



Models for Undergraduate Research

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Plan for the presentation

- ❖ Examples from the field: undergraduate research in different scenarios
- ❖ New REU solicitation and opportunities
- ❖ Upcoming conference: Trends in Undergraduate Research in the Mathematical Sciences --
-- October 2012 in Chicago

Examples from the Field (just illustrative – in no way complete!)

- PRISM project at Northeastern to encourage more STEM majors: *Math/Physics/Bio Integrated Research Course*
- CSUMS project at BYU: *Year-long computational training initially supported by NSF, now funded by local industry*
- REU project at NC State: *Partnership with nationwide industry and government*
- Summer research program at RIT for RIT science students: *Funded by the Institution*

Northeastern U: Attracting Students to Mathematics, Physics, and Biology Through Interdisciplinary Research and Discovery



- Funded through the NSF PRISM program to encourage more STEM majors; directed by Rick Porter and Chris King
- Focuses on freshman and sophomores
- Fall Interdisciplinary Research Seminar: Visits to labs, presentations by faculty and students

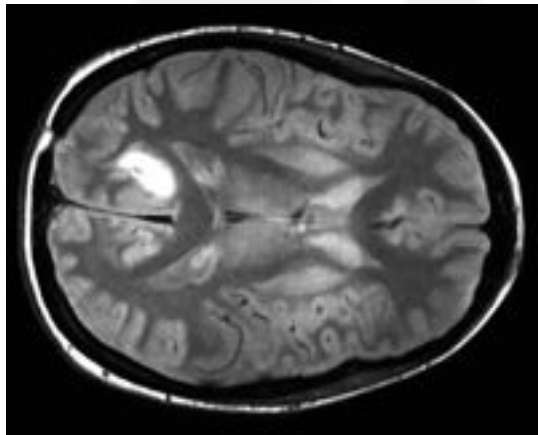


Northeastern U: Attracting Students to Mathematics, Physics, and Biology Through Interdisciplinary Research and Discovery

- Interdisciplinary Spring Course (1 credit)
 - Goal: for students to engage in work on open-ended problems and inquiry at the earliest stages of their undergraduate experience
 - Topics include: Boolean Networks for learning and memory; Quantum Information for cryptography and security; Diffusion Limited Aggregation for branching in nature; Synchronization of oscillators for understanding rhythmic movements; Probability in Evolutionary Genetics for tracking the ancestry of living forms.



BYU: Interdisciplinary Mentoring Program in Analysis, Computation, & Theory



- Year-long undergraduate team research program run by Jeffrey Humphreys
- Research focuses on examples that cut through application-specific jargon to examine common mathematical themes underlying seeming disparate problems (e.g. functional data analysis with applications to medical imaging, geosciences, finance)

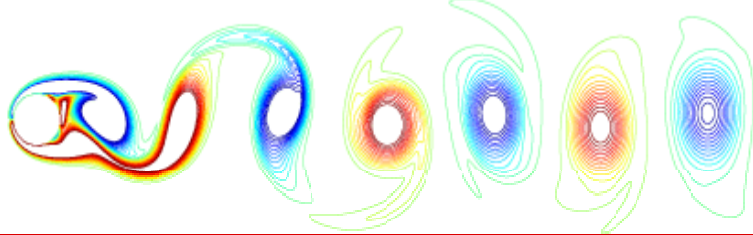
BYU: Interdisciplinary Mentoring Program in Analysis, Computation, & Theory



- Industrial cooperation to provide internship and career opportunities
- Funded initially by an NSF CSUMS award; expired in 2010. Program continues with investment from local insurance company which has hired 7 students

NC State REU: Modeling and Industrial Applied Mathematics

NC STATE University (REU)



- Run by Loek Helminck, in partnership with EPA, Calabazas Creek Research, Beth Israel Deaconess and HMS, Pfizer, NASA Langley
- Partners receive energetic help on problems of interest and satisfactory resolution to open problems
- Keys to Success: local faculty who can co-mentor, partners visit three times in 10 weeks, video conferencing in between



Quote from Lawrence Ives, President, CCR:

"... Probably, the most exciting thing was to develop a multiple beam gun. And, when I discussed it with the department head at one of the national lab in this country, it is physically impossible to do a doubly convergent multiple beam guns. So, if you have something that is impossible to do, what do you do? You give it to students who do not know that it is impossible...it was a great thrill for me to stand up at a conference, in front of my colleagues, who accepted that this is impossible, telling them, yes, it is possible. Here it is, and by the way, it was done by undergraduate students at North Carolina State University. How cool was that?! "

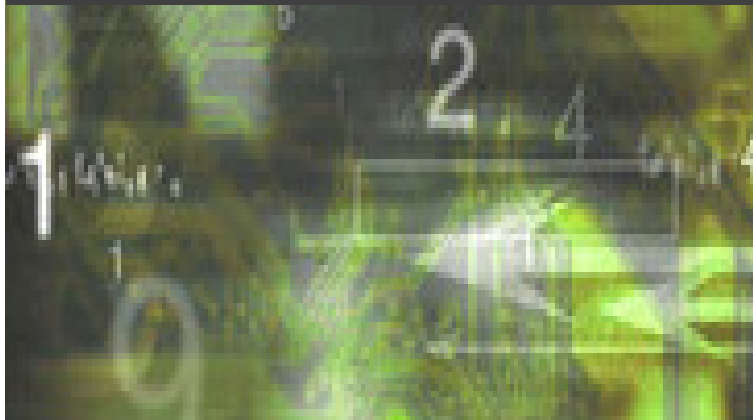
Summer Research at Rochester Institute of Technology

- Internal funding to support 24 undergraduates conducting research over the summer in science (2-3 in math)
- Originally started with support from the RIT Honors Program to fund 12 Honors students, but the model worked well and the Dean contributed matching support for 12 non-Honors students. Additional students are supported through McNair Scholars program and LSAMP program.
- Idea from Darren Narayan: Alumni “sponsor a student” to present research at national conferences. \$500-\$1000 range, Development Office helped, alumni excited to do it.

NSF Research Experiences for Undergraduates

- New solicitation NSF 12-569 issued this year (deadline September 9, 2012)

Research Experiences for Undergraduates (REU)



- Changes in indirect costs
- Section IX. Other Information lists resources summarizing impact of undergraduate research experiences that might be helpful when trying to design REU projects, advocate on your campus, and prepare assessment/evaluation

NSF Research Experiences for Undergraduates

- Bownell and Swaner (2010) surveys published research on effectiveness and outcomes of undergraduate research:
 - Encourage faculty to provide mentoring, not just oversight
 - Provide opportunities for real-life interaction such as publishing, giving presentations, or implementing actual projects
 - Develop intentionally designed curricula to enhance students' research skills
- Opportunity: In addition to REU sites, note possibility for REU supplements on existing DMS research grants.

2012 Trends in Undergraduate Research in Mathematical Sciences Conference

- October 26-28, 2012 at Westin O'Hare Hotel in Chicago
- Organized by MAA with support from NSF and NSA. Led by Joseph Gallian, Aparna Higgins, Darren Narayan, Michael Pearson, Ivelisse Rubio
- <http://www.maa.org/turms2012/>

Questions I am thinking about

- ▶ NSF cannot support projects indefinitely. How do we structure our Workforce programs so that the NSF investment allows universities to sustain important parts of projects?
- ▶ (for REU) Do we want a DMS REU Leadership Team / PI meetings / centralized assessment?



Thank you!

Questions ?

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