



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

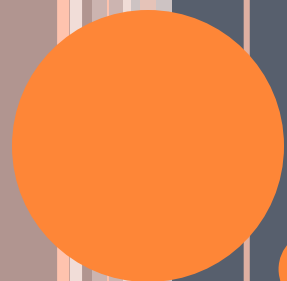
- Making coursework relevant
- Mentorship
- Student retention
- Integration of undergraduate education and teaching
- Exposure to fields and disciplines
- Allowing for longer-term, sustained research



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

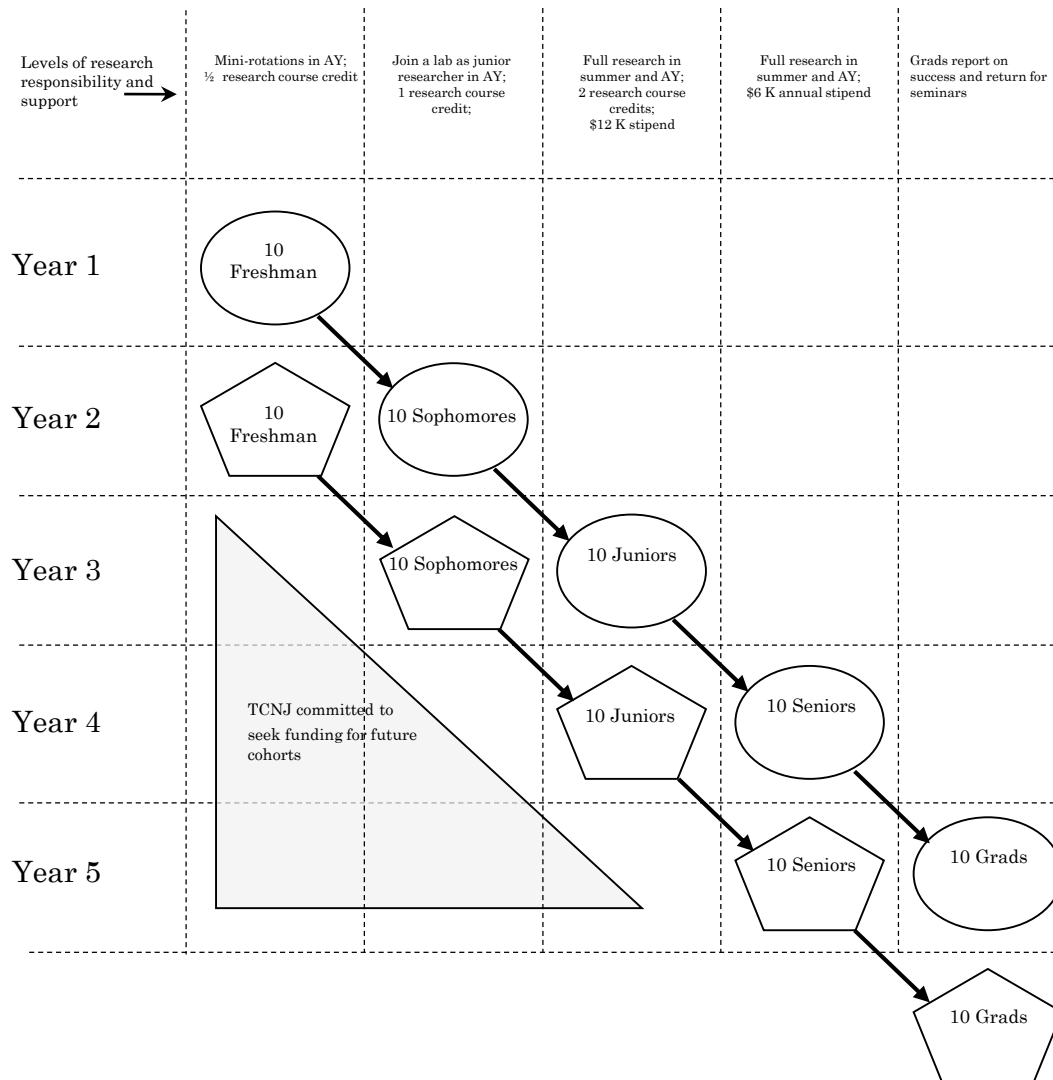




GATEWAY TO GRADUATE SCHOOL in BIOLOGY

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 . . .



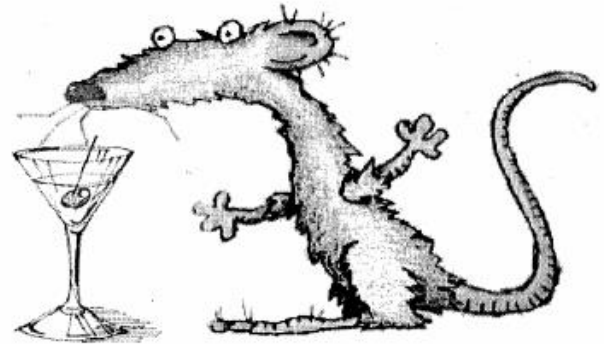
LAB LEARNING

- 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



ALCOHOL LAB



SCHOLARLY OUTCOMES FROM EARLY, THEN SUSTAINED RESEARCH ENGAGEMENT



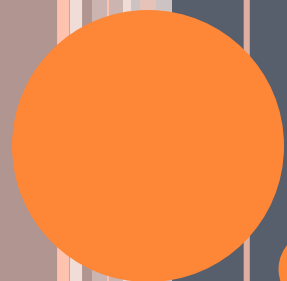
- More than a learning experience : production and dissemination of new knowledge
 - Professional conference presentations
 - Publications
- “Unpublished research is research that was never done”
- Faculty buy-in (esp. at PUIs)

Journal of the Torrey Botanical Society 134(1), 2007, pp. 1–17

Ecological comparison of two co-invasive species in eastern deciduous forests: *Alliaria petiolata* and *Microstegium vimineum*¹

Janet A. Morrison^{2,3}, Heather A. Lubchansky, Kerry E. Mauck, Kelly-Marie McCartney, and Brian Dunn
Department of Biology, The College of New Jersey, P.O. Box 7718, Ewing, NJ 08628

MORRISON, J. A., H. McMAHON, K. MAUCK, K. M. MCCARTNEY, AND B. DUNN. (Department of Biology, The College of New Jersey, P.O. Box 7718, Ewing, NJ, 08628). Ecological comparison of two co-invasive species in eastern deciduous forests: *Alliaria petiolata* and *Microstegium vimineum*. J. Torrey Bot. Soc. 134: 1–17. 2007.—Many communities invaded by one non-native plant species also are invaded by others due to a shared response to environmental factors that promote invasive species generally, such as fragmentation, disturbance, and proximity to seed sources. Direct comparison of these co-invasive species in their shared communities therefore is necessary for understanding the ecology of invaded communities, particularly if management resources must be prioritized. We compared ecological characteristics of two of the most important co-invasive herb layer species in forests of the eastern United States, *Alliaria petiolata* (garlic



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 Facts:

1. My first name is a palindrome: it is spelled the same way forwards and backwards (AMAM).
2. I like to collect earrings and other costume jewelry.
3. I love to laugh and spend time with family and friends.



Humanities PA

MAI ZE VANG



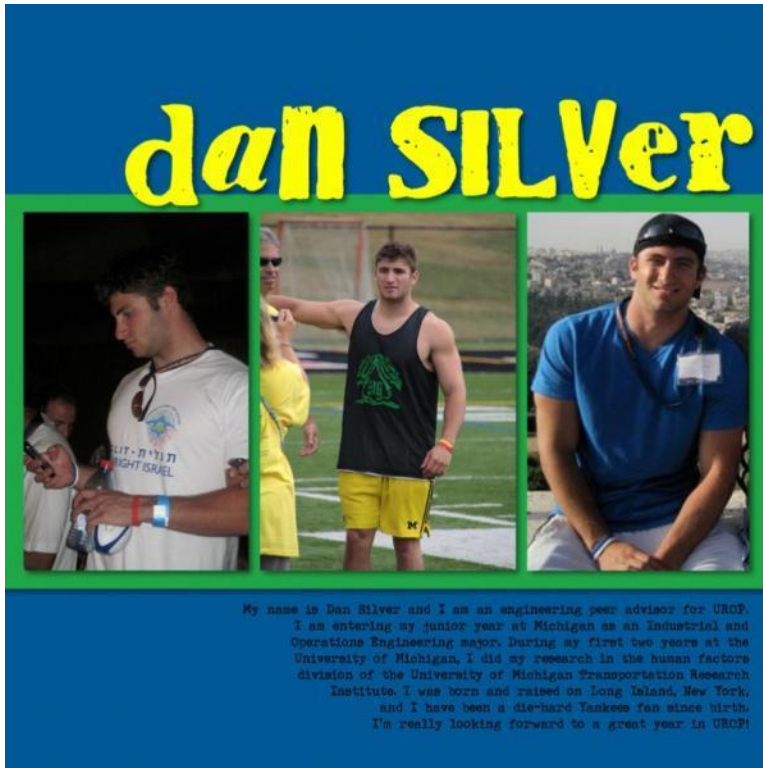
I believe that "I am the dream and the hope of the [Hmong]" (Maya Angelou). I am Mai Ze Vang, a transfer student from Northwestern Michigan Community College in Traverse City. Currently, I am part of the school of Literature, Science and the Arts and plan on graduating with a double major in Asian Studies 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've 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

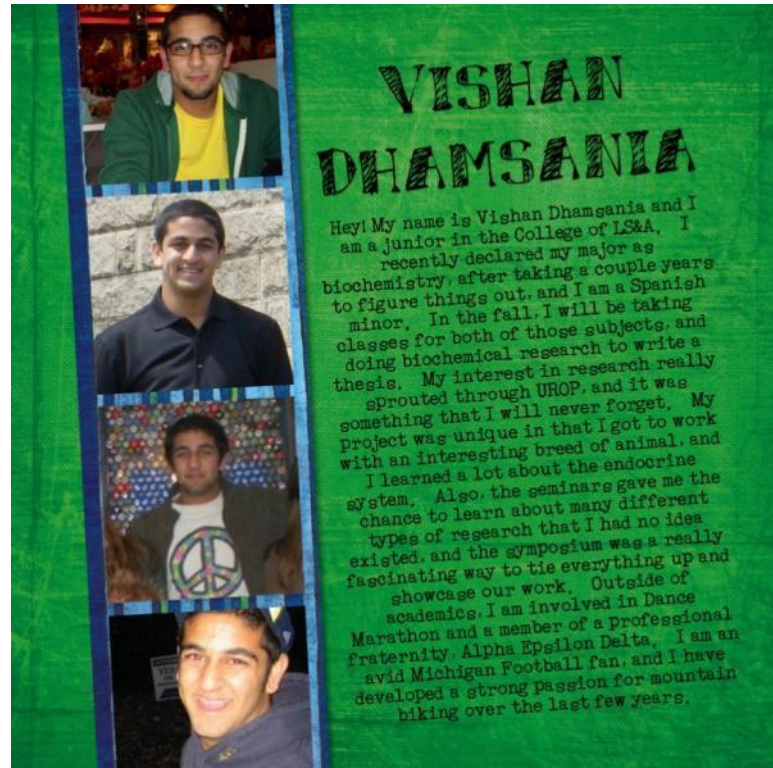


dan SILVER

My name is Dan Silver and I am an engineering peer advisor for UROP. 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 die-hard Yankees fan since birth. I'm really looking forward to a great year in UROP!

The profile for Dan Silver features a blue header with his name in yellow, stylized text. Below the header are three photographs: Dan in a white t-shirt with Hebrew text, Dan in a black tank top and yellow shorts on a field, and Dan in a blue t-shirt and white pants sitting outdoors. A block of text at the bottom provides a bio and a statement of interest in UROP.

Biomedical PA



VISHAN DHAMSANIA

Hey! My name is Vishan Dhamsania and I am a junior in the College of LS&A. 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 UROP, 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 seminars 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.

The profile for Vishan Dhamsania features a green header with his name in black, stylized text. Below the header are four photographs: Vishan in a green jacket and yellow shirt, Vishan in a black polo shirt, Vishan in a white t-shirt with a peace sign, and Vishan in a dark jacket. A block of text to the right of the photos provides a bio and details about his research and extracurricular activities.

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.





RESEARCH SYMPOSIUM

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

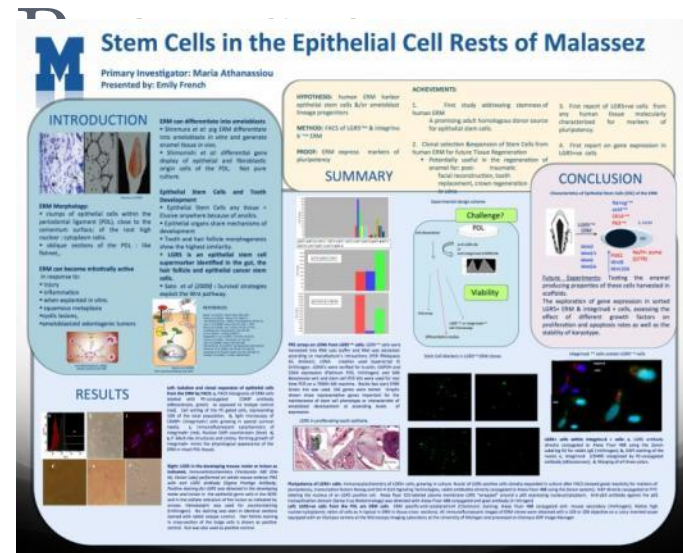


STUDENT PARTICIPATION/COMPENSATION

- Work-study funding
- Academic Credit
- Grants



EXAMPLES OF RESEARCH



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



The left side of the slide features a series of vertical stripes in shades of brown, tan, and grey. Overlaid on these stripes are several orange circles of varying sizes, arranged in a cluster that tapers towards the bottom.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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



SPOTLIGHT:

BENJAMIN JUDGE, '11

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



INCENTIVES FOR ENGAGEMENT

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

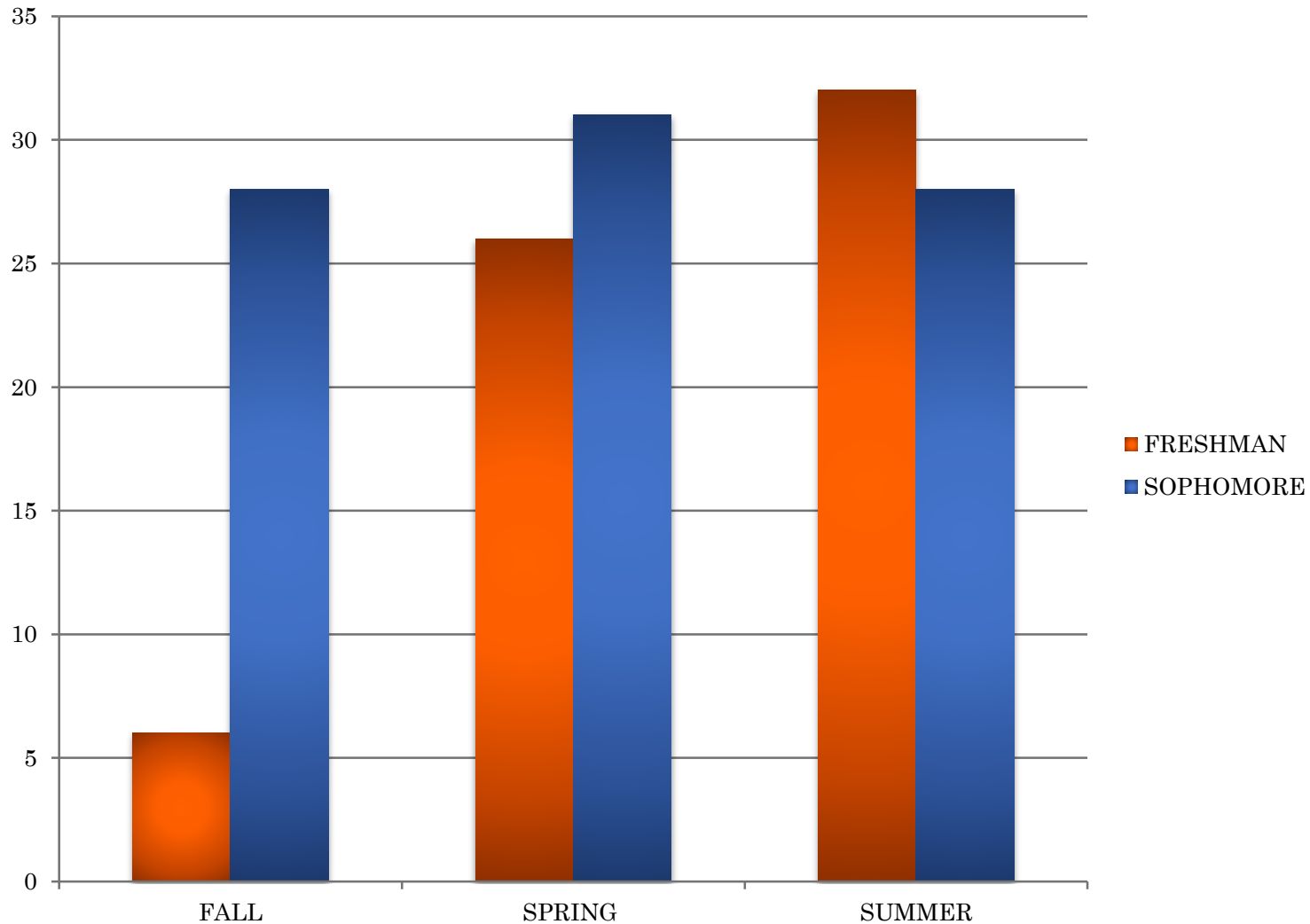


SAMPLE MIT FRESHMAN REGISTRATION FOR FALL

- **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



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.”



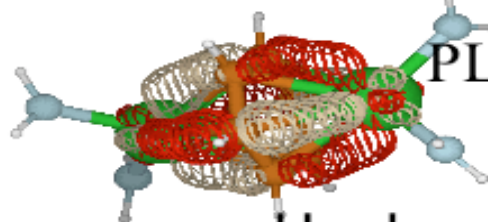
Photo: Len
Rubenstein



ENCOURAGING EARLY ENGAGEMENT: WHAT MIT ACADEMIC DEPARTMENTS DO...

- Poster Sessions
- Informational Meetings
- Open Houses
- Lectures
- Competitions
- Lab Tours





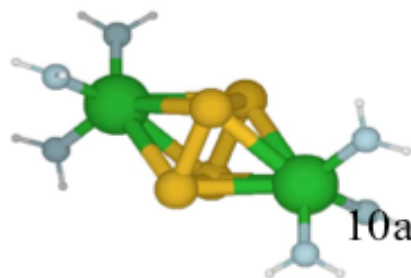
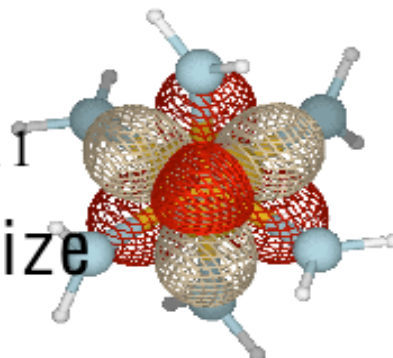
PLEASE JOIN US

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



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 PARTICLE 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