)

Interested in Research?

- **EXCEL Scholars (pay)**
 - SU 15: Talk to faculty ASAP
 - FA 15 or AY 15-16: Decision by late summer
 - SP 16: Late summer best, possible if decision made by FA15
- **Honors Thesis (seniors only, credit only)**
 - The earlier, the better
 - For non-seniors, get a feel for research via Excel or independent study (not requirement for honors thesis)
- **Independent Study (credit only)**
 - Not difficult to arrange, but based on faculty availability