Table of Contents

I. Overview ............................................................................................................ 1
   A. Department Administration........................................................................... 1
   B. Highlights.................................................................................................... 1
   C. Faculty Awards, Honors, Major Grants ................................................... 11

II. Faculty and Staff ............................................................................................. 12
    A. Faculty...................................................................................................... 12
    B. Affiliated Faculty ..................................................................................... 18
    C. Research Faculty ..................................................................................... 22
    D. Adjunct Faculty ....................................................................................... 23
    E. Visiting Faculty ....................................................................................... 24
    F. Staff .......................................................................................................... 25

III. Undergraduate Programs ............................................................................. 26
    A. Enrollment............................................................................................... 26
    B. Degrees Awarded .................................................................................... 26
    C. Courses Offered ...................................................................................... 27
    D. Objectives and Outcomes ....................................................................... 29
    E. Student Awards ....................................................................................... 30
    F. Student Organizations ............................................................................. 33
    G. Research Activities for Undergraduates ................................................. 33
    H. ENGMEDIC .......................................................................................... 34
    I. Tracking Alumni ..................................................................................... 34
    j. Senior Project Experience ..................................................................... 35

IV. Graduate Programs ....................................................................................... 41
    A. Recruitment ............................................................................................. 41
    B. Enrollment .............................................................................................. 42
    C. Teaching Fellows and Research Assistants ............................................ 42
    D. Degrees Awarded ................................................................................... 43
    E. Courses Offered ...................................................................................... 45
    F. Graduate Student Accomplishments ..................................................... 46
    G. Current Status of the Graduate Program .............................................. 51
    H. Future Initiatives .................................................................................... 52

V. Research .......................................................................................................... 53
    A. External Research Funding ..................................................................... 53
    C. Publications ............................................................................................ 54
    D. Active Research Laboratories ............................................................... 73
    E. Affiliated Research Centers .................................................................... 81
    F. Seminar Series ....................................................................................... 84
    G. Facilities ................................................................................................. 89

Submitted July 2009
Solomon R. Eisenberg, Sc.D., Chairman
&
Matthew Barber, Director
I. OVERVIEW

A. Department Administration

Chairman Dr. Solomon R. Eisenberg
Associate Chair for Graduate Programs Dr. Joyce Y. Wong
Associate Chair for Undergraduate Programs Dr. H. Steven Colburn
Director of Graduate Admissions Dr. Edward Damiano
Director of BME Core Facilities Dr. Amit Meller
Director Matthew Barber
Administrative Director for Research Jen Marron

Research Centers

- BioMolecular Engineering Research Center
  Co-Directors: Dr. Temple Smith, Dr. Sandor Vajda

- Center for Advanced Biotechnology
  Co-Directors: Dr. Charles Cantor, Dr. Maxim Frank-Kamenetskii

- Center for BioDynamics
  Co-Directors: Dr. Jim Collins, Dr. Nancy Kopell (Mathematics)

- Center for Nanoscience and Nanobiotechnology
  Director: Dr. Bennett Goldberg (Physics)
  Associate Directors: Dr. Selim Ünlü (ECE), Dr. Joyce Wong

- Hearing Research Center
  Director, Dr. H. Steven Colburn

- NeuroMuscular Research Center
  Director: Dr. Carlo DeLuca

B. Highlights

Biomedical Engineering at Boston University is a model of interdisciplinary research and education. We are among the largest Biomedical Engineering departments in the country in terms of the number of primary faculty. Our 32 primary faculty attracted over $18 million in extramural funds available for expenditure this year. This translates to over $572,000 per faculty. Our
graduate and undergraduate programs continue to be ranked in the top ten (7th and 9th, respectively) in the most recent US News and World Report rankings.

The BME Graduate Program has awarded 129 PhDs since our first in 1991, and has a current enrollment of 155 students (115 PhD Students). In the Fall we expect 39 new graduate students (26 PhD, 1 MD/PhD, 9 MS students and 3 MEng.) with the great majority being US citizens. Our Ph.D. applicant pool continues to grow; in 2008 we had 449 applications, and the quality of the matriculants remains very high with a mean GPA of 3.5 (US Students only). We are into our 8th year of our NIH training grant in quantitative biology and physiology, and just learned that we will receive a supplement as a result of Stimulus funds (ARRA), which will increase the number of training slots from 7 to 10 for the next two years.

Our faculty members are comprised of world renowned scientists and engineers who work across every scale of biology and in a wide spectrum of bioengineering subspecialties. Their research is driven by advancing fundamental understanding of biology and physiology in health and disease and then translating these principles to new technologies that impact the human condition and the practice of medicine. There are six interdisciplinary research centers directed or co-directed by BME faculty: Center for Advanced Biotechnology (CAB), Center for BioDynamics (CBD), Biomolecular Engineering Research Center (BMERC), Center for Nanoscience and Nanobiotechnology (CNN), Hearing Research Center (HRC), and NeuroMuscular Research Center (NMRC). The department also includes the following laboratories: Auditory Neurophysiology, Auditory Neuroscience, Binaural Hearing, Biomedical Microdevices and Microenvironments, Biomedical Optics; Biomicroscopy; Cell and Tissue Mechanics; Pulmonary Bioengineering; Biomimetic Materials Engineering, Biomimetic Systems, Biomolecular Systems, BioRobotics, Brain and Vision, Cell and Tissue Mechanics Cell and Subcellular Biomechanics, Cochlear Biophysics, Computational Genomics, Fields and Tissues, Medical Acoustics, Molecular Biotechnology, Motor Unit, Multi-Dimensional Signal Processing, Natural Sounds and Neural Coding, Olfactory Systems, Optical Characterization and Nanophotonics, Organogenesis, Orthopaedic and Developmental Biomechanics, Pulmonary Physiology and Dynamics, Respiratory Research, Respiratory and Physiological Systems Identification, Sensory Signal Processing, Single Molecule Biophysics and Nano-biotechnology, Structural BioInformatics, Vascular Interface and Microhemofluidics, and Visual Information Processing.

Some of the more significant faculty highlights include: Professor Jim Collins became a Howard Hughes Medical Institute Investigator on September 1, 2008 – Boston University’s first. In October, Dr. Collins delivered the 64th Boston University Lecture, “Biology by Design”, and was elected by the BME Students as the AY 08-09 Professor of the Year. Dr. Collins was also the inaugural recipient of Drexel University’s Anthony J. Drexel Exceptional Achievement Award. He accepted the $100,000 award at the Translational Medicine Alliance Forum on May 14 in Philadelphia. The award recognizes collaborative multidisciplinary research focused on solutions that change society. Dr. Collins’ award was based on his research that has led to the development of a new class of medical devices that address complications resulting from diabetic neuropathy, help restore brain function following stroke, and improve balance in the elderly. Just before commencement, he was also named as one of two inaugural William Fairfield Warren Distinguished Professors at Boston University. The professorships were established last year on the recommendation of an ad hoc committee of the Faculty Council as a way of recognizing the University’s most distinguished faculty.

Drs. Joyce Wong and Mark Grinstaff were elected to the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows, increasing the number of AIMBE Fellows in the BME faculty to 16. Drs. Wong and Grinstaff were also selected to be Inaugural Distinguished Faculty Fellows of the College of Engineering. Dr. Michael Smith, was awarded a three-year Innovation Career Development Professorship. This professorship is a highly-competitive award given annually to outstanding young faculty members in the first two years of their appointment at BU, regardless of discipline. Dr. Mark Grinstaff was awarded the Center for Integration of Medicine and Innovative Technology (CIMIT) Edward M. Kennedy Award for Health Care Innovation.

In September, Professor Sol Eisenberg was appointed chair of Biomedical Engineering,
continuing his leadership of the department from his ad interim appointment the previous year. Sol takes on this responsibility while continuing his duties as Associate Dean for Undergraduate Programs in the College of Engineering.

Dr. Tim Gardner continues his leave of absence with Amyris Biotechnologies in California, and Dr. Charles Cantor continues his leave of absence with Sequenom Inc.

We also learned that we will lose a long valued member of the BME Department when Temple Smith retires on August 31, 2009. He will continue to be affiliated with the department as a Professor Emeritus.

BME Faculty Recruitment

We welcomed Assistant Professor Michael Smith, Associate Professor James Galagan and Research Professor Dan Ehrlich to the BME faculty in Fall 2008. Our goal this year was to recruit an additional 2 junior faculty members. The faculty consensus was to search in the areas of: neuroscience and neurophysiology; biomedical optics and biophotonics; single-molecule and cellular biophysics. Our search yielded an exceptional group of candidates. We received over 150 applications, invited 11 candidates to BU to give two presentations and meet with the BME faculty. Partly because of the richness of the field and the particular circumstances of our top candidates, we were able to make three offers, also filling the position to be vacated by Temple Smith.

We are pleased to have the following high quality faculty members joining our department in the coming year.

Dr. Muhammad Zaman will arrive August 1, 2009. Since 2006, Dr. Zaman has been an Assistant Professor in the departments of Biomedical Engineering and Cell and Molecular Biology at UT Austin, and has also been a member of the Institute of Theoretical Chemistry, the Institute for Computational Engineering and Sciences and the Center for Synthetic and Systems Biology. Dr. Zaman's current research is focused on the biophysics of cell-matrix interactions in 3-D matrices. Prior to his position at UT Austin, he was a Hermann and Margaret Sokol Foundation Post-Doctoral Fellow at MIT and was a Burroughs Wellcome Foundation Graduate Fellow at the University of Chicago. Muhammad just received a University of Texas System Regents Outstanding Teaching Award, and will be an NAE Frontiers of Engineering participant in 2009. He has an R01 Grant from the NCI and a grant from the Robert A. Welch Foundation.

Dr. Jason Ritt will join the department January 1, 2010. Dr. Ritt is currently a Burroughs Wellcome CASI Postdoctoral Fellow working with Dr. Chris Moore in the McGovern Institute for Brain Research at MIT. Dr. Ritt was also the recipient of an NIH Kirschstein-NRSA Award 2004-07. Dr. Ritt's research explores how sensory processing in the brain builds upon "pre-neural computations" performed via the physical structure of the body, controlled by volitional and autonomic active sensing behaviors. He utilizes the rodent whisker tactile system in combined behavioral, electrophysiological and computational studies, including the use of cutting edge optogenetic techniques and with applications to rodent models of disease.
Dr. Xue Han will join the department September 1, 2010. Dr. Han is currently a Helen Hay Whitney Postdoctoral Fellow working with Drs. Edward Boyden and Robert Desimone in the Department of Biological Engineering and the McGovern Institute for Brain Research at MIT, and with Dr. Tirin Moore in the Neurobiology Department at Stanford. She recently received an NIH (NIMH) K99/R00 Pathway to Independence Award. Dr. Han's current research is aimed at developing radical new genetic, molecular, and optical neurotechnologies, and inventing molecularly-empowered optical neuromodulation devices and dynamic application protocols to treat neurological and psychiatric diseases.

We also added two faculty with secondary appointments in Biomedical Engineering. Assistant Professor Brandon Xia (primary in Chemistry) whose research area is computational structural and systems biology and developing computational techniques to model the structure, function, and evolution of complex bio-molecular systems, such as proteins and protein networks. Assistant Professor Katherine Zhang (Primary, Mechanical Engineering) whose research involves novel approaches to biomedical problems by integrating physical-chemical and physiological/biochemical approaches complemented with molecular modeling, molecular biology and other cell biology methods.

Dr. Dmytro Kozakov was appointed as Research Assistant Professor in the Biomedical Engineering Department. He had been a post doctoral fellow with Prof Sandor Vajda, and works with him on computational models of protein – protein and protein – ligand interactions.

Industrial Advisory Board and BME Visiting Committee

The BME Industrial Advisory Board met in October, 2008. The focus of this meeting was to update the Board on initiatives in our graduate and undergraduate program, but mainly focused on industry recruitment of BME students post-graduation. We asked the committee members to bring a brief presentation of their company’s hiring plans and there was a round table discussion to provide suggestions on how to better market BU BME to industry.

The newly formed BME Visiting Committee convened on April 30, 2009. As this was the inaugural meeting, the primary focus was to provide the Committee members an overview of the department, as well as to discuss initiatives in the graduate and undergraduate programs along with a review of our Coulter Translational Partnership Program. This group of academic and industrial leaders will continue to meet yearly, typically the day before the annual Senior Design Project Conference.
Industrial Advisory Board Members

Arthur Rosenthal, Ph.D. (Chair)

Doug Adams
Founder, CEO
SOLX, Inc.

Mark A. Beck
Division Vice President & Deputy General Mgr.
Life Sciences—Corning Incorporated

James W. Burns, Ph.D.
Senior Vice President and Head of Drug and
Biomaterial R&D
Genzyme Corporation

Robert W. Clarke, Ph.D. (Alumnus ’90)
Director, Biology and Preclinical Development
Pulmatrix, Inc.

Art Coury, Ph.D.
Genzyme Corporation (retired)

Ralf Faber
Co-Founder, President and CEO
3Wave Optics, LLC

John Gillespie, MS, MBA
Vice President, R&D
Solace Therapeutics

Steven D. Girouard, Ph.D. (Alumnus ’89)
Senior Director, Emerging Technologies
Johnson & Johnson COSAT

David R. Jones
Director, Quality Assurance, Regulatory Affairs
and Phillips Business Excellence
Philips Home Healthcare Solutions

Bruce H. KenKnight, Ph.D.
Vice President, Research & Business Dev.
Boston Scientific CRM

Robert T.V. Kung, Ph.D. (retired summer 2009)
Senior Vice President and CEO
ABIOMED, Inc.

Walt Olson, Ph.D.
Vice President, CRM Research
Medtronic, Inc.

Peter Russo
Professor, SMG
Director, Entrepreneurship & Mgt. Institute
Boston University

Gregg A. Vandesteeg, Ph.D.
Vice President, Research & Development
3M Health Care

BME Visiting Committee

Ravi Bellamkonda, Ph.D.
Professor of Biomedical Engineering
Wallace H. Coulter Department of Biomedical Engineering,
Georgia Institute of Technology

James W. Burns, Ph.D.
Senior Vice President and Head of Drug and
Biomaterial R&D
Genzyme Corporation

Art Coury, Ph.D.
Genzyme Corporation (retired)

Steve Girouard, Ph.D. (Alumnus ’89)
Senior Director, Emerging Technologies
Johnson & Johnson COSAT

Warren M. Grill, Ph.D. (Alumnus ’89)
Addy Professor of Biomedical Engineering
Department of Biomedical Engineering
Duke University

Sheila Hemeon-Heyer, JD, RAC (Alumna ’81)
Vice President, Global Regulatory Affairs
Boston Scientific Corporation

Patrick Loughlin, Ph.D. (Alumnus ’85)
William Kepler Whiteford Professor of
Bioengineering, and Electrical & Computer
Engineering
University of Pittsburgh

David F. Meaney, Ph.D.
Professor and Chair
Department of Bioengineering
University of Pennsylvania

Kristina Ropella, Ph.D.
Professor and Chair
Department of Biomedical Engineering
Marquette University

Art Rosenthal, Ph.D.
Chair, BME Industrial Advisory Board
Research

Faculty Research: BME faculty received funding from new and continuing awards for a total of $18,294,961. These funds were distributed by agency as indicated in the chart below.

**BME Grant Funding By Agency**

- **NIH** 63%
- **Foundations** 20%
- **Other Gov't** 10%
- **NSF** 3%
- **Industry** 4%

**Coulter Foundation Translational Partnership:** This year marks the fourth year of the department’s Coulter Foundation Translational Partnership Award, which provides $4.58 M over 5 years with a potential $10M endowment after 5 years. Dr. Arthur Rosenthal, Adjunct Professor of Translational Research in Biomedical Engineering continues his insightful leadership as the Program Director. New and continuing funding was provided to 6 projects:

- Chemotherapy-Eluting Strips for the Prevention of Locally Recurrent Lung Cancer (Mark Grinstaff/Yolanda Colson)
- Clinical Utility of a Lab-on-a-Chip Diagnostic (Alexis Sauer-Budge/Catherine Klapperich/Christine Odell)
- Fluorescence Endomicroscopy with Out of Focus Rejection (Jerome Mertz/Satish Singh)
- Computed Tomography Contrast Agent for Diagnosis of Osteoarthritis (Mark Grinstaff/Brian Snyder/Ali Guermazi)
- Specific Detection of Viruses Human Specimens (Maxim Frank-Kamenetskii/Nancy Miller).
- Development and Preclinical Testing of a Closed-Loop Control System for Blood-Glucose Regulation in the ICU (Ed Damiano/Steven Russell)

**NIH Training Grant:** This interdisciplinary training program in quantitative biology and physiology (QBP) attends to the growing understanding that scientists must be interdisciplinary, and focuses on training students to use quantitative techniques to investigate biological systems from subcellular processes to large, complex physiological systems. We are into our 8th year of this training grant, and just learned that we will receive a supplement as a result of Stimulus funds (ARRA), which will increase the number of training slots from 7 to 10 for the next two years. We have had 37 students in the program: 9 have earned PhD degrees, 4 have graduated with MS degrees, and 23 students remain in the program. The incoming class this year will add 5 more. In Fall 2008, the NIH QBP students organized our sixth Annual Symposium in Quantitative Biology and Physiology at which the students...
and invited speakers gave presentations highlighting their quantitative biology and physiology-based research.

---

**BU College of Engineering**

**5th Annual BME Symposium on Quantitative Biology and Physiology**

Friday January 16, 2009
1 pm, School of Management Auditorium (SMG 105)

---

3 pm, Keynote presentation:

**Brain mechanisms of visual motion perception**

*Dr. Anthony Movshon*

Professor of Neural Science and Psychology, New York University

Practically everything of interest in the world moves, and even the retinal images of stationary objects move because the eyes are never entirely still. It is therefore not a surprise that the mammalian visual system has evolved a pathway that seems to be devoted to processing visual motion information. In monkeys, neurons in area MT (V5) of the extrastriate visual cortex are all direction-selective, and signal the true motion of complex visual patterns, a response pattern not seen in earlier visual areas. For this and other reasons, MT is thought to have a special role in visual motion processing; surprisingly, this complex neuronal behavior can be accurately captured by a linear feed-forward model that operates on the outputs of nonlinear directionally-selective V1 cells. This model reveals that the complex response properties of MT cells do not result only from the action of circuits in MT, but depend critically on computations that take place in earlier visual areas such as V1. This suggests that a relatively simple and experimentally tractable architecture may account for the complex transformations of visual information that take place beyond the primary visual cortex, but that evaluating this kind of architecture requires a good understanding of both cortical networks and their inputs. An incidental finding arising from tests of this model suggests, unexpectedly, that despite its central role in visual motion processing, there are important situations in which MT does not contribute to our experience of visual motion.

---

**Student presentations:**

1:10  *Corin Williams*  – Altered structure across multiple length scales can explain changes in tissue-level mechanical function in decellularized rabbit carotid arteries

1:30  *Patrick Allen*  – Using human vascular progenitor cells to create engineered microvascular networks

1:50  *Todd Jennings*  – An improved inferior colliculus cell model for interaural time difference analysis

2:10  *Rapecihi Navawongse*  – Responses of the dorsal cochlear nucleus in awake gerbil

4:30  *Finnegan Calabro*  – Depth segmentation during motion perception: psychophysics and computational physiology

4:50  *Kyle Lillis*  – Two-photon imaging of cell-type specific firing patterns and neuronal network correlations during epileptiform activity in hippocampal slices

---

**Faculty Research Accomplishments:** The Cell and Subcellular Bioengineering group had a very successful year. Professor Evan Evans continued a NIH R01 to study the dynamic strengths of leukocyte adhesion bonds. Professor *Micah Dembo* continued work on his NIH R01 grant to study quantitative models of cell shape and motion, and also has taken over as PI on Dr. Marc Herant’s NIH subcontract from UC Davis (PI Volkmar Heinrich, former BME Research Assistant Professor) for experimental and theoretical studies of phagocytosis. He has also received a new subcontract from the University of Pennsylvania from NIH to study force microscopy of endothelial cells on novel peptide materials. Professor *Joyce Wong* continued with her NIH R01 grant on vascular cell...
phenotype on physiologically relevant bioengineered substrata. She received a new award from the Hartwell Foundation to develop tissue engineering solutions to pediatric vascular surgical repair and reconstruction, and a grant from the Advanced Energy Consortium via a subcontract from the University of Texas at Austin to study the use of magnetic, sub-pore scale metal oxide particles for enhanced magnetic resonance and optical characterization of rock pore structure and fluid composition in reservoir rock. Joyce’s graduate student, Corin Williams continues her Fellowship from the American Heart Association. Dr. Mark Grinstaff continues his NIH R01 grant to study improved gene delivery by reversing electrostatic interactions, and another NIH grant to study bacteriophobic coatings for inhibition of pathogenic biofilms, he also continues his work on ophthalmic sealants and nano-scale functional dendrimer-DNA assemblies, also with funding from NIH. He received funding from the Advanced Energy Consortium through a subcontract from the university of Texas at Austin to research downhole lithium ion batteries based on network ionic liquids. He received funding from Schlumberger-Doll Research to study in-situ and on-demand modification of hydrogel characteristics and their applications for ‘non-intervention’ solutions. He received funding from the Sandler Family Supporting Foundation to study phosphorylation-specific prolyl isomerase (pin1) as a novel therapeutic target in asthma. From the Bill and Melinda Gates Foundation, a grant to study expansile nanoparticles for delivery of antibiotics, and he is studying gbilolubricants for viscosupplementation with funding from Flex Biomedical, Inc. (a former Coulter TP project) Dr. Joe Tien continues his NIH R01 award to study the synthesis and characterization of patterned microvascular networks, and received a new NIH R21 to engineer functional lymphatic networks in vitro. Dr. Ed Damiano continued his research on micro-viscometric studies of the ESL in microvessels with two NIH awards; he continued a Coulter Foundation Award through the BME Department’s Coulter Foundation Translational Research Partnership to engineer a fully automated closed loop control unit for glucose regulation in the ICU setting and he is continuing a multi year award from the Juvenile Diabetes Research Foundation International for the design of a closed-loop controller for automated management of type I diabetes.

In the area of Systems Biology and BioDynamics Dr. Jim Collins, in addition to the support he receives from the Howard Hughes Medical institute (HHMI), received grants from NIH, NSF, the Ellison Medical Foundation, and the Harvard Institute for Biologically Inspired Engineering. He is advancing design and application of synthetic genetic regulatory networks and using a systems identification approach for distilling out natural gene regulation networks. Dr. Collins’ work has received visibility ranging from the lay press to the most prestigious scientific journals.

In the area of biomedical optics, Dr. Irving Bigio continued a no-cost extension of his major multi-institutional U54 grant through NIH to advance the sharing of scientific and clinical information to accelerate the translation of basic cancer research to clinical practice in the field of optical imaging. He continues with his NIH R21 to use optical imaging to study fast neural activation patterns in brain tissue, and also is completing his R01 to make optical measurements of Fast Drug Kinetics in Tumors. He has NIH funding through a subcontract from Beth Israel Deaconess Medical Center to fund his graduate student, Sylvan Gioux, to study enhanced intra-arterial delivery of chemotherapeutic drugs to the brain. Dr. Jerome Mertz’s research synthesizes biomedical optics with neuroscience. He continues working on his NIH R21 grant to study wide field fluorescence microscopy with out of focus blur rejection, and a grant from CIMIT to study hybrid-illumination fluorescence microscopy with out of focus blur rejection. His post doc, Erwin Idoux, is funded by a Marie Curie Fellowship from the European Comission for the design and application of a dynamic calcium clamp, and he has funding from NIH through a subcontract with MGH to fund one of his graduate students. He also was awarded a Coulter Foundation Award through the BME Department’s Coulter Foundation Translational Research Partnership to develop fluorescence endomicroscopy with out of focus background rejection.

In the pulmonary engineering group, Dr. Ken Lutchen continued a NIH R01 to combine Hyperpolarized MRI imaging with oscillatory mechanics to study airway hyperreactivity and heterogeneity in asthma. Professor Bela Suki continued his NIH R01 grant to examine the role of
mechanical forces in the progression of emphysema, and received new funding from the DOD through a subcontract at the BU Medical School to study acute lung injury. Dr. Suki also received a new R01 award starting July 1, 2009 from NIH as part of the government economic stimulus package to study the effects of mechanical forces on lung injury and repair. Professor Dimitrije Stamenovic received a new NIH R21 award to study cell orientation control of airway smooth muscle by contractile torque. He also is completing a Coulter Foundation Award through the BME Department’s Coulter Foundation Translational Research Partnership to develop a novel knee osteoarthritis brace.

In the area of neuroengineering, Dr. John White retains an adjunct appointment at BU and continues as PI on a subcontract from Cornell to study open source, real time control systems. Dr. Carlo De Luca has two NIH grants on harnessing motoneuron activity and wearable-sensor system for monitoring motor activity. Dr. Chris Passaglia continues a NSF CAREER award on deciphering the neural basis of visual behavior and has a NIH R01 to study the retinal physiology in glaucoma.

In Biomolecular and Genomic Engineering, Professor Amit Meller continued his NIH R01 award for high throughput DNA sequencing using design polymers and nanopore arrays and his R21 for a nanopore-fret instrument for RNA folding analysis. He has NSF funding for electronic recognition of gene regulatory proteins bound to DNA. He has funding from the Human Frontiers of Science Program for folding kinetics and stability studies of individual RNA molecules with application to RNA. He is continuing work on his contract from Sequenom, Inc. to study the optimization of nanopore-based analysis for nucleic acids, and he received a new contract from a company in the UK, Oxford Nanopore Technologies LTD. To develop and evaluate composite solid state/protein nanopores fro high throughput applications. Dr. Dan Ehrlich continues his research on high throughput BioMEMs DNA sequencing with NIH funding that he moved from the Whitehead Institute. Dr. Sando Vajda was funded by multiple NIH awards to study protein docking problems. Dr. Charles DeLisi has three grant from the NIH to study computational methods for transcriptional mapping of eukaryotic genomes, new methods for cancer class discovery and prediction, and a system for integration mining visualization and analysis. Dr. Temple Smith continues his work on his NSF Grants to probe the “Eukaryotic Core” and has NIH funds to support graduate students through subcontracts from Harvard University and the Jackson Laboratory. Dr. Simon Kasif continued his two NIH and NSF grants on a comparative cross-species genomic analysis system and for gene annotation using evidence integration and propagation in functional linkage graphs. He also served as PI on a Sponsored Research Agreement with Sequenom Corporation in Center for Advanced Biotechnology (CAB). Within CAB, Dr. Maxim Frank-Kamenetskii continued a Coulter Foundation award to study specific detection of microbes in patient specimens. Dr. Charles Cantor continued active funding efforts via collaboration with CAB and Sequenom Inc. Dr Natalia Broude research was funded through a contract from Dithera Inc. Professor Cassandra Smith continued a grant from BioKit Corporation to study isothermal DNA ligation and amplification diagnostics.

In the Hearing Research Center Dr. Steve Colburn continued his grants from NIH to study bilateral cochlear implants in a subcontract through the Mass, Ear and Eye Institute, binaural hearing, and Core Center grant to fund research in the Hearing Research Center. Dr. David Mountain has funding from DoD/Navy for ESME Workbench Innovations. He has funding from the Woods Hole Oceanographic Institute to model mysticete hearing. Dr. Kamal Sen continued his NIH R01 award to study auditory cortical processing of communication sounds.

Student Activities and Successes: Our student societies were wonderfully active, sponsoring our 13th Annual Biomedical Engineering Day with great speakers, interview workshops, banquet and the BME Undergraduate Research Poster symposium. A large number of our undergraduates continue to work as research assistants in faculty laboratories. This year also marked the fifth year of BME’s industry sponsored Industrial Research Fellowship Program. The program provides support for the summer research of BME Juniors, who do 10 weeks of research over the summer in faculty labs and hopefully transition into a Senior Project. The BME Industrial Advisory Board was instrumental in
obtaining funding from Boston Scientific, Corning, Genzyme, Guidant, Phillips Medical, 3M, and Ethicon Inc. to sponsor this program. One of the most enjoyable and exciting moments of the past year was the 24th Annual Senior Project Conference held in May. Nearly 60 outside companies and well over 100 guests attended throughout the day, including many family members of these superb students.

Nine BME graduate students received special recognition this year. Ms. Katherine Calabro received the CIMIT Award for Translational Research in Medicine. Mr. Ari Friedland was the recipient of the BU College of Engineering Dean’s Award at the BU Science and Engineering Day 2009. Mr. Sylvain Gioux received the Gordon Research Conference “Discussion Panel on Challenges of Translating Biophotonics Technology to Clinical Practice” $300 awards. Mr. Gioux was also the recipient of a $650 travel award to the Society of Molecular Imaging Conference. Mr. Michael Kohanski received the 2008 Graduate Student Paper of the Year in Biomedical Engineering at BU in December. Ms. Pui Leng Leong received the CIMIT Fellowship for the second year. Mr. Eduard Reznik is the recipient of the Center for Biodynamics Fellowship. Ms. Corin Williams received the American Heart Association Predoctoral Fellowship (ongoing since 7/1/07). She also received a travel award to TERMIS-NA Annual Conference in San Diego, CA in December 2008. Ms. Jane Zhang received the CIMIT Graduate Student Medical Engineering Fellowship for 1/2008 through 1/2010. Ms. Zhang also won the most Innovative Research poster award at the CIMIT Innovation Congress Meeting in Boston, MA. Mr. Michael Koeris filed a patent with the BU Technology Development Office; founded a company including the technology developed in Prof. James Collins’ lab: Novophage Therapeutics, Inc. Mr. Koeris placed either first or second at the following competitions: first in the University of San Francisco Business Plan Competition (#1 of 92), second in the New Ventures World Competition at the University of Nebraska (#2 of 68), first at the Boston University ITEC 50K Business Plan Competition (#1 of 47), placed second at the Harvard Business School Business Plan Competition (#2 of 64), second at the University of California at Berkeley Business Plan Competition (#2 of 120), second at the MIT 100K Life Sciences Track (#2 of 42), and placed first at the University of Texas at Austin Global Moot Corp Challenge (#1 of 84).

**Our Vision and Goals:** Fundamental information at every level of biology and physiology is becoming available at mind-boggling rates. Such information ranges from protein structure and function, to gene, protein, and cell regulation, to micro and macro driven imaging insights on structure and material properties, to cell thru organ system dynamics. In parallel is the revolution in biomedical computation allowing much (but not yet all) of this information to be synthesized into comprehensive, structurally and mechanistically consistent models. The predictive power of these models continues to improve, and will be extraordinarily powerful in helping to develop new insights, sensors, technologies and experiments. We are at the dawn of a new era in advancing our understanding of how behavior derives from the integration of individual biological components in the context of structure. Indeed a great challenge to BME is to identify how to responsibly manage the generation and manipulation of the vast amounts of biological information that can now be acquired. One of the challenges faced in all BME programs is to bridge the gaps between basic scientific discovery and the development of new technologies that will improve the human condition. Translating such new technologies into appropriate environments to impact patient care is also a growing priority.

At BU, we continue to attract the highest quality students. Our curriculum is substantive and forward looking, and we are in the process of a comprehensive review at both the undergraduate and graduate levels to reassess our priorities, assess our strengths and indentify areas that need attention. We continue to address the challenge of creatively teaching molecular and cell biology to all bioengineers, both didactically and in the lab. We continue to infuse computation, design and translation more deeply and more seamlessly into our undergraduate and graduate curricula. Finally, we must leverage our core strengths towards a new set of large scale initiatives that cut across traditional academic and scientific boundaries. In this context, it is important to note that BME
continues to play a critical role in many of the University’s interdisciplinary initiatives. A challenge for BME going forward is to assure that we transcend these interdisciplinary initiatives and retain our unique identity.

Our success is a result of a dedicated faculty and staff that recognize teamwork as the essence of departmental success, and department success as the essence of individual success. Visitors to the department (prospective students, faculty, or visiting scientists) are struck by the degree of collaboration and cohesion apparent in the activities of our students and faculty. We are an integrated department not only within BME, but also with biology, chemistry, physics, math, computer science, and the life sciences at the medical school. Boston University has embraced this interdisciplinary excitement. Collaboration is in our DNA.

### C. Faculty Awards and Honors

<table>
<thead>
<tr>
<th>Name</th>
<th>Awards and Honors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irving Bigio</td>
<td>Honorary Guest Professor, University College London. Appointed Professor, BUSM, Department of Medicine.</td>
</tr>
<tr>
<td>Ed Damiano</td>
<td>Featured in an article in <em>USA Today</em>. Featured in a radio story broadcast on American Public Media. Friends for Life Conference Faculty.</td>
</tr>
<tr>
<td>Jim Collins</td>
<td>Howard Hughes Medical Institute Investigator Inaugural William Fairfield Warren Distinguished Professor at BU Drexel University’s Inaugural Anthony J. Drexel Exceptional Achievement Award Grand Prize, National Collegiate Inventors Competition 64th Boston University, University Lecture Boston Red Sox Medical All Star 8/29/08 Elected by the BME Students as BME Professor of the Year.</td>
</tr>
<tr>
<td>Carlo De Luca</td>
<td>Who's Who in American Education; in America; in the World; in the East; in Science and Engineering.</td>
</tr>
<tr>
<td>Maxim Frank-Kamenetskii</td>
<td>Visiting scholar at Bar Ilan University, Raman Gat, Israel.</td>
</tr>
</tbody>
</table>

| Mark Grinstaff        | Elected to the College of Fellows of the American Institute for Medical and Biomedical Engineering (AIMBE). Center for Integration of Medicine and Innovative Technology (CIMIT) Edward M. Kennedy Award for Health Care Innovation. Inaugural Distinguished Faculty Fellow of the College of Engineering. |
| Andrew Jackson        | Best Basic Science Presentation at the 2008 Scoliosis Research Society Annual Meeting |
| Simon Kasif           | Program Committee: RECOMB ISMB IJCAI. Editorial Board, IEEE/ACM Transaction on Computational Biology & BioData Mining. |
| Kamal Sen             | Chair, Auditory Session, Gordon Conference, Sensory Coding and the Natural Environment. |
| Michael Smith         | Innovation Career Development Professorship |
| Tom Szabo             | Elected Fellow of the American Institute of Ultrasound in Medicine. |
| Herb Voigt            | Organizational Service Plaque AIMBE |
| Joyce Wong            | Inaugural Distinguished Faculty Fellow of the College of Engineering. Elected as AIBME Fellow (Class of 2009) |
II. FACULTY AND STAFF

A. Faculty

The BME Department was led this year by Prof. Solomon Eisenberg as Chair. Prof. Joyce Wong served as the Associate Chair for Graduate Programs, and Prof. Steve Colburn served as the Associate Chair for Undergraduate Programs. Prof. Ed Damiano was the Director of Graduate Admissions and Prof. Amit Meller was the Director of the BME Core Facilities. Prof. Voigt served this year as the Accreditation Coordinator for Biomedical Engineering to coordinate the ABET self-study and preparations for the ABET accreditation visit in the Fall of 2009.

The Biomedical Engineering Department added two primary faculty this year increasing our number to 32. Associate Professor James Galagan joined the department on September 1, 2008 from the MIT – Broad Institute, where he was the Associate Director for the Microbial Genome Analysis and Annotation section. Dr. Galagan is jointly appointed at the Medical School in the Department of Microbiology and also is the Associate Director of the Systems Biology of Infectious Diseases Core, in the National Emerging Infectious Diseases Laboratory (NEIDL). His research area is computational genomics. The broad goal of his research is to apply genomic, computational and systems biology methods to the study of infectious disease, particularly Tuberculosis. Also joining the department last year starting July 1, 2008, is Assistant Professor Michael Smith. He comes to BU from a post-doctoral position at ETH Zurich. Dr. Smith’s research interests are in cellular mechanotransduction through the extracellular matrix; fibronectin structural biology; and microfabricated surfaces for engineering cell function.

Additionally, Dr. Dan Ehrlich joined the department in October, 2008 as a Research Professor. Dr. Ehrlich comes to us from the MIT/Whitehead Institute where he was a Principal Investigator and Director of the BioMEMS laboratory. Prior to joining the Whitehead, Dr. Ehrlich spent 18 years at MIT’s Lincoln Laboratory. He won the RW Wood prize from the Optical Society of America for “the outstanding discovery in the field of optics-1991.” Dr. Ehrlich’s research spans optics, lithography, biosensors and biomolecular assays, with a current emphasis on microfluidic instruments for high-content, high-throughput cell-based assays and deep-UV imaging. He has 23 issued patents and over 230 publications.

Early in fiscal year 2010 we will lose a long valued member of the BME Department when Temple Smith retires on August 31, 2009. He will continue his relationship with the department as a Professor Emeritus.

In FY09 the department planned to fill the positions vacated by John White and Zhiping Weng by conducting a faculty search to hire 2 new faculty in FY09. The BME faculty consensus was to search in the areas of: neuroscience/neurophysiology; biomedical optics/biophotonics; and single-molecule and cellular biophysics. Our search in FY09 yielded an exceptional group of candidates. Partly because of the richness of the field and the particular circumstances of our top candidates, we were able to make three offers, also filling the position to be vacated by Temple Smith.

Dr. Muhammad Zaman will join us August 1, 2009. Since 2006, Dr. Zaman has been an Assistant Professor in the departments of Biomedical Engineering and Cell and Molecular Biology at the University of Texas at Austin. Dr. Zaman's current research is focused on the biophysics of cell-matrix interactions in 3-D matrices.

Dr. Jason Ritt will join the department January 1, 2010. Dr. Ritt is currently a Burroughs Wellcome CASI Postdoctoral Fellow working with Dr Chris Moore in the McGovern Institute for Brain Research at MIT. Dr. Ritt's research explores how sensory processing in the brain builds upon "pre-neural computations" performed via the physical structure of the body, controlled by volitional and autonomic active sensing behaviors. He utilizes the rodent whisker tactile system in combined behavioral, electrophysiological and computational studies, including the use of cutting edge optogenetic techniques and with applications to rodent models of disease.
Dr. **Xue Han** will join the department September 1, 2010. Dr. Han is currently a Helen Hay Whitney Postdoctoral Fellow working with Drs. Edward Boyden and Robert Desimone in the Department of Biological Engineering and the McGovern Institute for Brain Research at MIT, and with Dr. Tirin Moore in the Neurobiology Department at Stanford. Xue's current research is aimed at developing radical new genetic, molecular, and optical neurotechnologies, and inventing molecularly-empowered optical neuromodulation devices and dynamic application protocols to treat neurological and psychiatric diseases.

The department added three new faculty members with secondary appointments in BME: Assistant Professor Katherine Zhang (Primary Mechanical Engineering); Assistant Professor Brandon Xia (Primary Chemistry); and Assistant Professor Satish Singh (Primary in Gastroenterology at the BU School of Medicine). The numbers of BU faculty with affiliated appointments in BME rose to **26**. BME also has **7** Adjunct Faculty, **6** Professorial-Level Research Faculty, **8** Senior Research Associates, **36** Research Associates, **12** Research Assistants, and **24** Visiting Faculty.
PRIMARY FACULTY

IRVING J. BIGIO
Professor, Biomedical Engineering, Electrical and Computer Engineering; & Physics
Ph.D., Physics, University of Michigan

Medical applications of optics, lasers and spectroscopy; biomedical optics and biophotonics; biomolecular dynamics; applied spectroscopy, especially to biomedical problems; nonlinear optics, quantum electronics and laser physics.

CHARLES R. CANTOR
Professor, Biomedical Engineering & Pharmacology
AB, Chemistry, Columbia Univ, PhD Biophysical Chemistry, Univ of California, Berkeley
LOA, CSO Sequenom Inc

Human genome analysis; molecular genetics; new biophysical tools and methodologies; genetic engineering

H. STEVEN COLBURN
Professor, Biomedical Engineering, Director, Hearing Research Center
S.B., S.M., Ph.D., Electrical Engineering, Massachusetts Institute of Technology

Measurement and modeling of binaural hearing performance. Modeling the activity of auditory brainstem neurons and measurement and modeling of spatial attributes of sound perception.

JAMES J. COLLINS
Professor, Biomedical Engineering; University Professor, Co-Director, Center for BioDynamics
A.B., Physics, College of the Holy Cross; Ph.D., Medical Engineering, University of Oxford

Synthetic biology; systems biology; engineered gene networks.

EDWARD DAMIANO
Associate Professor, Biomedical Engineering
Ph.D., Applied Mechanics, RPI; M.S., Mech Eng, Washington Univ; B.S., Biomedical Engineering, RPI

Integrated cellular and extracellular biomechanics; biofluid dynamics; microhemofluidics; microcirculation; vestibular biomechanics; non-Newtonian rheology; closed-loop blood-glucose regulation

CHARLES DELISI
Metcalf Professor of Science and Engineering; Dean Emeritus, College of Engineering
B.A., Physics, City College of New York, Ph.D., Physics, New York University

Developing and applying computational/mathematical methods, and high throughput experimental methods for inferring the structure and function of protein networks
CARLO J. DE LUCA
Professor, Biomedical Engineering & Neurology, Research Professor
Electrical and Computer Engineering; Director, NMRC; BASc, U of British Columbia, MSc, U of New Brunswick, Ph.D., Queens University (Canada)
Motor control of normal and abnormal muscles; objective evaluation of muscle fatigue, objective assessment of functional activities in humans; biosignals

MAXIM D. FRANK-KAMENETSKII
Professor, Biomedical Engineering, M.Sc., Ph.D., Biophysics, Moscow Physical-Technical Institute, Sc.D. (IVth degree), Physical and Mathematical Sciences, Institute of Chemical Engineering
DNA structures; DNA topology; DNA functioning, PNA (peptide nucleic acid)

MICAH DEMBO
Professor, Biomedical Engineering
B.S., Mathematics, Allegheny College, Ph.D., Biomathematics, Cornell University
Statistical mechanics in biological systems; cell information processing and signal transduction; thermodynamics and mechanics of cell adhesion; biophysics of cell deformation, active motility.

JAMES GALAGAN
Associate Professor, Biomedical Engineering and Microbiology, BUSM, Assoc. Dir. Systems Biology of Infectious Disease Core NEIDL, PhD Computational
Develop efficient and accurate methodologies for the analysis of genomic data, with a particular focus on infectious diseases

SOLOMON EISENBERG
Professor, Biomedical Engineering; Professor, Electrical and Computer Engineering, Assoc Dean for Undergrad Programs, College of Engineering S.B., S.M., Sc.D., Electrical Engineering, MIT
Electrically mediated phenomena in tissues and biopolymers; cartilage biomechanics; computational modeling of electric field distributions in the human thorax and heart during defibrillation; transcranial magnetic stimulation

TIM GARDNER
Assistant Professor, Biomedical Engineering Ph.D., Biomedical Engineering, Boston University; B.S., Mechanical Engineering, Princeton University LOA Amyris Biotech.
Gene circuit mapping, modeling and engineering; bacterial stress response and virulence regulatory circuits; metabolic network mapping/modeling; microbial energy production; microarray expression analysis; drug mechanism of action.

EVAN EVANS
Professor, Biomedical Engineering B.S., M.S., Engineering Physics, Rensselaer Polytechnic Institute, Ph.D., Engineering Science, University of CA at San Diego
Nano-microscale biomechanics; ultrasensitive force probes and extreme resolution optical techniques; material properties of cellular structure; role of structural forces in cell biochemistry

MARK GRINSTAFF
Associate Professor, Biomedical Engineering & Chemistry Ph.D., University of Illinois at Urbana-Champaign; A.B., Chemistry Honors, Occidental College
Biomaterials, tissue engineering, drug delivery, macromolecular chemistry and engineering, self-assembly, nanodevices
SIMON KASIF  
Professor, Biomedical Engineering  
B.Sc., Mathematics, Tel Aviv University; M.S. & PhD, Computer Science, University of Maryland  
Bioinformatics, Computational Genomics, Algorithm Design, Artificial Intelligence, High Performance Systems

ANDREW C. JACKSON  
Professor, Biomedical Engineering  
B.S., M.S., Mechanical Engineering, University of Nevada, Ph.D., Biophysics and Physiology, University of Mississippi Medical School  
Respiratory physiology; respiratory mechanics, role of airway closure in asthma

DAVID C. MOUNTAIN  
Professor, Biomedical Engineering & Otolaryngology  
B.S., Electrical Engineering, Massachusetts Institute of Technology, M.S., Ph.D., Electrical Engineering, University of Wisconsin  
Auditory information processing; sensory biophysics; computer simulation; biomedical electronics; biomedical signal processing; environmental engineering

KENNETH R. LUTCHEN  
Professor, Biomedical Engineering, Dean, College of Engineering  
B.S., Engineering Science, University of Virginia, M.S., Ph.D., Biomedical Engineering, Case Western  
Airway and lung tissue mechanics and ventilation; Computational modeling of structure-function relations in the lung; Mechanical ventilation; Integrated biomechanics of the lung; linear and nonlinear systems identification.

AMIT MELLER  
Associate Professor, Biomedical Engineering;  
Ph.D., Physics, Weizmann Institute of Science, Rehovot Israel, Msc, Pysics Weizmann Institute of Science, Rehovot Israel  
nanopore force spectroscopy of RNA folding kinetics, DNA switches and transcription initiation kinetics, RNA helicase activity, transcription factor/DNA interaction ultra fast DNA sequencing optical methods for single molecule detection

KAMAL SEN  
Associate Professor, Biomedical Engineering;  
Ph.D., Physics, Bates College, M.A., Ph.D., Physics, Brandeis University  
Electrophysiological recording of neural responses in auditory processing, theoretical methods to characterize neuronal encoding, computational models of natural sound processing

JEROME MERTZ  
Associate Professor, Biomedical Engineering & Physics  
Ph.D., Physics, Université Paris VI & University of California, Santa Barbara, B.A., Physics Princeton University  
Development and application of new optical microscopy techniques to biological imaging

CHRIS PASSAGLIA  
Assistant Professor, Biomedical Engineering  
Ph.D., Biomedical Engineering and Neuroscience, Syracuse University; B.S., Biomedical Engineering, University of Iowa  
Visual information processing and transmission; retinal physiology in normal and diseased states; computational models of neural coding, visual prostheses
CASSANDRA L. SMITH  
Professor, Biomedical Engineering; Biology, & Pharmacology, B.A., Biology & M.S., Medical Microbiology, West Virginia University Medical School, Ph.D., Genetics, Texas A&M University

Molecular Biotechnology and Genomics

BÉLA SUKI  
Professor, Biomedical Engineering  
M.S., Physics, and Ph.D., Biomechanics, Joszef Attila University, Szeged (Hungary)

Mechanical properties of living tissues; modeling the dynamic and nonlinear behavior of complex biological systems; pulmonary physiology

MICHAEL L SMITH  
Assistant Professor, Biomedical Engineering  
B.S. Mechanical Engineering University of Memphis, M.S. & Ph.D., Biomedical Engineering, University of Virginia, 2004

Cellular mechanotransduction through the extracellular matrix; fibronectin structural biology; and microfabricated surfaces for engineering cell function.

JOE TIEN  
Associate Professor, Biomedical Engineering, B.S., Physics, B.S., Mathematics, University of California, Irvine, A.M., Ph.D., Physics, Harvard University

Microvascular tissue engineering; microvascular physiology; hydrogels

TEMPLE F. SMITH  
Professor, Biomedical Engineering; Director, BioMolecular Engineering Research Center; B.S., Physics, Purdue Univ, Ph.D., Nuclear Physics, University of Colorado

The syntactic and semantic structure of the genetic information in biomolecular sequences, structures, and their evolution

LUCIA M. VAINA  
Professor, Biomedical Engineering & Neurology, MS, U. Timisoara and Urbino; PhD Mathematical Logic, Sorbonne, Doctorat d'Etat ès Sciences & Médecine (Neurologie), Human & Computational Vision, Institut National Polytechnique de Toulouse

Computational visual neuroscience; biological and computational learning; functional and structural neuroimaging

DIMITRIJE STAMENOVIĆ  
Associate Professor, Biomedical Engineering  
Dipl. Ing., Mechanical/ Aeronautical Engineering, University of Belgrade (Yugoslavia), M.S., Ph.D., Mechanics, University of Minnesota

Respiratory mechanics; cell mechanics; rheology of soft tissues; mechanics of foam-like structures

SANDOR VAJDA  
Professor, Biomedical Engineering, MSc, Electrical Eng, Gubkin Institute (Former USSR), MSc, Applied Mathematics, Eötvös Lorand Univ (Hungary), PhD, Chemistry, Hungarian Academy of Sci

Scientific computing applied to problems in engineering, biochemistry, and biology, with focus on molecular mechanics, protein structure determination, protein-ligand interactions, docking, and drug design
B. Affiliated Faculty

HERBERT F. VOIGT
Professor, Biomedical Engineering; Associate Research Professor, Otolaryngology, School of Medicine, Ph.D., Biomedical Engineering, Johns Hopkins University B.E. (E.E.), City College of New York
Auditory neurophysiology; neural circuitry; neural modeling

JOYCE WONG
Associate Professor, Biomedical Engineering SB, Materials Science and Engineering, MIT, Ph.D., Materials Science and Engineering, Program in Polymer Science and Technology, MIT
Biomaterials, tailoring cell-material interfaces for drug delivery and tissue engineering applications; direct, quantitative measurement of biological interactions

HERBERT F. VOIGT
Professor, Biomedical Engineering; Associate Research Professor, Otolaryngology, School of Medicine, Ph.D., Biomedical Engineering, Johns Hopkins University B.E. (E.E.), City College of New York
Auditory neurophysiology; neural circuitry; neural modeling

JOYCE WONG
Associate Professor, Biomedical Engineering SB, Materials Science and Engineering, MIT, Ph.D., Materials Science and Engineering, Program in Polymer Science and Technology, MIT
Biomaterials, tailoring cell-material interfaces for drug delivery and tissue engineering applications; direct, quantitative measurement of biological interactions

PIERRE DUPONT
Professor Primary Appointment Mechanical Engineering BS, MS, PhD, Mechanical Engineering Rensselaer Polytechnic Institute, 1988
Robot kinematics, dynamics and control. Medical Applications of robotics. Image Guidance of minimally invasive surgery.

SHYAMSUNDER ERRAMILLI
Professor Primary Appointment Physics BS, University of Pune; MS Indian Institute of Technology, PhD, University of Illinois, 1986
High-resolution infrared microscopy for studying biological systems.

THOMAS A. EINHORN
Professor Primary Appointment Orthopedic Surgery BUSM (Chair) MD, Cornell University Medical College, 1976.
Hip and knee replacement and reconstructive surgery, treatment of metabolic disease, orthopaedic trauma surgery, the biology of skeletal repair and regeneration

BENNETT GOLDBERG
Professor Primary Appointment Physics MS, PhD, Physics, Brown University; BA, Harvard University, 1987.
Experimental condensed-matter physics and polymer physics
LEONARD GOLDSBURY
Professor
Primary Appointment
Psychiatry BUSM
BA Columbia University,
MD and PhD Yale
University 1994.
Understanding the role of abnormal protein
aggregation in chronic degenerative disorders of
aging including Alzheimer’s disease, age-related
cataracts, and other diseases that involves
pathogenic protein aggregation.

STEPHEN
GROSSBERG
Professor
Primary Appointment
Wang Professor of
Cognitive and Neural
Systems, Founding
Chair, Dept of Cognitive
and Neural Systems
Ph.D., Mathematics,
Rockefeller University
Vision, audition, language, learning and memory,
reward and motivation, cognition, development,
sensory-motor control, mental disorders

JAMES A. HAMILTON
Professor
Primary Appointment
Research Professor of
Medicine Physiology and
Biophysics, BUSM
novel approaches to biomedical problems by
integrating physical-chemical and
physiological/biochemical approaches
complemented with molecular modeling,
molecular biology and other cell biology methods

ALLYN E. HUBBARD
Professor
Primary Appointment
Electrical and Computer
Engineering
B.S., M.S., Ph.D., Electrical
Engineering, University of
Wisconsin
Auditory physiology; experiments and modeling;
neurocomputing; VLSI in biomedical applications;
biosensors.

W. CLEMENT KARL
Professor
Primary Appointment
Electrical and Computer
Engineering
S.B., S.M., Ph.D., Electrical
Engineering and Computing
Science, MIT
Multiresolution statistical signal and image
processing; geometric estimation.

CATHERINE
KLAPPERICH
Assistant Professor
Primary Appointment
Disposable Diagnostics, Nanomechanics of
hydrated biomaterials, biocompatibility at the cell-
biomaterial interface, tissue engineering scaffold
and microfluidic device design.

NANCY KOPPEL
Professor
Primary Appointment
Dynamics of the nervous system especially
rhythmic behavior of networks of neurons, how
dynamical properties of local networks help to
filter and transform the patterned input from other
parts of the nervous system.

ELISE F. MORGAN
Assistant Professor
Primary Appointment
Mechanical behavior of biological materials;
mechanical stimulation of tissue differentiation;
micromechanics of multiscale media; damage
mechanics
MATTHEW NUGENT  
Professor  
Primary Appointment  
Departments of  
Biochemistry and  
Ophthalmology BUSM  
BA & PhD, Biochemistry  
Brandies University  

Response of tissues to injury and disease, design and use of polymer-based controlled drug delivery systems, tissue engineering, and the development of computational models of dynamic biological processes.

HAMID NAWAB  
Professor  
Primary Appointment  
Electrical and Computer Engineering,  
PhD, SM, SB, Electrical Engineering, MIT  

Computational signal processing, analysis of brain signals, analysis of patient activity signals, analysis of auditory signals.

MATTHW NUGENT  
Professor  
Primary Appointment  
Departments of  
Biochemistry and  
Ophthalmology BUSM  
BA & PhD, Biochemistry  
Brandies University  

Response of tissues to injury and disease, design and use of polymer-based controlled drug delivery systems, tissue engineering, and the development of computational models of dynamic biological processes.

MICHELE RUCCI  
Associate Professor  
Primary Appointment  
Psychology  
Laure Degree Electrical Engineering, University of Florence, PhD Biomedical Engineering, Scuola Superiore S. Anna, Pisa, 1995  

Integrating experiments in visual psychophysics with computational models of the brain and the embodiment of neuronal models in robotic systems.

MATTHEW NUGENT  
Professor  
Primary Appointment  
Departments of  
Biochemistry and  
Ophthalmology BUSM  
BA & PhD, Biochemistry  
Brandies University  

Response of tissues to injury and disease, design and use of polymer-based controlled drug delivery systems, tissue engineering, and the development of computational models of dynamic biological processes.

TYRONE PORTER  
Assistant Professor  
Primary Appointment  
Mechanical Engineering  
BS Electrical Engineering, Prairie View A&M Univ.,  
PhD Bioengineering, Washington University  

New ultrasound technologies and novel chemical formulations for assessing tissue perfusion, targeted contrast enhancements of diseases in ultrasound images, improving uptake and activity of drugs while reducing adverse side effects.

MICHELE RUCCI  
Associate Professor  
Primary Appointment  
Psychology  
Laure Degree Electrical Engineering, University of Florence, PhD Biomedical Engineering, Scuola Superiore S. Anna, Pisa, 1995  

Integrating experiments in visual psychophysics with computational models of the brain and the embodiment of neuronal models in robotic systems.

EUGENE STANLEY  
Professor  
Primary Appointment  
Physics  
BA Wesleyan University,  
PhD Harvard University, 1967  

Application of statistical physics to understanding and preventing diseases related to protein misfolding; to better understand economic questions (Econophysics), physical mechanisms in liquid water; and threat networks and threatened networks.
MATTHEW WACHOWIAK  
Assistant Professor  
Primary Appointment  
Biology  
BS Zoology, Duke University; PhD Neuroscience, University of Florida

MATTHEW WACHOWIAK  
Assistant Professor  
Primary Appointment  
Biology  
BS Zoology, Duke University; PhD Neuroscience, University of Florida

MALVIN CARL TEICH  
Professor  
Primary Appointment  
Electrical and Computer Engineering  
SB, Physics, MIT; MS, Electrical Engineering, Stanford University, PhD, Electrical Engineering, Cornell University

MALVIN CARL TEICH  
Professor  
Primary Appointment  
Electrical and Computer Engineering  
SB, Physics, MIT; MS, Electrical Engineering, Stanford University, PhD, Electrical Engineering, Cornell University

BRANDON (YU) XIA  
Assistant Professor  
Primary Appointment  
Chemistry  
BS Chemistry, Peking University; PhD Chemistry, Stanford University, 2003

BRANDON (YU) XIA  
Assistant Professor  
Primary Appointment  
Chemistry  
BS Chemistry, Peking University; PhD Chemistry, Stanford University, 2003

SELIM UNLU  
Professor  
Primary Appointment, Electrical and Computer Engineering  
PhD, Electrical Engineering, University of Illinois, Urbana-Champaign

SELIM UNLU  
Professor  
Primary Appointment, Electrical and Computer Engineering  
PhD, Electrical Engineering, University of Illinois, Urbana-Champaign

KATHERINE ZHANG  
Assistant Professor  
Primary Appointment  
Mechanical Engineering  
BEng, Tsinghua University; MS & PhD Mechanical Engineering, University of Colorado, Boulder, 2003

KATHERINE ZHANG  
Assistant Professor  
Primary Appointment  
Mechanical Engineering  
BEng, Tsinghua University; MS & PhD Mechanical Engineering, University of Colorado, Boulder, 2003

MARTIN STEFFEN  
Assistant Professor  
Primary Appointment  
Genetics and Genomics  
BUSM  
BA Chemistry, Dartmouth College; MD/PhD Chemistry, Stanford University

MARTIN STEFFEN  
Assistant Professor  
Primary Appointment  
Genetics and Genomics  
BUSM  
BA Chemistry, Dartmouth College; MD/PhD Chemistry, Stanford University

Tools of systems biology for mammalian cells, technique of mass spectrometry, identifying post-translational modifications, characterizing proteomic differences.

Tools of systems biology for mammalian cells, technique of mass spectrometry, identifying post-translational modifications, characterizing proteomic differences.

Wavelet analysis of fractal biological signals; neural coding; auditory and visual psychophysics; quantum imaging.

Wavelet analysis of fractal biological signals; neural coding; auditory and visual psychophysics; quantum imaging.

Optical characterization and nanophotonics, solid-state and biological phenomena at the nanoscale.

Optical characterization and nanophotonics, solid-state and biological phenomena at the nanoscale.

Computational structural and systems biology; develop computational techniques to model the structure, function, and evolution of complex biomolecular systems, such as proteins and protein networks.

Computational structural and systems biology; develop computational techniques to model the structure, function, and evolution of complex biomolecular systems, such as proteins and protein networks.

Novel approaches to biomedical problems by integrating physical-chemical and physiological/biochemical approaches complemented with molecular modeling, molecular biology and other cell biology methods.

Novel approaches to biomedical problems by integrating physical-chemical and physiological/biochemical approaches complemented with molecular modeling, molecular biology and other cell biology methods.
C. Research Faculty

NATALIA BROUDE
Research Associate
Professor, Biomedical Engineering
BS, MS Organic Chemistry, Moscow State University;
PhD, Organic Chemistry,
DSci Molecular Biology, Inst of Bioorganic Chemistry
Functional genomics, structure/function relationships in nucleic acids, development of advanced methods for genomic studies.

MARC HERANT
Research Assistant
Professor, Biomedical Engineering
Ph. D. Harvard University 1992; M.D., Washington University School of Medicine 2000
Modeling of cell shape and motion: dynamics of the lamella, dynamics of endocytosis; theoretical and numerical studies of fluid flow.

MARIO CABODI
Research Assistant
Professor, Biomedical Engineering
Ph. D. Cornell University, 2003, M. Sc. Imperial College of Science and Technology, London, UK
Microfluidic devices; tissue engineering, and biomaterials

DMYTRO KOZAKOV
Research Assistant
Professor, Biomedical Engineering
BS & MS Applied Math and Physics, Moscow Inst of Physics and Tech; PhD Biomedical Engineering Boston University 2006
development of: protein-protein and protein-ligand docking algorithms, fast and efficient scoring functions for screening large number of potential docked complexes, protein homology models suitable for docking

THOMAS L. SZABO
Research Professor, Biomedical Engineering
PhD, Physics, University of Bath, UK; MS, Electrical Engineering, University of Rochester; BS, Electrical Engineering, University of Virginia School of Medicine
Medical imaging, diagnostic ultrasound, tissue characterization, transduction, biomedical signal processing, wave propagation, nonlinear acoustics

DANIEL EHRlich
Research Professor,
Biomedical Engineering
B.S. Physics, Ph.D.
Optical Engineering, University of Rochester, 1977
Optics, lithography, biosensors and biomolecular assays, with a current emphasis on microfluidic instruments for high-content, high-throughput cell-based assays and deep-UV imaging.

SENIOR RESEARCH ASSOCIATES
Ousama A’amari (Bigio)
Cyrus Billimoria, (Sen)
Oded Ghizta (Kopell)
Bret Isenberg, (Wong)

Heiko Kuhn (Frank-Kamenetskii)
David O’Gorman (Colburn)
Remus Osan (Kopell)
Irina Smolina (Frank-Kamenetskii)
RESEARCH ASSOCIATES
Ascanio Araujo, (Suki)
Evrim Atas (Meller)
Qasim Beg (Segre)
Dimitri Beglov (Vajda)
Mark Brynildsen (Collins)
Diogo Camacho (Collins)
Deokeei Chon (Lutchen)
Ruby De La Torre (Meller)
Jaephil Do (Klapperich)
Daniel Dwyer (Collins)
Firas El-Khatib (Damiano)
Tom Ellis (Collins)
Aysegul Ergin (Bigio)
James Flanigon (Kasif)
Gilberto Grana (Passaglia)
Daniela Hristova (Broude)
Edwin Idoux (Mertz)
Ahmad Khalil (Collins)
Min Cheol Kim (Klapperich)
Igor Kuznetsov (Evans)
Hu Li (Collins)
Madhumita Mahalanabis (Klapperich)
Olga Mineava, (Goldstein)
Michael Molla (Collins)
Ruben J. Morones (Collins)
Herin Oh (C. Smith)
Harikrishnan Parameswaran (Suki)
Susumu Sato (Suki)
Moaz Shamir (Colburn)
Gautam Soni (Meller)
Jason Vertrees (Kasif)
Xiao Wang, (Collins)
Meni Wanunu (Meller)
Ragnild Whitaker (Wong)
Terrence Wu (Kasif)
Zhiliang Yu (Meller)

RESEARCH ASSISTANTS
David Anderson (Mountain)
Andrew Brughera (Colburn)
Ae Ja Chung (Vaina)
John Jiang (Damiano)
Frank Juhn (Collins)
Elizabeth McClaine (Sen)
Hemal Mehta (Jackson)
Ilaria Mogno (Gardner)
Kamila Naxerova (Kasif)
Silvia Santos (Mertz)
Alan Stockdale (Bigio)
Aleks Zosuls (Mountain)

D. Adjunct Faculty
Frank Guarnieri, Adjunct Professor
- Ph. D. New York University, 1996
- Chief Technology Officer, Solmap Pharmaceuticals Inc
- Course development and research collaboration with Prof Sandor Vajda

Hernan Jara, Adjunct Associate Professor
- Ph.D. University of Illinois at Chicago, 1985
- Assoc. Prof. or Radiology and Director of Radiological Sciences Boston Medical Center
- Teaches BE515, Intro to Medical Imaging, 1998

Arthur Rosenthal, Adjunct Professor of Translational Bioengineering
- Ph. D. University Mass, Amherst, 1973
- Former Chief Scientific Office and Senior Vice President, Boston Scientific Corp.
- Chair, Industrial Advisory Board. Teaches BE467, since 2004

Alexis Sauer-Budge Adjunct Research Assistant Professor
- Ph. D. Harvard University 2002
- Senior Scientist, Fraunhofer Center for Manufacturing Innovation.
- Research Collaboration with BME faculty and supervises students.
Stelios Smirnakis, Adjunct Assistant Professor
- Ph. D. Harvard University, 1997; M. D. Harvard Medical School, 1997
- Clinical Fellow in Neurointensive Care and Stroke Neurology at Mass General Hospital
- Supervises Students and collaborates on research in the Brain and Vision Research Lab.

Zhiping Weng, Adjunct Professor
- Ph.D. Boston University, 1997
- Professor and Chair, Bioinformatics Department, University of Massachusetts Medical Center
- Research collaborations with BME faculty and supervises BME Graduate Students

E. Visiting Faculty

Baltazar Aguda, Visiting Scholar, Senior Research Scientist, Bioinformatics Institute, Singapore.

Scott Beardsley, Visiting Research Asst Professor, Assistant Professor, Marquette University

Fouad Berrada, Visiting Scholar, Associate Professor Al Akhawayn University, Morocco

Gianluca Campana, Visiting Scholar, Assistant Professor of Psychology, University of Padova, Italy

Michel Camplo, Visiting Scholar, Lecturer in Medicinal Chemistry, Laboratory of Molecular Materials and Biomaterials, UMR-CNRS

Mark Dipresto, Visiting Scholar, Research Fellow, Harvard University

Paul DiMilla, Visiting Scholar, Senior Staff Engineer, Research & Development, Organogenisis Inc. Canton MA

John White, Adjunct Professor
- Ph. D. Johns Hopkins University, 1990
- Professor of Biomedical Engineering, University of Utah
- Research collaborations with BME faculty and supervises BME graduate students

Nathaniel Durlach, Visiting Scholar, Research Scientist, Massachusetts Institute of Technology

Robert Gilkey, Visiting Scholar, Associate Professor of Psychology, Wright State University.

Gobbi, Alessandro, Visiting Scholar, PhD Student in Biomedical Engineering at the Politecnico di Milano university, Milan, Italy.

William Hartman, Visiting Scholar, Professor of Physics, Michigan State University.

Hayette, Boris, Visiting Scholar, Senior Research Scientist, Gene Network Sciences, Cambridge, MA.

Heiko Hecht, Visiting Professor, Professor of Experimental Psychology, Johannes Gutenberg-Universitat Mainz

Hyam Gu Kang, Visiting Scholar, Senior Research Scientist, Institute for Aging Research Hebrew Senior Life, Harvard
Michael Kohanski, Visiting Scholar, MD
Student BU School of Medicine.

Tim Kwan-Ta Lu, Visiting Scholar, PhD
student, Harvard and MIT HST Medical
Engineering/Medical Physics Program

Giuseppe Marasco, Visiting Scholar,
Neurologist, Neurological Unit-Stroke Unit,
Ospedale Centro Traumatologico Ortopedico,
Naples (Italy).

Marina Marinkovic, Visiting Scholar,
Research Associate, MIPS, Department of
Environmental Health, Harvard School of
Public Health

Rossen Mirachev, Visiting Scholar, Research
Associate, Department of BCMP, Harvard
Medical School

Robert Pitts, Visiting Scholar, Consultant

Constance Royden, Visiting Res Assoc
Professor. Associate Professor, Mathematics
and Computer Science, College of the Holy
Cross

Leonardo Sassi, Visiting Scholar, Graduate
Student, University of Bologna

Rahim Shafa, Visiting Scholar, Scientific
Director, MeroWest & Greater Boston CRC,
Milford MA

Ruxandra Sireteanu, Visiting Scholar,
Professor, Physiological Psychology,
University of Frankfurt, Germany.

F. Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen, Phil</td>
<td>Senior Engineer/Instructor, Manager, Micro/Nano Imaging Core Facility</td>
</tr>
<tr>
<td>Bailey, Christen</td>
<td>Undergraduate Programs Coordinator.</td>
</tr>
<tr>
<td>Barber, Matthew</td>
<td>Director</td>
</tr>
<tr>
<td>Brown, David</td>
<td>BME Placement Coordinator</td>
</tr>
<tr>
<td>Brown, Xin</td>
<td>Manager, Biointerface Technologies Core Facility</td>
</tr>
<tr>
<td>Broude, Natalia</td>
<td>Senior Engineer/Instructor BE505 Lab</td>
</tr>
<tr>
<td>Butler, Joan</td>
<td>Center Administrator, CBD</td>
</tr>
<tr>
<td>Calieri, Jason</td>
<td>Financial Manager</td>
</tr>
<tr>
<td>Dolan, Debbie</td>
<td>Financial Manager</td>
</tr>
<tr>
<td>Feit, Ze’ev</td>
<td>Senior Engineer/Instructor, Manager of Clean Room Core Facility</td>
</tr>
<tr>
<td>Marron, Jen</td>
<td>Administrative Director for Research</td>
</tr>
<tr>
<td>McDonald, Tara</td>
<td>Senior Program Coordinator</td>
</tr>
<tr>
<td>Newhall, Susan</td>
<td>Senior Program Coordinator</td>
</tr>
<tr>
<td>Orzechowski, Irene</td>
<td>Financial Manager</td>
</tr>
<tr>
<td>Palmer, Mary-Ellen</td>
<td>Administrative Assistant to the Chair</td>
</tr>
<tr>
<td>Pratt, Raven</td>
<td>Center Administrator, HRC</td>
</tr>
<tr>
<td>Sands, Nancy</td>
<td>Center Administrator, BMERC/CAB</td>
</tr>
<tr>
<td>Smith, Maureen</td>
<td>Academic Programs Manager</td>
</tr>
<tr>
<td>Thompson, Luke</td>
<td>Coulter Administrator</td>
</tr>
<tr>
<td>Wilson, Jenn</td>
<td>HHMI Administrative Manager</td>
</tr>
</tbody>
</table>
III. UNDERGRADUATE PROGRAM

A. Enrollment

The BME Department had 421 students enrolled this year, 36% of the total enrollment of the College of Engineering. The percent of female and male students was 42% and 58%, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>55</td>
<td>61</td>
<td>116</td>
<td>88</td>
<td>218</td>
<td>306</td>
</tr>
<tr>
<td>Sophomore</td>
<td>50</td>
<td>56</td>
<td>106</td>
<td>88</td>
<td>237</td>
<td>325</td>
</tr>
<tr>
<td>Junior</td>
<td>36</td>
<td>58</td>
<td>94</td>
<td>65</td>
<td>196</td>
<td>261</td>
</tr>
<tr>
<td>Senior</td>
<td>34</td>
<td>71</td>
<td>105</td>
<td>65</td>
<td>208</td>
<td>273</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>175</td>
<td>246</td>
<td>421</td>
<td>306</td>
<td>859</td>
<td>1165</td>
</tr>
</tbody>
</table>

Figure 1. BME Enrollment History

B. Degrees Awarded

The Department awarded 96 Bachelor of Science degrees this academic year, a 23% increase from academic year 07-08 and 37% of all the BS degrees awarded by the college this academic year.

<table>
<thead>
<tr>
<th>BS DEGREES</th>
<th>BME</th>
<th>COLLEGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>96</td>
<td>257</td>
</tr>
</tbody>
</table>
C. **Courses Offered**

The BME department was responsible for teaching 55 courses during the 2008/2009 academic year. These courses and their enrollments are listed in the table below. The student credit hours for these courses total 6,613. The trend in credit hours taught over the past ten years is illustrated in Figure 2.

![Figure 2. Biomedical Engineering Teaching History](image-url)
BME Courses Offered for Academic Year 2008 – 2009

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Department Course Names</th>
<th>Course Instructor(s)</th>
<th>Enrollment Fall08</th>
<th>Enrollment Sprg09</th>
<th>Total Cr. Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 200</td>
<td>Introduction to Probability</td>
<td>Sen/A'amar</td>
<td>57</td>
<td>64</td>
<td>242</td>
</tr>
<tr>
<td>BE 209</td>
<td>Principles of Molecular Cell Biology and Biotech</td>
<td>Steffen/Brown</td>
<td>81</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>BE 401</td>
<td>Signals and Systems in BME</td>
<td>Colburn/Voigt</td>
<td>101</td>
<td></td>
<td>404</td>
</tr>
<tr>
<td>BE 402</td>
<td>Control Systems in BME</td>
<td>Collins</td>
<td></td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>BE 420</td>
<td>Introduction to Solid Biomechanics</td>
<td>Stamenovic</td>
<td>19</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>BE 436</td>
<td>Fundamentals of Fluid Mechanics</td>
<td>Damiano</td>
<td>97</td>
<td>388</td>
<td></td>
</tr>
<tr>
<td>BE 451</td>
<td>Directed Study</td>
<td>Faculty</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>BE 465</td>
<td>BME Senior Project</td>
<td>Bigio/Szabo</td>
<td>95</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>BE 466</td>
<td>BME Senior Project</td>
<td>Bigio</td>
<td>1</td>
<td>95</td>
<td>384</td>
</tr>
<tr>
<td>BE 467</td>
<td>Entrepreneurship in BME</td>
<td>Szabo</td>
<td>98</td>
<td>196</td>
<td></td>
</tr>
<tr>
<td>BE 491</td>
<td>Engineering Physiology Lab I</td>
<td>Passaglia</td>
<td>101</td>
<td>202</td>
<td></td>
</tr>
<tr>
<td>BE 492</td>
<td>Engineering Physiology Lab II</td>
<td>Jackson</td>
<td>92</td>
<td>184</td>
<td></td>
</tr>
<tr>
<td>BE 500</td>
<td>Special Topics in Biomedical Engineering</td>
<td>Galagan/Mountain</td>
<td>1</td>
<td>13</td>
<td>56</td>
</tr>
<tr>
<td>BE 505</td>
<td>Molecular Bioengineering I</td>
<td>Vajda/Broude</td>
<td>38</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td>BE 506</td>
<td>Cell Structure and Machinery</td>
<td>Evans/Meller</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>BE 509</td>
<td>Quantitative Physiology of the Auditory System</td>
<td>Shinn-Cunningham</td>
<td>17</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>BE 511</td>
<td>Biomedical Instrumentation</td>
<td>Mountain</td>
<td>19</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>BE 515</td>
<td>Introduction to Medical Imaging</td>
<td>Jara</td>
<td>54</td>
<td>216</td>
<td></td>
</tr>
<tr>
<td>BE 517</td>
<td>Optical Microscopy of Biological Materials</td>
<td>Allen/Mertz</td>
<td>17</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>BE/ME 521</td>
<td>Continuum Mechanics</td>
<td>Stamenovic</td>
<td>17</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>BE/ME/MS 523</td>
<td>Mechanics of Biomaterials</td>
<td>Klapperich</td>
<td>59</td>
<td>236</td>
<td></td>
</tr>
<tr>
<td>BE 526</td>
<td>Fundamentals of Biomaterials</td>
<td>Grinstaff/Wong</td>
<td>8</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>BE 527</td>
<td>Principles &amp; Applications of Tissue Engineering</td>
<td>Grinstaff/Wong</td>
<td>8</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>BE 560</td>
<td>Biomolecular Architecture</td>
<td>T. Smith</td>
<td>21</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>BE 561</td>
<td>DNA &amp; Protein Sequence Analysis</td>
<td>Kasif</td>
<td>20</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>BE 564</td>
<td>Biophysics of Large Molecules</td>
<td>Frank-Kamenetskii</td>
<td>9</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>BE 566</td>
<td>DNA Structure and Function</td>
<td>Frank-Kamenetskii</td>
<td>14</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>BE 567</td>
<td>Nonlinear Systems in Biomedical Engineering</td>
<td>Suki</td>
<td>27</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>BE 570</td>
<td>Introduction to Computational Vision</td>
<td>Vaina</td>
<td>7</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>BE 703</td>
<td>Numerical Methods &amp; Modeling</td>
<td>Damiano</td>
<td>27</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>BE 706</td>
<td>Quantitative Physiology for Engineers</td>
<td>Passaglia</td>
<td>29</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>BE 707</td>
<td>Quantitative Studies of Excitable Cells</td>
<td>Sen</td>
<td>7</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>BE/ME/MS 726</td>
<td>Fundamentals of Biomaterials</td>
<td>Grinstaff/Wong</td>
<td>19</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>BE/ME/MS 727</td>
<td>Principles &amp; Applications of Tissue Engineering</td>
<td>Grinstaff/Wong</td>
<td>15</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>BE 747</td>
<td>Advanced Topics in Signals and Systems</td>
<td>Colburn</td>
<td>11</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>BE/EC 785</td>
<td>Biomedical Optics &amp; Biophotonics</td>
<td>Mertz</td>
<td>18</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>BE 768</td>
<td>Biological Database Design</td>
<td>Benson</td>
<td>24</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>BE 777</td>
<td>Computational Genomics</td>
<td>Xia</td>
<td>14</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>BE 790</td>
<td>BME Engineering Seminar</td>
<td>Wong</td>
<td>35</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>BE 791</td>
<td>Ph.D. BME Lab Rotation</td>
<td>Wong</td>
<td>20</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>BE 801</td>
<td>BME Teaching Practicum</td>
<td>Wong</td>
<td>5</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>BE 900</td>
<td>Research</td>
<td>Faculty</td>
<td>104</td>
<td>100</td>
<td>731</td>
</tr>
<tr>
<td>BE 951</td>
<td>Independent Study</td>
<td>Faculty</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>Jackson</td>
<td>31</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>C. Smith</td>
<td>13</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>Vajda</td>
<td>38</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>Vaina</td>
<td>25</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>Voigt</td>
<td>16</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>EK 131/132</td>
<td>Introduction to Engineering</td>
<td>Wong</td>
<td>40</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>EK 424</td>
<td>Thermodynamics and Statistical Mechanics</td>
<td>M. Smith</td>
<td>107</td>
<td>428</td>
<td></td>
</tr>
</tbody>
</table>

Total Credit Hours Taught (2008-2009): 6613
D. Mission, Objectives and Outcomes

<table>
<thead>
<tr>
<th>Mission Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Mission of the Biomedical Engineering Department is to pursue excellence in biomedical engineering education, research, and innovation; creating and imparting knowledge for improving society, human health, and health care. To achieve our educational mission, we cultivate our students’ problem-solving and communication skills, nurture their creativity, promote their ability to think critically and independently, and help them to understand scientific and engineering approaches.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Educational Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduates of our undergraduate program are expected:</td>
</tr>
<tr>
<td>• to become successful practitioners of biomedical engineering or other professions (e.g., medicine, law, management) drawing upon and guided by their knowledge of biomedical engineering;</td>
</tr>
<tr>
<td>• to continue improving and expanding their technical and professional skills through formal or informal means (e.g., continuing education and training, attending conferences, learning new tools and methods); and</td>
</tr>
<tr>
<td>• to contribute to community and professional groups using the unique</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) An ability to apply knowledge of mathematics, science and engineering;</td>
</tr>
<tr>
<td>b) An ability to design and conduct experiments, analyze and interpret data;</td>
</tr>
<tr>
<td>c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, healthy and safety, manufacturability and sustainability;</td>
</tr>
<tr>
<td>d) An ability to function on multi-disciplinary teams;</td>
</tr>
<tr>
<td>e) An ability to identify, formulate and solve engineering problems;</td>
</tr>
<tr>
<td>f) An understanding of professional and ethical responsibilities;</td>
</tr>
<tr>
<td>g) An ability to communicate effectively;</td>
</tr>
<tr>
<td>h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context;</td>
</tr>
<tr>
<td>i) A recognition of the need for, and an ability to engage in life-long learning;</td>
</tr>
<tr>
<td>j) A knowledge of contemporary issues;</td>
</tr>
<tr>
<td>k) An ability to use techniques, skills, and modern engineering tools necessary for engineering practice;</td>
</tr>
<tr>
<td>l) An understanding of biology and physiology;</td>
</tr>
<tr>
<td>m) The ability to supply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology;</td>
</tr>
<tr>
<td>n) The ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undergraduate Committee:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The primary responsibility of the Department's Undergraduate Committee is to oversee the undergraduate curriculum in Biomedical Engineering. As such, the committee serves as the focal point for continued review and further development of the undergraduate programs. Professor Steve Colburn served as the Associate Chair for Undergraduate Programs starting September 1, when he succeeded Professor Voigt, who was appointed the Accreditation Coordinator for Biomedical Engineering. In his capacity as Undergraduate Associate Chair, Professor Colburn was the Chair of</td>
</tr>
</tbody>
</table>
the BME Undergraduate Committee. The BME Undergraduate Committee also oversees ABET accreditation efforts, and supported Professor Voigt in preparing the accreditation self-study. As Accreditation Coordinator for Biomedical Engineering, Professor Voigt was responsible for coordinating the self-study process, preparing the self-study document, and overseeing preparations for the ABET accreditation visit in the Fall.

The BME Undergraduate Committee (UGC) undertook a number of new and continuing initiatives in Academic Year 2008-2009:

- In addition to the ongoing assessment of each undergraduate course, including 500 level electives, the UGC made a concerted effort to assess the overall undergraduate curriculum, to evaluate the evolution of each course from its original course requisition to the current course content, and to make suggestions for improvement to the individual course instructors.
- The UGC continued to monitor the ongoing ABET preparation including, but not limited to, preparing the faculty for the impending visit, revising and approving BME educational objectives and departmental mission statement, approving submitted ABET syllabi and evaluating ABET binders.
- The UGC approved 4 new courses; BE 526, Fundamentals of Biomaterials; BE 527, Principles and Applications of Tissue Engineering; BE 513, Biological and Environmental Acoustics; and BE562, Computational Biology.
- The UGC reviewed and approved several minors for ENG majors: ME minor, EE Minor, BME minor, Materials Science and Engineering minor and Systems Engineering minor, as well as a new BME track for the existing Engineering Science minor.
- The UGC reviewed and approved the Energy Technologies and Environmental Engineering concentration and Nanotechnology concentration.
- The Undergraduate Program Office continued our Industry Nights where students have the chance to interact with company representatives at a casual reception. These were held on November 20th and March 26th.
- The UGC surveyed graduates of 2003 and 2006, in our continuing effort to see if our graduates have succeeded in achieving our educational objectives.
- The UGC revised BME Program Planning Sheets to reflect changes to prerequisites and the semesters in which some course are offered. When courses are offered both semesters, the program planning sheet reflects a suggested order.

E. Student Awards

In 2009 several of the BME Seniors were recognized for achievements and contributions to the University community and BME Profession. Also at the 2009 University Commencement BME Bachelor of Science graduate Daniel Bellin gave the student commencement address at the University wide commencement ceremony.

Adam M. Miller Memorial Award: For the graduating senior who has best advanced the reputation and prestige of the BME department through his/her involvement in department, college, university, or professional activities, organizations, as well as through the academic and Senior Design Project. This year the award was presented to Ashkay Navaladi.  

Daniel Bellin
Student Leader Alumni Award: For seniors who have made outstanding contributions to the College and University through their involvement in activities and organizations. Among the 4 award winners this year were BME seniors Aaron Colby and Aaron Seaman.

Student Advisor Award: Among the 18 award winners this year were BME seniors Mary Balaconis, Derek Cao, Julie Duran, Akshay Navaladi, Sruthi Ramakrishnan, Swathi Ramakrishnan, Ankita Shah, Sandra Teng, Rahul Vedula.
Outstanding Dean’s Host Awards, from left to right; Dr. Solomon Eisenberg, BME Chair, Amy Jones (ME), Aaron Colby, Vadim Gurevich (ME), Dr. Kenneth Lutchen, Dean, College of Engineering.

**Outstanding Dean's Host Awards:** Among the 3 award winners this year was BME senior Aaron Colby.

From left to right; Dr. Solomon Eisenberg, BME Chair, Paolo Belfiore, Ging S. Lee Award winner, Rahul Vedula, David Rozenberg and George Daabul, Outstanding Senior Project Award winners.

**Ging S. Lee Community Service Award:** This year the award was presented to Paolo Belfiore.

**Outstanding Senior Project Award:** The team of George Daaboul, David Rozenberg, and Rahul Vedula were recognized with the Department’s 2009 Outstanding Senior Design Project Award for their project “Compact Label-Free Immunoassay Diagnostic Platform for Global Health” under the supervision of Prof. Selim Ünlü (ECE/BME). The team took Prof. Ünlü’s existing laser-based
Spectral Reflectance Imaging Biosensor (SRIB) technology for high throughput label-free screening, and adapted it for point of care use in low-resource environments by replacing an expensive laser component with inexpensive LEDs. In addition to significantly reducing the cost, they also showed that the modification improved performance in detecting single viruses.

F. Student Organizations

Boston University Student Chapter of the Biomedical Engineering Society

The purpose of the Biomedical Engineering Society is: “To promote the increase of biomedical engineering knowledge and its utilization.” The student chapter at Boston University works towards this goal in all of its activities. The Biomedical Engineering Society provides a focus for community building among BME students with activities which strengthen their understanding of and interest in Biomedical Engineering. The Society provides students with literature, field trips, films, and guest lectures, which provide them with a "resource center" concerning such vital areas as career opportunities and graduate study in Biomedical Engineering.

BMES Officers AY08-09
Akshay Navaladi '09 President
Max Condren '10 Vice President
Lauren Ouellette '09 Secretary
Anand Patel '09 Treasurer
Willis Hong '09 Social Chair

Alpha Eta Mu Beta, Biomedical Engineering Honor Society

Alpha Eta Mu Beta is the honor society for biomedical engineering. The society promotes an understanding of the profession, and recognizes and encourages excellence within the field. The purpose of the society is to bring into closer union and to mark in an outstanding manner those biomedical engineers who have manifested a deep interest and marked ability in their chosen life work so as to promote an understanding of their profession and to develop its members professionally.

The Thirteenth Annual BME Day

BME Day is a nationally recognized event, where the department of Biomedical Engineering opens its doors to the Boston University and local communities. This year’s BME Day was on Wednesday, February 25th. The program was sponsored by the Engineering honor society, Alpha Eta Mu Beta (AEMB), the Biomedical Engineering Society, the College of Engineering and the Department of Biomedical Engineering

BME Day aims to expose individuals outside of the discipline to biomedical engineering, as well as to allow undergraduates and graduates to explore career options in the field. This year’s BME Day highlights included an undergraduate research symposium and luncheon with 2 guest speakers: Michael Kohanski, a PhD student in Professor Jim Collins’ Lab, winner of this year’s Graduate Student Paper of the Year with his article in the journal Cell, “Mistranslation of Membrane Proteins and Two-Component System Activation Trigger Antibiotic-Mediated Death”, Kohanski, MA, Dwyer, DJ, Wierzbowski, J, Cottarel, G, and Collins, JJ (2008) Cell 135, 679-690; and Dr. David Kaplan, the Chair of the Biomedical Engineering Department at Tufts University. In the evening there was a banquet dinner and Alpha Eta Mu Beta induction ceremony followed by a presentation by Dr. Christopher Shera, Associate Professor of Otology & Laryngology and Health Sciences & Technology, Harvard Medical School and Massachusetts Eye & Ear Infirmary.

G. Research Activities for Undergraduates

The BME Department, College of Engineering and Boston University have several programs that allow undergraduates to participate in research activities. The Undergraduate Research Opportunities Program (UROP) is a competitive program funded by Boston University. Students submit research
proposals with a faculty mentor and funding awards are made to the best projects to pay student salaries and purchase lab supplies. Supplemental Undergraduate Research Funds (SURF) are provided by the College of Engineering and the Biomedical Engineering Department to supplement faculty research funding to pay undergraduates to work on research projects in faculty labs during the academic year. The College, Department and the faculty member’s grant each pay one third of the student’s salary. The Summer Term Alumni Research Scholars (STARS) Program, funded by donations from College of Engineering Alumni, provides housing support for undergraduates who are working full time in faculty labs on summer research projects. In addition to these programs many BME undergraduates are hired by BME faculty to work on existing research grants.

The Industrial Research Fellowship Program, which is continuing into its fourth year, helps students to obtain summer research positions in biomedical engineering with potential to extend to Senior Design Projects during the subsequent academic year. This program is made possible by the donations from the Industrial Supporters of Boston University’s Biomedical Engineering Senior Project Program. Students work on research projects of their choosing in one of the many on campus laboratories or in local industry. The students are able to choose from a listing of available projects and laboratories. If a student is honored by receiving one of these prestigious Fellowships, they receive a $3,000 stipend for the summer and an allowance of up to another $3,000 to cover housing costs during the summer or access to on-campus housing at no cost. Each student is responsible for presenting a poster at the Undergraduate Research and Industrial Internship Symposium. Students benefit in several ways. They are able to get experience working on a project that will hopefully segue into their Senior Design Project, they are able to refine their bioengineering skills in practical and state-of-the-art areas, learn how their academic knowledge translates to real challenges, learn to work with a scientific team consisting of a hierarchy of experience and expertise, and enhance their marketability to future employers.

H. ENGMEDIC

The ENGMEDIC program is an early selection program in collaboration with our School of Medicine and is designed to train biomedical engineers who have the MD as their ultimate degree objective. ENGMEDIC admits to the School of Medicine a small number of highly qualified students who have completed two years of the premedical option of the biomedical engineering curriculum. The program is not designed to accelerate the engineering or the medical training, but rather to effect a better transition from undergraduate engineering study to graduate medical training. The BS in Biomedical Engineering is normally earned after 4 years of undergraduate study and the MD after an additional 4 years of study at the Boston University Medical School.

I. Tracking Alumni

In an effort to obtain reliable statistics regarding the immediate career plans of our graduating seniors, the College of Engineering conducts an exit survey of all such graduating students in late April/early May. The results of these interviews are shown in the table below.

<table>
<thead>
<tr>
<th>Status of '08-'09 BME Graduates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>17%</td>
</tr>
<tr>
<td>Graduate School</td>
<td>26%</td>
</tr>
<tr>
<td>Med School</td>
<td>11%</td>
</tr>
<tr>
<td>Seeking Employment</td>
<td>33%</td>
</tr>
<tr>
<td>Transitional/Other</td>
<td>13%</td>
</tr>
</tbody>
</table>
A major strong point of our undergraduate program continues to be the Senior Design Project. Every BME senior is required to develop a project proposal with an individual faculty member, local area scientific mentor, or even a bioengineering corporate technical advisor (with a BME faculty co-supervisor). The project is then carried out with the guidance of the student’s technical advisor. This brings together elements of engineering science and engineering design. In coordination with the technical work, this course includes experience in planning, establishing priorities, and formal training in technical communication including proposal, abstract, progress reports and oral and written presentations of the final work. In conjunction with the BME Department's Industrial Advisory Board, we have additional lectures from our industry partners to expose the students to elements of entrepreneurship, business plans, intellectual property, marketing, and clinical regulatory issues. The project continues over the full academic year and culminates in a Senior Design Project Conference that is attended by students, faculty, and representatives from BME industry, hospitals, and other academic institutions. The proceedings cover is shown on the right, and the companies that registered for this year's conference are listed on the next page, followed by a listing of the project presentations.
<table>
<thead>
<tr>
<th>1.</th>
<th>3M Health Care</th>
<th>St. Paul, MN</th>
<th>41.</th>
<th>i-Therapeutix</th>
<th>Waltham, MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>3Wave Optics</td>
<td>Boston, MA</td>
<td>42.</td>
<td>iWorx</td>
<td>Dover, NH</td>
</tr>
<tr>
<td>3.</td>
<td>Abiomed</td>
<td>Danvers, MA</td>
<td>43.</td>
<td>Johnson &amp; Johnson</td>
<td>Cleveland, OH</td>
</tr>
<tr>
<td>4.</td>
<td>Advanced Instruments</td>
<td>Norwood, MA</td>
<td>44.</td>
<td>Mark Benini and Co.</td>
<td>Allston, MA</td>
</tr>
<tr>
<td>5.</td>
<td>Angell Medical Center</td>
<td>Scituate, MA</td>
<td>45.</td>
<td>Massachusetts Eye and Ear Infirmary</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>6.</td>
<td>Arque, Inc.</td>
<td>Woburn, MA</td>
<td>46.</td>
<td>Massachusetts General Hospital</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>7.</td>
<td>Arrow International</td>
<td>Everett, MA</td>
<td>47.</td>
<td>Massachusetts Institute of Technology</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>9.</td>
<td>BAMM Labs</td>
<td>Cambridge, MA</td>
<td>49.</td>
<td>National Instruments</td>
<td>Woburn, MA</td>
</tr>
<tr>
<td>10.</td>
<td>BD Medical</td>
<td>Waltham, MA</td>
<td>50.</td>
<td>Neuroptix</td>
<td>Acton, MA</td>
</tr>
<tr>
<td>11.</td>
<td>Beth Israel Deaconess Medical Center</td>
<td>Boston, MA</td>
<td>51.</td>
<td>NMT Medical</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>14.</td>
<td>Boston Scientific</td>
<td>Natick, MA</td>
<td>54.</td>
<td>Oakwood Medical Investors</td>
<td>St. Louis, MO</td>
</tr>
<tr>
<td>15.</td>
<td>Brigham and Women's Hospital</td>
<td>Cambridge, MA</td>
<td>55.</td>
<td>Observant LLC</td>
<td>Waltham, MA</td>
</tr>
<tr>
<td>16.</td>
<td>Charles Stark Draper Laboratory</td>
<td>Boston, MA</td>
<td>56.</td>
<td>Omnisomics</td>
<td>Wilmington, MA</td>
</tr>
<tr>
<td>17.</td>
<td>Children's Hospital Boston</td>
<td>Boston, MA</td>
<td>57.</td>
<td>Orion Industries</td>
<td>Ayer, MA</td>
</tr>
<tr>
<td>18.</td>
<td>Cleveland Clinic</td>
<td>Cleveland, OH</td>
<td>58.</td>
<td>Perceptive Informatics</td>
<td>Waltham, MA</td>
</tr>
<tr>
<td>20.</td>
<td>Corning, Inc.</td>
<td>Corning, NY</td>
<td>60.</td>
<td>Philips Medical Systems</td>
<td>Bothell, WA</td>
</tr>
<tr>
<td>23.</td>
<td>Delsys, Inc.</td>
<td>Boston, MA</td>
<td>63.</td>
<td>Raytheon Company</td>
<td>Andover, MA</td>
</tr>
<tr>
<td>24.</td>
<td>Essex Orthopaedics and Optima Sports Medicine</td>
<td>Andover, MA</td>
<td>64.</td>
<td>Respironics</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>25.</td>
<td>Ethicon</td>
<td>Somerville, NJ</td>
<td>65.</td>
<td>Rogers Corporation</td>
<td>Rogers, CT</td>
</tr>
<tr>
<td>26.</td>
<td>Farmhispania</td>
<td>Barcelona, Spain</td>
<td>66.</td>
<td>Schepen's Eye Research Institute</td>
<td>Boston, MA</td>
</tr>
<tr>
<td>27.</td>
<td>Fraunhofer USA</td>
<td>Brookline, MA</td>
<td>67.</td>
<td>SensoMotoric Instruments</td>
<td>Needham, MA</td>
</tr>
<tr>
<td>28.</td>
<td>Gems Sensors- Controls</td>
<td>Plainville, CT</td>
<td>68.</td>
<td>SOLX, Inc.</td>
<td>Waltham, MA</td>
</tr>
<tr>
<td>29.</td>
<td>General Electric-Healthcare</td>
<td>Lawrence, MA</td>
<td>69.</td>
<td>SonaMed Corp</td>
<td>Waltham, MA</td>
</tr>
<tr>
<td>30.</td>
<td>Genzyme</td>
<td>Cambridge, MA</td>
<td>70.</td>
<td>St. Jude Medical</td>
<td>Sylmar, CA</td>
</tr>
<tr>
<td>31.</td>
<td>Glemser Technologies</td>
<td>Woburn, MA</td>
<td>71.</td>
<td>Stryker Development</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>32.</td>
<td>Harvard Medical School</td>
<td>Boston, MA</td>
<td>72.</td>
<td>SurgiQuest, Inc.</td>
<td>Orange, CT</td>
</tr>
<tr>
<td>33.</td>
<td>Harvard-MIT Division of Health Sciences and Technology</td>
<td>Cambridge, MA</td>
<td>73.</td>
<td>Teleflex Medical</td>
<td>Woburn, MA</td>
</tr>
<tr>
<td>34.</td>
<td>Harvard School of Dental Medicine</td>
<td>Boston, MA</td>
<td>74.</td>
<td>Teradyne</td>
<td>North Reading, MA</td>
</tr>
<tr>
<td>35.</td>
<td>Harvard University</td>
<td>Cambridge, MA</td>
<td>75.</td>
<td>Transform Pharmaceuticals (Johnson and Johnson)</td>
<td>Lexington, MA</td>
</tr>
<tr>
<td>36.</td>
<td>Hologic</td>
<td>Marlborough, MA</td>
<td>76.</td>
<td>Tyco Healthcare</td>
<td>Princeton, NJ</td>
</tr>
<tr>
<td>37.</td>
<td>Infoscitex</td>
<td>Waltham, MA</td>
<td>77.</td>
<td>US Army Research Institute of Environmental Medicine</td>
<td>Natick, MA</td>
</tr>
<tr>
<td>38.</td>
<td>InfraReDx</td>
<td>Burlington, MA</td>
<td>78.</td>
<td>Wyle, Inc.</td>
<td>Houston, TX</td>
</tr>
<tr>
<td>39.</td>
<td>Instrumentation Laboratory</td>
<td>Lexington, MA</td>
<td>79.</td>
<td>Xceed Molecular</td>
<td>Wellesley, MA</td>
</tr>
<tr>
<td>40.</td>
<td>Integra LifeSciences</td>
<td>Burlington, MA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DEPARTMENT OF BIOMEDICAL ENGINEERING

24th Annual Senior Project Conference
— Friday, May 1, 2009 —

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:15 – 8:00 AM</td>
<td>Continental Breakfast</td>
</tr>
<tr>
<td>8:00 AM</td>
<td>Welcome and Opening Remarks: Prof. Irving Bigio</td>
</tr>
<tr>
<td>8:10 – 10:15 AM</td>
<td>SESSION I</td>
</tr>
<tr>
<td>PHO 206</td>
<td>Fooling Mother Nature: Tissue Engineering and Tissue Manipulation</td>
</tr>
<tr>
<td></td>
<td>Session Chair: Prof. Joyce Wong</td>
</tr>
<tr>
<td></td>
<td>Design of Experimental and Statistical Tools for Analyzing Mechanical Regulation of Tissue Fate</td>
</tr>
<tr>
<td></td>
<td>Daniel Bellin, Karen Chien</td>
</tr>
<tr>
<td></td>
<td>Articular Cartilage Deformation in an Osteochondral Plug Model</td>
</tr>
<tr>
<td></td>
<td>Mohit Butaney, Mathew Stephen</td>
</tr>
<tr>
<td></td>
<td>Cavitation-Enhanced Fragmentation of Tissue Using Ultrasonic Surgical Aspirating Horns</td>
</tr>
<tr>
<td></td>
<td>Derek Yue Cao, Brian Roach</td>
</tr>
<tr>
<td></td>
<td>Tissue Stretcher System for Engineered Small Diameter Blood Vessels</td>
</tr>
<tr>
<td></td>
<td>Warren Ferris, Timothy Lyford, Sean Taylor</td>
</tr>
<tr>
<td></td>
<td>A Bottom-Up Approach for Engineering 3D Vascularized Tissue Constructs</td>
</tr>
<tr>
<td></td>
<td>Majid Ghodousi, Nikhil Haas</td>
</tr>
<tr>
<td></td>
<td>Engineering a 3D Lung Extracellular Matrix</td>
</tr>
<tr>
<td></td>
<td>Avinash Oza, Kelsey Derricks</td>
</tr>
<tr>
<td></td>
<td>Monitoring Glucose Levels with Fluorescent Sensors in Tissue-Engineered Constructs</td>
</tr>
<tr>
<td></td>
<td>Mary Balaconis, Jaclyn Lautz</td>
</tr>
<tr>
<td></td>
<td>3D Freeform Fabrication of a Hybrid Hydrogel Scaffold</td>
</tr>
<tr>
<td></td>
<td>Francis Doyle, Jr., Samuel Polio</td>
</tr>
<tr>
<td>10:15 – 10:30 AM</td>
<td>BREAK</td>
</tr>
</tbody>
</table>
10:30 – 12:30 PM SESSION IIa
PHO 206 A Picture of Life: Imaging

Session Chair: Prof. Tom Szabo

A New Concept in High Definition Digital X-Ray Imaging
Madeline Abrams, Justin Martin

Sensor Locator for Surface EMG Array
Megan Fessenden, Allie Paquette

Quantifying Multi-Spectral Parameters in Tissue-Mimicking Gel Phantoms that Exhibit Magnetization Transfer Phenomena: A Multi Field Study
Natalya Kotlyar, Katherine Schwendinger-Roy, Jaime Shaw

Design of an Anatomical Ultrasound Simulator
Kevan Desai, Michael Habib, David Scaduto

Driving System for a Portable Ultrasound Brain Imaging Device for Use in Forward Battlefield Areas
Julie Duran, Karla Mercado

Optical Imaging of Coral Regeneration at the Cellular Level
Ryan Burke, Lauren Tuthill

HiLo Fluorescence Endomicroscope
Visar Ajeti, Brett Allaire

10:30 – 12:30 PM SESSION IIb
PHO 205 NUMB3RS: Computation/Simulation/Analysis

Session Chair: Prof. Ed Damiano

Analysis Methods for Neurovisual Rehabilitation
David Ahern, Muftah Ahmed

Simulating Echolocation Systems Using Computational Models of Auditory Physiology
Andrew Dumas, Andrew Rothman

The Role of Temporal Fine Structure Cues in Enhancing Speech Intelligibility for Simulated Cochlear Implant Listening
Sruthi Ramakrishnan, Swathi Ramakrishnan

Asymmetries in Experimentally-Measured Inter-Aural Time and Level Sensitivity: Dependence on Spatial Origin and Type of Stimulus
Raymond Keffer, Akshay Navaladi

Implications of a Meta-Analysis of the Control Properties of Motor Units
Joshua Kline

Determination of Viscoelastic Properties of a Blood Clot via Acoustic Levitation
Kai Pong, Hiroo Shimoda, Hsiaoching Teng

The Effects of a Soy Protein Diet on the Bone Material and Structural Properties of Estrogen-Depleted Cynomolgus Monkeys
James Schmitz, Sonia Shah

DNA Sequence Analysis of Genes Linked to Schizophrenia
Mary Harrison, Amy Nehring

12:30 – 1:15 PM LUNCH
1:15 – 3:00 PM SESSION IIIa
PHO 206

What's up, Doc?: Diagnostic Technologies and Microfluidic Systems

Session Chair: Prof. Chris Passaglia

Development of an Automated Microfluidics Platform for Chemical Methodology
Meredith Blakely, Anna Yanko

Pressure Control of Optical Fiber Probes Used for Detecting Cancer
John D'Agostino, Gregory Ekchian

A Thermoplastic Micro-Electro-Mechanical System (MEMS) for Microfluidic Diagnostic Platforms
Theodorus de Groot, Megan Rexius

Development of Microfluidic Device Technology for HIV Diagnostics
Peter Lombardozzi, Anoli Shah

Developing an Automated Microfluidic Device to Purify and Concentrate Bacteria from Whole Blood for SERS Bacterial Diagnosis
Michael Koan, Kenny Lin, Shauna Zane

Compact Label-Free Immunoassay Diagnostic Platform for Global Health
George Daaboul, David Rozenberg, Rahul Vedula

A Microfluidic Chip for Analysis of Mechanical Forces Generated During Cell Migration
Sean Collignon, Else Frohlich

1:15 – 3:00 PM SESSION IIIb
PHO 205

Wired: Instrumenting Living Systems and Measurement of in vivo Conditions

Session Chair: Prof. Kamal Sen

Transmitter Board Enclosure Design for EM Tracking System
Michael Augelli, Yue Ma

Design and Integration of a Temperature Sensor into the BIS Monitoring System
Bruce Miller, Lauren Ouellette

Ambulatory Vestibular Monitoring Device
Guilherme Goretkin, Kevin Lada

Design of Real-Time System for Partitioning Volume versus Flow Dependence of Respiratory System Resistance in Asthmatics
Nathaniel Steiger, Brian Trautman

The Effects of Mechanical Forces on the Progression of Emphysema
Gopesh Sharma, Venkat Subramaniam

Understanding Contrast Adaptation in Vision
Wilson Kwan, Wan Seo

Design of an Apparatus to Assess the Visual Abilities of Rats
John Greifenberger, Nathan Lavallee

3:00 – 3:15 PM BREAK
3:15 – 5:00 PM  
**SESSION IV**  
**PHO 206**  
Small Things: Nanotechnology, Molecules, Cellular Control

**Session Chair: Prof. Steve Colburn**

Nanotechnology in Biomedical Engineering: Nanoelectrical Biosensors  
*Kyum Lee, Willie Feng*

Nanotechnology in Biomedical Engineering: Nanomechanical Biosensors  
*Nirav Bhavsar, Anand Patel*

Threshold-Based Detection in *Escherichia coli*: Interfacing Synthetic Gene Networks  
*Ioana Lupascu, David Shi*

Acoustically-Driven Microbubbles Mediate Cellular Uptake of Impermeable Biomolecules  
*Ruby Gill, Brittany Simone*

Triggering Genetic Toggle Switch through Ultrasound-Induced Heating  
*Willis Hong, Jason Maley*

Design and Characterization of a Polymer-Based Implant for Treatment of Age-Related Macular Degeneration  
*Rahul Ahuja, Balaji Nithianadam*

Optimizing Drug Delivery Systems Using Single Molecule Imaging in Live Cells  
*Aaron Colby, Ankita Shah*

---

**5:00 PM Final Conference Comments:** Prof. Irving Bigio, Prof. Thomas Szabo,  
Dean Kenneth Lutchen, BMES President Akshay Navaladi  
**RECEPTION IN THE ATRIUM, 2nd FLOOR, PHOTONICS CENTER**
IV. GRADUATE PROGRAM

A. Recruitment

Recruitment of outstanding students is one of the Admissions Committee’s and Graduate Committee’s most crucial, challenging, and time-consuming tasks. In AY 2008-09, the department’s goal was to recruit a class of 20 new Ph.D. students, while maintaining the quality of matriculants. A second goal was to recruit a small group of MS students, also of outstanding quality. The third goal was to recruit and matriculate our second MEng class. Graduate recruitment has become more challenging over the last few years due to the explosive growth of BME graduate programs in the United States. Nonetheless, we were able to meet our goals.

Recruiting efforts included: updating and continual development of the website, and the Annual Graduate Recruitment visits. This year three recruitment week-ends were held, 52 students visited; 17 accepted our offer of admission for an overall yield of 33% (open house #1: 4 of 12 (33%); open house #2: 6 of 24 (25%); open house #3: 7 of 16 (44%).

In academic year 2008/2009 the BME program received 469 applications, of which 126 were admitted, and 49 students matriculated (Table 1). For fall 2009 we received 449 applications, 148 were admitted and we expect 38 matriculants in the Fall 2009 (Table 2).

Table 1. Admission Statistics for AY 2008 – 2009

<table>
<thead>
<tr>
<th></th>
<th>APPLICANTS</th>
<th>ADMISSIONS</th>
<th>MATRICULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEng</td>
<td>MS</td>
<td>PhD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Male</td>
<td>3</td>
<td>41</td>
<td>128</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>28</td>
<td>78</td>
</tr>
<tr>
<td>Int’l Male</td>
<td>0</td>
<td>31</td>
<td>72</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>29</td>
<td>54</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>8</td>
<td>129</td>
<td>332</td>
</tr>
</tbody>
</table>

Table 2. Admission Projections for Fall 2009

<table>
<thead>
<tr>
<th></th>
<th>APPLICANTS</th>
<th>ADMISSIONS</th>
<th>MATRICULATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEng</td>
<td>MS</td>
<td>PhD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Male</td>
<td>22</td>
<td>30</td>
<td>128</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>16</td>
<td>72</td>
</tr>
<tr>
<td>Int’l Male</td>
<td>7</td>
<td>17</td>
<td>69</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>16</td>
<td>43</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>58</td>
<td>79</td>
<td>312</td>
</tr>
</tbody>
</table>

During our recruiting efforts this year offers of financial aid were made to 108 students, including fellowships, research assistantships and ½ tuition scholarships. 38 students accepted our offer of admission (26 PhD, 9 MS and 3 MEng) to form the entering class for fall 2009. Additionally, one MD/PhD student will join us in Fall 2009 after completing 2 years at BUSM, which brings the total number of PhD students to 27. As has been typical over the last few years, the BU BME program has competed directly with the top programs in Biomedical Engineering in recruiting the best students.
Of the 38 matriculating students in fall 2009, 28 are fully funded (all PhD and one MS). Five students will receive ½ Tuition Scholarships and one student will be funded through LEAP. The new students come from several strong programs, including Carnegie Mellon University, Case Western Reserve University, Columbia University, Johns Hopkins University, MIT, Princeton University, Purdue University, Rutgers University, Stanford University, Stetson University, Tufts University, University of California at Berkeley, University of Maine, University of Utah, University of Virginia, Vanderbilt University, Washington University, and our own Boston University. Four entering Ph.D. students attended international universities at Indian Institute of Technology, McGill University, Nanyang Technological University and University College in Dublin.

The entering PhD class has a mean undergraduate GPA of 3.5 (US students only).

Recruitment of underrepresented minorities remained a challenge and a priority in AY 2008-09. Despite aggressive efforts in advertising and recruiting, only a small number of applications from underrepresented minorities were received.

B. Enrollment

Overall, 155 students are currently enrolled in BME graduate programs, as shown in Table 3.

Table3. BME Graduate Student Breakdown

<table>
<thead>
<tr>
<th></th>
<th>MS</th>
<th>MD/PhD</th>
<th>PhD</th>
<th>MEng</th>
<th>Total</th>
<th>Underrepresented Minorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>US:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Program</td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>4</td>
<td>49</td>
<td>3</td>
<td>73</td>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>1</td>
<td>27</td>
<td>2</td>
<td>38</td>
<td>Female</td>
</tr>
<tr>
<td>Intl:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>0</td>
<td>26</td>
<td>0</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>5</td>
<td>115</td>
<td>6</td>
<td>155</td>
<td></td>
</tr>
</tbody>
</table>

C. Teaching Fellows and Research Assistants

Table 4. Graduate Student Funding Sources for AY 2008 – 2009

<table>
<thead>
<tr>
<th></th>
<th>MEng</th>
<th>MS</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Assistants</td>
<td>16</td>
<td>80</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>NIH QBP Training Grant</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF Fellowship</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF Research Training Grant (CBD)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIMIT Fellowship</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIH NRSA Fellowship</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHA Fellowship</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clair Booth Luce Fellowship</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomolecular Pharmacology</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary Training Grant</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Funding</td>
<td>13</td>
<td>16</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>6</td>
<td>1.5</td>
<td>1</td>
<td>8.5</td>
</tr>
<tr>
<td>Leave of Absence</td>
<td>1</td>
<td>0.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>TOTALS</td>
<td>6</td>
<td>31.5</td>
<td>117.5</td>
<td>155</td>
</tr>
</tbody>
</table>
Table 5. Graduate Teaching Fellows

<table>
<thead>
<tr>
<th></th>
<th>MS FTE</th>
<th>PhD FTE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Int'l</td>
<td>0.5</td>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>5.5</td>
<td>9</td>
<td>14.5</td>
</tr>
</tbody>
</table>

Note: one FTE is a full academic year GTF, fall and spring.

D. Degrees Awarded

Fourteen students were awarded their PhD degrees this year (including one who completed the MD in the MD/PhD Program and was awarded the MD/PhD concurrently) (Table 6). Thirteen students completed the MS (Table 7) this year, and 3 students completed the MEng. Once again, emphasis has been placed on reviewing student status and encouraging steady progress through the program. To date, 129* PhD’s in Biomedical Engineering have been awarded since 1991, but the rate is increasing significantly.

(* an audit of degrees awarded since 1991 was conducted resulting in 129 degrees awarded through Spring 2009)

Table 6. AY 2008 – 2009 PhD Degrees Awarded

<table>
<thead>
<tr>
<th>Name / Defense Date</th>
<th>Title &amp; Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHUANG, Gwo Yu April 2009</td>
<td>FFT-based Small Molecule Mapping: Development and Applications Dissertation Committee: Sandor Vajda, Ph.D., Advisor Maxim Frank-Kamenetskii, Ph.D., Gloria Callard, Ph.D., Ioannis Paschalidis, Ph.D., Adrian Whitty, Ph.D.</td>
</tr>
<tr>
<td>DEANS, Tara November 2008</td>
<td>Engineering a Mammalian Genetic Switch Dissertation Committee: James Collins, Ph.D., Advisor Joyce Wong, Ph.D., Charles Cantor, Ph.D., Timothy Gardner, Ph.D., Donald Ingber, Ph.D.</td>
</tr>
<tr>
<td>DESBIENS, Sophie April 2009</td>
<td>Therapeutic Agents for Cocaine Addiction: A Systems Pharmacology Approach Dissertation Committee: David H. Farb, Ph.D., Research Advisor, James Collins, Ph.D., Academic Advisor John A. White, Ph.D., Shelley J. Russek, Ph.D., Charles Cantor, Ph.D.</td>
</tr>
<tr>
<td>DUNCANSON, Wynter December 2008</td>
<td>Targeted Binding of Polymer Ultrasound Contrast Agents for Molecular Imaging Dissertation Committee: Joyce Wong, Ph.D., Advisor Robin Cleveland, Ph.D., Catherine Klapperich, Ph.D., Ed Damiano, Ph.D., R. Lynn Holt, Ph.D.</td>
</tr>
<tr>
<td>FREEMAN, Daniel October 2008</td>
<td>Light and Contract Sensitive Gain Controls in the Retina Dissertation Committee: Christopher Passaglia, Ph.D., Advisor Kamal Sen, Ph.D., Paul B. Cook, Ph.D., John A. White, Ph.D.</td>
</tr>
<tr>
<td>LANDOLIN, Jane July 2008</td>
<td>DNA Sequence and Epigenetic Features that Drive Human Promoter Function Dissertation Committee: Zhiping Weng, Ph.D., Advisor Mark A. Kon, Ph.D., Yu Xia, Ph.D., Tom D. Tullius, Ph.D., Charles DeLisi, Ph.D.</td>
</tr>
<tr>
<td>LIANG, Zhuangli June 2008</td>
<td>Multi-Component Image Reconstruction and Artifact Mitigation in Cardiac Multi-Detector Computed Tomography Dissertation Committee: W. Clement Karl, Ph.D., Advisor Homer Pien, Ph.D., H. Steven Colburn, Ph.D., Janusz Konrad, Ph.D.</td>
</tr>
<tr>
<td>Name / Defense Date</td>
<td>Title &amp; Committee</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| LILLIS, Kyle April 2009 | Development of Neural Recording Techniques and the Study of Epileptiform Activity In Vitro  
Dissertation Committee: John A. White, Ph.D., Advisor  
Jerome Mertz, Ph.D., Timothy Gardner, Ph.D., Kamal Sen, Ph.D. |
| NAWAWONGSE, Rapeechai December 2008 | Extracellular Single Neuron Recording in Dorsal Cochlear Nucleus of Awake Gerbil  
Dissertation Committee: Herbert F. Voigt, Ph.D., Advisor  
H. Steven Colburn, Ph.D., Kamal Sen, Ph.D., Barbara Shinn-Cunningham, Ph.D., Christopher Passaglia, Ph.D. |
| NEWBURG, Seth December 2008 | Mechanical Response of the Basilar Membrane to Lateral Micromanipulation  
Dissertation Committee: David C. Mountain, Ph.D., Advisor  
Paul E. Barbone PhD, H. Steven Colburn PhD, Allyn E. Hubbard PhD |
| PALOMARES, Kristy May 2007 Ph.D. May 2009 M.D. | Mechanobiochemical Regulation of Cell Molecular Expression and Tissue Differentiation During Bone Healing  
Defense Committee: Elise F. Morgan, Ph.D., Advisor  
Solomon Eisenberg, Sc.D., Chair; Dimitrije Stamenovic, Ph.D., Louis C. Gerstfeld, Ph.D., Philip Trackman, Ph.D. |
| PATEL, Hemali April 2008 | Decoding Transcriptional Regulatory Networks Activated During Stringent Response in Escherichia Coli  
Dissertation Committee: Timothy Gardner, Ph.D., Advisor  
James Collins, Ph.D., Joyce Wong, Ph.D., Caroline Genco, Ph.D., Daniel Segre, Ph.D. |
| PARAMESWARAN, Harikrishnan March 2009 | Effect of Microscopic Structural Changes on Macroscopic Functional Properties: Imaging and Modeling the Lung Parenchyma in Three Dimensions  
Dissertation Committee: Bela Suki, Ph.D., Advisor  
Wayne Mitzner, Ph.D., Dimitrije Stamenovic, Ph.D., Kenneth R. Lutchen, Ph.D., Elise F. Morgan, Ph.D. |
| WOLINSKY, Jesse December 2008 | Prevention of Lung Tumor Recurrence Through Localized Drug Delivery Via Paclitaxel-Eluting Glycerol-Based Polymeric Films  
Dissertation Committee: Mark W. Grinstaff, Ph.D., Advisor  
Yolonda L. Colson, M.D., Ph.D., Michael L. Smith, Ph.D., Catherine Klapperich, Ph.D., Matthew Nugent, Ph.D. |

Table 7. AY 2008 – 2009 MS Degrees Awarded

<table>
<thead>
<tr>
<th>Name / Defense Date</th>
<th>Title &amp; Committee</th>
</tr>
</thead>
</table>
| CHOW, Ming-Jay August, 2008 | Biaxial Tensile Tests of Various Arteries  
Defense Committee: Katherine Zhang, Ph.D., Research Advisor  
Joyce Wong, Ph.D., Academic Advisor, Bela Suki, Ph.D. |
| CUSACK, William June, 2008 | The Development of a Platform for Designing and Testing Control Schemes for Robotic Gait Retraining  
Defense Committee: Paolo Bonato, Ph.D., Research Advisor  
Lucia Vaina, Ph.D., Academic Advisor, James Collins, Ph.D. |
| HERNANDEZ, Victor January, 2009 | Elucidating a Role for Regenerative Photon Events in Limulus Nigh Vision Using a Cell-Based Model  
Defense Committee: Christopher Passaglia, Ph.D., Advisor  
David C. Mountain, Ph.D., Barbara Shinn-Cunningham, Ph.D. |
| HOUTECHENS, Graham September, 2008 | Multiphase Microemulsions Using Microfluidic Flow Focusing  
Defense Committee: Joyce Wong, Ph.D., Advisor  
Catherine Klapperich, Ph.D., Robert Gyurko, Ph.D. |
| JENNINGS, Todd June, 2008 | An Improved Interior Colliculus Cell Model for Interaural Time Difference Analysis  
Defense Committee: H. Steven Colburn, Ph.D., Advisor  
Kenneth Hancock, Ph.D., David C. Mountain, Ph.D., Kamal Sen, Ph.D. |

(Prospectus in Lieu of MS Thesis)
<table>
<thead>
<tr>
<th>Name / Defense Date</th>
<th>Title &amp; Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>JESUDASON, Rajiv</td>
<td>The Effects of Mechanical Forces on Elastase Activity in Lung Tissue</td>
</tr>
<tr>
<td>February, 2009</td>
<td>Defense Committee: Bela Suki, Ph.D., Advisor</td>
</tr>
<tr>
<td></td>
<td>Erzsebet Bartolak-Suki, M.D., Philip Allen, Ph.D., Philip Stone, Ph.D., Dimitrije</td>
</tr>
<tr>
<td></td>
<td>Stamenovic, Ph.D.</td>
</tr>
<tr>
<td>LARSON, Eric</td>
<td>Modeling Discrimination of Complex Sounds by Cortical Neurons</td>
</tr>
<tr>
<td>January, 2009</td>
<td>Defense Committee: Kamal Sen, Ph.D., Advisor</td>
</tr>
<tr>
<td></td>
<td>H. Steven Colburn, Ph.D., Barbara Shinn-Cunningham, Ph.D., Michael Hasselmo, Ph.D.</td>
</tr>
<tr>
<td>LYFORD, Nicholas</td>
<td>Evaluating Vibrotactile Tilt Feedback for Balance-Deficient Subjects</td>
</tr>
<tr>
<td>August, 2008</td>
<td>Using Waveform-Based Display Coding</td>
</tr>
<tr>
<td></td>
<td>Defense Committee: Carlo DeLuca, Ph.D., Advisor</td>
</tr>
<tr>
<td></td>
<td>Conrad Wall, Ph.D., Tyrone Porter, Ph.D.</td>
</tr>
<tr>
<td>MENDONCA DAVIS, Nancy</td>
<td>Utility of Airway Distensibility Versus Standard Spirometry for Assessment of</td>
</tr>
<tr>
<td>March, 2009</td>
<td>Hyperreactive Airways</td>
</tr>
<tr>
<td></td>
<td>Defense Committee: Kenneth Lutchen, Ph.D., Advisor</td>
</tr>
<tr>
<td></td>
<td>George O’Connor, Ph.D., Bela Suki, Ph.D.</td>
</tr>
<tr>
<td>RADWAN, Basma</td>
<td>Calibration of Infrared Video-Based Eye Tracker in Rodents and a Preliminary</td>
</tr>
<tr>
<td>September, 2008</td>
<td>Assessment of Their Eye Movements in Free Condition</td>
</tr>
<tr>
<td></td>
<td>Defense Committee: Davide Zoccolan, Ph.D., Research Advisor</td>
</tr>
<tr>
<td></td>
<td>Herbert Voigt, Ph.D., Academic Advisor, Christopher Passaglia, Ph.D.</td>
</tr>
<tr>
<td>RINEHOLD, Brett</td>
<td>Validation of a Real-Time Virtual Auditory System for Dynamic Sound Stimuli and</td>
</tr>
<tr>
<td>August, 2008</td>
<td>its Application to Sound Localization</td>
</tr>
<tr>
<td></td>
<td>Defense Committee: H. Steven Colburn, Ph.D., Barbara Shinn-Cunningham, Ph.D.,</td>
</tr>
<tr>
<td></td>
<td>Nathaniel Durlach, M.A.</td>
</tr>
<tr>
<td>SPENCER, Nathaniel</td>
<td>Tailoring the Microenvironment to Achieve Functional Cultures of the Avian Inner</td>
</tr>
<tr>
<td>April, 2007</td>
<td>Ear</td>
</tr>
<tr>
<td>(Prospectus in Lieu of MS Thesis)</td>
<td>Defense Committee: Douglas A. Cotanche, Ph.D., Research Advisor</td>
</tr>
<tr>
<td></td>
<td>Catherine Klapperich, Ph.D., Academic Advisor, Joyce Wong, Ph.D., David C. Mountain, Ph.D.</td>
</tr>
<tr>
<td>TRUSLOW, James</td>
<td>Design of Drainage Systems for Engineered Microvascular Tissue</td>
</tr>
<tr>
<td>September, 2008</td>
<td>Defense Committee: Joe Tien, Ph.D., Advisor</td>
</tr>
<tr>
<td></td>
<td>Dimitrije Stamenovic, Ph.D., Paul Barbone, Ph.D.</td>
</tr>
</tbody>
</table>

### E. Courses Offered

<table>
<thead>
<tr>
<th>Number</th>
<th>Course Name</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 500</td>
<td>Special Topics in Biomedical Engineering</td>
<td>Galagan</td>
</tr>
<tr>
<td>BE 500</td>
<td>Special Topics in Biomedical Engineering</td>
<td>Mountain</td>
</tr>
<tr>
<td>BE 505</td>
<td>Molecular Bioengineering I</td>
<td>Vajda/MFK/Broude</td>
</tr>
<tr>
<td>BE 506</td>
<td>Molecular Bioengineering II</td>
<td>Evans/Meller</td>
</tr>
<tr>
<td>BE 509</td>
<td>Quantitative Physiology of the Auditory System</td>
<td>Shinn-Cunningham</td>
</tr>
<tr>
<td>BE 511</td>
<td>Biomedical Instrumentation</td>
<td>Mountain</td>
</tr>
<tr>
<td>BE 515</td>
<td>Introduction to Medical Imaging</td>
<td>Jara</td>
</tr>
<tr>
<td>BE 517</td>
<td>Optical Microscopy of Biological Materials</td>
<td>Allen/Mertz</td>
</tr>
<tr>
<td>BE 521</td>
<td>Continuum Mechanics</td>
<td>Stamenovic/Damiano</td>
</tr>
<tr>
<td>BE/ME/MS 523</td>
<td>Mechanics of Biomaterials</td>
<td>Klapperich</td>
</tr>
<tr>
<td>BE 526</td>
<td>Biomaterials and Tissue Engineering I</td>
<td>Grinstaff/Wong</td>
</tr>
<tr>
<td>BE 527</td>
<td>Biomaterials and Tissue Engineering II</td>
<td>Grinstaff/Wong</td>
</tr>
<tr>
<td>BE 560</td>
<td>Biomolecular Architecture</td>
<td>T. Smith</td>
</tr>
<tr>
<td>BE 561</td>
<td>DNA &amp; Protein Sequence analysis</td>
<td>Kasif</td>
</tr>
<tr>
<td>BE 564</td>
<td>Biophysics of Large Molecules</td>
<td>Frank-Kamenetskii</td>
</tr>
<tr>
<td>BE 566</td>
<td>DNA Structure and Function</td>
<td>Frank-Kamenetskii</td>
</tr>
<tr>
<td>BE 567</td>
<td>Nonlinear Systems in Biomedical Engineering</td>
<td>Suki</td>
</tr>
<tr>
<td>BE 570</td>
<td>Introduction to Computational Vision</td>
<td>Vaina</td>
</tr>
</tbody>
</table>
### Number | Course Name | Instructor(s)
--- | --- | ---
BE 703 | Numerical Methods & Modeling | Damiano
BE 706 | Quantitative Physiology for Engineers | Passaglia
BE 707 | Quantitative Studies of Excitable Cells | Sen
BE/ME/MS 726 | Biomaterials and Tissue Engineering I | Grinstaff/Wong
BE/ME/MS 727 | Biomaterials and Tissue Engineering II | Grinstaff/Wong
BE 747 | Advanced Topics in Signals and Systems | Colburn
BE/EC 765 | Biomedical Optics & Biophotonics | Mertz
BE 768 | Biological Database Design | Benson
BE 777 | Computational Genomics | Xia
BE 790 | BME Engineering Seminar | Wong
BE 791 | Ph.D. BME Lab Rotation | Wong
BE801 | BME Teaching Practicum | Wong
BE 900 | Research | Faculty
BE 951 | Independent Study | Faculty

### F. Graduate Student Accomplishments


Table 5. Graduate Student Presentations 2008-2009

<table>
<thead>
<tr>
<th>Name</th>
<th>Conference</th>
</tr>
</thead>
</table>
| ALLEN, Patrick | Vascular Matrix Biology and Bioengineering Conference, of the North American Vascular Biology Organization  
March 16-19, 2009 in Whistler, BC, Canada  
Poster Title: Human Progenitor Cells Generate Engineered Vasculature in Collagen, Fibrin, and Hydrogel Matrix Materials  
Dr. M. Judah Folkman Research Day 2009 for Research Fellows at Children’s Hospital  
May 20, 2009 in Boston, MA  
Poster Title: Human Progenitor Cells Generate Engineered Vasculature in Collagen, Fibrin, and Hydrogel Matrix Materials |

46
<table>
<thead>
<tr>
<th>Name</th>
<th>Conference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANDKEN, Kerry Lee</td>
<td>Northeast Bioengineering Conference</td>
</tr>
<tr>
<td></td>
<td>April 3-5, 2009 at Harvard Medical School in Boston, MA</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Optical Monitoring of Tumor Angiogenesis</em></td>
</tr>
<tr>
<td>CALABRO, Finnegan</td>
<td>Thirteenth International Conference on Cognitive and Neural Systems</td>
</tr>
<tr>
<td></td>
<td>May 27-30, 2009 in Boston, MA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>Modeling Disparity Tuning Properties of MT for Depth Segmentation During Motion Perception</em></td>
</tr>
<tr>
<td>CAMPANA, Lisa</td>
<td>American Thoracic Society Conference</td>
</tr>
<tr>
<td></td>
<td>May 17-20, 2009 in San Diego, CA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>The Influence of Lung Volume on Airway Resistance During Sleep</em></td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>Age Dependence of Heart Rate Indices in a Healthy Cohort as Measured by Phase-Rectified Signal Averaging</em></td>
</tr>
<tr>
<td>CAREY, Ryan</td>
<td>Keystone Symposia, Chemical Senses: Receptors and Circuits</td>
</tr>
<tr>
<td></td>
<td>March 15-19, 2009 in Tahoe City, CA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>Temporal Structure of Sensory Input to the Olfactory Bulb</em></td>
</tr>
<tr>
<td>CHU, Ken</td>
<td>Novel Techniques in Microscopy</td>
</tr>
<tr>
<td></td>
<td>April 26-29, 2009 in Vancouver, BC</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Two-photon Differential Aberration Imaging with a Modulating Mirror</em></td>
</tr>
<tr>
<td>COSGROVE, Elissa</td>
<td>Biomedical Engineering Society 2008 Annual Fall Meeting</td>
</tr>
<tr>
<td></td>
<td>October 2-4, 2008 in St. Louis, MO</td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>Predicting Gene Targets of Perturbations via Network-Based Filtering of mRNA Expression Compendia</em></td>
</tr>
<tr>
<td>DESBIENS, Sophie</td>
<td>2009 New England Pharmacologist Meeting</td>
</tr>
<tr>
<td></td>
<td>February 27-28, 2009 in Burlington, VT</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Cocaine-Priming Induced Reinstatement of Drug Seeking is Attenuated by Pregnanolone Hemisuccinate: A Negative Modulator of Glutamate Receptor Function</em></td>
</tr>
<tr>
<td>GAGNON, Louis</td>
<td>The SPIE Photonics West BIOS Conference</td>
</tr>
<tr>
<td></td>
<td>January 25, 2009 in San Jose, CA</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Double Layer Estimation of Flow Changes Using Diffuse Correlation Spectroscopy</em></td>
</tr>
<tr>
<td>GIOUX, Sylvain</td>
<td>Lasers in Medicine and Biology Gordon Research Center</td>
</tr>
<tr>
<td></td>
<td>July 20-25, 2008 in Lanconia, NH</td>
</tr>
<tr>
<td></td>
<td>Poster Title: <em>Spatially-Modulated Optical Imaging: Towards a New Clinical Quantitative Imaging System</em></td>
</tr>
<tr>
<td></td>
<td>World Molecular Imaging Conference</td>
</tr>
<tr>
<td></td>
<td>September 10-13, 2008 in Nice, France</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Spatially-Modulated Near-Infrared Imaging for Image-Guided Surgery</em></td>
</tr>
<tr>
<td></td>
<td>Frontiers in Optics 2008</td>
</tr>
<tr>
<td></td>
<td>October 19-23, 2008 in Rochester, NY</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: <em>Fluorescence Lifetime and Spatially Modulated Light for Image-Guided Surgery</em></td>
</tr>
<tr>
<td>Name</td>
<td>Conference</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GRISET, Aaron</td>
<td>35&lt;sup&gt;th&lt;/sup&gt; Annual Meeting and Exposition of the Controlled Release Society</td>
</tr>
<tr>
<td>HEINE, Walter</td>
<td>ARVO</td>
</tr>
<tr>
<td></td>
<td>Smith Family Awards Program for Excellence in Biomedical Research</td>
</tr>
<tr>
<td>KHOO, Xiaojuan</td>
<td>Biointerface Science Gordon Research Conference 2008</td>
</tr>
<tr>
<td></td>
<td>GML Symposium on Interdisciplinary Graduate Research 2009</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Multifunctional Peptide-Based Coatings for the Facile Modification of Devise Interfaces</td>
</tr>
<tr>
<td></td>
<td>35&lt;sup&gt;th&lt;/sup&gt; Northeast Bioengineering Conference (NEBEC) 2009</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Multifunctional Peptide-Based Coatings for the Facile Modification of Devise Interfaces</td>
</tr>
<tr>
<td>KOHANSKI, Michael</td>
<td>48&lt;sup&gt;th&lt;/sup&gt; ICAAC / 26&lt;sup&gt;th&lt;/sup&gt; IDSA</td>
</tr>
<tr>
<td></td>
<td>BME Day</td>
</tr>
<tr>
<td>KINAHAN, Michelle</td>
<td>CIMIT Innovation Congress 2008</td>
</tr>
<tr>
<td></td>
<td>Physics and Chemistry of Microfluidics Gordon Research Conference</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Tunable Silk Fibers: Mimicking Natural Silkworm Processing with Microfluidics</td>
</tr>
<tr>
<td>Name</td>
<td>Conference</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>KRAUS, Benjamin</td>
<td>Society for Neuroscience Annual Meeting 2008 November 15-19, 2008 in Washington, DC</td>
</tr>
<tr>
<td></td>
<td>Poster Title: A Novel Spatial Alternation Task for Exploring Context-Dependent Hippocampal Activity</td>
</tr>
<tr>
<td>LAPRAD, Adam</td>
<td>American Thoracic Society International Conference May 15-20, 2009 in San Diego, CA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Effects of Mechanical Stretch on the Responsiveness of Intact Airways, Airway Wall Strips, and Airway Smooth Muscle Strips</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Statistically Robust and Semiautomatic Quantification of Ventilation from Static Hyperpolarized 3He MRI: Application to Asthma</td>
</tr>
<tr>
<td></td>
<td>Biomedical Engineering Society Conference October 1-4, 2008 in St. Louis, MO</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Modulating Reactivity in the Intact Airway: Effects of Pressure Oscillations and the Extracellular Matrix</td>
</tr>
<tr>
<td>LIM, Daryl</td>
<td>Novel Techniques in Microscopy April 26-30, 2009 in Vancouver, Canada</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Wide-Field Fluorescence Sectioning with HiLo Microscopy</td>
</tr>
<tr>
<td>LIU, Jiahui</td>
<td>Biomedical Engineering Society Conference October 1-4, 2008 in St. Louis, MO</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Decoding the Output of the Limulus Circadian Clock</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Behavioral and Neural Discrimination of Time-Warped and Intensity-Varying Complex Natural Sounds</td>
</tr>
<tr>
<td>MULVEY, Christine</td>
<td>Biomedical Applications of Light Scattering III, Photonics West January 24-29, 2009 in San Jose, CA</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation Wavelength-Dependent Backscattering Measurements for Quantitative Real-Time Detection of Apoptosis in Living Cells</td>
</tr>
<tr>
<td>NEWBURG, Seth</td>
<td>Mechanics of Hearing Workshop; July 26-31, 2008 Keele University in UK</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Mechanical Response of the Basilar Membrane to Lateral micromanipulation</td>
</tr>
<tr>
<td></td>
<td>The Association for Research in Otolaryngology, Midwinter Meeting February 14-19, 2009</td>
</tr>
<tr>
<td></td>
<td>Oral Presentation: Lateral Micromanipulation of the Gerbil Basilar Membrane</td>
</tr>
<tr>
<td>SAZONOVA, Olga</td>
<td>2009 Biophysical Society Annual Meeting March 3-5, 2009 in Boston, MA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Matrix Mechanics and Cell Density Modulate Integrin and Syndecan Gene Expression in Vascular Smooth Muscle Cells</td>
</tr>
<tr>
<td>TA, Terence</td>
<td>BU Center for Nanoscience and Nanobiotechnology Nanomedicine Symposium May 13, 2009 at Boston University Medical School in Boston, MA</td>
</tr>
<tr>
<td></td>
<td>Poster Title: High-Intensity Focused Ultrasound-Triggered Release of Doxorubicin from Thermosensitive Liposomes</td>
</tr>
<tr>
<td>TRUSLOW, James</td>
<td>2008 Biomedical Engineering Society Conference October 1-4, 2008 in St. Louis, MO</td>
</tr>
<tr>
<td></td>
<td>Poster Title: Vascular Designs that Maintain Transmural Pressure</td>
</tr>
<tr>
<td>Name</td>
<td>Conference</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nine BME graduate students received special recognition this year. Ms. Katherine Calabro received the CIMIT Award for Translational Research in Medicine. Mr. Ari Friedland was the recipient of the BU College of Engineering Dean’s Award at the BU Science and Engineering Day 2009. Mr. Sylvain Gioux received the Gordon Research Conference “Discussion Panel on Challenges of Translating Biophotonics Technology to Clinical Practice” $300 awards. Mr. Gioux was also the recipient of a $650 travel award to the Society of Molecular Imaging Conference. Mr. Michael Kohanski received the 2008 Graduate Student Paper of the Year in Biomedical Engineering at BU in December. Ms. Pui Leng Leong received the CIMIT Fellowship for the second year. Mr. Eduard Reznik is the recipient of the Center for Biodynamics Fellowship. Ms. Corin Williams received the American Heart Association Predoctoral Fellowship (ongoing since 7/1/07). She also received a travel award to TERMIS-NA Annual Conference in San Diego, CA in December 2008. Ms. Jane Zhang received the CIMIT Graduate Student Medical Engineering Fellowship for 1/2008 through 1/2010. Ms. Zhang also won the most Innovative Research poster award at the CIMIT Innovation Congress Meeting in Boston, MA. Mr. Michael Koeris filed a patent with the BU Technology Development Office; founded a company including the technology developed in Prof. James Collins’ lab: Novophage Therapeutics, Inc. Mr. Koeris placed either first or second at the following competitions: first in the University of San Francisco Business Plan Competition (#1 of 92), second in the New Ventures World Competition at the University of Nebraska (#2 of 68), first at the Boston University ITEC 50K Business Plan Competition (#1 of 47), placed second at the Harvard Business School Business Plan Competition (#2 of 64), second at the University of California at Berkeley Business Plan Competition (#2 of 120), second at the MIT 100K Life Sciences Track (#2 of 42), and placed first at the University of Texas at Austin Global Moot Corp Challenge (#1 of 84).

G. Current Status of the Graduate Program

During Academic Year 2008-09 the Department of Biomedical Engineering Graduate Committee members were: Joyce Wong, Chair, Micah Dembo, James Galagan, Mark Grinstaff, Simon Kasif, Amit Meller, Bela Suki (Spring), Dimitrije Stamenovic (Fall) and Sandor Vajda.

The Admissions Committee members were: Ed Damiano, Director, Irving Bigio, Evan Evans, Maxim Frank-Kamenetskii, Simon Kasif, Jerome Mertz, Kamal Sen and Lucia Vaina. The mission of the admissions committee was:

- Review, admit and recruit all applicants to the MEng., MS, PhD, and MD/PhD graduate programs.
- Identify financial aid candidates for new and continuing students. Forms of financial aid include departmental, college and university fellowships.

The central mission of the Graduate Committee is the governance and administration of the graduate programs (MEng, MS, PhD and MD/PhD) within the Biomedical Engineering Department. This mission is carried through the following specific activities:

- Develop and maintain quality graduate MEng, MS and PhD curriculum.
- Develop policies and procedures associated with the curriculum and maintain written set of guidelines.
- Manage, administer and grade the Biomedical Engineering PhD Qualifying Examinations.
- Review student petitions, waivers and appeals.
- Maintain and review academic records of students, including tracking the degree progress of each student.
- Advertise the graduate programs (web page, Departmental brochures, bulletins, Peterson’s Guides, etc.).
- Contribute to the Annual Reports of the Department and the College of Engineering.
The above list emphasizes day-to-day management of the graduate program. A more global mission is to improve the national ranking of the department’s graduate program. The committee takes on extremely demanding responsibilities.

Other Initiatives from Academic Year 2008-09:

AY 2008-09 was the 8th year of the NIH training program in Quantitative Biology and Physiology. The program now has 24 trainees total, including 2 underrepresented minorities. Five students will join in September 2009. Four students, including one minority student, completed their degree requirements and graduated in January 2009 and/or May 2009. The NIH journal club continues to be student-run. In collaboration with the Provost Office, NIH trainees were given exposure to issues in ethics during the academic year.

Fall 2008 was the first year that the department admitted students for the Master of Engineering (MEng) degree. Five students matriculated in AY 2008-09. Another three students are expected to enter in the fall 2009. The program requirements have been tweaked to better align with the program mission to train students for technical leadership careers in industry.

In January 2009, the NIH Trainees held their fifth symposium, largely run by the students. More advanced students presented their thesis work, along with some outside guests of the students. The keynote speaker was Anthony Movshon, Professor of Neural Science and Psychology at New York University.

In fall 2008, the department planned career presentation seminars on effective-presentation skills offered by Prof. Irving Bigio, resume writing offered by David Brown in the ENG Career Office and a Grant Writing Workshop offered by a panel of faculty and graduate students. Career planning seminars will continue to be offered during the fall 2009 semester.

At the suggestion of the graduate students, a Course Forum Workshop was held the day before our orientation meeting for new graduate students in August 2008. This Course Forum Workshop was hosted by Allison Squires, David Hall, Kevin Litcofsky, Michele Savery and Kim Zubris and was well received by the incoming class. The workshop will be continued in the fall 2009.

Several initiatives were undertaken to improve the development of graduate students through the program. These included: holding to established guidelines regarding the timing of the prospectus defense and the formation of the dissertation committee; mandating periodic (at least yearly) meetings of the dissertation committee to foster better opportunities for mentoring and monitoring candidates as they make progress on their research.

H. Future Initiatives

Improving outreach to minority applicants: Experience has emphasized how difficult it is to recruit minority applicants. In the future, we will attempt to recruit students from traditionally minority universities more vigorously, with visits, multiple mailings and personal phone calls to engineering and physics faculty and students at such schools. We also attempt to make use of personal contacts in other well-known BME departments to encourage their minority students to apply and matriculate at BU.

Oral Qualifying Examination: The Graduate Committee is reviewing the Oral Qualifying Examination process for future changes to improve efficiency.

Improving the web page: We recognize that prospective students get much of their information from the departmental web site; we considered it a priority to update and improve the site. Improvements to the web site included better organization of financial aid information, as well as updated of pages describing faculty research. This project is ongoing.
V. RESEARCH

A. External Research Funding

The Biomedical Engineering Department maintains a vibrant research program in its approximately 68,000 square feet of space at 24-44 Cummington St., on Boston University’s Charles River Campus. We are comprised of 34 separate research laboratories and 6 research centers (described separately at the end of this section). The research can be characterized by a combination of

- empirical and theoretical work with an attention to explicit mathematical models for the phenomena under study,
- intensive computer use for experimental and theoretical work,
- a basic scientific flavor to the fundamental questions being asked,
- an attention to the applications of the work to the improvement of health care, and a thorough understanding of the underlying physiological processes.

### RESEARCH AREAS IN BME

<table>
<thead>
<tr>
<th>Biomechanics &amp; Biomaterials</th>
<th>Biomolecular Eng. &amp; Biotech.</th>
<th>Sensory Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellular and Subcellular</td>
<td>Bioinformatics</td>
<td>Cochlear Structure-Function</td>
</tr>
<tr>
<td>Tissue and Biomechanics</td>
<td>Protein Modeling</td>
<td>Auditory Signal Processing</td>
</tr>
<tr>
<td>Systems Biomechanics</td>
<td>Genome Sequencing</td>
<td>Psychophysics</td>
</tr>
<tr>
<td>Posture Control</td>
<td>DNA Structure-Function</td>
<td>Visual Perception Models</td>
</tr>
<tr>
<td>Biomedical Optics</td>
<td>Genetic, Protein &amp; Cell Regulation</td>
<td>fMRI Structure-Function</td>
</tr>
<tr>
<td></td>
<td>Functional Genomics</td>
<td>Photoreceptor Biology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cardiopulmonary Engineering</th>
<th>Neuroscience</th>
<th>Micro and Nano Biosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure-Function in Lungs</td>
<td>Ion-Channel kinetics</td>
<td>Cell &amp; Tissue Engineering</td>
</tr>
<tr>
<td>Noninvasive Diagnostics</td>
<td>Neural Firing Systems</td>
<td>BioMEMs</td>
</tr>
<tr>
<td>Blood Cell Biology</td>
<td>Neuromuscular Control</td>
<td>Cell Encapsulation</td>
</tr>
<tr>
<td>Arrhythmia Control</td>
<td>Functional Activities</td>
<td>Programmable Cell Environments</td>
</tr>
<tr>
<td>Nonlinear Dynamics</td>
<td></td>
<td>Biotherapeutics &amp; Drug Delivery</td>
</tr>
</tbody>
</table>

BME Faculty Annual Total Grant Funding

![Graph showing BME Faculty Annual Total Grant Funding from 2000 to 2009](image)

BME Grant Funding By Agency

![Graph showing BME Grant Funding By Agency](image)
During the period 7/1/2008 through 6/30/2009 the BME faculty received funding from 78 new and continuing funding awards for a total of $18,294,961. Over $52M in research proposals were submitted. Awards and proposals were received from and submitted to federal agencies such as NIH, NSF, DOD, and DOE, international agencies such as the European Commission Marie Curie Fellowship Program, private agencies such as the Wallace H. Coulter Foundation, the Juvenile Diabetes Research Foundation International, The Bill and Melinda Gates Foundation, The Ellison Medical Foundation, Children’s Orthopedic Surgery Foundation, The Sandler Family Supporting Foundation, The Hartwell Foundation, and private industry such as Schlumberger-Doll Research, Flex Biomedical Inc., Dithera Inc., Oxford Nanopore Technologies LTD, International Association of Oil and Gas Producers.

B. Publications

The BME Department primary faculty published 10 book chapters, 96 journal articles (refereed), 36 conference proceedings and abstracts, 6 patents and gave 75 invited lectures; the research faculty published 1 book chapters, 5 journal articles (refereed), 5 conference proceedings and abstracts, 2 patents and gave 10 invited lectures; and the affiliated faculty published 2 book chapters, 117 journal articles (refereed), 28 conference proceedings and abstracts, 3 patents and gave 47 invited lectures

Irving Bigio

Book Chapters

Conference Proceedings/Abstracts:


Journal Articles - Refereed:
“Elastic scattering spectroscopy for detection of cancer risk in Barrett’s oesophagus: experimental and clinical validation of error removal by


Patents
“Pattern recognition algorithms for spectral classification with applications to detection/screening of cancer and other pathologies using optical spectroscopy” (disclosure)

Invited Lectures


Colloquium, Duke University, Fitzpatrick Photonics Institute, “Elastic light scattering spectroscopy for the detection of pre-cancer” (Nov. 2008)

OSA Traveling Lecturer: University of Michigan, “Elastic light scattering spectroscopy for the detection of pre-cancer” (March 2009)


OSA Traveling Lecturer: University of Arizona, College of Optical Sciences, “Elastic light scattering spectroscopy for the detection of pre-cancer” (April 2009)

Natalia Broude

Journal Articles - Refereed:

Invited Lectures
Dr. Broude was an invited speaker at the conference “Imaging Technologies for Target Discovery”, October 20, 2008, World Trade Center, Boston MA

Charles Cantor


**Steve Colburn**

**Book Chapters**


**Journal Articles - Refereed:**


**Conference Proceedings and Abstracts**


**Invited Lectures**


**James Collins**

**Journal Articles - Refereed**


Invited Lectures

"A network biology approach to antibiotic action and bacterial defense mechanisms." Fourth Annual NIH Director's Pioneer Award Symposium, Bethesda, MD, September 22-23, 2008.


"Biology by Design", University Lecture, Boston University, October 21, 2008.


"Biodesigns: Nature's Living Machines and Bioengineered Gizmos", Graduate Program in Painting and Sculpture, Boston University, November 18, 2008.


"Turn Up the Noise: Noise-Enhanced Sensorimotor Function", BU Academy, April 9, 2009.


Edward Damiano

Journal Articles - Refereed

Carlo DeLuca

Journal Articles - Refereed

Conference Proceedings and Abstracts:


Charles DeLisi

Journal Articles - Refereed

Hu, Zhenjun; Snitkin, Evan S; DeLisi, Charles, VisANT: an integrative framework for networks in systems biology. Briefings in Bioinformatics, 2008: 9, 4 Pages: 317-25


Holloway DT, Kon M and DeLisi C Classifying transcription factor targets and discovering relevant biological features, Biology Direct, 22,2008
Micah Dembo

Journal Articles - Refereed


Invited Lectures

Evan Evans

Journal Articles - Refereed

Invited Lectures
Gordon Conference on Barrier Function of Mammalian Skin, New Hampshire, 2009
International Symposium on Genomic Biomechanics: 21st Century Frontier, La Jolla, 2008
Neuroscience Summer School, International Institute of Neuroscience, Natal, Brazil 2008

Daniel Ehrlich

Journal Articles - Refereed:
Ueberfeld J, McKenna B, Rubin-Berjerano I, Verstrepen, K, and Ehrlich DJ; Reaction-Mapped Quantitative Multiplexed PCR on a Microfluidic Device (Analytical Chemistry, 80, 7430-7436 (2008).

Ueberfeld J, Mckenna, B, Ramdhanie K, and Ehrlich DJ; Microdevice DNA Forensics (Humana Press 2009 (in Press).


Mckenna BK, Salim H, Brighurst FR and Ehrlich DJ; 384-Channel Parallel Microfluidic Cytometer for Rare-Cell Screening, Lab on a Chip 9, 305-310, 2009.


Maxim Frank-Kamenetski

Conference Proceedings and Abstracts:

Patents
M. Frank-Kamenetskii and H. Kuhn “Duplex Nucleic Acid Detection” US Provisional No. 61/158,168 Filing Date: March 6, 2009 NP Ref. No: 70158-061621-P2

James Galagan

Journal Articles - Refereed

Tim Gardner

Journal Articles - Refereed


Invited Lectures
“Metabolic Engineering of Isoprenoids at Amyris Biotechnologies.” Second q-bio Conference on Cellular Information Processing, Santa Fe, New Mexico, August 6-9, 2008.


Mark Grinstaff

Journal Articles - Refereed:


Conference Proceedings and Abstracts:


Invited Lectures


Simon Kasif

Journal Articles - Refereed


Catherine Klapperich

Journal Articles - Refereed


Invited Lectures
C. Klapperich, “Molecular Diagnostics in Plastic Microfluidics,” Brandeis University, Waltham, MA, Department of Physics Seminar Series, 16 July 2009. (Invited Talk)


C. Klapperich, “Tiny Chips on Target to make a Big Difference in Global Health,” BU Women’s Council, 18 March 2009, Boston, MA. (Invited Talk)

C. Klapperich, “Towards the Application of Molecular Diagnostics in Global Health,” Washington University, St. Louis, MO, Biomedical Engineering Seminar Series, 3 December 2008. (Invited Talk)


Patents


Kenneth Lutchen

Journal Articles - Refereed


Invited Lectures
“Synthesizing Imaging and Structural Models to Probe Airways and Airway Structures Responsible for Asthma” Keynote Speaker 1st International Conference on Mathematical and Computational Biomedical Engineering; June 29 – July 1, 2009, Swansea, UK

Amit Meller

Book Chapter

Journal Articles - Refereed


Jerome Mertz

Journal Articles - Refereed

Elise Morgan

Journal Articles - Refereed


Hunter, DJ, Gerstenfeld, LC, Bishop, G, Mason, ZD, Einhorn, TA, Maciewicz, RA, Newham, P, Morgan, EF. Bone marrow lesions from osteoarthritic knees are characterized by sclerotic bone that is less well mineralized. Arthritis Research, 2009; 11(1): R11.


Hayward, LNM and Morgan, EF. Assessment of a mechano-regulation theory of skeletal tissue differentiation in an in vivo model of mechanically induced cartilage formation. Biomechanics and Modeling in Mechanobiology, 2009; Jan 21 [Epub ahead of print].


Conference Proceedings and Abstracts:


**Invited Lectures**  
Department Seminar, Bioengineering, University of Utah, February, 2009.


Invited Talk, World Congress on Osteoporosis, Bangkok, Thailand, December, 2008.

Department Seminar, Bioengineering, University of Pennsylvania, November, 2008.

Department Seminar, Bioengineering, University of Maryland, October, 2008.

Invited Lecture, Orthopaedic Trauma Association Basic Science Fracture Forum, Denver, CO, October, 2008.

**David Mountain**

**Book Chapters**  

**Journal Articles - Refereed**  


**Conference Proceedings and Abstracts:**  


**Christopher Passaglia**

**Journal Articles - Refereed:**  
http://www.jove.com/index/Details.stp?ID=1384

http://www.jneurosci.org/cgi/content/full/29/8/2467

**Conference Proceedings and Abstracts**  
Park BH, Passaglia CL, deBoer JF. Optical
detection of action potential propagation using
phase-sensitive interferometry. SPIE Photonics
West Annual Conference (San Jose, CA, Jan
2009) // Werner B, Cook PB, Passaglia CL. Temporal
dynamics and contrast rectification of excitatory
synaptic inputs to cells in the ON and the OFF
pathway of the salamander retina. Society for
Neuroscience Annual Meeting (Washington, DC,
Nov 2008)
Freeman DK, Passaglia CL. Adaptation of rat
retinal ganglion cells to a probed-sine wave
paradigm. // Society for Neuroscience Annual
Meeting (Washington, DC, Nov 2008) 
Passaglia CL, Hernandez VF. Elucidating a role for
regenerative photon events in Limulus night vision
using a cell-based model. Society for Neuroscience
Annual Meeting (Washington, DC, Nov 2008) //
Liu JS, Passaglia CL. Decoding the output of the
Limulus circadian clock. Biomedical Society
Annual Meeting (St. Louis, MO, Oct 2008) // 

Kamal Sen

Journal Articles - Refereed
Grana GD, Billimoria CP, Sen K. Analyzing
variability in neural responses to complex natural
sounds in the awake songbird. Journal of
Neurophysiology 2009 Apr 8 [Epub ahead of
print].

Larson E, Billimoria CP, Sen K. A biologically
plausible computational model for auditory object
recognition. Journal of Neurophysiology 2009

Billimoria CP, Kraus BJ, Narayan R, Maddox RK,
Sen K (2008). Invariance and sensitivity to
intensity in neural decoding of natural sounds.

Spike Train Metric. Neural Computation
0(6):1495-511.

Conference Proceedings and Abstracts:
Behavioral and Neural Discrimination of time-
warped and intensity varying natural sounds.
Society for Neuroscience Abstract.

Discrimination Using a Biologically Plausible
Circuit That Implements a Spike Distance Metric.
Computational and Systems Neuroscience Meeting
Abstract.

Compensation for natural timing variations and
time warping in cortical discrimination of complex
sounds. Computational and Systems Neuroscience
Meeting Abstract.

Invited Lectures
Workshop on Calculation for Communication:
neural coding of songs in the bird brain,
Computational and Systems Neuroscience
Meeting, 2009.

Auditory Session, Gordon Conference on Sensory
Coding and the Natural Environment, Il Ciocco,
Italy, 2008.

Workshop on Linking Auditory Neurophysiology
to Perception, Computational and Systems
Neuroscience Meeting, 2008.

Center for Brain Science Seminar Series, Harvard
University, 2008.

Barbara Shinn-Cunningham

Journal Articles - Refereed
Lee, AKC, S Babcock, and BG Shinn-Cunningham
(2008). “Measuring the perceived content of
auditory objects using a matching paradigm,”
Journal of the Association for Research in
Otolaryngology, 9, 388-397.

Gallun, FJ, NI Durlach, HS Colburn, BG Shinn-
Cunningham, V Best, CR Mason, and G Kidd, Jr.
explanation accounts for binaural release from
informational masking,” Journal of the Acoustical
Society of America, 124, 439-449.

Best, V, E Ozmeral, N Kopco, and BG Shinn-
Cunningham (2008). “Object continuity enhances
selective auditory attention,” Proceedings of the
National Academy of Sciences, 105, 13174-13178.

Kopco, N and BG Shinn-Cunningham (2008).
“Influences of modulation and spatial separation on
detection of a masked broadband target,” Journal
of the Acoustical Society of America, 124, 2236-
2250.


Dent, M, E McClaine, V Best, EJ Ozmeral, R Narayan, K Sen, and BG Shinn-Cunningham (in press). “Spatial unmasking of birdsong in Zebra Finches (Taeniopygiz guttata) and Budgerigars (Melopsittacus undulatus),” Journal of Comparative Psychology.

Conference Proceedings and Abstracts:


Invited Lectures


“Speech understanding in complex settings,” Johns Hopkins Summer Workshop on Human Language Technology [plenary lecture], Johns Hopkins University, Baltimore, MD, 30 July [invited plenary speaker]

“Scene analysis and attention,” Center for Neuroscience Seminar, University of California, Davis, CA, 11 December. 2009

“Auditory objects and auditory attention,” Department of Psychology Colloquium, Brandeis University, Waltham, MA, 26 February.


“Auditory objects and switching attention,” UC Irvine Center for Hearing Research Seminar, Irvine, CA, 3 April.

“Communicating in the everyday world,” Research Usability Colloquium, Deutsche Telekom Laboratories, Berlin University of Technology, Berlin, Germany, 21 April.


“Auditory and cross-modal attention, Cognitive science program review, Alexandria, VA, 27 May.


Cassandra Smith

Book Chapters

Journal Articles - Refereed
Invited Lectures
"The Nature and Nurture of Schizophrenia"
Mathematical Biology Institute, Ohio State University, Ohio February 2008

"The Nature and Nurture of Schizophrenia"
National Institute of Mental Health Bethesda, MD November 3, 2008


Panel Discussion of Pharmacogenomics in Austism National Autism Conference Tampa, FL November, 2008

Michael Smith

Book Chapters

Journal Articles - Refereed


Invited Lectures
Fibronectin fiber mechanics: translating mechanical force into alterations in function. Boston University School of Medicine, Department of Biochemistry. April 7, 2009.


Temple Smith

Book Chapters

Journal Articles - Refereed


Patents
Pending, Application No. 10/763,039, “Alien Sequences” (disclosure)

Pending, “Extended Genetic Algorithm” (disclosure)

Dimitrije Stamenovic

Journal Articles - Refereed:


Conference Proceedings and Abstracts:


Invited Lectures
"Mechanics of the Cytoskeleton: Role of Engineers, Physicists and Mathematicians in Modern Biology", seminar in the Department of Mechanics, Faculty of Applied Mathematical and Physical Sciences, National Technical University of Athens, Athens, Greece, March 25, 2009.

"Rheology of Mammalian Cells", seminar in the Department of Mechanical and Aeronautical Engineering, University of Patras, Patras, Greece, April 9, 2009.

Martin Steffen

Journal Articles - Refereed:


Bela Suki

Journal Articles - Refereed:


Tom Szabo

Book Chapters

Journal Articles - Refereed


Conference Proceedings and Abstracts:


Invited Lectures
T. L. Szabo, “Advances in Medical and Diagnostic Ultrasound Imaging, IEEE Life Members Meeting, MIT Lincoln Laboratory, Lexington, MA , Dec. 10, 2008


Patents:


Joe Tien

Book Chapters

Journal Articles - Refereed

Invited Lectures
“Engineering Functional Human Microvessels In Vitro” Harvard University, School of Engineering and Applied Sciences (Cambridge, MA; 2009)

“Invascrilization of Microfluidic Type I Collagen Gels” Tissue Engineering and Regenerative Medicine International Society 2008 Annual Conference (San Diego, CA; 2008)

“Engineering Functional Human Microvessels In Vitro” University at Buffalo, Department of Chemical and Biological Engineering (Buffalo, NY; 2008)

“Microfluidic Gels for Microvascular Tissue Engineering” Center for Integration of Medicine and Innovative Technology (CIMIT) Summer Education Series (Boston, MA; 2008)

Lucia Vaina

Journal Articles - Refereed:
Daniel M. Goldenholz, Seppo P. Ahlfors, Matti S. Hämäläinen, Dahlia Sharon, Mamiko Ishitobi, Lucia M. Vaina, Steven M. Stufflebeam Mapping the signal-to-noise-ratios of cortical sources in magnetoencephalography and electroencephalography, NeuroImage 30 (4) 2009 p 1077-1086) Published Online: May, 2009

Sandor Vajda

Book Chapters

Journal Articles - Refereed


Conference Proceedings and Abstracts:
Invited Lectures
Modeling of Protein Complexes by Docking and Low Resolution Experiments. Workshop on Applications of Protein Models in Biomedical Research, University of California, San Francisco, July 11, 2008.

Patents
BU2008-38 “FTmap: System and method for the identification of druggable hot spots of proteins for high throughput screening” (disclosed)

BU2008-39 “PIPER: An FFT-Based Protein Docking Program with Pairwise Potentials” (disclosed)

Herbert Voigt

Journal Articles - Refereed


Joyce Y. Wong

Journal Articles – Refereed


Conference Proceedings and Abstracts:

Invited Lectures
University of Texas-Austin, Dept of Biomedical Engineering Seminar Series, Apr 2009, Austin TX


D. Active Research Laboratories

Auditory Neurophysiology Laboratory
Professor Voigt
- Experimental and theoretical studies of the neuronal circuitry in the cochlear nucleus.
- Single-and multi-unit recording and analysis techniques used to study the responses of neurons and neural nets to acoustic stimulation.
- Intracellular recording and marking techniques associate specific neurons to their physiology.
- Computational neural models test hypotheses of cochlear nucleus function.

Binaural Hearing Laboratory
Professor Colburn
The Binaural Hearing Laboratory is focused on studies of binaural interaction, including phenomena such as sound localization for which monaural processing also plays a major role. The goal of these studies is an integrated understanding of binaural interaction and its role in human sound perception including the interpretation of acoustic cues in complex sound environments (e.g., multiple sources in reverberant spaces). Specific projects range from signal processing models of physiological activity to empirical measurements of
the hearing abilities of listeners with hearing losses and/or neurological lesions. In the neural modeling area, we are evaluating the abilities of simple neural models to generate firing patterns equivalent to those seen in binaural cells in brainstem nuclei such as the MSO, LSO, and IC. In psychophysical studies of normal listeners, current interests include interaural discrimination and binaural detection, especially detection with reproducible noise maskers. In studies of listeners with hearing impairments, we are trying to relate listeners' abilities on a variety of binaural tests to a primary set of psychophysical measures. In studies of sound localization and recognition, we are studying and simulating the cues that lead to externalization, localization, and separation of sources.

Biomedical Microdevices and Microenvironments Laboratory

Professor Klapperich

The Biomedical Microdevices and Microenvironments Laboratory is focused on the interactions between biological molecules and cells and synthetic microenvironments. Specifically, we are interested in building microenvironments in vitro that mimic the physiological environment. These synthetic microenvironments are intended for use in diagnostics, high throughput drug screening, and to enable previously impossible basic science studies. Currently we have projects aimed at recapitulating the microenvironments of the breast, cochlea and motor neurons. We are also engaged in the design and engineering of manufacturable disposable microfluidic systems for low-cost point of care molecular diagnostics. We are currently working on devices for the detection of C. difficile, influenza and C-Reactive Protein, an inflammatory marker in heart disease.

Biomedical Optics Laboratory

Professor Bigio

The focus of our research is the development of minimally-invasive diagnostics and therapeutics based on optical and photonic technologies. We often collaborate with clinical researchers who test the new technologies on animals or human subjects. With noninvasive optical measurements there is minimal risk to the patient, but significant medical benefits are possible. Some of our ongoing projects include:

- "Optical biopsy": development of fiber-optic probes that perform spectroscopic measurements on tissue in vivo and noninvasively to instantly diagnose cancer and other pathologies in specific organ areas.
- "Optical pharmacokinetics": fiber-optic probes designed to measure drug concentrations in tissue, dramatically reducing the number of animals required for drug studies. This can also be used to determine the optimum type and dosage of novel (light-activated) chemotherapy agents for individual patients.
- Sensors to monitor the response of tumors to specific treatments.
- Optical methods for noninvasive imaging of neuronal activation and brain function.
- Optical methods for identifying different types of infectious agents.

Biomicroscopy Laboratory

Professor Mertz

The Biomicroscopy Lab focuses on the development of new optical microscopy techniques and on their applications to biological imaging. Our aim is to invent new techniques or to improve on existing techniques, usually for the purpose of high resolution imaging in thick tissue. We have built several experimental setups, three of which are based on femtosecond laser sources. Our current research areas include multiphoton microscopy, second harmonic generation, autoconfocal microscopy, graded field microscopy, and dynamic speckle illumination microscopy.

Our goal is to apply these techniques to biological imaging, in particular brain tissue imaging, either in-vitro (slice) or in-vivo (anesthetized animal). For this we are currently engaged in collaborations with the Neuronal Dynamics Lab (John White) and the Matt Wachowiak Lab in the Biology Department.
Biomimetic Materials Engineering Laboratory

Professor Wong

Dr. Wong’s research focuses on the development of biomaterials to probe how structure, material properties and composition of the cell-biomaterial interface affect fundamental cellular processes. Her current research interests include tissue engineering of small diameter blood vessels for bypass and intravascular pharmacology (e.g. stents); development of targeted nano- and micro-particle contrast agents for multi-modal (magnetic resonance, ultrasound, and optical) detection of atherosclerotic and vulnerable plaque; and engineering biomimetic systems to study restenosis and breast cancer.

Biomimetic Systems Laboratory

Professors Mountain and Hubbard

The long range goal of the Auditory Systems Laboratory is to develop large-scale biophysically-based models of the auditory pathways. The purpose of these models is to aid the interpretation of and the design of physiological and psychophysical experiments as well as to study auditory models for their usefulness as preprocessors for automated recognition of acoustic signals. Experimental approaches range from single-unit recordings to auditory evoked potentials obtained from the scalp and modeling approaches range from computational approaches to electronic hardware implementations. This laboratory is also engaged in the study of natural acoustic signal sources and acoustic environments. The purpose of this effort is to develop a better understanding of the evolutionary pressures which have shaped the auditory pathway as well as to develop computer simulations of natural environments for use as input to the auditory models. Other current projects include the use of auditory models for the acoustic transients and development of models for processing temporal sequences.

Biomolecular Systems Laboratory

Professor DeLisi

The Biomolecular Systems Laboratory develops and applies computational/mathematical methods, and high throughput experimental methods, to analyze changes in gene and protein expression profiles of cells in response to various endogenous and exogenous signals. In collaboration with the Fraunhofer Center for Manufacturing Innovation, and the Departments of Chemistry and Physics, we are developing and applying new DNA and peptide microarray technologies for fingerprinting the complete molecular state of a cell. Examples include the response to ligands (drugs, toxins, hormones etc), and changes that occur as normal cells mature, differentiate, progress toward disease. The long range goal is to relate expression patterns to pathways, pathways to networks and networks to function.

Brain and Vision Laboratory

Professor Vaina

Fundamental and applied research of visual information processing and perceptual learning in humans:

- Eye-movements and visual-perceptual abilities of neurological patients: measurement and rehabilitation.
- Structural and functional neuroimaging for functional-anatomical mapping of the visual motion system in humans
- Functional plasticity in the human visual system: characteristics, computational models, and applications to rehabilitation.
- Computational methods for aiding visually-guided navigation in visually-impaired patients

The Cantor Laboratory

Professors Cantor and Broude

Development of mass spectrometry of nucleic acid chips as a new general diagnostic platform for genetic diseases, cancer, and infectious disease

- Molecular engineering of streptavidin, a general prototyping system for solid state biochemistry, DNA and antibody based assays
- Development of high contrast methods for detecting nucleic acids in living cells and manipulating cells expressing specific MRNAs
Cell and Tissue Mechanics Laboratory
Professor Stamenovic
Fundamental and applied research of soft tissue rheology and mechanical properties of cells:
- Measuring and modeling mechanical properties of the cytoskeleton of living cells and its interactions with the extracellular matrix.
- Measuring and modeling rheological behaviors of living cells.
- Modeling of pneumatic osteoarthritis knee brace.
- Measurements and nonlinear modeling of the dynamic stress-strain relationship of soft tissues, in particular, of lung tissues.
- Image processing of fluorescently labeled components (such as collagen and elastin fibers) of tissues.
- Nonlinear dynamic modeling of various physiological phenomena such as avalanche mechanism of airway reopening.

Cellular and Subcellular Mechanics Laboratory
Professors Dembo and Evans
Experiments use extremely sensitive mechanical probes, novel materials and advanced optical microscopy to expose the physical actions and material properties of single cells and of the ultra fine macro molecular machines sensors and transducers that drive and control cellular and subcellular processes. Advanced computational methods are needed for data processing to obtain solutions for equations and for the final physical analysis used to establish definitive mechanistic interpretations of experimental data. A core teaching laboratory for training in nano-to-micro mechanical instrumentation has been set up to enable students and faculty to develop new research projects in biomedical engineering.
- We have a goal of achieving force measurements with resolution on the scale of the thermal energy divided by a molecular dimension (approximately 10E-10 gm wt). We are also trying to develop non-invasive detectors that will be capable of measuring displacements with resolution of a few nanometers at very high temporal rates
- We are conducting studies to investigate the role of structural mechanics in regulating biochemical pathways, biological adhesion phenomena, cytoskeletal deformation and active cellular motility
- We are developing novel materials that mimic the interfacial properties of natural biomaterials and we are studying the interactions of cells with such artificial substrata
- We are developing novel biomaterials as substrata for control of cell adhesion and cell motility. For example, materials with patterned surface modifications are used to investigate the effect of their physical, chemical, and mechanical properties on interactions with living cells

Cochlear Biophysics Laboratory
Professors Mountain and Hubbard
The long range goal of the Boston University Cochlear Biophysics Laboratory is to improve understanding of the hearing process through a synergistic combination of engineering and physiological techniques:
- Identify, quantify, and model the mechanisms responsible for mechanical sensitivity and frequency selectivity of the mammalian cochlea (inner ear). Recent experimental evidence suggests that the outer hair cells of the cochlea act as electromechanical amplifiers which increase hearing sensitivity one-hundred fold. Our efforts are directed towards confirming this hypothesis and clarifying our understanding of the underlying mechanisms.
- As a byproduct of their normal function, the outer hair cells also produce acoustic energy which can be measured in the external ear canal (otoacoustic emissions). These otoacoustic emissions have provided scientists and clinicians with a unique noninvasive tool to study cochlear function. In spite of hundreds of studies on otoacoustic emissions, the details of their production and their propagation back to the ear canal are not well understood. Our research, which builds on extensive experience with otoacoustic emissions, cochlear electrophysiology and biomechanics, and computer simulation, is expected to shed new light on this important clinical tool.
Collins Lab  
Professor Collins  
The Collins Lab focuses on developing nonlinear dynamical techniques and devices to characterize, improve and mimic biological function. Our specific interests include:  
(1) systems biology - reverse engineering naturally occurring gene regulatory networks, and  
(2) synthetic biology - modeling, designing and constructing synthetic gene networks.

Computational Genomics Laboratory  
Professor Kasif  
The research we pursue in partnership with major genomic centers and several other laboratories involves the development of new biotechnology and computational frameworks for the analysis, computational representation, measurement and modeling of biological systems. We are interested in human cells (e.g. insulin signaling networks) as well as bacterial genomics. 1) Computational Functional Genomics: new gene identification, functional classification and gene expression analysis. 2) Computational comparative genomics: methods for comparing complete genomic sequences at different levels of detail. 3) Discovery and modeling of biological pathways using probabilistic networks. 4) Genomic Biotechnology: new computer-assisted genomic and proteomic technologies. 5) Clinical Research focusing on Diabetes and Cancer.

Ehrlich Laboratory  
Professor Ehrlich  
The emerging view is that cancer shares an analogy to contagious disease. Under healthy systemic control, or with the intervention of drugs, an evolving balance is developed between healthy and potentially malignant rare progenitor cell types. Therefore, “base-line” genomic data is insufficient, and averaged genomic data or averaged expression patterns are very indirect and blunt as a diagnostic.

Our laboratory is developing the new methods and instruments needed to gather sufficiently detailed molecular snapshots from sufficiently specific rare-cell phenotypes for both drug development and clinical diagnosis. To some large part, the technology that can fill the gap can be assembled from high-speed microscopy and microfluidics, however, the instruments and work flow need to be redesigned, and other elements such as efficient cost-effective quantitative expression analysis need to be re-thought in format.

Fields and Tissues Laboratory  
Professor Eisenberg  
Research in the area of electrically mediated phenomena in tissues and biopolymers:  
- Computational modeling of current distributions in the heart and thorax during electrical defibrillation  
- Finite element modeling of magnetically induced currents in inhomogeneous anisotropic tissues and bodies  
- Microcontinuum and microstructural models of electromechanical interactions in connective tissues; tissue mechanics

Frank-Kamenetskii Laboratory  
Professor Frank-Kamenetskii  
Experimental and theoretical studies of DNA structure and function. New principles of DNA-drug interactions, Equilibrium and kinetic specificity of DNA-ligand interaction, Complexes of a DNA mimic, peptide nucleic acid (PNA), with duplex, Modulation of activity of proteins working on DNA using PNAs, Molecular beacons and their applications, DNA nanostructures based on PNA, Applications of the PNA technology for genome analysis and DNA detection.
Gardner Laboratory  
Professor Gardner  
Microbial organisms are something of a double-edged sword for humankind. They can cause debilitating or fatal infections; but they are also the source of many therapeutic drugs, may be used to detoxify polluted environmental areas, and may even offer solutions to the world's expanding demand for energy. To identify novel treatments that overcome bacterial resistance, and to unlock the full catalytic potential of microbes for bioremediation and energy production, a clearer understanding is needed of the complex systems of genes, proteins and metabolites underlying cell function. We are currently focused on developing computational and experimental tools for mapping and modeling system-wide properties of gene regulatory networks in microbes.

Grinstaff Laboratory  
Professor Grinstaff  
The Grinstaff group pursues highly interdisciplinary research in the areas of biomedical engineering and macromolecular chemistry.

- creating novel polymeric coatings termed “interfacial biomaterials” that control biology on plastic, metal, and ceramic surfaces.
- designing electrochemical-based sensors/devices using conducting polymer nanostructures and specific DNA structural motifs.

Medical Acoustics Laboratory  
Professor Porter  
Research in the Medical Acoustics Laboratory is directed towards developing new and exciting medical applications of ultrasound. Studies conducted in this laboratory combine acoustics, fluid dynamics, chemistry, biology, and biomedical engineering for:

- fabricating targeted ultrasound contrast agents for molecular imaging of diseases
- designing ultrasound-triggered drug delivery systems
- evaluating the underlying mechanisms for ultrasound-induced cellular uptake of drugs, genes, and proteins
- studying the mechanisms responsible for ultrasound-enhanced drug activity

Molecular Biotechnology Laboratory  
Professor Cassandra Smith  
Research in the Molecular Biotechnology Research Laboratory brings novel approaches and tools from the interface of genomics, genetics and biotechnology to complex disease studies. A major focus is on preventing schizophrenia by understanding how monozygotic (aka identical) twins can be discordant for disease. Another project focuses on the specific delivery of DNA therapeutic reagents (called aptamers) to cancer cells. Here, the goal is to develop effective targeted therapies for cancer treatment and diagnosis that minimize damage to bystander cells. Other projects focus on the development of novel DNA and RNA detection and analysis methods.

Natural Sounds and Neural Coding Laboratory  
Professor Sen  
How do neurons in the brain encode complex natural sounds? What are the neural substrates of selectivity and discrimination of different categories of natural sounds? How are these substrates shaped by learning?

The Natural Sounds and Neural Coding Laboratory investigates these questions in the model system of the songbird. Electrophysiological techniques are used to record neural responses from hierarchical stages of auditory processing. Theoretical methods from areas such as statistical signal processing, systems theory, probability theory, information theory and pattern recognition are applied to characterize how neurons in the brain encode natural sounds. Computational models are constructed to understand the processing of natural sounds both at the single neuron and the network level, to model neural selectivity and discrimination, and to explore the role of learning in shaping the neural code.
Organogenesis Laboratory

*Professor Tien*

Research applying techniques adopted from microlithography, self-assembly, microfluidics, and developmental biology to develop methods of assembling cells into ordered three-dimensional aggregates and use these aggregates as artificial tissue and as in vitro models of disease. Current work focuses on the fabrication of branched networks such as vasculature and pulmonary trees, and spatially complex organoids such as liver acini. This laboratory is a part of the Micro and Nano Biosystems Research facilities.

Pulmonary Physiology and Dynamics Laboratory

*Professor Suki*

- Roles of collagen remodeling and network breakdown in pulmonary emphysema
- Role of mechanotransduction in pulmonary emphysema
- Measurements and nonlinear modeling of the rheological properties of soft tissues including lung tissues and tissue engineered constructs
- Imaging of the extracellular matrix components such as collagen and elastin fibers and cells during stretching
- Statistical mechanical modeling of various physiological phenomena such as avalanches in airway reopening and fluctuations in cellular contraction in recurrent airway diseases
- Surfactant secretion in epithelial cells induced by dynamic stretching
- Noise-enhanced life-support systems including mechanical ventilation

Respiratory Research Laboratory

*Professor Jackson*

The Respiratory Research Laboratory's major research objectives are: using engineering and scientific principles to provide insight into the function of the respiratory system; developing methods of non-invasively quantifying changes in lung function resulting from disease or pharmacological interventions. Specific activities include:

- Measurement of the mechanical impedance of the respiratory and pulmonary systems. Measurement and analysis of the underlying microscopic and macroscopic properties of the pulmonary tissues and cells
- Development of instrumentation for measurements of pulmonary function in adults, infants, and patients in intensive care units
- Prediction of the system's behavior through detailed morphometrically based computer models that include the acoustic properties of the branching airways, non-linear visco- and plasto-elastic properties of the tissues
- Develop constitutive descriptions of the respiratory tissues based on their molecular, cellular, and systems structure and function
- Use of systems identification techniques to extract physiologically relevant parameters from complex mechanical impedance data
- Computer modeling of gas transport and mixing in the lung

Respiratory and Physiological Systems Identification Laboratory

*Professor Lutchen*

Development of novel linear and nonlinear systems identification approaches for probing mechanisms associated with healthy and diseased physiological systems. Principal applications in respiratory physiology. Research efforts include:

- Development of measurement, monitoring, and signal processing techniques that provide new insights on the structural airway and tissue conditions of the healthy and diseased lung
- Advanced application of mechanicistic and morphometrically based models for interpreting the structure-function relations in the lung with emphasis on the mechanisms that compromise breathing capability and ventilation
- Advancing linear and nonlinear systems identification science, sensitivity analysis, and optimal experiment design to evaluate the efficacy of applying models to physiological data with emphasis on structural lung models and cardiovascular dynamics
- Understanding the origins of linear and nonlinear properties of physiological systems
Segre Laboratory
Professor Segré
Metabolic networks are among the most conserved and best understood networks in biological systems. Yet, deciphering how metabolism at the cellular level responds to genetic (e.g. gene deletion) and environmental (e.g. nutrient shift) perturbations is an open challenge, relevant both to understanding physiological regulation and evolutionary adaptation. In our group, we approach these questions using kinetic and flux balance models of metabolic networks. In flux balance models, metabolic networks are treated as steady state systems, whose reaction rates (fluxes) can span a space of solutions constrained by fundamental mass conservation laws. Efficient optimization algorithms can search this space for flux arrangements that optimize a given objective function, such as maximization of cellular growth, or minimization of the deviation of fluxes with respect to a previously achieved state. Using these approaches, we can perform large-scale computer experiments of single and double gene deletions, generate global maps of predicted epistatic interactions between genes, and study the interplay between physiological and evolutionary adaptation in different organisms.

Single Molecule Biophysics and Nano-biotechnology Laboratory
Professor Meller
Research is directed toward the development of novel experimental techniques for the study of biomolecular interactions and dynamics, at the single molecule or at the single complex level. In particular, his research is focused on:
- Employing nanopore force spectroscopy to study RNA unfolding and re-folding kinetics
- DNA switches and transcription initiation kinetics
- RNA helicases activity
- Mapping of transcription factors interactions with DNA
- Ultra fast DNA sequencing
- Development of novel optical methods for single molecule detection in biomedical applications

Steffen Laboratory
Professor Steffen
Our efforts in the area of technology development aim at identifying protein interactions using mass spectrometry. We are developing two methods: (1) for identifying strong, stable interactions in complexes, such as those that might be found in a ribosome, polymerase or other multi-subunit complex; (2) for identifying weak, transient interactions, such as those that are involved in signal transduction. Our efforts in bioinformatics revolve around pathway and network identification. We have developed an algorithm for automated modeling of pathways in yeast, based only on two-hybrid protein interaction and microarray data. No prior knowledge of the pathway is needed. We now wish to extend this method to C. elegans and drosophila, and will explore application of this algorithm to mouse and human. Other computational efforts involve integrating known pathway and network data with proteomic and microarray experiments

Structural BioInformatics Laboratory
Professor Vajda
The focus of this laboratory is the development and application of computational tools for the analysis of protein structure and protein-ligand interactions. Some of the particular problems we currently study are the evaluation of binding free energy in protein-protein complexes, development of efficient docking algorithms, computational solvent mapping of proteins using molecular probes to identify the most favorable binding positions, method development for fragment-based drug design, construction of an enzyme binding site database, and improving the prediction of protein active sites by homology modeling.

Szabo Laboratory
Professor Szabo
Professor Szabo’s research goals are overcoming present limitations in imaging the body using ultrasound and other imaging modalities and finding new ways of extracting diagnostically useful information about tissue structure, health and function noninvasively. His work involves the following: multi-modal and 3D digital imaging and beamforming, signal processing, ultrasound-induced bioeffects, simulation and measurement of mechanical tissue properties, and scanning acoustic microscopy.
Vascular Interface and Microhemofluidics Laboratory
Professor Damiano

One of the major thrusts of our research is to investigate cellular and molecular interactions at the interface between blood and the vascular endothelium in order to advance our understanding of cardiovascular health and disease. Specific interests include (1) studying the role of the endothelial surface layer (ESL) in inflammation, (2) determining the extent of the ESL on endothelial-cell monolayers in vitro and throughout the vasculature in vivo, (3) analyzing the implications of the ESL for microvascular hemodynamics, and (4) studying the role of the ESL in atherosclerosis and in the vascular complications of hyperglycemia. Another major thrust of our research is centered around designing, testing, and implementing a closed-loop control system for regulating blood glucose in type 1 diabetes. Based on results from our pre-clinical studies in diabetic pigs, we have recently received FDA approval to test our blood-glucose control system in subjects with type 1 diabetes. Clinical trials have begun in the Mallinckrodt General Clinical Research Center at the Massachusetts General Hospital.

Visual Information Processing Laboratory
Professor Passaglia

The Visual Information Processing Lab investigates the computational strategies employed by the nervous system to process and encode a visual scene. Behavioral, electrophysiological, histological, theoretical, and computer modeling techniques are applied to animals with visual systems of varying complexity in order to gain a broad spectrum of insights into the neural basis of visual perception. The research efforts of the lab are primarily directed at the retinal network of the eye and its synaptic contacts in the brain. The aim is to understand how visual images are represented in the retinal output and how the representation changes as ocular diseases, such as glaucoma, inflict damage to the network.

E. Affiliated Research Centers

BIOMOLECULAR ENGINEERING RESEARCH CENTER (BMERC)
Established in 1991
Temple F. Smith & Sandor Vajda, Co-Directors

The BioMolecular Engineering Research Center (BMERC) has two major research objectives: to develop statistical and other computational approaches that will detect syntactic and semantic patterns in DNA, RNA, and protein sequences; and to use statistical/computational approaches to identify structure, function, and regulation in these molecules. In meeting these objectives, the BMERC is continually developing new computer-assisted analytical approaches that address basic problems in molecular biology.

CENTER FOR ADVANCED BIOTECHNOLOGY (CAB)
Established 1992
Natalia Broude, Charles Cantor, Maxim Frank-Kamenetskii

The Center for Advanced Biotechnology focuses on the development of new methodologies and biological materials. Among the new materials are genes involved in human behavior and particular human diseases such as schizophrenia, breast cancer, hypertension, and DNA analogs potentially suitable as new gene-specific drugs. Among the new methodologies are techniques for much more rapid DNA sequencing, improved techniques for faster genetic and physical mapping, methods for controlling the fate of environmentally released microorganisms, much more sensitive methods for DNA and antigen detection, potentially useful in new diagnostic tests, and novel blood cell uses.
The Center for Biodynamics (CBD) is a multidisciplinary, interdepartmental center, which strives to advance training and research between dynamical systems, biology, and engineering. The CBD trains undergraduates, graduate students, and postdoctoral fellows in leading techniques from these disciplines. The CBD emphasizes the integration of research and education, as well as the vertical integration of students and mentors at all levels within Boston University. Training is often done through involvement in cross-disciplinary collaborations and co-mentored projects.

**CENTER FOR NANOSCIENCE AND NANOBIO TECHNOLOGY (CNN)**

Established 2004

**Bennett Goldberg Director, M. Selim Ünlü and Joyce Wong Associate Directors; Members Mark W. Grinstaff, Catherine M. Klapperich, Amit Meller, Jerome C. Mertz, Joe Tien**

Nanoscience and nanotechnology research and development are leading a revolution in basic materials science and engineering. New advancements with designed functionality are poised to enable a huge range of applications in everything from developing fundamental building block in the electronics, photonics, and materials sectors, to sensors, biomimetic and biocompatible platforms throughout the biomedical and health sector.

The strength of Boston University’s efforts in interdisciplinary nanoscience and nanotechnology form an axis that begins in basic materials science, surface science, physics, chemistry, and engineering, extending into molecular and cellular biology, biophysics, and the technologies of microfluidics, MEMS, and onto manufacturing. Our strengths are in developing and using nanotechnology advances in materials and platforms with our capabilities in biomedical engineering to focus on applications in understanding subcellular processes, biomolecular function and human physiology.

The new Center for Nanoscience and Nanobiotechnology is established to advance academic and technological research and development in nanoscience and nanobiotechnology. The Center serves as a hub for nanoscience researchers from the Charles River and Medical Campuses and build activities that develop interdisciplinary research and training. The Center will connect scientists from disparate disciplines with each other in seminars, meetings, joint visitor programs and seeded projects to enhance the development of interdisciplinary nanoscale research. The Center will lead large, interdisciplinary proposal development and run funded programs for both research and training, as well as support individual researchers in their efforts by linking them with resources throughout the University and beyond. The Center will also build linkages between the research and technological commercialization resources at BU including the Photonics Center, the Technology Commercialization Institute, and Fraunhofer and with external partners and industrial affiliates.

**HEARING RESEARCH CENTER (HRC)**

Established in 1995

**H. Steven Colburn, Director, Douglas Cotanche, Nat Durlach, Allyn Hubbard, Hamid Nawab, David Mountain, Kamal Sen, Barbara Shinn-Cunningham, Malvin Teich, Herbert Voigt**

The Boston University Hearing Research Center (HRC) includes 20 faculty members from 6 departments in 4 Boston University schools and colleges. The HRC was formed in 1995 for the development and dissemination of knowledge that will improve the nation's auditory health and allow the fullest utilization of the sense of hearing. The specific goals of the HRC are:

- the encouragement and support of the highest quality research in hearing science and its applications
- the development and support of educational activities, particularly graduate education, in these areas
- the encouragement of collaborative research and teaching activities among faculty and staff from all appropriate units at the University
The NMRC was established in October 1984. Its mission is to increase our understanding of human motor control and improve the quality of life for the neuromuscularly impaired. It pursues these goals by performing basic and applied research, and by developing new techniques and technology in electromyography and biomechanics. The NMRC has active collaborations with various hospitals and clinics in the Boston area as well as research groups in seven countries throughout the world.

The NMRC is organized into six laboratories. Each laboratory is supervised by a faculty member with a scientific staff of research faculty, research assistants, and graduate students, drawn from engineering, medicine, psychology and allied health. The NMRC attracts scientists and researchers from universities throughout the world and has a staff of over 20 professionals and students.

The Design Lab is supervised by L. Donald Gilmore. This laboratory develops novel instrumentation that is used by the staff in its investigations. Several devices and specialized electrodes for detecting and analyzing EMG signals have been developed here; for example, the quadrifilar needle electrode, the parallel-bar surface electrode, the Double-Differential detection technique and the Muscle Fatigue Monitor.

The Injury Analysis and Prevention Lab is supervised by Professor Lars I.E. Oddsson. It is dedicated to studies of injury mechanisms related to postural control during slips and falls, lifting and other types of manual load handling. Biomechanical, neurophysiological and epidemiological tools are used to develop a better understanding of mechanisms causing injury. In addition, assistive technologies as well as training methods to improve balance function in individuals with gait and balance problems are developed in the lab. The lab is equipped with "BALDER" a custom-built balance platform used to impose postural perturbations, a video based motion analysis system (APAS), various exercise and strength testing devices as well as EMG equipment.

The Motion Analysis Lab is dedicated to developing and implementing engineering and mathematical concepts to study the neural control and biomechanics of posture and locomotion. It is equipped with two motion analysis systems. The facility also has two permanently installed force platforms, two portable platforms, accelerometers, and EMG equipment.

The Motor Control Lab is supervised by Professor Gerald L. Gottlieb. It is dedicated to the study of voluntary control of human limbs. The aim is to partition and characterize the three major determinants of movement: higher motor centers, reflex mechanism, and muscle properties. The Linear Synergy hypothesis originated in this lab. A specially designed servomotor powered manipulandum is used to study single-joint movements of the upper limb. A motion analysis system is used to study unconstrained movements of the arms and body. This work explores both the normal motor control and the behavior of patients with diverse movement disorders.

The Motor Unit Lab is supervised by Professor Carlo J. De Luca. It is dedicated to studying how the brain and spinal cord control the activation of muscle fibers to produce muscle force. The Precision Decomposition Technique was developed here. It is used to identify all the action potentials of concurrently active muscle fibers from the complex EMG signal detected during a muscle contraction. This technique has achieved international recognition and has been used to understand the code used by the central nervous system to excite muscle fibers. The Common Drive and the Onion Skin phenomena of motor unit control were discovered in this lab. Current interests include studies of motor unit control during muscle fatigue.

The Muscle Fatigue Lab is supervised by Professor Serge H. Roy. It is dedicated to developing and implementing surface EMG techniques for objectively measuring muscle fatigue. Current interests include the fatigue process of lower back muscles associated with lower back pain, and the effects of prolonged space flight on antigravity muscles. The Back Analysis System and a novel procedure for monitoring fatigue during Repetitive dynamic activities evolved in this laboratory.
F. Seminar Series

Biomedical Engineering Seminar Series

Tuesday, October 14, 4:00, ERB 203
Dr. Alexis Sauer-Budge, Senior Research Scientist, Fraunhofer Center for Manufacturing Innovation- Boston University
“Integrating microfluidic sample preparation and molecular diagnostics into a low cost disposable”

Tuesday, October 21, 4:00, ERB 203
Dr. Marcus Textor, Biointerface Group, Dept. of Materials, ETH Zurich
“Bioinspired surface modification and characterization for applications in the biosciences”

Tuesday, November 4, 4:00 ERB 203
Dr. Hatice Altug, Peter Paul Career Development Assistant Professor, Electrical and Computer Engineering Department, Boston University
“Nanophotonic devices for on-chip bio-sensing and single cell proteomics:”

Tuesday, November 18, 4:00 ERB 203
Dr. Richard Price, Dept. of Biomedical Engineering, University of Virginia
“Bursting Microbubbles with Ultrasound: A Platform Technology for Targeted Nanoparticle Delivery, Therapeutic Revascularization, and Tumor Ablation”

Tuesday, December 9, 4:00 ERB 203
Dr. Satish K. Singh, Assistant Professor of Medicine, Boston University School of Medicine; Staff Gastroenterologist, VA Boston Healthcare System
“Improving Course Handicaps in Endoscopic Colorectal Cancer Prevention”

Monday, December 15, 11:00, ERB 203
Dr. Todd Thorsen, Dept. of Mechanical Engineering, MIT
"Microfluidic Tools for Metabolomics"

Wednesday, January 14, 4:00, ERB 203
Dr. Patrick Drew, University of California – San Diego
"Plasticity and Plumbing in the Cortex"

Wednesday, January 21, 4:00 ERB 203
Dr. Kim Woodrow, Dept. of Biomedical Engineering, Yale University
“Polymeric nanoparticles for delivering RNA interference”

Wednesday, January 28, 4:00, ERB 203
Dr. Harold Kim, Dept. of Molecular and Cellular Biology, Chemistry, and Chemical Biology, Harvard University
“How the packaging of DNA influences gene expression”

Wednesday, February 4, 4:00 ERB 203
Dr. David Altman, Dept. of Chemistry, Stanford University
“Regulating the function of the molecular motor myosin VI”

Wednesday, February 11, 4:00 ERB 203
Dr. Christian Baker, Department of Electrical and Computer Engineering Worcester Polytechnic Institute
“Virtual Imaging Man : Interactive Training System for Medical Ultrasound”
Wednesday, February 18, 4:00pm, ERB 203
Dr. Khalid Salaita, Dept. of Chemistry, University of California, Berkeley
"Deconstructing Receptor Signaling with Chemically Patterned Interfaces"

Wednesday, February 25, 4:00, ERB 203
Dr. Myung-Han Yoon, Dept. of Chemistry and Chemical Biology, Harvard University
“Neuronal Interfacing: Controlling Cellular Function and Monitoring Activity”

Monday, March 16, 4:00 pm, ERB 203
Dr. Muhammed Zaman, Dept. of Biomedical Engineering, U. Texas, Austin
“Cell- Matrix Interactions in 3D Environments: From Systems Biology to Multi-Scale Modeling”

Wednesday, March 18, 4:00 pm, ERB 203
Dr. Xue Han, Dept. of Biological Engineering, MIT
“Developing novel cell-type specific optical neural control prosthetics”

Wednesday, March 25, 4:00 pm, ERB 203
Dr. Nick Lesica, Dept. of Biology, LMU Munich, Germany
“Adaptive Processing of Natural Sensory Stimuli”

BME DISTINGUISHED SCIENTIST LECTURES 2008-2009

Thursday, March 12, 4:00 ERB 203
Dr. Peter Nielsen, Dept. of Cellular and Molecular Medicine, The Panum Institute, Faculty of Health Sciences, University of Copenhagen
“Peptide Nucleic Acids (PNA): Can they be turned into gene therapeutic drugs?”

Wednesday, April 1, 4:00 ERB 203
Dr. Dennis E. Discher, Biophysical Engineering. & NanoBio-Polymers Lab, University of Pennsylvania
“Foreign vs Self decisions of Macrophages & Matrix elasticity effects on Stem Cell differentiation”

The Sixteenth F.A. Bourke Distinguished Lecture

Tuesday, April 14, 2009
5:00 p.m. Photonics Building- 206
8 St. Mary’s Street Boston, MA.

“Synthetic Biology in Pursuit of Low-Cost, Effective, Anti-Malarial Drugs”

Jay D. Keasling, Ph.D.

Hubbard Howe Jr. Distinguished Professor of Biochemical Engineering in the Departments of Chemical Engineering and Bioengineering at the University of California, Berkeley. Senior Faculty Scientist Director of Physical Biosciences Division at the Lawrence Berkeley National Laboratory. Chief Executive Officer of the Joint BioEnergy Institute

Lecture Synopsis

Synthetic biology is the design and construction of new biological entities such as enzymes, genetic circuits, and cells or the redesign of existing biological systems. Synthetic biology builds on the advances in molecular, cell, and systems biology and seeks to transform biology in the same way that synthesis transformed chemistry
and integrated circuit design transformed computing. The element that distinguishes synthetic biology from traditional molecular and cellular biology is the focus on the design and construction of core components (parts of enzymes, genetic circuits, metabolic pathways, etc.) that can be modeled, understood, and tuned to meet specific performance criteria, and the assembly of these smaller parts and devices into larger integrated systems that solve specific problems. Just as engineers now design integrated circuits based on the known physical properties of materials and then fabricate functioning circuits and entire processors (with relatively high reliability), synthetic biologists will soon design and build engineered biological systems.

We are using synthetic biology to create inexpensive, effective, anti-malarial drugs. Currently, malaria infects 300–500 million people and causes 1-2 million deaths each year, primarily children in Africa and Asia. One of the principal obstacles to addressing this global health threat is a lack of effective, affordable drugs. The chloroquine-based drugs that were used widely in the past have lost effectiveness because the Plasmodium parasite which causes malaria has become resistant to them. The faster-acting, more effective artemisinin-based drugs — as currently produced from plant sources — are too expensive for large-scale use in the countries where they are needed most. The development of this technology will eventually reduce the cost of artemisinin-based combination therapies significantly below their current price. To reduce the cost of these drugs and make them more widely available, we have used synthetic biology to engineer microorganisms to produce artemisinin from renewable resources. I will describe the process by which we engineered production of this important drug and the prospects for translating this research to people most in need of the drug.

---

**Brain and Vision Seminar Series**

Mon. - Apr.13, 2009 - 3pm  
44 Cummington St. Rm. 705  
Dr. Nicolae Duta - Nuance Communications  
"Vision applications to automated medical diagnosis"

Wed. - Apr.8, 2009 - 3pm  
44 Cummington St. - Rm. 705  
Dr. Nicolae Duta - Nuance Communications  
"Vision-based biometric (person identification) systems"

---

**Hearing Research Center Seminar Series**

September 9, 2008  
Bill Hartmann  
Michigan State Physics and Astronomy  
[Visiting faculty member, Boston University fall 2008]  
"Detecting Interaural Incoherence and the Masking Level Difference"

September 12, 2008  
Morten Jepsen  
Centre for Applied Hearing Research, Technical University of Denmark  
"Modeling auditory perception in normal-hearing and hearing-impaired listeners"

September 19, 2008  
Oded Ghitza, Ph.D.  
Center for BioDynamics and Hearing Research Center, Boston University  
Sensimeometrics Corporation  
"Consonant Discrimination of Degraded Speech using an Efferent-inspired Closed-loop Cochlear Model"
September 26, 2008  
Douglas Cotanche, Ph.D.  
Hearing Research Center and Department of Otolaryngology, Boston University  
"Hair Cell Regeneration and Stem Cell Transplantation in the Vertebrate Inner Ear: Their Potential as Therapeutic Treatments for Deafness"

Binaural Bash 2008  
October 17 & 18, 2008

Gary Jones  
“Channel interactions in bilateral cochlear implant users: monaural and binaural effects”

Doug Oliver  
“A new synapse in the inferior colliculus”

Yi Zhou  
"Responses of cortical neurons to concurrent/sequential sounds from multiple spatial locations"

Neil Aaronson  
"Responses of cortical neurons to concurrent/sequential sounds from multiple spatial locations"

Andy Brughera  
“Membrane and ITD responses suggest further adaptation in the IC”.

Les Bernstein  
“Manipulations of temporal features of the envelopes of high-frequency stimuli: Effects on sensitivity to ITD and challenges to modeling”

Bernard Delgutte & Ken Hancock  
"Jitter unmasks neural ITD sensitivity with cochlear implants"

Mathias Dietz  
“Modeling lateralization with independent fine-structure and envelope-based temporal disparities”

Erick Gallun  
“Modeling binaural interference for older and hearing impaired listeners”

November 7, 2008  
Prof. Karen Helfer, Ph.D.  
University of Massachusetts, Amherst  
Title: TBA
December 5, 2008
Rapeechai Navawongse, Ph.D. candidate
Department of Biomedical Engineering, Boston University
"Extracellular Single Neuron Recording in Dorsal Cochlear Nucleus of the Awake Gerbil"

December 12, 2008
Prof. Jens Blauert, Ph.D.
Ruhr University, Bochum, Germany
"Room-Related Presentation of Auditory Scenes via Loudspeakers"

January 16, 2009
Prof. Sharon Kujawa
Department of Otology and Laryngology, Harvard Medical School, Director of Audiology, MEEI
"Acute, Chronic and Delayed Consequences of Noise Exposure: Conventional Wisdom and Recent Findings"

February 13, 2009
Dipl.-Biol. Astrid Klinge
Zoophysiology & Behaviour Group, Department of Biology and Environmental Science, Carl-von-Ossietzky Universität Oldenburg
"Frequency analysis in harmonic complexes in relation to grouping cues in Mongolian gerbils"

February 26, 2009
Prof.dr.ir. Hendrikus (Diek) Duifhuis
Professor of Biomedical Engineering, University of Groningen, Groningen, The Netherlands
"What can a time-domain cochlea model tell us about biophysical cochlear mechanics?"

March 25, 2009
Nicholas Lesica, Ph.D.
Ludwig Maximilians University Munich, Department of Biology
"Adaptive Processing of Natural Sensory Stimuli"

April 3, 2009
Robert Gilkey, Ph.D.
Professor of Psychology, Wright State University, Dayton, Ohio
"The relation between molecular psychophysics and informational masking"

April 10, 2009
Prof. Allyn Hubbard, Ph.D.
Professor, Electrical and Computer Engineering Department, Hearing Research Center, Boston University
"Joining the TWAMP & SANDWICH models of the cochlea: Combining stereocilia and somatic hair cell forces."

April 17, 2009
Josh McDermott, Ph.D.
Center for Neural Science, New York University
"Sound Texture Perception via Texture Synthesis"

April 24, 2009
Bo Wen, Ph.D.
EPL Neural Coding Group, Postdoctoral Fellow, R.L.E., M.I.T.
"Dynamic range adaptation to sound level statistics in the auditory nerve"

May 15, 2009
Sasha Devore
Doctoral Candidate, EPL Neural Coding Group, M.I.T.
"Neural correlates and mechanisms of sound localization in everyday reverberant settings"
G. Facilities

Offices: The BME Department Administrative Offices consist of approximately 4,700 square feet of office space primarily located on the fourth floor of 44 Cummington St. There is approximately 5,300 square feet of office space provided for individual offices for departmental faculty. These offices are generally located in the proximity of faculty laboratories and support the faculty’s administrative, research and teaching needs. In addition to their primary office faculty are also provided with office space for their students and post docs. The amount of space provided varies among the faculty but totals approximately 7,000 square feet.

Research Laboratories: The Biomedical Engineering Department maintains state of the art instructional laboratories to support its educational programs. These facilities are enumerated below and comprise a total of ~8400 sqft. Additionally, Department facilities support a vibrant research program in approximately 42,600 square feet of research laboratories at 24-44 Cummington St., on Boston University’s Charles River Campus. These facilities include 44 separate research laboratories and 6 research centers. While these facilities primarily support research and graduate education, they are inherently tied to the environment experienced by undergraduates. Additionally, these facilities support the Senior Design Project Courses as well as serve as homes for all students who become engaged in undergraduate research.

Instructional Laboratories:

Biomedical Engineering Instructional Laboratory, ERA 209/211 (1,837 sqft)
The Biomedical Engineering Instructional Laboratory is a 14 workstation wet lab designed to aid in teaching core Biomedical Engineering concepts and skills in several courses. Each station is equipped with a dual-core processor PC (2.2 GHz Core2Duo, 2 GB system memory), a data acquisition card (DAQ) and breakout box, and benchtop testing equipment (triple power supply, digital multimeter, function generator, low-noise differential amplifier, and oscilloscope). Students are able to design and conduct experiments to record a variety of physiologically important signals such as electrocardiograms, nerve conduction, and lung volumes. Each PC is also loaded with analytical software including Matlab, Mathcad, LabView, and SigmaPlot for data analysis and professional presentation.

BME Computational Simulation Facility, LSEB B03/B04 (1,851 sqft)
The Biomedical Engineering Computational Simulation Facility is a high-performance computing laboratory located at 24 Cummington Street, basement rooms B03 and B04, with a smaller computational classroom located at 48 Cummington Street, basement room B11. The satellite facility in 48 Cummington was completed in 2001 and the main facility in LESB was completed in 2005. The facility consists of high-performance Linux workstations at each of over fifty seats and rack-mounted computational nodes in a separate server room. The facility is available for classroom instruction, homework and research projects requiring high computational power, and all machines are clustered together as part of a parallel computing grid for remote access to regular scientific applications and for processing long, computationally intensive jobs.

Hardware:
- Class/Lab Rooms:
  - 58 dual-processor AMD Opteron workstations (model Sun w2100z) simultaneously working as compute nodes each with 2G RAM, U320 SCSI disk
  - Cisco 3500-series Ethernet switches with gigabit fiber uplinks
  - Split into two rooms, separable by a retractable wall LCD projectors, chalkboards and whiteboards in each room Configurable as: 1 small room with 16 student stations and 1 instructor station and 1 large room with 40 student stations and 1 instructor station; or 1 very large room with 56 student stations & 2 instruct stations, with both LCD projectors and AV equipment outputting same or different data.
- Server Room:
  - 49 dual-processor AMD Opteron 1U rackmount compute nodes Each with 2G RAM, U320 SCSI disk (same as workstations) 2 identical machines configured with 4G RAM (as grid controllers) 2 8-processor AMD Opteron 3U rackmount compute nodes for large shared-memory jobs each with 20G RAM, 2 U320 SCSI disks in RAID array 2 Cisco 3560 gigabit Ethernet switches one 48-port, one 24-port, with fiber uplinks and SFP stacking cable
- Disk Backend:
  - 2 Network Appliance Filer 3050's multiple gigabit Ethernet uplinks and > 10TB storage (now), maintained by College of Engineering. Provides access to same user data across all OS platforms constantly being expanded to meet growing needs of College

Software:
Boston University Linux x86_64
64-bit Linux distribution maintained in-house by dedicated BU Linux development team. Based on Red Hat Enterprise, CentOS, and Fedora Core Linux. Contains AFS and Kerberos network file access and authentication and provides access to all academic and commercial software maintained by Office of IT, as well as software maintained by College of ENG. BU Linux AD Login subsystem an environment developed by College of Engineering and Office of IT to provide platform-agnostic access to the same data and authentication backends for all users on all platforms

Sun Grid Engine 6.0
Open-source, commercially-supported local-area and wide-area clustering backend for a variety of OS and hardware platforms, including Windows and MacOS as well as other UNIXes. Allows future scalability beyond college of ENG and beyond Linux

BME Computational Classroom, ERA B11 (473 sqft)
This lab contains 12 dual-processor Intel Xeon workstations with 1G RAM each. All systems are running BU Linux and are used simultaneously as workstations and as nodes for distributed supercomputing, available continuously through in-lab or remote access. The lab is equipped with overhead LCD Projection capabilities to enhance computer based lectures. The center supports smaller computational classes. Whenever classes are not being held, it is available for open lab use by students and researchers.

Cell and Biomolecular Mechanics Instructional Laboratory, ERB B08 (1,276 sqft)
The Cell and Biomolecular Mechanics Instructional Laboratory supports BME courses in Cellular and Subcellular Biomechanics and Molecular Bioengineering. The laboratories focus is on methods for study and manipulation of biomolecules and structural components of cells. Some of the equipment used in lab projects include: DSC microcalorimeter, ITC microcalorimeter, Freezing Point Osmometer, Vapor Pressure Osmometer, Microforge, Multitrough/Film balance, Video cameras, Micropipette puller, computers for automated experimentation and professional data analysis and representation, Real-time PCR machine, PCR thermocycler, UV-spectrophotometer equipped with thermo-regulated compartment, protein and DNA gel electrophoresis, gel documentation, Optical microscope equipped with: fluorescent attachment, optional Hoffman Modulation Contrast illuminating system, accessories for micromanipulation and pipette aspiration

BME Micro/Nano Imaging Facility (1,000 sqft)
Core Director: Phil Allen, Ph. D.
The Micro and Nano Imaging (MNI) Facility suite is a central teaching and research facility with a focus on imaging biological materials ranging from tissues to individual molecules. Instrumentation includes Confocal, TIRF and multiple Widefield systems with the ability to maintain cells and tissues under appropriate conditions.

Micro and Nano Fabrication Facilities (1000 sqft)
The Micro/Nano Fabrication Facilities are the focal point for all soft lithography. Two clean rooms (a class 100 and class 1000) house all of the necessary capabilities to write patterns and create devices that span the nano to micro size scale in nonstandard organic/inorganic biomaterials. Micro/nano fabrication classes will utilize both the Class 100 and Class 1000 clean rooms, but the Class 1000 area will allow space for items that do not need the ultra clean environment of the Class 100 room.

Biointerface Technology Core (1000 sqft)
Core Director: Xin Brown, Ph. D.
The BioInterface Technologies Facility is a central teaching and research facility with a focus on biomaterial and tissue engineering. It offers instrumentation and service in biomaterial synthesis, property (chemical, physical, mechanical) analysis and biological assessment.