EARLY ENGAGEMENT OF STUDENTS IN RESEARCH

Council on Undergraduate Research
Gateways to best practices for undergraduate research program directors

June 15, 2011
Presenters

- Michael Bergren, Associate Dean Academic and Research Initiatives, Massachusetts Institute of Technology

- Sandra Gregerman, Director Undergraduate Research Opportunity Program, University of Michigan, Ann Arbor

- Janet Morrison, Professor of Biology and Director of Faculty-Student Collaborative Activity at The College of New Jersey
WHAT MATTERS IN COLLEGE?

- The nature of a student’s peer group.
- The quantity and quality of interactions with faculty outside the classroom.
- Integration of students’ social and academic lives.
- Opportunities to make challenging coursework applicable and relevant.
- Engagement and understanding of the intellectual life and demands of a field or discipline beyond the classroom setting.
- The ability to see future selves.

(Astin, Terenzini, Kuh, and others)
WHAT UNDERGRADUATE RESEARCH DOES

- Integrates students’ academic and social lives.
- Increases faculty/student interactions outside the classroom but through a common intellectual activity.
- Makes coursework more relevant and difficult coursework more understandable by providing a context.
- Develops a students’ critical thinking and problem solving skills for other courses and situations.
- Socializes a student about the demands and rigor of a discipline and increases a student’s ability see oneself in a field or discipline.
- Produces new knowledge and supports faculty productivity.
CHALLENGES AND BENEFITS OF EARLY ENGAGEMENT

Challenges

- Student skill level
- Adjustment to college
- Faculty Time
- Staff Time
- Campus culture
- Time management

Benefits

- Making coursework relevant
- Mentorship
- Student retention
- Integration of undergraduate education and teaching
- Exposure to fields and disciplines
- Allowing for longer-term, sustained research
Presenters will share different models and perspectives

- Early engagement means getting students involved in research in their first and second years of college and in some cases pre-matriculation

- There is much debate on the benefits and challenges of early engagement

- Panelists will share perspectives and examples of programs on respective campuses
THE COLLEGE OF NEW JERSEY
THE COLLEGE OF NEW JERSEY

- Primarily Undergraduate Institution (PUI)
- 6,500 well prepared students
  - e.g. average SATs 1250 (verbal + math)
  - science student SATs 1320
- “Faculty-Student Scholarly and Creative Collaborative Activity” v. “UR”
Models from Biology and Psychology
Important Principles about early engagement illustrated by TCNJ models

- Developmental, structured faculty mentoring
- Peer mentoring
- Opportunity for more sustained engagement
- Process AND goal oriented:
  - importance of finished products --
    - e.g.
      - professional conference presentations
      - co-authored journal articles
      - honors theses
  - benefit to students and faculty
Biology

Peer mentoring program for freshmen

Research shadowing

Independent Research courses

NSF URM grant: Freshman year mini-rotations
PEER MENTORING PROGRAM FOR FRESHMEN

- Student-initiated
- Social connection to Juniors and Seniors in the Biology major
- All types of advice, including about research:
  - When to get involved
  - How to get involved
  - What to expect: opportunities and responsibilities
Freshman Shadowing

- Student seeks out the opportunity
- Screens for students with potential
- Half-day per week; supports academic performance
- Partnered with experienced student
- Attend lab meetings, “read” scientific papers
- Observation, then hands-on assistance
  - Begins skill development
  - Familiarizes student with intellectual aspects
  - Establishes teamwork model
DEVELOPMENTAL COURSE CREDIT: INDEPENDENT RESEARCH I AND II

**BIO 393**
- Sophomores
- Skill development
  - Field, lab techniques
  - Data analysis
- Immersion in the literature
- Develop collaborative research proposal with faculty mentor, for BIO 493
- Often peer-mentored

**BIO 493**
- Juniors / Seniors
- Apply skills and knowledge of the literature
- Independent work supervised by faculty mentor
- Act as peer mentor
- Outcome: poster(s) and scientific manuscript

393 and 493 count for in-major credit and college electives
GATEWAY TO GRADUATE SCHOOL

in

BIOLOGY

Merit scholarships
Four years of research and mentoring
Preparation for graduate school
Freshmen: 6 one-month long mini-rotations (1/4 course credit per semester); Help with recruitment for Cohort 2.

Sophomores: Join a lab as a junior researcher with peer mentor; Develop proposal (1/2 course credit per semester).

Summer: MUSE or REU

Juniors: Stipend; Research for full course credit per semester; Act as peer mentor; Present at regional meeting.

Summer: REU or MUSE

Seniors: Stipend; Research for full course credit first semester, ½ course second semester; Act as peer mentor; Present at national meeting; Prepare manuscript.
GGSB Freshman Year Mini-Rotations

- One month each; half day per week
- Students rank by interest
- 3 from environmental biology
- 3 from cell/molecular biology
- Peer mentored (freshman shadowing)
- Purpose: to maximize possibility of a great faculty-student research “match”
  - Students fully explore their interests
  - Students become familiar with six lab groups:
    - Area of research, faculty mentor, peer mentors, lab culture
LAB MATCHING

- 9 out of 10 students retained in GGSB
- All 9 matched to 1st or 2nd choice labs
- Mostly A and B grades in science, math courses
Psychology

PIPER

Lab Learning

S.T.A.R.
PARTICIPATING IN PSYCHOLOGICAL EXPERIENTIAL RESEARCH -- PIPER

- Freshmen as research subjects
- Course requirements
- First-hand experience of research
- Exposure to a range of different TCNJ faculty-student research labs
  - Alcohol Lab
  - Emotion Lab
  - Memory and Aging Lab
  - Prejudice and Development Lab
  - ERP Lab
  - And more . . .
LAB LEARNING

- PSY 390 Collaborative Research: Lab Learning
  - Sophomores or Juniors
- PSY 492 Senior Collaborative Research: Lab Learning
- PSY 396/496 Senior Honors Thesis
  - Add experiment of their own design
- On-going scholarly program directed by a faculty member
- Team of student researchers (6-12)
- Developmental: increasing responsibility, peer mentoring, & lab management
S.T.A.R. SYSTEM

- Dr. Margaret Martinetti
- Student (390)
  - Basic skills
- Trainer (390)
  - Trains new students
- Associate (492)
  - Demonstrated devotion and interest
- Researcher (492 or 396/496)
  - Full commitment; lots of time
  - Major responsibility for completion of collaborative experiments
Scholarly Outcomes from Early, Then Sustained Research Engagement

- More than a learning experience: production and dissemination of new knowledge
  - Professional conference presentations
  - Publications

“Unpublished research is research that was never done”

Faculty buy-in (esp. at PUls)
UNIVERSITY OF MICHIGAN
UNIVERSITY OF MICHIGAN
UNDERGRADUATE RESEARCH OPPORTUNITY PROGRAM

- Focus on first and second year students.
- Academic Year Program
- Involves all schools and colleges.
- Peer advising program
- Diverse students engaged in program.
- Faculty participation in a major undergraduate initiative that has multiple goals including student academic success, transition and retention.
- Evaluation activities.
Research Assistants

- Students spend 6-12 hours per week engaged in research with faculty.
- Assist research sponsors with ongoing research projects and/or initiating new projects
INDIVIDUAL PEER ADVISING
**Peer Advisors**

**Biomedical PA**

**Ama Achampong**

I am a junior from Detroit, MI majoring in Sociology/Pre-Medicine. I have participated in UROP since my freshman year and I have gained significant insight in to the field of research. For the past two years, my research has primarily focused on the relationship between social support and African American birth outcomes. I have also developed an interest in community-based participatory research. I am interested in the societal aspect of health, particularly the cultural, socioeconomic, and political dimensions of health and healthcare.

Fun/Interesting Fact:

1. My first name is spelled the same way forwards and backwards (AMA).
2. I like to collect savings and other costume jewelry.
3. I love to laugh and spend time with family and friends.

**Humanities PA**

**Mai Ze Yang**

I believe that "I am the dream and the hope of the [Hmong]" (Maya Angelou). I am Mai Ze Yang, a transfer student from Northwestern Michigan Community College in Traverse City. Currently, I am part of the school of Literature, Science and the Arts and plan on graduating with a double major in Asian Studies and English, and a minor in Women’s Studies or Linguistics. UROP has been a part of my life from the very beginning of my U of M experience. I have been in UROP for two years. During my first year in UROP, I was a Jack Kent Cooke Summer Research Fellow, researching on "Cervical Cancer Among Hmong Women in the United States". I continued my research during the academic year of 2009-2010 during the fall and winter, performing research on "U of M - A corpus-based analysis of citation practices of Generation 1.5 and international student writers".

Now, I am a peer advisor for the Jack Kent Cooke Research Summer Fellowship and also an assistant this summer for UROP. My experience in UROP has taught me to understand, respect, opened many doors, and prepared me for a world of research. UROP’s influence is ubiquitous and is seen through my ability to grow, to be disciplined, and committed in both my academic and personal experiences, and I hope that it does the same for you.
**Peer Advisor Profiles**

Engineering PA

**Dan Silver**

My name is Dan Silver and I am an engineering peer advisor for UMSP. I am entering my junior year at Michigan as an Industrial and Operations Engineering major. During my first two years at the University of Michigan, I did my research in the human factors division of the University of Michigan Transportation Research Institute. I was born and raised on Long Island, New York, and I have been a diehard Yankees fan since birth. I'm really looking forward to a great year in UMSP.

Biomedical PA

**Vishan Dhamsania**

Hey! My name is Vishan Dhamsania and I am a junior in the College of LSA. I recently declared my major as biochemistry after taking a couple years to figure things out, and I am a Spanish minor. In the fall, I will be taking classes for both of those subjects and doing biochemical research to write a thesis. My interest in research really sprouted through UMSP and it was something that I will never forget. My project was unique in that I got to work with an interesting breed of animal, and I learned a lot about the endocrine system. Also, the seminar gave me the chance to learn about many different types of research that I had no idea existed, and the symposium was a really fascinating way to tie everything up and showcase our work. Outside of academics, I am involved in Dance Marathon and a member of a professional fraternity, Alpha Epsilon Delta, I am an avid Michigan football fan, and I have developed a strong passion for mountain biking over the last few years.
RESEARCH PEER GROUPS

Students meet twice monthly to share information about research, hear presentations by faculty, postdocs, graduate students and others about research methods, cutting edge research, discuss research ethics and integrity, participate in skill building workshops, etc.
End of year UROP Research Symposium

Over 900 students present research in poster formats to each other and campus community.
RESEARCH SKILL BUILDING WORKSHOPS
Skill Building Workshops

- Introduction to Scholarly Resources in the Library (humanities, social sciences, engineering, physical sciences, biomedical and life sciences, etc.)
- Endnote/RefWorks
- GIS
- Matlab
- Excel
- SPSS
- STATA
- NVIVO
- Keeping a Laboratory Notebook
- Animal Handling
- OSEH Laboratory and Radiation Safety
Fall Syllabus

Project Search
  Research Sponsor Expectations
Designing a Research Project
Reading the Peer Reviewed Literature in the Field
Research Methods in Your Discipline
  Part I and Part II (survey, experimental design, case studies, community based research, simulations, field research)
Research Integrity and Responsibility
Winter Syllabus

- MLK Symposium
- Multicultural Issues in Research
- Research Methods cont’d
- Research Fieldtrips
- Interdisciplinary Research
- Poster Presentations
- Career Fair
- Research Symposium
STUDENT PARTICIPATION/COMPENSATION

- Work-study funding
- Academic Credit
- Grants
EXAMPLES OF RESEARCH PROJECTS

How Do You Respond When You Hear Good News? Cultural Differences in Perceived Response to Positive Event Disclosures on Relationship Satisfaction

Stem Cells in the Epithelial Cell Rests of Malassez

Restless Calligraphy

Headed by Professor Mark Norris
RESEARCH ACTIVITIES

- Computer-aided Design, Modeling and Programming
- Literature Reviews and other library research
- Laboratory experiments
- Website design and development
- Transcription and coding
- Conducting simulations and experiments
- Cataloging, coding, and analysis
- Survey design and administration
- Conducting interviews
- Materials collection and analysis
  - Computer Programming
  - Field Testing
  - Conducting simulations and experiments
  - Data cataloging, coding, and analysis
STUDENT RECRUITMENT

- Mailings
- Presentations at campus visitation days
- Information Sessions
- Student Organizations
- Word of mouth
- Social Media
- Academic Advisor referrals
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
UNDERGRADUATE RESEARCH OPPORTUNITIES
PROGRAM (UROP)

- Est. 1969
- Focus on all four years
- Academic Year, Summer Program
- Involves all MIT disciplines
- Compensation: Pay, Credit, Volunteer
- Faculty commit significant time and dollars toward research education of MIT undergrads
- Supervision, mentorship from faculty, post-docs, graduate students, upperclassmen
- Post-experience evaluation from student and mentor
LEVERAGED FREEDOM CHAIR

“My UROPs with the Mobility Lab have allowed me to discover my personal interests within design and engineering, and the fields that I would like to continue into the future... UROP allowed me to follow what I was passionate in.”
OUTCOMES, BENEFITS OF ENGAGEMENT

- Understanding research and experimentation in a specific discipline
- Developing skills to conduct research
- Contributing to a body of knowledge
- Getting to know faculty
- Obtaining recommendation from research mentor
- Adapting to demands of the research enterprise
- Developing collaborative skills
- Preparation for graduate school, career

Shuler, 2008
INCENTIVES FOR ENGAGEMENT

- Gain technical expertise
- Acquire general research experience
- Explore possible major
- Connect with faculty
- Pursue special interests
- Prepare for a specific career

Shuler, 2008
SAMPLE MIT FRESHMAN REGISTRATION FOR FALL

- Single Variable Calculus
- Classical Mechanics
- Principles of Chemical Science/Introduction to Solid State Chemistry
- Communication Intensive subject in the Humanities, Arts, and Social Sciences
FRESHMAN AND SOPHOMORE PARTICIPATION

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Freshman</th>
<th>Sophomore</th>
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<tbody>
<tr>
<td>Fall</td>
<td>5</td>
<td>27</td>
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<tr>
<td>Spring</td>
<td>25</td>
<td>30</td>
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<tr>
<td>Summer</td>
<td>30</td>
<td>28</td>
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FRESHMAN UROP @ MIT: RECENT EXAMPLES

- Geochemical mapping and data collection in Morocco
- Creating a pedal-powered butter churn
- Analysis of development of technology in medical genetics
- Development of social learning companion to help people with social phobias
- Investigating long term synaptic depression
SOPHOMORE UROP @ MIT: RECENT EXAMPLES

- Higher order spectral analysis in L to H mode transitions
- Topical delivery of siRNA
- Urban sustainability assessment
- Entrepreneurship and competition (iPhone/iPad vs. Android)
- Photomultiplier tube characterization for dark matter detector
SPOTLIGHT: RYAN ALEXANDER, ’12

ROLE OF microRNAs AS THERAPEUTICS FOR OBESITY AND OTHER DISEASES

“I may not have developed my talent nor gone the extra mile if I hadn’t participated in UROP. It’s been the foundation of my experience at MIT. Now, I dream that I’ll contribute to a project in the future that will lead to the development of a new drug that will help millions of people.”
ENCOURAGING EARLY ENGAGEMENT: WHAT MIT ACADEMIC DEPARTMENTS DO...

- Poster Sessions
- Informational Meetings
- Open Houses
- Lectures
- Competitions
- Lab Tours
PLEASE JOIN US

Chemistry Undergraduate Research Symposium

Saturday, April 23, 2011

$250.00 Strem Prize for Excellence in Undergraduate Research will be awarded to a participating student

Poster Session
10am – 12 noon, Room 56-154

Oral Presentations
12:30 – 2 pm, Room 56-114

Special presentations by former MIT undergraduates
2pm – 3pm, Room 56-114

Refreshments and lunch will be provided

Contact Allison Kelsey (akelsey@mit.edu) for more information.
ENCOURAGING EARLY ENGAGEMENT: WHAT UROP ADMINISTRATION DOES...

- “How to Find a UROP” Sessions
- Student Panels: Campus Preview, Freshman Orientation
- Lab Tour Program
- Resources for New Faculty
- Hosted Tables @ Academic Expos, Fairs
- Target Outreach (Diverse Populations, etc.)
- January UROP “Expo”
How to Find a UROP

UROP Staff
Mon Jan 10, 03-04:00pm, 4-149
Thu Jan 27, 04-05:00pm, 4-149

No enrollment limit, no advance sign up
Repeating event. Participants welcome at any session
Prereq: N/A

Learn about UROP and how to find a UROP that is right for you. We will discuss approaching faculty supervisors, when and where to look for projects, UROP proposal system and registration procedures. Please bring your questions!
Discussion will be led by UROP staff.
Web: http://web.mit.edu/urop/
Contact: UROP Staff, 7-104, x3-7306, urop@mit.edu
Want to participate in UROP?
Don’t know how to get started?

IAP 2011 UROP EXPO

THURSDAY
January 20
2-4PM
Kresge Lobby

Meet faculty, staff, and students representing UROP Departments, Labs, and Centers. Find out about UROP in the areas that interest you most!

Office of Undergraduate Advising and Academic Programming (UAAP)
Office of Minority Education (OME)

urop@mit.edu
2011 UROP “EXPO”
SPOTLIGHT: JIA ZHU, ’11

USING GOLD NANOPARTICLE MEMBRANES FOR DRUG DELIVERY

“Research is not easy, but making it through the rough patches is part of the fun. Working for weeks on each individual component and finally putting the results together in the end after months, even a year of work, has been the most rewarding experience I have ever had at MIT.”
Q&A And Discussion