



FIU

FLORIDA INTERNATIONAL UNIVERSITY
Miami's public research university

Biomedical Engineering Department Annual Report July 2008-June 2009

1 BME Academic Programs

The BME Department is leading the State in biomedical engineering education. Of the eleven universities in the State University System (SUS) of Florida, FIU is the only university with the full slate (BS, MS, PhD) of programs in BME. Enrollment as of spring 2009: BS – 209 FT and 55 PT (117 FT upper division); MS – 20; PhD – 28. The department offers no University Core Curriculum courses. Based on the number of faculty contributing to the undergraduate program (7 FTE tenured/tenure track faculty plus 2 FTE instructors), the Student/Faculty ratio was $209/9=23$ FT Undergraduate; $117/9=13$ FT Undergraduate upper division (junior and senior status). Based on the number of faculty contributing to the graduate program (7 FTE tenured/tenure track faculty), the graduate Student/Faculty ratio was $48/7=6.9$. There have been >80 graduates from the BS program.

The student headcount and graduation rates in the BS program have risen steadily since the beginning of the program in 2002 (Tables 1-3). The number of FTE's has also risen steadily (Table 3) despite the fact that BME offers no "service" courses, and three of our core engineering courses are taken through either ECE or MME. The BME BS program is comprised of about 40% females and in 2007-08, 60% of the 32 BME BS degrees were awarded to females. In fall 2008, 50% of the BS graduates were female. The program boasts an active student section of the Biomedical Engineering Society (BMES) and a newly established Alpha Eta Mu Beta (AEMB) Biomedical Engineering Honor Society chapter. Both societies provide for enrichment of both undergraduate and graduate students.

Five PhD students were admitted into the PhD program in fall 2008 and spring 2009 with an average GRE score of 1268. As of the end of fall 2008, there have been 4 PhD graduates, three of them females. Of the 89 MS graduates to date, 30% were female. The Department's ratio of RA's supported by C&G funds to TA's supported on E&G funds has been greater than 1:1 until fall 08 when it dropped below 1:1 because six students are supported directly by UGS. The total number of GRAD II level FTE's has also been increasing steadily since 2004 (Table 3) and we expect it to increase even further as the PhD program continues to mature. The GRAD I level FTE's spiked in 06-07 and 07-08 due to the influx of MS students. The program is now emphasizing the PhD program with less emphasis on the MS program.

Table 1: BME BS, MS, and PhD Headcount Enrollment*

	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008
BS	53	131	190	227	244	264
MS	30	42	36	38	36	23
PhD	NA	8	14	19	26	30
Total	83	181	240	284	306	317

* MS program started in 1999, BS program started in 2002, PhD program started in 2004.

Table 2: BS, MS and PhD Degrees Awarded in BME

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-2009
BS	0	8	11	25	32	27
MS	11	14	10	14	11	22
PhD	NA	NA	1	0	1	2
Total	11	22	23	39	44	51

Table 3: BME BS, MS and PhD FTE

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-2009
Lower UG	1.1	2.3	4.2	3.5	3.8	4.1
Upper UG	3.3	13.1	18.9	29.7	35.0	36.3
GRAD I	5.3	10.3	12.5	18.8	17.4	11.2
GRAD II	0.5	2.9	3.9	7.7	10.5	12.0

Table 4: Ratio of C&G to E&G Support of Graduate Students*

	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008
E&G	9	11	8	8	13 ^{&}	16 [#]
C&G	14	16	17	16	21	12
Total	23	27	25	24	34	27
Ratio	1.56	1.45	2.13	2.00	1.62	0.75

* Only including students that are fully supported on either E&G or C&G funds.

& Includes one student supported directly by UGS ; # Includes six students supported directly by UGS

2 Student Chapter Activities

Outside of the classroom, the BME Department supports a very active student BMES group. The BMES student chapter has over 100 active members. The group has sponsored several activities including raising funds to send students to each BMES Annual Fall Meeting since 2003. Each year BMES students volunteer and attend the International Symposium on Endovascular Therapy Conference in Miami. Each year the chapter collaborates with different collegiate organizations, which has allowed them to organize numerous events including club fairs, academic fairs, social events, leadership seminars, and research seminars. Each year the BMES volunteers participate in several special events that strengthen the College of Engineering and Computing. In 2007 an AEMB Honor Society chapter was started. The AEMB, with 36 inductees and 21 current members, has started a monthly journal club as well as other academic, community service and social activities. The two societies have teamed up to begin a mentoring program to better prepare freshmen and sophomores for the rigors of an engineering education and improve undergraduate retention.

3 BME Research Programs

Faculty size and Research Focus

The Department has 8 faculty members (total of 7 FTE) at the rank of Assistant Professor and above (two are joint positions with Electrical and Computer Engineering). The department has two full time Instructors, one serving as the Undergraduate Advisor. Sharan Ramaswamy will be joining the faculty at the rank of Assistant Professor in spring 2010. The Department's research programs are in the following areas:

- Bio-imaging and bio-signal processing
Adjouadi, Barreto, Godavarty, Lin, McGoron
- Bio-instrumentation, devices and sensors
Barreto, Christie, Godavarty, Lin, Li
- Biomaterials and bio-nano technology
Huang, Li, McGoron, Christie
- Cellular and tissue engineering
Huang, Tsoukias

4 Research Funding and Scholarly Productivity

The Department is deeply involved in translational research, particularly in the areas of cardiovascular and neural engineering and oncology. The research and scholarly productivity is presented in Tables 7 and 8.

Table 7: Summary of BME Research Programs in the Last Five Years

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Research Awards	\$805,918	\$2,040,895	\$2,319,273	\$1,817,046	\$1,570,751
Research Expenditures	\$1,130,000	\$1,137,000	\$1,525,000	\$1,290,000	\$1,202,734
RA (C&G Supported)	16	17	16	14	12
FTE Faculty*	9	9	10	9	9

* Includes two instructor positions

Table 8: Summary of Faculty Scholarly Production for the Last Five Years

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
FTE Tenure-track faculty	7	7	8	7	7
Manuscripts published in major journals	38	36	32	26	22
Presentations at major scientific meetings	38	47	54	43	38
Research grant applications submitted	27	30	19	23	29
Research grant applications awarded	6	15	23	11	9
Patent Applications Filed (US and foreign)	1	5	4	4	5

5 New Faculty in 2008

Two new faculty members joined the department to replace faculty who left during or after the 2007-2008 academic year. Yen-Chih Huang received his PhD in Biomedical Engineering from the University of Michigan. He joins FIU as an Assistant Professor following a 3-year post-doc, also at the University of Michigan. His research is in the area of tissue engineered skeletal and cardiac muscle. Michael Christie received his PhD in Materials Science Engineering from Rutgers University. He joins FIU as Instructor and the Undergraduate Advisor following a career at Johnson & Johnson and after establishing his own materials and quality consulting firm.

6 Individual Faculty Accomplishments in 2007-2008

Malek Adjouadi, Professor. In the last year, researchers in the CATE Center have secured \$765,000 in funding, out of which \$330,000 of new funding was in support of the research thrust entitled “Integrated Approach to Information Processing in Neuroscience” under the National Science Foundation-Center for Research Excellence in Science and Technology (NSF-CREST) program, and \$104,143 of new funding from the NSF-Broadening Participation in Computing (NSF-BPC) program geared at recruiting more student into the graduate program and onto professorship. Melvin Ayala, CATE lab manager, and Malek Adjouadi have been recently granted the following patent: Artificial neural network design and evaluation tool.

Armando Barreto, Associate Professor, Joint Appointment, continued work on two active grants in 2008-2009, and had a 5-year proposal to NSF “*Human-Computer Interaction for Universal Access*” accepted. Dr. Barreto serves as PI of this project, which is part of the NSF Center for Research Excellence in Science and Technology (CREST) titled: “Center for Innovative Information Systems Engineering” (Center Director, Dr. Yi Deng). Dr. Barreto’s project is expected to receive \$825,000 of support, over 5 years.

Michael Christie, Undergraduate Advisor received \$1500 for Training Program for Establishing and Sustaining and Undergraduate Research Program in Biomedical Engineering from the Academy for The Art of teaching.

Anuradha Godavarty, Assistant Professor, received funding (\$403,971) from Florida Department of Health (BankHead Coley Program) and Department of Defense (Breast Cancer Research Program) towards her research related to diagnostic breast imaging. Additionally, she received the Kauffman Professorship Award for Year 2009 from Florida International University. Her research on breast cancer was recognized and highlighted at Radiological Society of North America's Annual Meeting (via RSNA-on-the-air broadcast) in December 2008 and via WSVN (Miami, Channel 7) telecast in Feb 2009. Dr. Godavarty's student (Sarah Erickson, PhD student) received a DoD Pre-Doctoral Traineeship Award.

Chenzhong Li, Assistant Professor, received a \$ 54,000 award from the U.S. Air Force Office of Scientific Research to work on the development of biosensors for the in-field detection of toxins. He also received a Faculty Research Award and Kauffman Professor Award in 2009 for the research and education in the fields of biosensors and nanomedicine. In addition, Dr. Li has received \$ 20,000 from the Everglades Foundation to develop a new biosensing tool to monitor

the environmental pollutants in everglade water system. Dr Li was Co-PI, with investigators from MME, on a \$398,000 major instrumentation award titled "MRI: Acquisition of a Nanoimprinting System for Research and Education," from the NSF. He also successfully co-organized the 25th Southern Biomedical Engineering Conference with Dr. McGoron and Dr. Lin.

Anthony J. McGoron, Associate Professor and Acting Chair, received a grant from the Florida Department of Health for \$200,000 to develop a new Image Guided Therapy for cancer. A gift of \$250,000 from the Rinker Family Foundation to Dr Seza Gulec in the College of Medicine was received to establish a Nuclear Oncology Laboratory in the BME department. Dr McGoron is also a Co-PI with Dr Norman Munroe from the Mechanical and Materials Engineering Department on a new \$300,000 grant from the NIH to study the biocompatibility of new vascular stent materials.

7 BME Partnership Program

There are 29 companies on the advisory board. Three companies joined in the past year. The mission of the BME Department is to integrate academia, clinical medicine, and the biomedical industry into the biomedical engineering education and research programs. To this end, the BME Partnership Program at FIU was initiated in June of 2001. It is a joint enterprise of FIU, clinical research establishments, and biomedical companies. Its mission is to foster excellence in biomedical education and training; support biomedical innovation, invention, and discovery; cultivate biomedical research and development; and promote biomedical engineering entrepreneurship in South Florida. The Partnership Program provides the structural support to the clinical rotations and senior design projects for the BS program. The Partnership Program also provides graduate students opportunities for applied research through the Collaborative Technology Innovation Program. This program joins BME faculty with personnel from one of the Partner organizations and provides funding for joint projects that present the potential for discovery, innovation, invention, and future commercialization or other external funding.

An example of the Partnership Program influence on the BME programs is the BME Technology Expo & Competition. It is a required curricular activity for undergraduate BME seniors. In this biannual event, individual student teams present their senior design projects. The presentations are made to a panel of judges comprised of members of the BME advisory board representing academia, industry and clinical medicine. In addition to providing a venue for students to display the products of their effort, the event offers biomedical companies and entrepreneurs a view of FIU's graduating biomedical engineers and innovative biomedical technology.

8 BME Endowed Programs

The earnings of the endowment from the Wallace H. Coulter Foundation grant (approximately \$500,000 per year) fund the following programs:

- Excellence Fund – this is a general use fund for the overall enhancement of the biomedical engineering education and research programs.
- Graduate Fellowships – provide stipends for graduate students each year. Two PhD students received support this year.
- Excellence Scholarships – up to five scholarships are provided each year to undergraduate students. The scholarships are for two years. Eight students received scholarship support this year and six new scholarships will be awarded to students next year.
- Research Initiation Program. – provides seed funding to faculty for development of their research programs with Partnership Program members. One new grant was awarded this past year to Dr Chenzhong Li and World Precision Instruments (Project title: Development of Implantable Micro sensor for the Detection of ROS induced DNA damage).
- Research Center Fund – supports the Cardiovascular Engineering Center.

- Eminent Scholars Chair and Professorship – funds two endowed faculty positions in the Department. The Distinguished Professor in Bioinstrumentation and Biomeasurements is held by Joe Leigh Simpson, Executive Associate Dean for Academic Affairs, College of Medicine. The Eminent Chair position is currently unfilled.
- Young Inventor Program – funds a post-doctoral fellow for up to two years. The Young Inventor Award is currently held by Romila Manchanda. She received her PhD in Chemistry from the Institute of Genomics and Integrative Biology CSIR, University of Delhi. She received a Young Scientist Project Award from the Indian Department of Science and Technology before joining FIU.
- Lecture Series – Fourteen lectures were held in 2007-2008.

In 2006 the Ware Foundation awarded FIU a \$1.42 million grant to endow the Ware Foundation Laboratory for Brain Research and Neuro-Engineering Applications, jointly operated by the FIU BME Department and the Miami Children's Hospital Brain Institute. Funding is used to support Mercedes Cabrerizo, post-doc fellow. In addition, the Miami Children's Hospital supports one half of the BME faculty position held by Dr. Wei-Chiang Lin, which carries the title Miami Children's Hospital Assistant Professor in Neuro-engineering.

The FIU BME Department presents awards for undergraduate students to participate in faculty research during the summer from the proceeds of a \$100,000 gift from Norman R Weldon received in 1998. The awards support students with an interest in pursuing a career in research with plans to pursue graduate studies in BME. Two students are selected to conduct research in a faculty's laboratory for 20 hours each week for 12 weeks over the summer.

9. Departmental Priorities over the Next Five Years

1. Strengthen cross-disciplinary collaborations with science and health related departments, and the Applied Research Center (ARC), and increase the number of faculty with joint appointments. In particular establish collaborations with the College of Medicine.
2. Broaden funding sources and increase NIH Funding. We have submitted and received grants through the MBRS SCORE program and faculty in the department currently have undergraduate and graduate students supported through the MBRS RISE program.
3. Fill the vacant WHC Endowed Chair position.
4. Hire a permanent Chairperson to lead the department.
5. Improve mentoring to help junior faculty be successful.
6. Apply for training grants, such as the NIH T32 training grant and NSF IGERT (Integrative Graduate Education and Research Traineeship), to support graduate students and post-docs.
7. Develop mechanisms to increase the number of research faculty and post-doctoral fellows in the department (but without decreasing the number of PhD students supported)
8. Take advantage of new cluster hires, for example in the area of bioinformatics, environmental-toxicology.
9. Increase the number and amount of gifts received from foundations to support the Department's academic and research activities.
10. Coordinate with Community Colleges to better prepare their AA students to enter BME. An articulation agreement is being developed with Miami Dade College to allow students from their Biotechnology program to enter the FIU BS BME program.
11. Increase participation of all Advisory Board members. Develop new academic initiatives and research collaborations.
12. Student Recruitment
 - a. Expand our graduate student recruiting
 - b. Raise the quality of undergraduate majors in BME
 - c. Develop an Honors College program that will attract the best and brightest students.
 - d. Add exposure to the PhD program through research publications and advertising.