Information session:
SUMMER RESEARCH OPPORTUNITIES in BIOLOGY

Mon, Nov 16th
4:30 – 5:30pm
SC101

- on- and off-campus
- funding sources
- application procedures

Please consult individual programs for deadlines: Deadlines are as early as January and, at the latest, early March

Swarthmore deadline: February 10, 2016

http://www.swarthmore.edu/student-life/summer-research-opportunities.xml
SUMMER RESEARCH OPPORTUNITIES

Deadline February 10, 2016

- Application period opens January 19!
- Apply through mySwarthmore.
- Application information at link below.
- Link can be found on The Dash.
- Deadline Weds Feb 10 at 11:59:59 pm.

www.swarthmore.edu/student-life/summer-research-opportunities.xml
Research & Work Opportunities

Interdisciplinary Special Majors

Swarthmore students may pursue interdisciplinary curricula developed by the faculty, or they may take the initiative to define their own distinct academic program with the support of faculty mentors.

- Biochemistry
- Biology and Educational Studies
- Environmental Science
Summer fellowships for research projects with NSE faculty members: deadline Feb 10, 2016

- Division of Natural Sciences & Engineering (NSE)

- Howard Hughes Medical Institute (HHMI) grant
  - Including some fellowships for 1st-year or 2nd-year students who are either first-generation college students or members of groups that are underrepresented in science.

- Biology Department Funds for Field Research

- Individual faculty research grants
  
  Contact faculty members whom you admire to explore your interests!
Summer fellowships for projects at another university or research institute:
deadline Feb 10, 2016

• Many summer research programs at universities across the country
  – see Biology Dept website > Opportunities for Students > Research Opportunities > Summer Research Elsewhere

• Biology Department Funds for Field Research

• Howard Hughes Medical Institute (HHMI) grant
  – Applicants must explain and justify the project. Applications must be accompanied by two letters: one from the off-campus researcher who will directly mentor the student's project and one from a Swarthmore faculty member in the NSE Division who knows the student, has reviewed the proposal, and will serve as on-campus liaison. VERY COMPETITIVE
**How to apply?**

*Talk to faculty EARLY – before the end of fall semester*

- **How to find a faculty research mentor** –
  Someone who has taught you in course/lab
  Are their interests compatible with your own, e.g.,
  biological questions posed
  techniques / experimental approaches

- **Consider your qualifications**
  experience (and performance) in courses
  interest – how is that demonstrated?
  initiative and commitment
Timeline: start early, don’t procrastinate

- Meet with faculty before you leave for winter break
- Line up people who will write letters of recommendation
- Give each recommender a copy of your resume
- Apply as soon as you return for 2016
Handout

• FAQs
http://www.swarthmore.edu/summer-research-opportunities/frequently-asked-questions

• IRB: Human Subject Research – extra paperwork – *allow for extra time!!!!!!*
http://www.swarthmore.edu/irb

IRB = institutional Review Board
Student Research Panel
Ask STUDENT RESEARCHERS about their experiences in an informal setting!

Hosted by the Swarthmore Biology Club
Interested but can’t attend or have questions? email kpalmqu1

Tuesday, November 24th
4:30-5:30PM
Science Center 105

What is the difference between independent research and research through a program?

What kind of future is a summer in research setting me up for?

What are good ways of choosing research labs?
Some students who did research on or off campus – how did they find opportunities?

- Karl Palmquist
- Shaina Lu
- Casey Simon-Plumb
- Maxine Annoh
- Chris Bourne
- Gurrein Madan
- Jonathan White
Research experience – with Biology faculty

- Biology faculty who stay here on campus
- Biology faculty who go elsewhere for the summer (field work)
Biology Faculty

Baugh
Davidson
Formica
Hiebert Burch
Mayack
Nichols
Schottenfeld-Roames
Siwicki
Vallen

Will help students find opportunities elsewhere:

Kaplinsky
Machado
Merz
Vollmer
Alex Baugh
Animal communication
reproductive pairs collected in pine barrens
question: why are [some] females so choosy?
method: female frog phonotaxis mate choice testing
Hypothesis: differences in acute reproductive status of females generates individual differences in choosiness
• development of individual differences in physiology, behavior and life history

• real time decision making

decision
Brad Davidson

Brad Davidson
Assistant Professor
Developmental Biology
bdavids1@swarthmore.edu
610-690-5718
Martin 302
Davidson Lab: Heart development in a simple chordate
Visual readout of heart cell identity + targeted manipulations...

2 heart precursors

FoxF 5'  RFP
+ Mesp  GFP

No heart cells

+ Mesp  dnFGFR
Davidson Lab: Heart development in a simple chordate Cell Behavior
Comparative approach (Swarthmore Genomes)

- Ciona intestinalis
  - Ciona savignyi
    - Corella inflata
    - Corella willmeriana
    - Phallusia mammillata
    - Phallusia fumigata
  - ~200 mya
- ~300 mya
- ~500 mya
- Oikopleura dioica
- ~300 mya
- ~500 mya

- Halocynthia roretzi
- Halocynthia aurantium
- Boltenia villosa
- Boltenia echinata
- ~300 mya
- ~500 mya
Vince Formica – The evolution of social networks
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Students working with Vince live at 4000ft at the Mountain Lake Biology Station from Early June – Mid August.
Rufous hummingbirds migrate long distances every spring and fall.

~2500 miles
Hummingbird gut microbes

- To accomplish these long flights, rufous hummingbirds fatten
- During the fall migration, they may **almost double their body mass** by putting on fat!
- At the end of migration, they return to the lean state even if given unlimited food

pre-migratory  ►  migratory  ►  post-migratory
In mammals (including humans), obese individuals have different gut microbes than lean individuals.

Microbes transplanted from the gut of an obese individual make a lean individual obese.
**QUESTION:**
Are changes in gut microbes also involved in the natural fattening cycle of rufous hummingbirds?

**Field work**
- Capturing hummingbirds
- Collecting anatomical and physiological data
- Collecting urine and fecal samples (they’re small!)

**Lab work:**
- Using new techniques to identify bacteria
- Determining relative abundance
Nick Kaplinsky
Plant developmental genetics
Structure → function

Proteins unfold at high temperatures → loss of function

Normal temperature
Folded correctly
Functional

High temperature
Unfolded
Non-functional
Small Heat Shock Protein (sHSP) function
Regulation of the heat shock response
Main research themes

- 1. Understanding the regulatory mechanisms involved in the evolution of social behavior

- How is appetite and energetic state of the honeybee regulated?

- How does the response of hunger vary across levels of sociality and does it play a role in the
Main research themes

2. Improve honeybee health

- Understand the behavioral and physiological effects of honeybee diseases (*Nosema*)

- Establish indicators of healthy and diseased honeybee hives by the volatiles they produce
The Liz Nichols Lab
Environmental Change and Conservation

Project 1. Infection and biodiversity-ecosystem function (BEF)

- **Objectives:**
  - Study how infection shapes biodiversity-ecosystem function (BEF) relationships through quantify variation in ecological functions attributed to altered behavior due to helminth infections.

- **Data:** Existing data from Brazil’s Atlantic Forest

- **Activities:**
  - Address conceptually important questions using pre-existing field data.
  - Pursue methodological and analytical advances in BEF research.
  - Collect new experimental data if need be.

- **Additional collaborators:**
  - Universidade de São Paulo’s Landscape Ecology and Conservation Lab, Lancaster University’s Insect Parasite and Ecology Group

- **Recent example:**

Project 2. Cascading impacts of mammal hunting: a meta-analysis

- **Objective:**
  - Conduct a global meta-analysis on cascading impacts of mammal hunting on dung beetles.

- **Data:** Existing data from Brazil, Peru, Panama & West Africa

- **Activities:**
  - Address conceptually important questions using pre-existing field data
  - Pursue conceptual and analytical advances in trophic cascade research

- **Additional collaborators:**
  - Universidade Estadual de São Paulo (UNESP), Conservation International (Washington DC), University of East Anglia (UK).

- **Recent example:**
  - Nichols, E., et al. (2013). Human-induced trophic cascades along the fecal detritus pathway. PLOS ONE 8:e75819
I am interested in understanding how branched, tubular organs (such as our vascular system) form. To study this, I utilize the *Drosophila* tracheal system, the respiratory organ of the fruit fly, as a model system.

I analyze mutant flies to learn about the genes required for tube formation.

So far my has found roles for:

The cytoskeleton
Polarity complexes
Membrane trafficking
during tubulogenesis.

This is a SINGLE tracheal terminal cell. (just one cell !) It forms beautiful branched extensions, like neurons, but with each branch hollowing out to form a tube that carries oxygen throughout the fly.
Neurobiology of *Drosophila* Courtship Behavior

- **Genetically programmed**
  - $XX = \text{females}$
  - $XY = \text{males}$

  *How do genes produce sexually dimorphic wiring of brain circuits?*

- **Modified by experience**
  - Short-term memory - males become less active courters after repeated experience with unreceptive females.

  *What brain structures and molecules are responsible for this memory?*
A cell biologist’s view of coral reefs
Liz Vallen

Photo by Ian Yarett ‘09
Coral reefs

- Interesting, beautiful diverse ecosystems
- Important economically
- Biomedical applications of reef compounds
  - Anti-cancer drugs
  - Neuroactive peptides
    - Painkillers, epilepsy treatment
A Critical Relationship:
Symbiodinium (unicellular algae) and cnidarians (corals and sea anemones)

Symbiotic relationship important for nutrient exchange – trophic basis of reef ecosystems
Coral bleaching caused by expulsion of symbionts
Possible research projects:

Photo by Ian Yarett '09
Symbionts are inside the cells of cnidarians.

(1) How are cells remodeled to host the symbionts?

Farah Hussain '09
(2) How do the symbionts move when infecting a new host?

Sara Kim ‘11 and Erin Scanlon ’10
Valentina Garcia ‘14 and Sarina Lowe ‘14
Iris Chan ’17, Amanda Chan ’16, Kelly Hernandez ‘18
(3) The genome and transcriptome of ‘our’ anemone have recently been described. There are a number of novel genes, including many that are differentially expressed in animals with and without symbiotic algae!

What can we figure out about their function?

Baumgarten et al. 2015 PNAS
Opportunities elsewhere: NSF REU sites
https://www.nsf.gov/crssprgm/reu/reu_search.jsp
Monell Science Apprenticeship Program
Growing roots in science

How do you want to spend YOUR summer?

Are you...
- Extremely interested in science and research?
- A high school or undergraduate student?
- Eligible to work in the United States?

THEN APPLY TO MSAP!

MSAP focuses on groups often underrepresented in science, such as women and minorities, and strives to provide all students with a unique, fun, and educational experience.

You’ll get:
- Research experience: get paid to work alongside real scientists!
- Professional development opportunities and resume writing.
- To meet professionals working in science, engineering, and medical fields.
- Presentation opportunities: present your individual research

Application deadline for Summer 2016: December 15, 2015

Application materials are available on our website www.monell.org/sap. For more information, contact us at studentprogram@monell.org or 267-519-4719.

Connect with us on Facebook (MonellSAP) and Twitter (MonellSci).
MONELL SCIENCE APPRENTICESHIP PROGRAM
UNDERGRADUATE STUDENT APPLICATION

Submit all applications materials by: December 15, 2015
Incomplete or late applications will not be considered

Mailing: Science Apprenticeship Program
Monell Chemical Senses Center
3500 Market Street
Philadelphia, PA 19104-3308

Email: studentprogram@monell.org
(with "MSAP 2016 App" in the subject line)
Fax: 215-573-0909 (ATTN: MSAP)

APPLICATION CHECK LIST: ☐ Completed MSAP application ☐ Letter of recommendation ☐ Personal statement
Systems Biology at Harvard

http://sysbio.harvard.edu/summer-internship

A great way for undergrads to get research experience and learn a bit more about different graduate schools.
Searched for “Biology summer internships”
Every email Biology chair receives regarding summer internships

• Sent to Career Services
• Posted on Biology site
# Summer Research Opportunities

**Resources by Field**

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<td>Multi-Disciplinary</td>
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<td>Science &amp; Mathematics</td>
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<tr>
<td>Social Sciences</td>
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**Multi-Disciplinary Research Programs**

**Highlighted Resource: Swarthmore Summer Research Opportunities**

Grants from a variety of college-administered sources are available to support research by students in each of the three divisions during the summer. All continuing students are eligible to apply for summer research support; however, priority is generally given to students who are currently completing their junior year. Graduating seniors are not eligible. [More.](#)

- **Committee on Institutional Cooperation** Twelve midwestern universities sponsor a summer program for students who are planning to pursue a graduate degree. Participants receive a stipend and are paired with a faculty mentor for 8-10 weeks.
Opportunities at Outside Institutions

Many opportunities are available for fellowships and jobs for both sophomores and juniors from outside institutions and from other universities; a few programs also invite applications from first-year students. Students can pursue these opportunities during their academic year, often in collaboration with faculty members. The university offers a variety of resources to support students in their search for these opportunities, including workshops and advice sessions. By engaging in these experiences, students can gain valuable skills and knowledge that will be beneficial in their future academic and professional careers.
Motivation for Research

• Authentic (not just ‘checking a box’)
• Investment of time, resources, effort
• Being part of a culture of research
  – Summer meetings, social events
• Outcomes – results to present/publish, enrichment of your research experience, mentor, letter of recommendation
Research requires a strong and sustained commitment

• It’s not graded, but….it requires responsibility, initiative, maturity:
  • Experience
  • Results, records
  • Posters, papers
  • *Letter of recommendation* (give us good material)
DEADLINES – they are your responsibility

Talk to faculty before your leave for the holidays
  • about letters of recommendation
  • about a research project in his/her lab

Some faculty require that you take a course with them prior to considering you for a position in the research lab
  • faculty’s familiarity with you, your work ethic
  • your familiarity with basic techniques, etc.

E-mail and suggest 3 possible 30 minute meeting times
Requesting letters of recommendation

• Ask the appropriate person
  – Someone who has experience teaching you or working with you in a laboratory situation

• Give the person at least 3 weeks for the first letter; as much time as possible for subsequent letters
  – A spreadsheet with all programs, deadlines, whether the letter should be submitted online or sent through the mail, or email attachment
  – To whom letter should be addressed