



REU Site: Integrated Bioengineering Research, Education, and Outreach Experiences for Females and Underrepresented Minorities at WPI (EEC0754996)

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Abstract

Worcester Polytechnic Institute has had an REU Site in Bioengineering since 2005 involving over 35 undergraduates from across the country. Students have engaged in Bioengineering research in three different departments at WPI. A unique feature of the program is that the undergraduate students participate in outreach by becoming mentors to middle school students during a one-week Bio-Discovery Program. This poster highlights the activities and findings from summer 2009.

Educational goals and objectives:

1. to provide meaningful research experiences for the participants in bioengineering
2. to facilitate personal and professional development of the students in areas important for careers in engineering
3. to provide middle school students with one-on-one mentored laboratory experiences with positive engineering role models that they can identify with



REU Activities and Examples

| Activities | Examples |
|---|--|
| Independent bioengineering research projects | Tissue engineering, biomaterials, biomechanics, microbial infections, and bio-sensing |
| Faculty mentors from multiple departments | Biomedical Engineering, Chemistry and Biochemistry, and Chemical Engineering |
| Weekly seminars and workshops | Mentoring skills, ethics in science, balancing work and family life, how to choose a graduate school, professional writing, etc. |
| REU students act as mentors to middle-school students | One-week full time Bio-Discovery Program |
| Professional presentations | Program symposium and national conferences (BMES, AIChE) |

Outcomes for REU Students

Research activities: REU students reported increases in all 5 areas assessed: Propose a hypothesis and research plan for a specific experiment ($p = 0.01$); Perform laboratory experiments ($p = 0.04$); Create a data analysis plan (n.s.); Use laboratory equipment ($p = 0.02$); Interpret data to make decisions (n.s.)

Professional proficiency: REU students reported gains in all areas (although not generally statistically significant): Research presentations Professional writing, Professionalism and ethics, Preparation for applying to graduate school, and Mentoring

Middle-School Student Program

| Activities | Outcomes |
|--|--|
| Group projects (examples): <ul style="list-style-type: none"> • Pig heart dissection • Engineered skin • Bacteria and biofilms • "Cell" cookies and liquid N₂ ice cream! | <ul style="list-style-type: none"> • 70% report more interested and 30% slightly more interested in science than they were before. • 85.7% rated interaction with their REU mentors "excellent." |
| Independent projects: <ul style="list-style-type: none"> • 1-on-1 mentoring by REU student • Posters based on individual projects, e.g., "Artificial Skin," "Human Skeletons," "Staining <i>E. coli</i>," "X-rays," "Diffusion," etc. | <ul style="list-style-type: none"> • Student quotes: "I loved every part," "the pig heart was amazing," • Parent comment: "Every day after camp she would say 'camp is awesome. I can't wait until tomorrow.'" |

REU Student Profile (2009)

105 Applicants: 81% female, 44% under-represented minority (13% black, 10% Hispanic)

9 Participants: 100% female, 33% under-represented minority (22% black, 11% Hispanic)
 71% from schools that do not offer Ph.D. in BME (including 2 from community college)
 First research experience for >80%
 2 participated as supplement to RET

Broader Impacts (2004-2009)

- Training provided to 35 female undergraduates in bio-engineering research (>25% underrepresented minorities)
- Positive career impact encouraging graduate study
- High percentage present at national meeting (e.g., BMES) (6 of 9 in 2009, and others planned for 2010)
- Positive mentoring experience
- Mentoring provided for 32 female middle-school students
- Improved interest in STEM for middle school girls

Methods of Evaluation and Assessment

| Cohort | Instrument | Particip. |
|------------------------|------------------------------|-----------|
| REU Students | Pre and post-program surveys | 100% |
| | Bi-weekly feedback sessions | 100% |
| Faculty | Post-program survey | 100% |
| Middle School Students | Post-program survey | 90.9% |
| | Tracking number of returnees | N.A. |
| Middle School Parents | Post-program survey | 72.7% |



Bio-Discovery Student Profile (2009)

11 students; 100% female
 5th-8th graders
 1 returnee
 Focus on City of Worcester public schools



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