



# RESEARCH WITH UNDERGRADUATES

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*(based on previous sessions led by Laura Rademacher, Josh Galster, Chris Kim, Rachel Beane, Elizabeth Catlos, Kathy Surpless, and many others)*

# Overview

- Your motivation
- Goals for undergraduate research
- Types of undergraduate research
- Who are undergraduates?
- Approaches to project design
- Outcomes & preserving knowledge
- Your plan for success





# Your Motivation

- What are the benefits of undergraduate research? In other words, why involve undergraduates in your research?
- What are the challenges and pitfalls of working with undergraduates in research?

# Goals for Undergraduate Research

- What do you want students to gain from the research experience?





# Goals for Undergraduate Research

- Advance knowledge of discipline and/or result in new scholarly and creative works
- Students learn ways of the discipline
  - process is as important as outcome
  - challenge to pose and answer meaningful questions
  - develop quantitative, problem-solving, and presentation skills
- Enliven intellectual climate on campus
  - stimulate discussion & collaboration within/across disciplines
  - increase # of high quality interactions between students & faculty outside of classroom
  - Provide a student-centered space to brainstorm ideas and discuss research

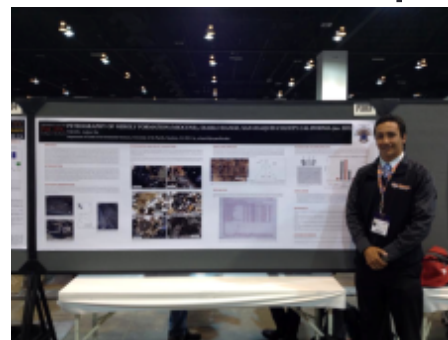
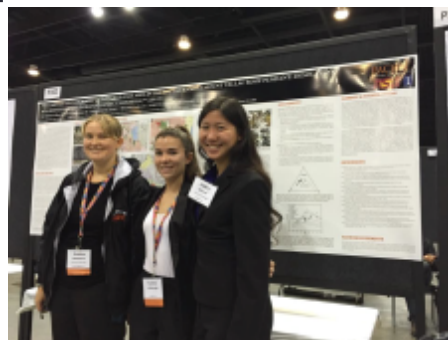
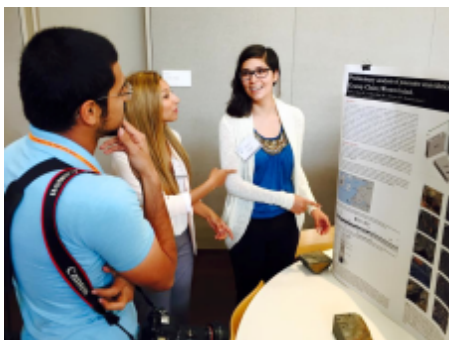
# Types of Undergraduate Research

- Research as part of an undergraduate class (another session here on this!)
- Summer research / paid assistantship
- Independent study / honors thesis research



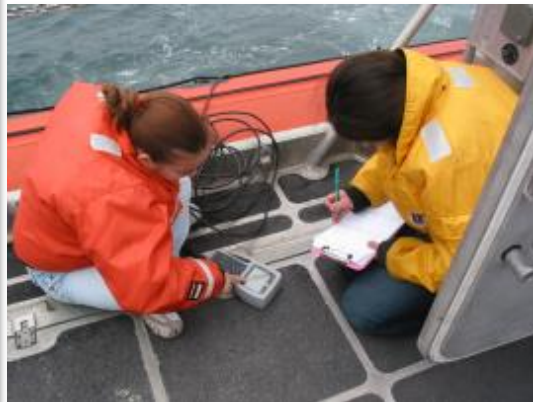
# Successful Undergraduate Research: *Process vs Outcome*

- Learning experience for student
- Provide student with guidance to understand significance of problem/question, practice methods, and execute project
- Facilitate communication between student & professor
- Investigate significant rather than trivial problems
- May lead to class presentations, senior theses, conference presentations, contributions to papers...



# Undergraduate Students Are:

- Eager
- Fast learners
- Better connected
- Affordable
- Searching
- Rewarding
- Less experienced
- More time-intensive
- Overcommitted
- With you for shorter timeframes
- Distracted
- Naive





# Recruiting, Selecting, and Contracts

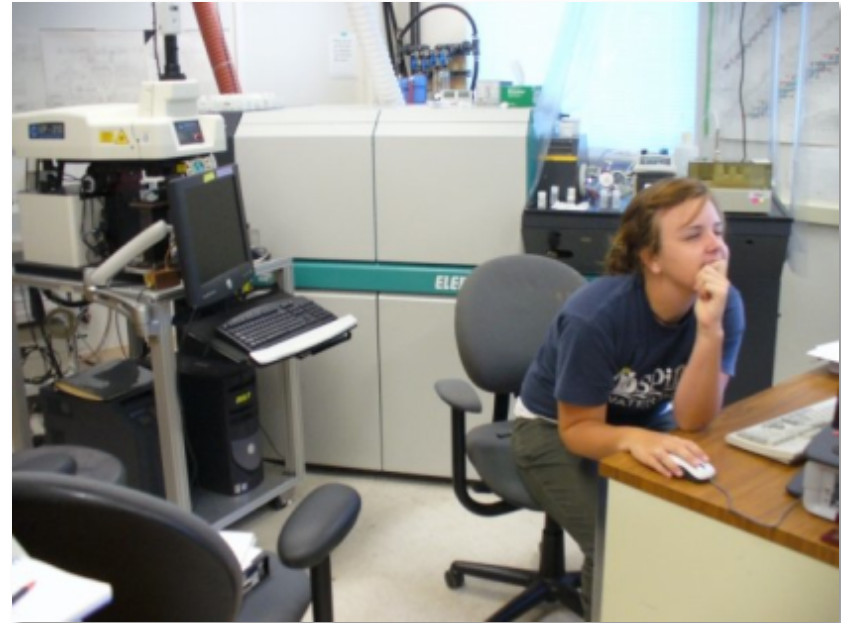
- Recruiting: You are the best advertisement!
  - Formal: ads, emails, events, & webpages
  - Informal: Word of mouth, class announcements, approaching good candidates directly



- Selection
  - Academic criteria: GPA, class and lab experience
  - Time available and compatible schedules
  - Compensation: salary, credit, volunteer
- Research Contracts
  - Explicit expectations for both student & advisor

# Designing “Doable” Projects

- Consider:
  - time allotted (as an estimate, multiply x3...or more!...the time it would take you to complete a step)
  - student’s ability and motivation
  - student’s & your other responsibilities



# Undergraduate Research Approach

- Work on piece of mentor's larger research project(s)
  - Work on projects of their own design
  - Work on research topics of peripheral interest to mentor's research
  - Work on continuing previous projects
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- Students at different levels involved in research team
  - Students complete research within class context
  - Students complete research as part of structured Honors Program (*or similar*)

# Project Design Approach

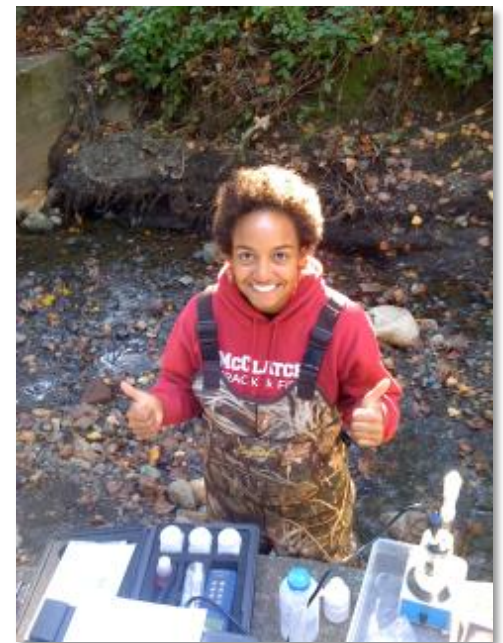
- Multi-student, multi-year project
  - Students work on different pieces of larger project
- Example: Lead contamination in Philadelphia soils
  - Field soils analysis
  - Lab soil analysis
  - Multiple sites
  - Geochemical modelling
  - Historic records





# Project Design Approach

- Adapting research to local field areas
  - Develop field-based program close to campus for class & summer
  - Foster balance between family, research, teaching
- Example: Investigating local pollution
  - Field soil analysis
  - Lab soil analysis
  - Soil collection & observations
  - Historic records

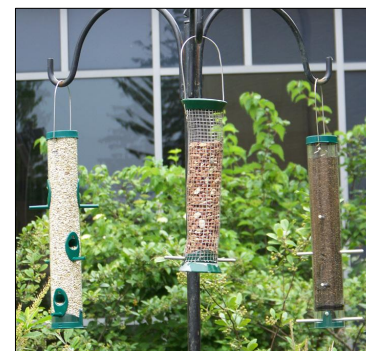


# Project Design Approach

- Adapting research for inclusion in a course
  - Exposes many more students to research practices
- Example: place bird feeders at beginning of semester
  - Collect data throughout
  - Analyze data as part of syllabus
  - Have a final product



## Feeders in the Outdoor Classroom



*Above left:* safflower; *Above middle:* peanuts;  
*Above right:* thistle/nyjer



*Below:* black oil sunflower seeds



*Right:* mix of black oil sunflower seeds,  
striped sunflower seeds, safflower

# Outcomes & Preserving Knowledge

- Presentations
  - Abstracts
  - Posters and/or Talks
- Symposia & Professional Technical meetings
  - Networking
- Theses
- Publications
  - Multiple student researchers may be needed
  - Have them write the straightforward parts: Methods, Results, Figures
- Knowledge Preservation
  - Lab books & wiki
  - **File-sharing and backups**

# Your Suggestions & Questions?

- How have you designed projects for undergraduate researchers?
- What questions do you have about designing projects and working with undergraduates?







# Design Your Project! Keep in mind:

- Topic
- Goal
- Number of students involved
- Recruitment method
- Scale
- Expected outcome

# Planning Questions

1. Goal for incorporating undergrads into your research?
2. Important criteria to consider when selecting undergrads to conduct research with you? How will you recruit them?
3. Brief description of your scholarly research that will/does involve undergrads.
4. Strategy to conceptualize your research into undergraduate-ready projects?
5. Outcomes you anticipate from research with undergrads?
6. Your main challenge to conducting research with undergraduate students?
7. One effective way to address this challenge based on what you've heard today?

# Some Resources

- Undergraduate research:  
<http://serc.carleton.edu/introgeo/studentresearch/index.html>
- Collaborating with students:  
<http://serc.carleton.edu/NAGTWorkshops/earlycareer/research/students.html#thoughts>
- Guidelines for students:  
<http://serc.carleton.edu/NAGTWorkshops/earlycareer/research/students.html#guidelines>
- Advisor, Teacher, Role-Model, Friend: On being a mentor to students in science and engineering (full text online):  
[http://www.nap.edu/openbook.php?record\\_id=5789](http://www.nap.edu/openbook.php?record_id=5789)