MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Orientation 2005

The BioTECH

Volume 4, Issue 1

(BIOLOGICAL ENGINEERING)-BIOMEDICAL ENGINEERING SOCIETY

Biological Engineering Major Welcomes Class of '09

By ***Justin Lo '08***, *SECRETARY*

The Biological Engineering (BE) Division is launching a new BE SB degree in the 2005-2006 Academic Year, just in time to welcome the incoming class of 2009. The Dean of Engineering Dr. Thomas Magnanti has recently requested that MIT recognize BE with a course number (Course 20).

The curriculum for the degree was developed by the BE Undergraduate Programs Committee and approved by a unanimous vote of the MIT faculty in February 2005 as the first new major course of study at MIT in nearly 30 years. The first class will graduate in 2008.

The BE curriculum comprises nine brand new core subjects that define Biological Engineering as a discipline at the undergraduate level, as underlined in the talks given by Professor Douglas Lauffenburger, Director of BE Division: "Biological Engineering and the BE SB degree: Philosophy and Plans."

BE celebrated the new major in April (see p. 6).

Highlights of the BE curriculum include two new lab courses that address fundamental biological engineering techniques and instrumentation (*BE.109* and *BE.309*). In light of the lab capacity, enrollment in the BE SB degree is currently limited to 20 students per class for the classes of 2008 and 2009.

Expansion of faculty and physical space are under way to accommodate more students in the future. Meanwhile, interested students are encouraged to contact the BE Academic Office at <be-sb-apply@mit.edu> to indicate their intent to apply to BE SB.

Applications are accepted during the fall term of the students' sophomore year, and admission is considered based on completion of core requirements. So far, approximately 40 Class of 2008 students have signed up to be placed on the candidate list, and approximately 100 students have preregistered for *BE.110, Thermodynamics of Biomolecular Systems*, one of the core requirements to complete for applying. Updates can be found at <http://web.mit.edu/be/education/ugrad.htm>.

Meritorious Achievement Award Winner

MIT BMES again selected as ***Chapter of the Year***

Award to be presented at the National BMES Fall Conference on September 29, 2005 at Hyatt Regency in Baltimore, MD

FAQ on BE

By ***Brian Chase '06***, *MANAGING EDITOR*

Q: What is Biological Engineering? What is Biomedical Engineering? What is Bioengineering? Is there a difference?

A: MIT has been at the forefront of establishing a new engineering discipline based in modern molecular life sciences – Biological Engineering – where engineering principles in design, synthesis, and analysis are applied to biology at the molecular and cellular level, in contrast to Biomedical Engineering, which is the application of traditional engineering disciplines to medical problems without any necessary grounding in molecular life sciences.

In other words, biological engineering, at least as it's viewed at MIT, is the discipline of using engineering principles and quantitative measurements to be able to both *understand* and *engineer* biological systems and molecules.

For example, MIT biological engineers have modeled quantitatively how bone marrow cells and white blood cells take up and process an important growth factor called Granulocyte Colony-Stimulating Factor (GCSF).

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The BioTECH

MIT (Biological Engineering)-Biomedical Engineering Society Publication

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The *BioTECH* is a publication by the MIT (Biological Engineering)-Biomedical Engineering Society (BE-BMES) as a vehicle to inform, involve, and mobilize our membership regarding the complex and evolving bioengineering landscape at MIT and nationwide. Founded in Spring 2003, the *BioTECH* has grown from a campus publication to one with wider constituencies, a bridge for inter-chapter relations and a catalyst to spark discussions on the national scene — the BMES Bulletin, for example, printed our *Letter to the Editor* in a full page coverage (p.3) of its summer 2004 issue <http://www.bmes.org/pdf/vol28_2.pdf>.

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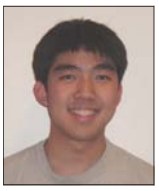

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Letter to the Editor

Dear Editor,

Thanks a million times for putting your last issue online [http://web.mit.edu/bmes/www/thebiotech_vol3no1.html].

I have spent about two hours looking through it — it is so interesting because it really shows me ahead of time all the options there are once I get to MIT. For example, in the "'Bio' + 'Eng' Options @ MIT" section, I thought Christina Fuentes [Brain & Cog. Sci. major-BME minor] and Brian Chase's [Biology-BE double major] combinations were really interesting.

> *"I found it interesting that the engineering in BE was designed specifically for biology. I have always been interested in bioengineering, while not necessarily wanting to take classes that were focused on engineering alone without exploring the underlying biological principles."*

I have been, at least up to now, focused on biological sciences, and brain function is definitely an area I would like to study. I have been thinking about studying a biological science along with a more applicable connection, such as BME, BioE, or BE. I am also considering pursuing applied math (to biology) because I know that I have always wanted to combine math and science. And I'd like to be get into research right from the start as an undergraduate.

I found it interesting that the engineering in BE is designed specifically for biology. I have always been interested in bioengineering, while not necessarily wanting to take classes that were focused on engineering alone without exploring the underlying biological principles. It seems like BE might be what I am looking for.

Thanks for your publication. It really has opened a lot of options for me in respect to what I could accomplish at MIT.

Sincerely,
Cristina Fernandez
Pine Crest School,
Fort Lauderdale, FL

BE & BME information & advising sessions

Date: Tues, Sept. 6 (Reg Day)
Time: 3-5 pm
Place: 56-514

3:00	Intro to BE & BME @ MIT, including the new BE Major (for freshmen & sophomores)
3:20	Intro to the BME Minor, including updates of new courses and corrections to web course listings (for freshmen, sophomores, and juniors)
3:40	BE M.Eng. degree program
4:00	Q&A, individual advising

BE Major Advising Session for Sophomores

Date: Fri, Sept. 2
Time: 3:30-4:30 pm
Place: 56-514

Date: Tues, Sept. 6 (Reg Day)
Time: 10-11 am
Place: 56-614

Interested sophomores are requested to contact Suzette Clinton <sclinton@mit.edu> to schedule a session for fall-term advising regarding the BE Major. They should also sign up on the list of potential BE majors by sending an email to <be-sb-apply@mit.edu> if they have not already done so.

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Frequently Asked Questions about Biological Engineering Answered

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The model predicts that a version of GCSF that binds less well inside the cell compared to the surface will last longer in the bloodstream and thus require less frequent administration (such models are discussed in *BE.320*).

Such "cell physiology" models — molecular thermodynamic models of the binding of the GCSF molecule to its receptor — enable predictions of how to "engineer" a better GCSF by substituting key amino acids in the binding site for ones with different charge (this example is analyzed in *BE.110*). In fact, natural GCSF is a billion+ $$/year drug, and the new version developed by MIT biological engineers is now in development.

At MIT, Biological Engineering is considered a "discipline" – so much so that the Dean of Engineering Dr. Thomas Magnanti has requested that MIT award a Course Number (20) to BE. Biomedical Engineering (BME), on the other had, involves application of traditional engineering disciplines, such as Mechanical Engineering or Electrical Engineering, to any of the various problems the medical field, without necessarily any understanding of mechanistic biology, but often some understanding of anatomy or organ-level physiology. This could include designing new surgical robots, methods to acquire and transmit medical images, or new artificial hearts.

At MIT, Biomedical Engineering is not considered a discipline itself but rather an application field of many engineering disciplines. Accordingly, from an education standpoint, there is no major in biomedical engineering at MIT, and no plans for one. Students who are interested in applying engineering to medicine can major in any engineering discipline.

As with Bioengineering, it is a term often used to encompass facets of both Biological Engineering and Biomedical Engineering.

Q: Does Biological Engineering involve a lot of math? What if I don't want to do bio lab work?

A: Biological engineering offers diverse options for exploring biological questions and also offers opportunities for synthesis of new things.

Some aspects of BE are focused on measurements of biological systems behavior, particularly in response to well-defined cues, so that those systems can be modeled, further studied, and ultimately controlled at the molecular scale.

> ***Biological Engineering** is a discipline where engineering principles in design, synthesis, and analysis are applied to biology at the molecular and cellular level, in contrast to **Biomedical Engineering**, which is the application of traditional engineering disciplines to medical problems without any necessary grounding in molecular life sciences.*

There are also aspects that involve sequencing and modeling DNA and proteins, and predicting new ways for biological systems to behave. Individual projects in BE may emphasize either the mathematical/computational side, or the biological/measurement side of the problem.

Most BE research projects include some computational components, and all include some biological aspects, so students studying BE get trained in both and learn how to do engineering based in biology.

Q: How do I study Biological Engineering or Biomedical Engineering at MIT?

A: As you may have heard, Biological Engineering was approved this spring as MIT's first new undergraduate major in 29 years, and is offered on a limited enrollment basis to students of the class of 2008 or later. The curriculum for the BE SB can be found on the BE website at <http://web.mit.edu/be/index.htm>.

Biomedical Engineering can be pursued through the major by adding appropriate electives to the core class schedule. The BME minor degree, which is administered by BE, is a minor designed to supplement students' primary education with some of the tools needed to successfully apply their engineering of choice to medicine. The curriculum of this minor can be found at this website: <http://web.mit.edu/be/education/ugradreq.htm>. Pamphlets containing all these materials are available in the BE office (56-651) and at the (BE)-BMES booth at the Activities Midway.

Q: What kind of careers is open to students who pursue BE?

A: Many careers are possible in this expanding field. Biotech, pharmaceutical, and medical device companies have increasing needs for engineers who can "engineer biology" and are looking to MIT to provide this new breed of students.

The BE Department and (BE)-BME Society are developing a summer internship program specifically tailored to students of biological engineering, in response to the growing industrial demand that parallels the academic development of this new discipline. A variety of recruiting events and seminars serves to facilitate students' connections to these companies. BE also prepares students for graduate school and a research career. Students may also pursue other professional career paths, including medicine, law, and financial analysis ("Wall Street").

Q: What is BE-BMES? How can it help me?

A: (BE)-BMES, or the (Biological Engineering)-Biomedical Engineering Society, is the official academic society of the BE department and the only MIT-recognized BE student organization on campus.

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A Spectrum of Bio/Engineering Degree Options offered at MIT

By *Ye Ding '08*, *OPERATIONS EDITOR*

While the Biological Engineering Major is being launched, a spectrum of bioengineering-related education programs is also taking shape at MIT.

A presentation on "Bio/ Engineering Undergraduate Degree Options at MIT" was delivered last fall by four feature speakers: Jean-Francois Hamel from the ChemE department, Prof. Anne Mayes from Materials Sci & Eng, Prof. Dennis Freeman from EECS, and Prof. Matthew Lang from MechE. Prof. David Schauer also spoke about the Biological Engineering major.

The presenters highlighted the special features of their respective programs in the context of preparing students for a career in biological or biomedical science and engineering. They also pointed out overlapping requirements with the BME Minor.

Course 10B Chemical-Biological Engineering

Hamel briefly explained that a chemical engineer learns about target molecules, derives processes that yield marketable products, and designs a system to reproduce lab reactions on the scale of reactor tanks. Hamel then introduced Course 10B, the Chemical-Biological S.B. program approved two years ago.

One key aspect of the 10B curriculum is *10.28 Biological Engineering Laboratory*, which covers bioprocess techniques such as vector selection and production, separation, and characterization of the recombinant product. Alternatively, students can take *10.29 Biological Engineering Project Laboratory*, which places students in teams working on projects often suggested by local industry.

The 10B curriculum also covers core subjects from Course 7 Biology: *7.02 Introduction to Experimental Biology*, *7.03 Genetics*, *7.05 Biochemistry*, and *7.06 Cell Biology*.

Chemical engineers are among those professionals receiving the highest starting salaries, Hamel said, especially because of the versatility of ChemE, the sequencing of the human genome, and the financial investment in life science and in nanotechnology. Moreover, Course 10B subjects are "well identified by potential employers."

Course 3 Materials Science & Engineering

Although there is no formal bioengineering degree option in Materials Science and Engineering, Mayes highlighted how biotechnology has been incorporated into the Course 3 curriculum. One such course is *3.034 Organic and Biomaterials Chemistry*, usually taken by juniors. It covers topics such as polymers, protein folding, antibodies, lipids, carbohydrates, as well as the specificity, reaction routes, and self-assembly of molecules.

The Course 3 degree option requires four REST subjects, such as *3.051 Material for Biomedical Applications*, a course that examines the surface interactions between biomaterials and the cell, as well as adhesion, coagulation, and response toward foreign molecules.

Upon the completion of a graduate degree (M.Eng., S.M., Ph.D., Sc.D., etc), a student may work for the FDA, especially in evaluating its regulatory decisions, or join the industry in biomaterial interaction and tissue regeneration.

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(BE)-BMES Serves as the Official Academic Society of BE Dept.

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The (BE)-BME Society is aimed at the professional development of students pursuing the BE Major, the BME Minor, and/or similar educational interests, and serves as the nexus of communication between faculty and students regarding courses and educational programs in BE and BME. The Society welcomes students from any major with interests at the Biology/Engineering interface.

The (BE)-BME Society sponsors a wide range of activities to promote career development and faculty-student interactions. For example, they host industry visitors events where potential employers come to talk with the students, and work with BE on developing an industry internship program. They also host many advising sessions regarding educational programs at MIT and the application process to graduate school in related fields.

The publication you are reading is the *BioTECH*, the (BE)-BME Society's publication that prints articles, information, and interviews pertaining to BE and BME. In the coming year, as the BE major starts up, (BE)-BMES will take an increasingly visible role in supporting BE and BME students, including opening up a student lounge, procuring bibles for BE classes, and establishing a honor society for BE students.

The (BE)-BMES website is <http://web.mit.edu/bmes/www/>, where a lot of information pertaining to the BE Department and its programs are accessible, and where you can get in contact with (BE)-BMES officers <bmes-request@mit.edu>, who would be happy to answer any other questions you may have and/or add you to the members email list.

The BioTECH Staff would like to thank Professor Linda Griffith, Chair of the BE Undergraduate Program Committee, for reviewing this FAQ article.

Among the festivities was a cake adorned with BE labels and the (BE)-BMES banner.

BE Celebrates the Newly Launched Major

By *Joao Paulo Mattos '08*,
FEATURES EDITOR

On Tuesday, April 26, 2005, students, faculty, staff, and alumni gathered in the Bush Room to celebrate the launch of the new Biological Engineering (BE) Major this year, along with the 10th anniversary of the Biomedical Engineering (BME) Minor and the (BE)-BME Society.

Of course, this was plenty reason to celebrate: the BE SB is the first new Course to have been established at MIT in the last three decades; the BME Minor is the first interdepartmental minor to exist and flourish here; (BE)-BMES is a vibrant student organization on campus that has grown tremendously over the past 10 years.

The event began at 5 pm, with Professor Linda Griffith opening the ceremony with a brief history of the bioengineering landscape at MIT. The Institute was at first reluctant to support an interdepartmental minor, she said, but the success of BME Minor today has set a precedence for such educational initiatives in the future.

Griffith also talked about the BE Major, saying that over the years MIT has become more and more interested in the link between biology and engineering. Echoing this message, Professor Douglas Lauffenburger, Director of the BE Division, spoke of the motivation for pioneering a new biology-based engineering discipline and led a toast to the kick-off of the Celebration.

During Griffith's speech and in later conversations, she emphasized the important role that students have played in the development of the BME Minor and the BE Major.

The Bush Room was transformed with balloons, banners, cake, and champaign.

The crowd looked on as the Dean of Engineering took the floor.

*The Dean of Engineering **Dr. Thomas Magnanti** spoke at the BE Celebration about the significance of this new major.*

*The BE community joined **Prof. Douglas Lauffenburger**, Director of BE Division, in a toast to the kick-off of the Celebration.*

Past and present leaders of (BE)-BMES gathered for a camera shot: ***Alexis DeSieno '05, Melissa Kemp '97, Julie Tse '06, George Eng '06, Charles Morton '97*** *(left to right).*

Faculty advisors of (BE)-BMES proudly sported the Society T-shirt: ***Prof. Matthew Lang, Prof. Roger Kamm, Prof. Linda Griffith,*** *and* ***Prof. Douglas Lauffenburger*** *(left to right).*

Year in Review: Healthcare Panel
Joia Ramchandani '07 *(center, standing up), VP of Special Programs last year, introduced the panelists at the Health Panel held on April 27, 2005 in 6-120.*

(Continued from page 6)

"The students are the real bioengineers," she said. Having mentored (BE)-BMES in the past 10 years as Senior Faculty Advisor, she expressed her heartfelt appreciation for the work carried out by this student society and its key members, including previous president Alexis DeSieno '05 and founding members Charles Morton '97 and Melissa Kemp '97.

"I'm always amazed by their initiative," she said.

The students are just as grateful towards the faculty. Morton, who was a sophomore when the BME Minor was first created in 1995, has returned to MIT for its graduate program in BE. He explained that he decided to enroll at MIT because he knew he'd be working with the great professors, such as Griffith, Lauffenburger, and Professor Peter Dedon.

Likewise, Kemp was proud to come back and see how much (BE)-BMES had grown, remembering how small it had been when it first started. Ten years ago they had little manpower, but she remembers and appreciates how helpful and resourceful the faculty had always been.

DeSieno also shared her enthusiasm, having experienced (BE)-BMES during its earlier, more fledgling stages. Since she joined the Society in 2002, the group's mailing list has grown from 100 to over 900 members, which include both undergraduate and graduate students.

Our special thanks go to Jennifer Fang '05, Suzette Clinton, Dan Darling, and Catherine Greene for organizing this event and transforming the place with balloons, slideshows, *Hors D'Oeuvres*, cake, and champaign. With the demonstrated energy and synergy of students, faculty, staff, and alumni in this bioengineering community, we look forward to what new developments we may be celebrating 10 years from now.

Year in Review: Biotech Panel
Jennifer Fang '05 *(standing in front), VP of Industrial Relations last year, introduced the panelists at the Biotech Panel held on February 16, 2005 in 2-105.*

Year in Review: Activities Midway
Julie Tse '06 *and* ***George Eng '06,*** *Co-Presidents, and* ***Aparna Rao '07,*** *Vice President (left to right), manned the (BE)-BMES booth at the Activities Midway on the 2005 Campus Preview Weekend in April.*

Prof. Linda Griffith, *Chair of the BE UG Programs Committee, opened the ceremony with a brief history of the bioengineering landscape at MIT.*

A slideshow in the background cycled through memorable images from the past 10 years of BME Minor and (BE)-BMES.

Student Research Spotlight

Immortal DNA Strand Hypothesis in Adult Stem Cell Regeneration

Melissa Wu, a recent graduate with a degree in Biology, started working in Professor James Sherley's lab in Summer 2004. Her project is to investigate whether immortal DNA strands exist in the germline stem cells of Drosophila ovaries. Her work is an extension of Sherley's research on immortal DNA strands in mammalian cells to cells of another adult type and species.

By *Melissa Wu '05*

Adult stem cells are rare cells in adult tissues that produce two daughters — an adult stem cell daughter and a differentiating, functional daughter — through asymmetric divisions.

Because of this regenerative capacity, accumulated mutations in the genomes of adult stem cells can lead to cancer. Finding that the experimental rate of mutations predicted higher rates of cancer than existed, John Cairns proposed a mechanism for adult stem cells to minimize the accumulation of mutations, called the immortal DNA strand hypothesis.

The immortal DNA strand hypothesis proposes that instead of segregating DNA strands randomly during mitosis, the adult stem cell co-segregates a template set of DNA strands to the daughter adult stem cell (Figure 1). This co-segregation allows errors from DNA replication to be passed on to the differentiating daughter.

Segregation of DNA strands can be visualized by labeling newly synthesized DNA with bromodeoxyuridine (BrdU). Two complementary assays are being used — one incorporates BrdU into the immortal strands, the other incorporates BrdU into the non-immortal strands.

After allowing the cells to divide in BrdU-free conditions, different patterns of BrdU labeling in the adult stem cell and differentiating daughter result if there is random segregation versus co-segregation.

I am testing this hypothesis in fly ovarian germline stem cells, which offer the advantage of being easily identifiable. Various methods have been attempted for labeling the fly ovaries, and directly feeding the BrdU to them has worked for larvae and adult flies (Figure 2). I am currently determining when germline stem cells form to test if immortal strands can be labeled, and determining their cell cycle time for testing segregation of non-immortal strands.

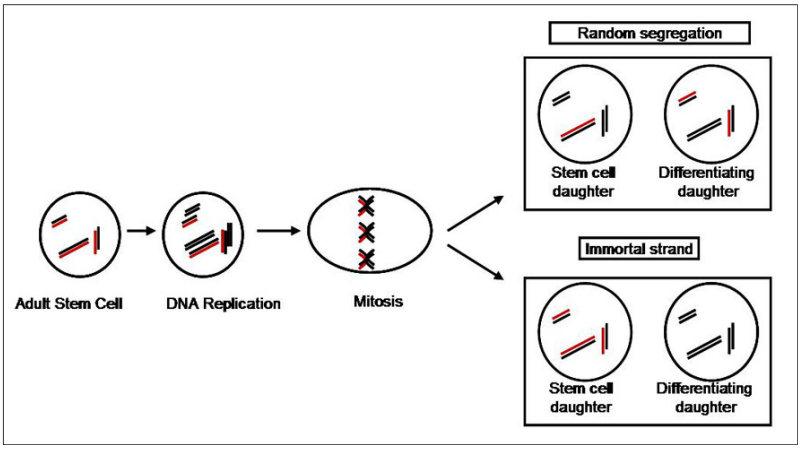

Figure 1. Random Segregation and Immortal Strand Mechanism
This schematic depicts the results of a random segregation mechanism and an immortal strand mechanism. In red are the older parental strands (denoted immortal strands in the immortal strand mechanism). *Illustration by Melissa Wu.*

> "After reading an MIT spotlight article about Professor Sherley's research, I met with him to see if he had any open positions. Luckily for me, he had an opening starting that summer. Since then he has been a great mentor, gently guiding my research and always excited about my results. Research on adult stem cells is a promising field that can lead to therapies for many different diseases, and I am hoping that my results can contribute to this field."
>
> **Melissa Wu**,
> Course 7, Class of 2005

Understanding whether adult stem cells use this mechanism is important for research on cancer development and treatment. Loss of regulation of the immortal strands may result in either death of the adult stem cells or over-proliferation leading to cancer.

Cairns suggested that weak DNA damage causes adult stem cells to undergo apoptosis rather than risk repairing and mutating immortal strands. This hypothesis suggests that DNA-damaging drugs currently used in cancer therapy also may induce death of the adult stem cells.

Feedback from Wu's UROP Mentor, Prof. James Sherley

The ideal of the UROP is for students to have a first hand, active experience in original research. Whether the experience progresses from only participating in a research project to conducting an independent research project depends on many factors, including the laboratory head's philosophy, the timing of the UROP period with respect to opportunities for independent projects in the research group, and the motivation and ability of the student.

All UROP experiences should begin with students learning and mastering new concepts and techniques that will enable their subsequent research. Thereafter, the goal is for students to advance to independently addressing an original research problem.

There is no better way to achieve a realistic appreciation of the nature of research than to have early opportunities for significant creative input into the development and pursuit of an original research problem.

Melissa's research embodies all of these ideals. As her direct supervisor, I have watched her develop research skills commensurate with graduate students. She effectively designs experiments, develops and modifies required techniques, troubleshoots technical problems that arise, critically evaluates data, and is a partner in setting the creative agenda for the project.

Though related to my group's core research, her project is new and reflects the input of her ideas, motivation, and talent. Melissa exemplifies the impact that UROP students can have on research at MIT.

Student Research Spotlight

Why? Research is an ongoing dialogue — share your work and get feedback from faculty and peers with different backgrounds but similar interests!

How? Submit a concise and informative description of research in a BME-related field.

Interested? Contact TheBioTECH@mit.edu for more details. We hope to hear from you soon!

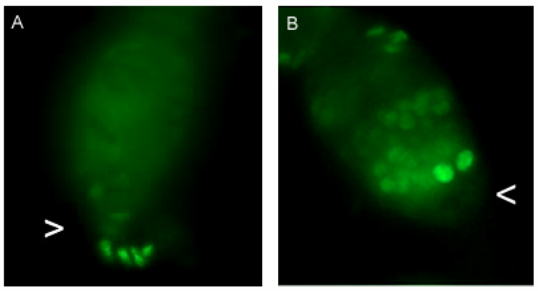

Figure 2. BrdU Incorporation in Ovarian Cells by Feeding. A. BrdU incorporation and retention in an adult fly, after being fed BrdU as larvae. B. BrdU incorporation in an adult fly ovary, after being fed BrdU as an adult. Arrows point to germline stem cell position. *Photos by Melissa Wu.*

Bioengineering Options Span ChemE, Materials, EECS, Mech E, & More

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Course 6 Electrical Engineering & Computer Science

A perhaps surprising aspect of bioengineering is Electrical Engineering & Computer Science (EECS). There is actually an area of concentration in Course 6-1 EE, known as Bioelectrical Engineering. Classes under this heading include *6.021/6.022 Quantitative Physiology*, *6.024 Biomechanics*, and *6.121 Bioelectronics Lab*.

Freeman outlined the methodology used in Course 6 — "measure, model, manipulate, and build." Unlike ChemE or Materials Sci & Eng, which introduces drugs or nano-objects, EECS creates products such as prostheses, models for gene and protein interaction networks, and MRI imaging equipment that helps a surgeon visualize the patient's anatomy during operation. Thus EECS could involve mechanics, biomedical signal and image processing, biosensors, and computational techniques in systems biology.

Course 2A Mechanical Engineering Biotrack

The fourth speaker, Lang, explained the curriculum of Course 2A Mechanical Engineering — Biotrack, which was developed to complement the existing ABET-accredited 2A degree program in providing additional support for MechE students with a special interest in bioengineering.

The Biotrack requires two of the five second-level MechE core classes in addition to all the basic cores, freeing 60-66 units for students to pursue an individualized course of study in bioengineering with the guidance of a 2A faculty advisor.

Graduates may continue in MechE or take up a different field, such as biomedical engineering, medicine, nano- and micro- system design, or management and entrepreneurship.

Additional information sessions were held last spring, with the following speakers presenting: Prof. Douglas Lauffenburger and Prof. David Schauer from BE, Prof. Christine Ortiz and Prof. Krystyn Van Vliet from Mat Sci & Eng, Prof. Jean-Francois Hamel and Prof. Greg Rutledge from ChemE, and Prof. Dennis Freeman and Prof. Joel Voldman from EECS.

New England Science Symposium 2005 Showcased Research

By *Ye Ding '08*, *Operations Editor*

The Fourth Annual New England Science Symposium (NESS) took place at the Conference Center of Harvard Medical on March 4, 2005. It was sponsored by the Biomedical Science Careers Program and the Harvard Medical School Minority Faculty Development Program.

Each year, the Symposium seeks to reach out to more researchers, particularly those from the ethnic minorities. Medical, dental, graduate, and undergraduate students, or sometimes even post-doctoral fellows present their research, either orally to an audience or in person at a poster session. Presenters had to apply. Otherwise, admission was free.

This year, Eric Huang, a medical student from Brown Medical School, began the series of presentations. His research was titled "Intratumor Injection of Fas Ligand Vesicles Triggers Innate Immunity." He hypothesized that an intratumor injection of transmembrane FasL microvesicles would induce vigorous inflammation, tumor rejection, and long-term systemic protection from metastases.

The researcher injected tumor cells to the back of the eyes of the mice in a control group and observed that all of them had succumbed to metastasis disease by the thirteenth day. The diseased animals were euthanized.

On the other hand, 30% of the mice that received mFasL microvesicles along with tumor cells exhibited tumor rejection. The survivors showed protection against a follow-up subcutaneous challenge of tumor cells, suggesting a tumor-specific immune response. Huang concluded that early inflammation is critical in terminating immune privilege and initiating rejection of ocular tumors.

***Cindy Xi '05** interacted with an attendee at the New England Science Symposium (NESS) poster session. Her poster title was "Uridine Increase Neurite Outgrowth in Nerve Growth Factor-differentiated PC12 Cells." The work was done with graduate student Amy Pooler in the Wurtman lab of the MIT Brain & Cognitive Sciences department.*

> "NESS is a smaller symposium with presenters from many areas of science, so it was very low-stress and a great learning experience. It was interesting to hear the questions that people had, because they become less obvious to you after you've been working on the same few problems for so long."
>
> ***Cindy Xi '05***

After a lunch break, oral presentations continued, followed by a poster session. Representing MIT was Cindy Xi '05, who presented her work titled "Uridine Increase Neurite Outgrowth in Nerve Growth Factor differentiated PC12 cells." The work was done in collaboration with graduate student Amy Pooler in the Wurtman lab of the MIT Brain & Cognitive Sciences department.

Later on in the evening, five panelists discussed their careers in medical science. In short, some physicians and medical scientists eventually take on administrative responsibilities, namely in hospitals and in government agencies such as the National Institute of Health (NIH).

On the other hand, Benjamin Ortiz, a graduate of Hunter College, has returned as an assistant professor of Biological Sciences at his alma mater. Having completed a PhD and some post-doctoral work, Ortiz now tries to integrate teaching, research, and administration.

***Professor James Sherley,** serving as a judge at the NESS poster sessions, listened to Nicole Reynolds, a graduate student from Tufts, as she explained her research.*

The fifth panelist, Max Tejada, PhD, is a scientist from the quality control department of Genentech, Inc. Lately he has become interested in the business aspect of biotechnology. He also emphasized the importance of networking.

At the end of the day, four judges, including Professor James Sherley from MIT, finished rating the performance of the presenters. The oral presentation winner was Joeli Marrero, a PhD candidate from Tufts University School of Medicine. The title of her presentation was "Cell-Cell Interactions Mediated by Inner Membrane Proteins Prevent Conjugal DNA Transfer Between Donors."

The winner of the poster session, and the first and the second runner-ups in each of the two types of presentation were also named.

The Symposium afforded researchers with an unique opportunity to present their ideas. A few doctoral candidates talked about writing the event in their CVs. Attendees not making any presentation could learn about biomedical research and meet representatives from Biogen Idec, Genentech, St. Jude Children's Research Hospital, or any of the presenters and speakers.

Timeline & Calendar of Events for Bioengineering Opportunities

September:

9/7 "Manufacturing new materials using peptide motifs" (Professor Shuguang Zhang) *66-110 at 7:00PM* **[EMBS-BMES Distinguished Lecture Series]**

9/15 **"**Towards Molecular Imaging of Neural Activity in Behaving Animals" (Professor Alan Jasanoff of MIT) *56-114 at 4:10PM*

9/23 "Special Bioethics Seminar" (William Stempsey of Holy Cross) *56-114 at 1:30PM* **[BE Industrial Seminar Series]**

9/29 Chapter Meritorious Achievement Award presented to MIT (BE)-BMES at the 2005 National BMES Fall Conference at Hyatt Regency in Baltimore, MD

October:

10/6 "Meet the Lab" (Prof. Kristala Jones Prather of MIT) *56-114 at 4:10PM*

10/12 "High-throughput Mass Spectrometry" (Dr. Can Ozbal, BioTrove) *66-110 at 7:00PM* **[EMBS-BMES Distinguished Lecture Series]**

10/13 "Challenges in the Biopharm Industry and the Role of the Center for Biomedical Innovation" (Dr. Frank Douglas) *56-114 at 4:10PM*

10/20 "Effect of Adhesion and Mechanical Signals on Eukaryotic Cell Differentiation: Lessons from Yeast and Human Embryonic Stem Cells" (Prof. Sean Palacek of U. of Wisconsin) *56-114 at 4:10PM*

10/27 Dr. Cecil Plickett of the Schering-Plough Research Institute **[Wogan Lecture]** *56-114 at 4:10PM*

10/28 "Special Bioethics Seminar" (Thomas Shannon of Worcester Polytechnic Inst.) *56-114 at 1:30PM* **[BE Industrial Seminar Series]**

November:

11/3 "Meet the Lab" (Schauer Group of MIT) *56-114 at 4:10PM*

11/10 "The Met Receptor Tyrosine Kinase: Tubes, Tumorigenesis and More" (Dr. Morag Park of McGill U.) *56-114 at 4:10PM*

11/17 "Engineering Synthetic Multicellular Systems" (Prof. Ron Weiss of Princeton U.) *56-114 at 4:10PM*

December:

12/1 "Hyaluronan-based Matrices in Inflammation" (Dr. Vince Hascall of Cleveland Clinic) *56-114 at 4:10PM*

12/2 Mark Trusheim (Massachusetts Biotechnology Council) *56-114 at 1:30PM* **[BE Industrial Seminar Series]**

Alexis DeSieno '05 *(center right), last year's President, represented MIT BMES in receiving the 2003-2004 Chapter Meritorious Achievement Award at the 2004 National BMES Fall Conference in Philadelphia, PA, with Professor* ***Douglas Lauffenburger*** *(right), Director of MIT Biological Division,* ***Nupur Garg '07*** *(left), and* ***Aparna Rao '07*** *(center left), Co-VP's of Campus Relations.*

The (BE)-BME Society invites you to attend our first Distinguished Lecture Series of the 2005-2006 academic year:

Wed, September 7, 2005
Refreshments at 6:30 pm
Lecture at 7:00 pm
Room 66-110

Manufacturing New Materials Using Peptide Motifs

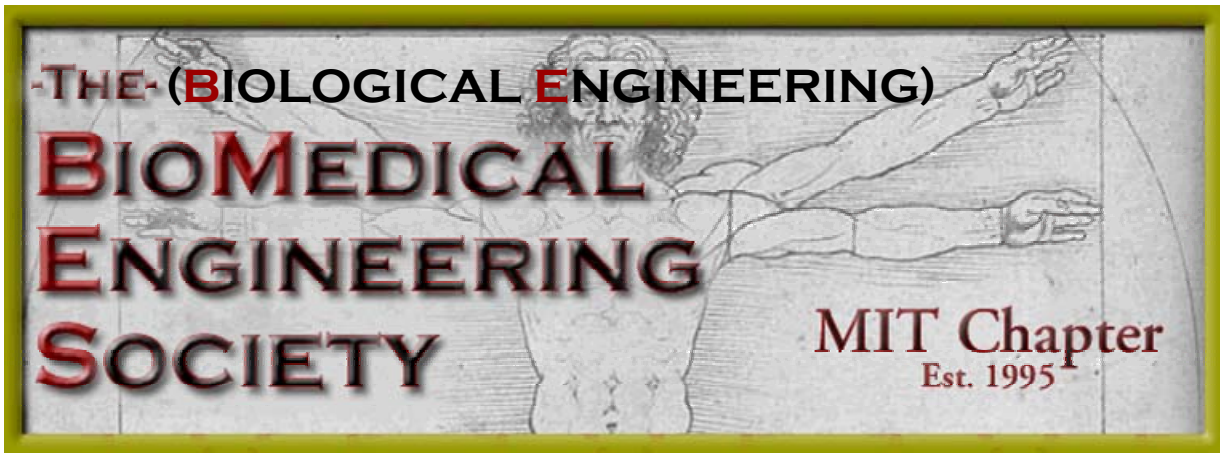
Dr. Shuguang Zhang
Associate Director
Center for Biomedical Eng., MIT

Chemistry has generally been associated with inorganic and organic synthesis, metal-organic composites, coordinate metal chemistry, catalyses, block copolymer, coating, thin film, industrial surfactants, and small-molecule drug development.

That is about to change. Chemistry will also expand to the discovery and fabrication of biological and molecular materials with diverse structures, functionalities, and utilities. The advent of nanobiotechnology and nanotechnology accelerated this trend. Similar as the construction of an intricate architectural structure, diverse and numerous structural motifs are used to assemble a sophisticated complex.

Nature has selected, produced and evolved numerous peptide and protein molecular architectural motifs over billions of years for particular functions. These molecular motifs can now be used to build biochemical materials from the bottom up. Chemical science will begin to harness nature's enormous power to benefit other disciplines and society.

Co-sponsored by the IEEE-EMBS, Boston Chapter.



(BE)-BMES is the official academic society of the Biological Engineering Department and the only MIT-recognized BE student organization on campus.

The Society is aimed at the professional development of students pursuing the BE Major, the BME Minor, and/or similar educational interests, and serves as the nexus of communication between faculty and students regarding courses and educational programs in BE and BME. The Society welcomes students from any major with interests at the Biology/Engineering interface.

Benefits of (BE)-BMES Membership:

- ✓ Receive firsthand information about BE Major & BME Minor
- ✓ Contact BE faculty as advising resources
- ✓ Interact with fellow students with similar aspirations
- ✓ Earn distinction for outstanding research and scholarship
- ✓ Gain exposure through distinguished lecture series, industrial site tours, and UROP & internship opportunities
- ✓ Stay informed through our members email list and the *BioTECH* publication

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