CONFERENCE-BASED UNDERGRADUATE EXPERIENCES:

LOWERING THE BARRIER FOR LEARNING ABOUT COMPUTATIONAL BIOLOGY

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SCIENTIFIC MEETINGS

Conferences are the cornerstone of CS dissemination

Great Lakes Bioinformatics Conference
May 19-22, 2019
The University of Wisconsin-Madison

Undergraduates can benefit from conference attendance

• See how \textit{real research} is done
• Get a \textit{broad sense} of active research (even if it’s hard to understand)
• \textbf{Network} with PIs who may be looking for graduate students
The catch: which undergraduates get this opportunity?

Attending a Conference

Contribute to a Project

Research Opportunity (local or REU)

Talk about Research

Unfinished project, lack of travel support, graduated & moved on

Usually done in “Disciplinary Silos” [Davis 2015]

Work/family obligations, cannot obtain funding

Some students may not even think to ask about research

Challenges
The goal: Expose more undergraduates to research

An Example: the Genomics Education Partnership (GEP) [Lopatto 2008]
CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Integrate conference attendance with a course

Lowers the barriers for conference attendance

- Any student with the prereqs can attend

Students are not necessarily CS majors or interested in graduate school

- Focus on learning about research and career opportunities

- Goal is for students to clarify their career interests

Great Lakes Bioinformatics Conference
Why did we do this?
• Scientific Conferences
• Integration in a Course

How was it implemented?
• The Institution & Course

What’s next?

CCF #1643361 (2016-2017)
Private Liberal Arts Institution
- About 1,400 undergraduates
- About 140 faculty
- Year-long intensive senior thesis

Biology Department
- 11.5 Faculty (one of the largest)
- Emphasis on research (informally)

Computer Science Department
- 3 Faculty (est. this year)
- CS Major established Fall 2017

Students have deep research experiences in a limited number of fields
BIO331: COMPUTATIONAL SYSTEMS BIOLOGY

- “Applied Graph Algorithms” implementation-heavy course (Python)
- **Prerequisites:** Intro to CompBio (BIO131) or CS1 + some bio

**NSF Grant for Undergraduate Travel**
- Implemented the 1st time BIO331 was offered
- Students didn’t know conference travel would be part of the course
- Grant funded an additional two students to ACM-BCB 2017

Food Webs  Animal Social Networks  PPIs  GRNs  Signaling Pathways

CCF #1643361 (2016-2017)
**STUDENT MAKEUP**

**Thirteen Students**
- 7 students in BIO331
- 4 students from Intro to Comp Bio
- 2 recent graduates living in Seattle
- 38% women; 31% URM

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![Group Photo](image)

**Year @ Time of Conference**
- Senior 53.8%
- Grad 15.4%
- Junior 15.4%
- Sophomore 15.4%

**Majors @ Time of Conference**
- Biology 23.1%
- Math-Bio 15.4%
- Bio+X* 38.5%
- Math/CS/Stats 23.1%
Why did we do this?
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How was it implemented?
- The Institution & Course
- The Conference

What's next?

CCF #1643361 (2016-2017)
Flagship conference of the ACM SIGBio

- Intentionally Broad: CompBio, Bioinformatics, and Health Informatics
- Relatively diverse in terms of women, PIs from all career stages
- Easy to Get To: 3 hours by train
- Relevant: Workshop directly related to Computational Systems Biology
  - CNB-MAC: Computational Network Biology: Modeling, Analysis, and Control
Inferring Microbial Interaction Networks from Metagenomic Data Using SgLV-EKF Algorithm

Predictive Modeling of Drug Effects on Signaling Pathways in Diverse Cancer Cell Lines

DIGNiFI: Discovering causative genes for orphan diseases using protein-protein interaction networks

Gene Expression Based Computation Methods for Alzheimer’s Disease Progression using Hippocampal Volume Loss and MMSE Scores

SEQUOIA: Significance enhanced network querying through context-sensitive random walk and minimization of network conductance

Detecting Communities in Biological Bipartite Networks

Comparison of tissue/disease specific integrated networks using directed graphlet signatures

SNP by SNP by Environment Interaction Network of Alcoholism

1. Read Abstracts from CNB-MAC
2. Prepare to field questions
STUDENT ASSIGNMENTS

Before the Conference
1. Read Abstracts from CNB-MAC
2. Prepare to field questions

During the Conference
1. Submit short summaries of 3 talks and 2 posters

After the Conference
1. Write a 1-2 page paper summary
2. Write a 1-2 page reflection

Students could choose which tracks & workshops to attend

Independent Project (BIO331)
1. Give a talk
2. Write a mini-paper
Field Trip! Computational Biology on the Road

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ABSTRACT
A few weeks ago I took my students to the Association for Computing Machinery Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB) in Seattle, WA. It was a fantastic experience for everyone involved, and the organizers did an excellent job running the conference. I asked my students to reflect on the conference, and I figured I should do the same.

This report also highlights some features of the ACM LaTeX template. The original tex331-sample.tex file is available on Moodle.

Keywords
ACM; conferences; undergraduate research

1. MOTIVATION
When I learned that ACM-BCB 2016 was going to be held in Seattle, I jumped at the chance to take Reed students. ACM-BCB is a computer science conference focused on applications to computational biology and health informatics, and I have published there in the past [1]. My upper-level class, Computational Systems Biology, included a great mix of biology and math/CS majors. Thirteen Reed students attended ACM-BCB (Table 1).

1.1 Broader Impacts of Conference Travel
The timing and location of the conference coincided perfectly with my Computational Systems Biology class, and I received funding from the NSF for student travel. The grant, titled "A Course-Based Undergraduate Conference Experience in Computational Biology," offers the following broader impacts (planning borrowed from the proposal abstract). First, it will promote interdisciplinary research by educating students about computer science applications within biology. Second, it will empower students with a unique opportunity that few undergraduate obtain, leading to an anticipated increased confidence in engaging in science and scientific research. Third, it will provide an opportunity for Principal Investigators (PIs) from other institutions to interact with strong interdisciplinary undergraduates.

1.2 Recruiting and Retaining STEM Students
As a computer scientist, I am interested in recruiting students to computational fields and supporting them if they decide to continue this line of study. My classes are interdisciplinary in nature, offering a unique opportunity to engage students in computational biology material. As I wrote in the NSF proposal, conference travel is available to any student who takes my upper-level class, encouraging students from both computational and non-computational backgrounds to attend.

The proposed travel is also a potential mechanism for recruiting underrepresented students to stem careers. As the speaker from my background, I have been involved in efforts to increase diversity in my field. Hence, a group of students (and the proposal conference travel) include a group that is diverse in terms of gender, class year, and declared major.

2. REFLECTION
With such a large cohort of undergraduates at a scientific conference, my role shifted to encompass one of an educator as well as a researcher. I honed in on the accessibility of the material in talks, helping a bit of pride when the speakers showed an image or mentioned a topic I have taught in class. I also had some moments of "wow, should I have taught them that" when a speaker presented a fundamental concept we have not yet covered. Many of my students came out of sessions excited about what they had just learned. They talked with the speakers, asked for their papers, and are now delving into this new material. Graduate student attendees became mentors, fielding questions about why they went to graduate school and how they picked their research topic. ACM-BCB was an ideal site – the conference had compelling talks and tutorials while being small enough to chat with the keynote speakers and conference organizers. I caught up with existing colleagues and met some potential collaborators in the Pacific Northwest. I also found myself in discussions with graduate students about my position in a liberal arts environment. Reed had a research presence, since three Reed students submitted posters to the poster session. My students had garnered enough research experience – either through their thesis, summer research, or independent projects in class – to engage in conversations with other attendees.

2.1 Lessons Learned
The trip to ACM-BCB as a class taught everyone (including me) the importance of logistics. Some general tips:

1. Make sure the taxi to the train station can fit the entire group.
2. Remember who you gave the posters to in your mad dash to find parking before your train departs (see #1).
3. Make sure the PCard credit limit is set so it’s not declined at the hotel.
4. Tell your students the correct time of the first keynote.

5/20/2019 (Education III)

3. REFERENCES
CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

Why did we do this?
- Scientific Conferences
- Integration in a Course

How was it implemented?
- The Institution & Course
- The Conference
- Student Experiences

What’s next?

CCF #1643361 (2016-2017)
CURE survey is not particularly informative

- 11 pre-test responses, 5 post-test responses
- Reed students already have ample course-based research experience
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No one knows the outcome, work as a whole class
Students have input & student-designed project
UNEXPECTED (ANECDOTAL) OUTCOMES

Positive Outcomes

• Professional preparation was useful for students
• Grad students were engaged in the process
• PIs got to meet undergraduates, many of whom are considering graduate school

Not-so-positive Outcomes

• In one case, the experience isolated a student even more
• Missing class was hard, even for the exceptionally strong students
• Don’t want to dilute the quality of the meeting
LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents

**Student Responses:**

“*Helped me figure out that I do eventually want to go to graduate school*”

“*It underlined the importance computational bio would continue to have on my career.*”

“*Concreted that I wanted to go into academia*”

“*Helped me understand the importance of having both computational & biological understanding.*”

“*Meeting older students (including grad students) at conferences was part of what made me consider going to grad school.*”
LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents

How much did you feel you learned about...

- Conference Topic
- Academic Research
- Other Institutions
- Graduate School
- Scientific Careers
- Professional Networking
- Professional Travel
LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents

How well did you get to know...

- Reed undergrads
- Non-Reed undergrads
- Grad students
- Reed Faculty
- Non-Reed Faculty
- Other Researchers
LONG-TERM STUDENT RESPONSES

April 2019 Survey: 11 respondents

Similar results for a larger set of 25 students who have attended scientific meetings (CS/compbio/cell bio)
CONFERENCE BASED UNDERGRADUATE RESEARCH EXPERIENCES

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What’s next?

DBI #1750981 (2018-2023)

CCF #1643361 (2016-2017)
**Local Initiative:** Bio331 Conference Attendance 2020-2023
- Travel to a meeting
- Reduce the impact of missed courses
- Scale with class size

**National Initiative:** ACM-BCB Student Scholarships 2020-2023
- Hotel & Registration for 10 students (preferred driving distance to BCB from resource-limited schools)
- No previous research experience necessary

The 10th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics

**ACM BCB 2019**
Niagara Falls, NY, Sept 7-10, 2019
NEAR FUTURE:
GUIDELINES FOR ATTENDING CONFERENCES

Conference Advice Template

Outline

Logistics

Conference Attendance

Conference Attire

What to Bring

What will people ask you?

What can you ask people?

Reimbursements

Conference Attendance

- Before the conference, carefully look at the program and plan out the main topics you want to attend.
  - The keynotes are usually very good general overviews of a sub-field.
  - Track talks are more technical (discussing work from one paper, for example).
  - Vendor booths offer lots of swag and cool opportunities. Depending on the conference, make sure you have extra space for swag.
- The poster session is the best chance to talk to people about their research.
  - Posters are usually presented by graduate students or postdoctoral researchers, though sometimes the PI presents the work.
  - This is a great time to learn about grad school from current students doing interesting work.
- When you first get to the conference, you will check in and pick up a conference program, a name tag, and other items. Often times conferences will let you get your registration packet the night or day before. Do it if you can. You'll avoid lines.
  - Everyone will have a name tag denoting their affiliation. Put your nametag near your right shoulder. If it's on a lanyard, shorten the lanyard so that people can actually see your nametag.
  - There should be wifi at the conference, but hotel wifi is sometimes spotty.
  - Conference days are very very long - it is acceptable to take a break when you need to.
  - There will probably be alcohol at some of the events. Remember that you are representing your institution when you’re at a professional meeting.
  - The conference may have a social media policy. You can follow the conference hashtag if there is one and you’re on twitter. Respect the stated norms on what can/cannot be tweeted (this varies by discipline and by meeting, especially when people are presenting unpublished work).

This and all other links will be available on my website within a few weeks.
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The proposed travel is also a potential mechanism for recruiting underrepresented groups in STEM. The introductory computational biology courses in 2015-2016 included students from all years (freshmen through seniors) majoring in eight different areas (including four outside the Division of Math & Natural Sciences). Further, 60% of the students who completed the course were women, a group traditionally underrepresented in computer science. Thus, the pool of students eligible for the upper-level course (and the proposed conference travel) include a group that is diverse in terms of gender, class year, and declared major.
RELEVANT REFERENCES


CURE/SURE surveys:
https://www.grinnell.edu/academics/resources/ctla/assessment/cure-survey
(PDF forms of surveys available, comparison to background data no longer available)