

Changing the Playing Field for URM Students in Biomedical Engineering



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2010-2011 Data for BME Department at The City College of New York

- **Research productivity (12 faculty)**
 - Research expenditure \$4,348,340 (\$362K/faculty)
 - Refereed journal pub. 70 (5.8 pubs./faculty)
 - ISI Literature citations 2010 2360 (196 cit./faculty)
- **Diversity**
 - Faculty (female, URM) 6/12
 - Undergraduate students URM > 50%
 - PhD students URM 11/36 31%
- **Revised 2011 NRC rankings (74 BME PhD programs)**
 - S ranking 5 (5th %) 28 (95th %)
 - Research Activity 4 27
 - Diversity 1 4
- **USN&WR ranking 43, S ranking NRC ~ 8**

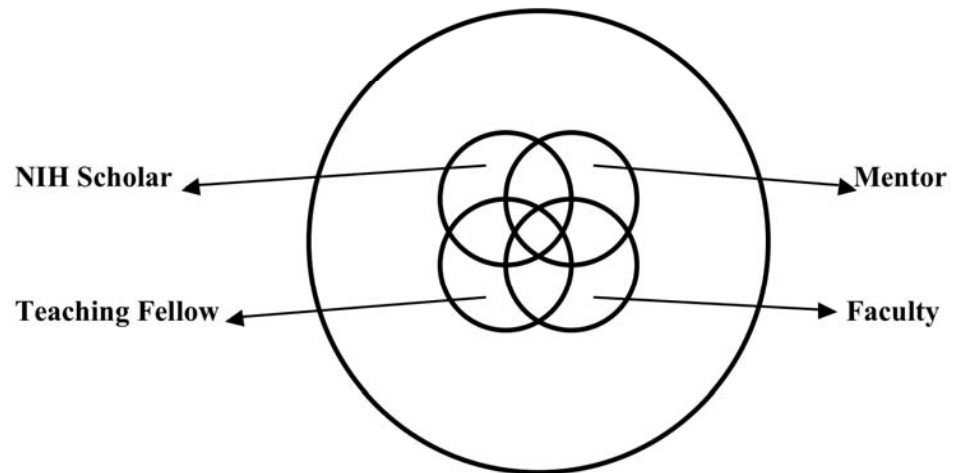


In the beginning...



In 2001, the Department of Biomedical Engineering (BME) at The City College of New York-CUNY received a \$2.5 million grant from NIH for minority undergraduate education. Support 25 NIH scholars/yr for the next five years (renewed in 2006). The overall goal of the NIH Scholars Program is to increase the number of underrepresented minority (URM) undergraduate students trained in biomedical engineering and prepare them for advanced industrial and clinical research careers.

NIH Scholars Program



NIH Grant for Minority Undergraduate Education in Life Sciences (2001-2011)

- **25 minority students/yr in BME or BME concentration, 70% BME majors**
- **Full tuition, \$6,000 stipend school year, \$4000 for summer research experience**
- **All students must do a research project as juniors and seniors, \$4000 supplies and travel/yr**
- **Every student has a personal PhD student mentor who meets with him/her weekly plus TA's**
- **Maintain GPA > 3.0, average GPA seniors > 3.5**
- **NIH Scholars Research Day, Fall and Spring**
- **NIH Social Events, Fall and Spring**

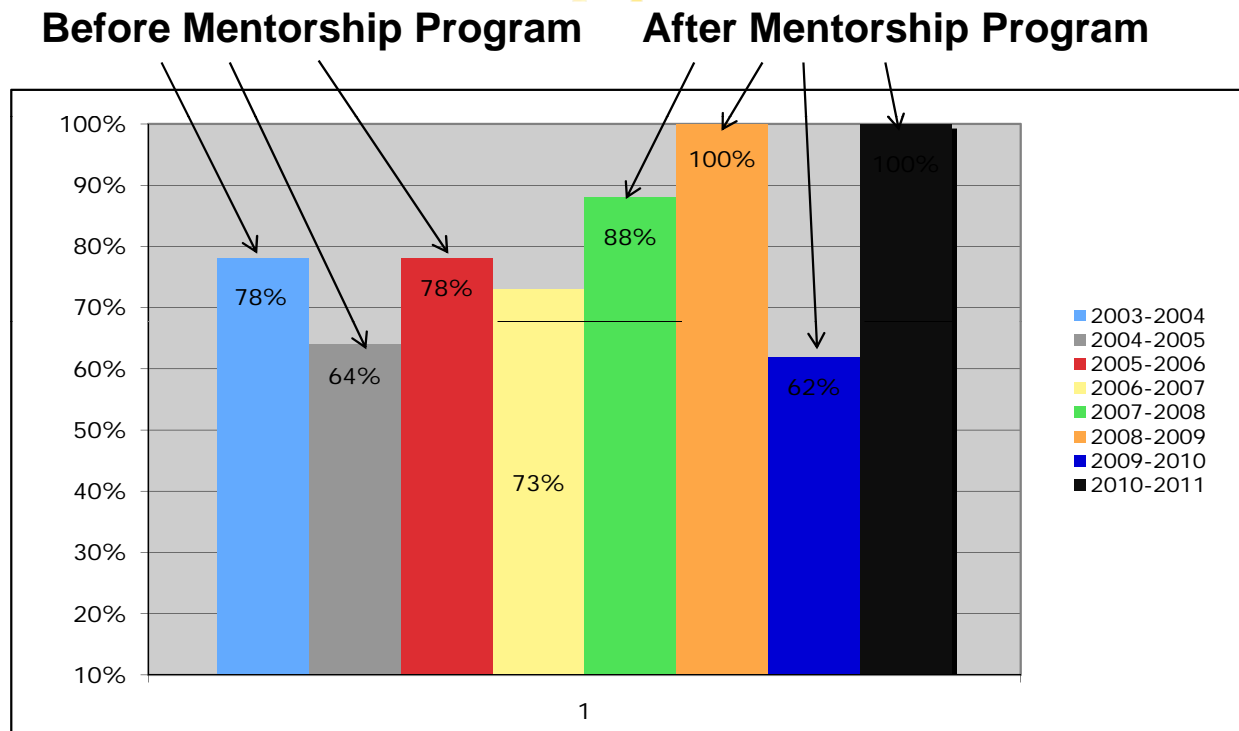


URMs in Biomedical Engineering

- **URMs represent 34% of 18 to 24 year olds**
- **URMS are 12 % of the BS degree recipients in the U.S. but only 8% in BME**
- **URMs are < 3% of the PhD recipients in BME**
- **Early BME programs at private universities**
- **BME is projected to have the largest percentage increase in employment of any engineering discipline 2011-2018**

Annual Retention Rate

Retention rates before and after Mentorship Program



Students leave program to change major or due to academic performance (<3.0 GPA). Program involving PhD mentors became fully operational in fall 2007. Program initiated in spring 2007 because retention of BME majors was not up to expectations.

Five year retention

- **Retention 2002-2006** (before mentoring)

35 enter, 8 graduate, 11 continue, 16 leave

Retention 54%

- **Retention 2007-2011** (after mentoring)

42 enter, 21 graduate, 10 continue, 11 leave (7 GPA, 3 transfer, 1 leave CCNY)

Retention 74%

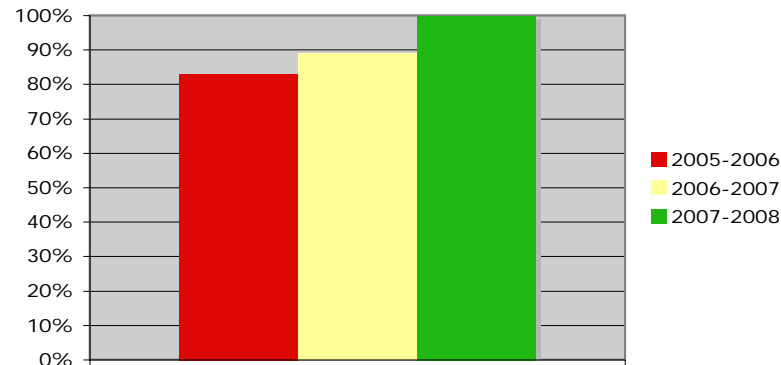
Average GPA of graduates 3.5, highest performing group

Two class valedictorians since 2006



NIH Scholar Satisfaction

Overall, I feel satisfied with my experiences in the NIH Scholars Program (Very Satisfied-Satisfied)



"I was really taken aback because just everything that's offered, all the help and advice and motivation and the pushing and everyone's just willing to be there, like, for you. Specifically. It just lets me know that I'm not in this college process alone." [Scholar]

"There is a special experience to this [program]. There are help networks, support groups... They can come talk to us. I don't know how you can call that—family, extended family. It's a good feeling." [NIH Teaching Fellow]



NIH Minority Scholars Educational Goals

A majority of the NIH Scholars surveyed planned to earn degrees beyond the bachelor's degree, and most were planning to stay in BME or enter a BME-related field. Among survey participants, 88% strongly agreed or agreed with the statement, "Because of the NIH Scholars Program, I am more likely to continue in the field of BME after graduation".

Educational Goals	Percentage/ Number of Students		
	2006	2007	2008
<i>No Education beyond BS planned</i>	<i>0% (0)</i>	<i>12.5% (2)</i>	<i>5.9% (1)</i>
<i>Masters Degree in BME</i>	<i>62.5% (10)</i>	<i>31.3% (5)</i>	<i>29.4% (5)</i>
<i>Doctorate Degree in BME</i>	<i>50% (8)</i>	<i>56.3% (9)</i>	<i>52.9% (9)</i>
<i>Medical Degree</i>	<i>31.2% (5)</i>	<i>12.5% (2)</i>	<i>17.6% (3)</i>
<i>Masters Engineering Management</i>			<i>6% (1)</i>
<i>Master in Business Degree (MBA)</i>			<i>6% (1)</i>

Does not equal 100%. More than one goal can apply.

38/63 or 60% plan to go on for PhD or MD



Undergraduate Research Experience

Each NIH Scholar is required to do two full years of research at least 8 hours/wk starting in the fall semester of their junior year including at least one summer in addition to their regular courses. The results of this research are presented each semester on NIH Scholars Research Day. Representative Scholar comments below:

The Program Provides Research Experience

"The research experience was so great because I learned so many things that I didn't learn in any class. I was able to have experiences doing experiments in the lab and getting information by myself. Learning to look up references. It kind of helped me for the classes."[NIH Scholar]

The Program Paves the Way for Future Research Experiences

"Research, research, research. I wouldn't be in an MD/PhD program right now if it weren't for it. Thanks!"[NIH Scholar]

Every Scholar has a PhD Mentor

Every NIH Scholar has a personal PhD student mentor to advise on professional development issues, such as applying for internships, what to expect in graduate school and personal and academic issues directly related to the BME program. This is in addition to research mentoring by faculty and PhD students in their research labs. Mentors meet informally with mentees at least one hr/wk and have a social event each semester.

96% of Scholars said this was one of the most helpful parts of the program.

In addition to helping the Scholars, participation in the NIH Scholars Program benefits the Mentors through the development of their own skills and interests. The following is a representative comment:

'I'm pretty much sure [my Mentee's] learning a lot from me, but at the same time, I'm deeply affected by this mentorship. First of all, I realize, I make sure I'm helping somebody. Whatever I say to him may affect his future. The thing is, if somebody trusts you, chances are, you're working a little bit harder than ever to improve yourself, to be a better person.' [NIH Mentor]



Impact on BME Department as viewed by Dean

Dean Barba attributed the Department's success to departmental leadership and a "trickle-down" model of mentoring:

- *"BME is perhaps the most student-centered program, undergraduate and graduate. The senior members mentor the junior faculty. And together, they augment the graduate students and undergraduate students. I think it's a successful model. I don't think anybody in the school does it as well as they do."*

Another practice among the senior faculty in the BME Department is that they have continued to foreground diversity in its vision of departmental development and strength. Dean Barba noted:

- *"In terms of the faculty they're attracting, they're very conscious to bring women in, trying to bring in underrepresented people in engineering. They're building very strong research groups."*



Summary of Program Impact

- **Five year retention 74% since fall 2007.**
- **39 projected graduates, 60% pursue PhD and/or MD.**
- **Nearly every BME PhD student volunteered to be TA or mentor.**
- **“Trickle down” mentoring from faculty to grad students to UG.**
- **TA’s greatly enhance UG performance of dept. as a whole. Invaluable support for faculty.**
- **Symbiotic Relationship between NIH Scholars Program and BME Department.**
- **Highest rated teaching dept. in GSOE. Highest teaching evaluation in GSOE 4.6/5.0.**





TA's are provided for:

Course	Title
BME 220	Biostatistics & Research Methods
BME 305	Dynamical Systems and Modeling
BME 405	Biomedical Transducers & Instrumentation
BME 450	BME Senior Design I
BME 460	BME Senior Design II
BME 503	Cell & Tissue Biomaterial Interactions
BME 505	Image & Signal Processing in Biomedicine
ChE 229	Chemical Engineering Thermo I
Chem.103	General Chemistry I
Chem.104	General Chemistry II
Engr.204	Electrical Circuits
Math 201	Calculus I
Math 202	Calculus II
Math 391	Differential Equations
Math 392	Linear Algebra/Vector Analysis
ME 246	Engineering Mechanics I
ME 330	Mechanics of Materials
Phy.207	General Physics I
Phy.208	General Physics II