



# FIU

FLORIDA INTERNATIONAL UNIVERSITY  
*Miami's public research university*

## **Biomedical Engineering Department Annual Report July 2009-June 2010**

## 1 Departmental Overview

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. The department is endowed with \$11 million from the Wallace H. Coulter Foundation, the Ware Foundation and the State of Florida. One of the strengths of the growing BME department is its close alignment with the Herbert Wertheim College of Medicine.

## 2 BME Academic Programs

The BME Department continues to lead 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 Fall 2010: BS – 259 (upper and lower division); MS – 20; PhD – 33. The department offers no University Core Curriculum courses. Based on the number of faculty contributing to the undergraduate program (9 FTE tenured/tenure track faculty plus 2 FTE instructors), the Student/Faculty ratio was  $259/11 = 23.5$ . Based on the number of faculty contributing to the graduate program (9 FTE tenured/tenure track faculty), the graduate Student/Faculty ratio was  $53/9=5.9$ . There have been 142 graduates from the BS program, 95 graduates of the MS program and 7 from the PhD program (as of spring 2010).

The student headcount and graduation rates in the BS program have rose steadily through 2008 but appear to have leveled off since (Tables 1 and 2). 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, 64% Hispanic, and 9% African American. 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.

Six PhD students were admitted into the PhD program in fall 2009 and spring 2010 with an average GRE score of 1222. As of the end of fall 2009, there have been 7 PhD graduates, four of them women. Of the 95 MS graduates to date, 30% were women. The Department's ratio of RA's supported by C&G funds to TA's supported on E&G funds was about 1:1 during the last year.

**Table 1: BME B.S., M.S., and Ph.D. Headcount Enrollment\***

	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
B.S.	53	131	190	227	244	267	259
M.S.	30	42	36	38	36	23	20
Ph.D.	NA	8	14	19	26	30	33
Total	83	181	240	284	306	320	312

\* M.S. program started in 1999, B.S. program started in 2002, Ph.D. program started in 2004.

**Table 2: BME B.S., M.S. and Ph.D. Degrees Awarded**

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Total
B.S.	NA	0	8	11	25	32	29	37	142
M.S.	7	11	14	11	14	11	20	7	95
Ph.D.	NA	NA	NA	1	0	1	2	3	7
Total	7	11	22	23	39	44	51	52	249

### **3. Curriculum Improvement**

The BSBME has 2 required laboratory courses, BME 4050L and BME 4051L, and a laboratory component to EEE 4202C Medical Instrumentation Design. BME 4050L and BME 4051L have both been held in EC 2355. This is a typical wet laboratory with space for at most 10 workstations. The laboratory course has been held in this room but also in faculty research labs. However, the department has only one set of most equipment so that only one group at a time can be working on a particular laboratory exercise. Therefore, the current model is to have different groups working on different exercises at the same time, often in faculty labs using the faculty research equipment. The chair and the laboratory instructor are converting the courses to a more traditional model in which all of the students are doing the same exercise at the same time and in the same room. Additional equipment has been purchased and the first phase has taken place and BME 4050L has been partially converted to this model. In addition, a full semester experimental design exercise has been implemented in BME 4050L concurrent with the existing laboratory exercises.

The laboratory component of EEE 4202C was also improved. Benches and chairs and 5 HP Compaq workstations were purchased to replace units that were obsolete. We have incorporated Labview into the curriculum in EEE 4202C and the BME Undergraduate Laboratories. Last year Labview was installed on all 5 of the workstations in EC 2350 and on one workstation in EC 2355. This year we added two more Labview installations on computers in 2355. Solid Works is also now available on all of the EC 2350 computers for Senior Design coursework, as well as on the machine in the EC 2685 TA/BMES Office. Three Dell workstations were moved from CATE to EC 2355 to expand the computer hardware available in all student teaching labs. Each of these are loaded with Biopac Student lab and equipped with USB MP30's for data acquisition (DAQ). Two of these will also have Labview mounted to enable their use with existing DAQ hardware. Existing DAQ's from National Instruments (NI 9172 buss modules with NI 9137 and 9263 and 9949 modules) were purchased in 2008. These are also available for research use. One UPB 6009 DAQ was purchased to improve the EEE 4202C lab. A TI Chronos wireless interface was purchased to enable development of a lab protocol for data logging of ECG, motion, GPS location etc to Labview. A chest belt type BM-CS5SR-US-S000 wireless ECG measurement was also purchased. New laboratory exercises are being developed to use the new equipment. If successful, additional sets will be purchased and installed.

### **4 Student Activities and Achievements**

FIU students received 15 FASEB Minority Access to Research Careers (MARC) travel awards for the 2009 Biomedical Engineering Society (BMES) Annual meeting valued at \$28,000. The Alpha Eta Mu Beta (AEMB) Honor Society, established in 2007, has 71 inductees and 31 current members. The AEMB and BMES Societies have partnered to create a mentoring program for students at Miami Dade College and the TERRA Magnet High School. The AEMB recently established a monthly journal club. At the 2009 BMES Annual Meeting, the FIU AEMB chapter won the Outstanding Community Service Award and the Most Active Student Chapter Award. AEMB was recognized as the most active of all 200 FIU student organizations in spring 2010. A Student Advisory Board was established to provide feedback to the department.

Sarah Erickson (PhD student) won a Department of Defense Pre-Doctoral Research Fellowship (2009-2011) from the DOD's Breast Cancer Research Program and the Lydia I. Pickup Scholarship for 2009-2010 from the Society of Women Engineers at their national competition.

Reshmi Banerjee (PhD student) won the best poster award in the March 2010 WM2010 conference in Phoenix AZ. The title of the poster was "Response of Hanford Site Soil Arthrobacter isolates to uranium contamination".

Carolina Bautista (BS 2010) was accepted to the New York Medical College, Sam Espinal (BS 2010) is on the waiting list at NOVA Dental School. Misael de Valle (MS 2008) was accepted to Georgetown Medical School, Sean Chislett (BS 2009) was accepted to University of Texas Medical School. Over the past three years, in total 8 of 10 BME graduates that have applied to medical or dental school have either been accepted or are on the waiting list.

BME PhD graduates have landed post-doctoral training positions and highly respected universities: Jaijai Ge (U of Iowa), Qiang Wang (U of Pittsburg), Yalin Ti (U of Pennsylvania). Jiali Wang is a Medical Physicist, at West Physics Consulting, LLC and studying for the American Board of Radiology exams for certification as a Medical Physicist. Each had two peer reviewed journal papers published or accepted at the time of graduation or shortly after.

## **5 New Infrastructure**

We purchased equipment for two additional electronic stations (for a total of five) to support the EEE 4202C Medical Instrumentation Design laboratory course. The department purchased a PerkinElmer RamanStation 400 Surface Enhanced Raman Spectrometer and microscope to support bionanosensor research (cost: ~\$100,000) and a Perkin Elmer HPLC with UV/Vis and Fluorescence detectors (~\$40,000). The BOSE ElectroForce was upgraded through a CTIP grant to Dr. Ramaswamy (~\$10,000). The ViVitro Pulse Duplicator left heart simulator was also upgraded (~\$10,000). A microtome and supplies for histology were purchased as well as a RT-PCR system from Applied Biosystems (~\$17,000), and a Kyowa Interface Science Co contact angle and surface energy meter (~\$12,000). Approximately ½ of the PhD computers were replaced last year. New Benches and chairs and 5 HP Compaq workstations were purchased to replace units that were obsolete in EC 2350. Other equipment was purchased to improve the undergraduate laboratory experience as described above.

## **6 Events**

The 25<sup>th</sup> Southern Biomedical Engineering conference was organized and held in Miami May 15-17, 2009. There were more than 170 attendees delivering 134 papers. Springer published the papers from the conference in the proceedings of the International Federation of Medical and Biological Engineering (IFMBE) and provided the conference with 190 fully searchable CDs. The Organizing committee included Anthony McGoron, Wei-Chiang Lin and Chen-Zhong Li.

## **7 Research Programs**

The Department has 9 faculty members at the rank of Assistant Professor and above (one of which joined in spring 2010). The department has two full time Instructors, one serving as the Undergraduate Advisor. A summary of faculty research and scholarly production is given in Tables 3 and 4. The Department's research programs are in the following areas:

- Bio-imaging and bio-signal processing
- Bio-instrumentation, devices and sensors
- Biomaterials and bio-nano technology
- Cellular and tissue engineering

### **Faculty Research Highlights**

Sharan Ramaswamy joined the faculty as an assistant professor in spring 2010 following postdoctoral training at the NIH and Research Assistant Professor Position at the University of Pittsburgh McGowan Institute for Regenerative Medicine. He received his PhD in Biomedical Engineering from the U of Iowa. His research interests include heart valve tissue engineering, cartilage tissue engineering, MRI-based methods for monitoring tissue engineered constructs,

computational predictive modeling in engineered tissue growth studies, bioreactor design/development and cardiovascular biomechanics. He is currently the PI on a 4-yr scientist development grant from the American Heart Association (\$91,000 has been transferred to FIU).

Anthony McGoron and Chenzhong Li are Co-Investigators with Principal Investigator Joe Leigh Simpson, M.D. on a \$1.4M grant awarded in July 2010 from the U.S. Army Research Institute of Environmental Medicine.

Anuradha Godavarty received a Wallace H Coulter Early Career Award and was recently selected as one of three finalists for the Greater Miami Chamber of Commerce 2010 Health Care Heroes Awards. FIU filed One US Non-Provisional and one US Provisional Patent.

James Byrne was awarded a Grant from the FIU Technology Fee mechanism in the amount of \$11,299.50 for 2009-2010. This permitted obtaining 110 licenses for Labview and 45 concurrent licenses of Solid Works to be used college wide.

Malek Adjouadi and Armando Barreto along with Naphthali Rishe (Computer and Information Sciences) received a \$2.9M MRI award from NSF for the Development of an Instrument for Information Science and Computing in Neuroscience.

Wei-Chiang Lin renewed the Miami Children's Hospital Professorship in Neuro-Engineering.

**Table 3a: Summary of BME Research Programs in the Last Seven Years  
(Including funds from the Wallace H. Coulter Foundation)**

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Research Awards	\$969,236	\$1,151,036	\$2,158,350	\$2,353,409	\$1,803,738	\$1,570,751	\$2,811,528
Research Expenditures	\$860,000	\$826,959	\$740,511	\$1,493,877	\$1,290,000	\$1,343,538	\$1,704,879
RA (C&G Supported)	7	16	16	18	14	12	18
FTE Faculty*	8	9	9	10	10	9	11 <sup>†</sup>

\* Includes instructor positions where applicable

<sup>†</sup>. @2009-2010 data include Drs. Adjouadi and Barreto at 100% each, previously included at 50% each. Ramaswamy joined in spring 2010.

**Table 3b: Summary of BME Research Programs in the Last Seven Years  
(Not including funds from the Wallace H. Coulter Foundation)**

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Research Awards	\$750,320	\$872,025	\$1,706,891	\$1,816,340	\$1,333,619	\$1,078,252	\$2,227,964
Research Expenditures	Not available	Not available	\$1,227,411	\$1,222,220	\$1,313,346	\$1,117,978	\$1,227,774

**Table 4: Summary of Faculty Scholarly Production for the Last Seven Years**

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
FTE Tenure-track faculty	8	7	7	8	7	7	9 <sup>†</sup>
Manuscripts published in major journals	30	38	36	32	26	22	48
Presentations at major scientific meetings	38	38	47	54	43	38	45
Research grant applications submitted	17	21	21	22	24	39	36
Research grant applications awarded	6	7	14	10	8	9	9
Disclosures	4	6	4	1	6	4	8
Patent Applications Filed	0	0	6	3	3	4	4

<sup>†</sup> Drs. Adjouadi or Barreto included at 100%, previously included at 50% each. Dr. Ramaswamy joined in spring 2010.

