

# The BioTECH



BMES Executive Board met with Dr. Larry McIntire, Wallace H. Coulter Chair and Professor of Biomedical Engineering at Georgia Tech and Emory University, at a luncheon on February 12 to discuss future directions in biomedical engineering education. Members present (from left to right) were Lili Peng, VP of Special Projects, Jennifer Fang, Secretary, Dr. Larry McIntire, Prof. Linda Griffith, Faculty Advisor, Judy Yeh, BioTECH Editor, Alexis DeSieno, President, Prachi Jain, VP of Campus Relations, Amy Shi, Student Advisor, Prof. James Sherley, Faculty Advisor, and Prof. Matthew Lang, Faculty Advisor.

## Updates on BE Major & BME Minor

By Jonathan Wu, WRITER

The BME Minor will continue to evolve over the next two years as final preparations are made for the anticipated Biological Engineering (BE) Major. Unfortunately, the SB in BE will be available to students entering MIT in Fall '04 at the earliest.

The Biomedical Engineering minor will continue to change shape as the Biological Engineering Division continues to revamp current classes and develop new subjects. This is an exciting time for students considering the minor because new classes will unveil every semester until the full curriculum of the major is implemented.

The BE Division will be adding courses to the core as well as retiring some of the subjects currently taught. In addition, new BE electives will be making an appearance in the next year.

Some of the subjects currently given in the fall or spring will be swapping seasons in order to accommodate faculty members who have joint teaching appointments with other departments.

*(Continued on page 4)*

## Active BMES Membership Witnessed

By Alexis DeSieno, BMES PRESIDENT

In the last six months, biomedical engineering at MIT has changed.

With plans for the creation of the new major underway and excellent leadership from your executive board, biomedical engineering and the BMES have changed on many levels, from student interest to member activeness.

Last semester, BMES saw an increase in membership, an increase in the number of general body and executive meetings, and an increase in the publication of The BioTECH. The BMES also continued its core programs, including the monthly EMBS-BMES Distinguished Lecture Series, the student/faculty luncheon in October, and seminars featuring guest speakers to advise you on applying to graduate school and internships.

But most importantly, it saw an increase in member activeness. The BMES

is no longer a society in which the executive board dominates and the members get free food. From "student research spotlights" in the BioTECH, to the Johnson and Johnson research award, you have become active contributors to the Society. You have become an integral part of our events and will continue to become more important in the creation of a real "society," in which the members

are as active as the executive board.

For the spring term, I encourage you to become more involved with BMES. Submit an article to The BioTECH. Become a big or little sibling. Participate in a BMES sponsored community service event. Attend the BMES Mixer. BMES offers many ways that you can contribute, and every little bit makes a difference in creating a stronger society and biomedical engineering community.

*(Continued on page 7)*

*"In the last six months, biomedical engineering at MIT has changed."*

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## Lauffenburger, Morrison, and Faraci Spoke at Lecture Series



Professor **Doug Lauffenburger**, Director of Biological Engineering (BE) Division, introduced the audience to MIT's new biology-based engineering discipline on December 10. Lauffenburger's talk offered an overview of the emerging BE discipline, focusing on novel directions in research, education, and career opportunities.

*By Mandy Yeung, VP OF SPECIAL PROGRAMS*

Following the three successful EBMS-BMES distinguished lecture series in September, October, and November, another trio of well-attended talks took place in December, January, and February.

On December 10, 2003, Professor Doug Lauffenburger, Uncas & Helen Whitaker Professor of Bioengineering in the Biological Engineering (BE) Division, Biology Department, and Chemical Engineering Department spoke on the new biology-based engineering discipline being developed at MIT.

The driving force for the new discipline is one toward goals of increasing

fundamental understanding of how biological systems operate and creating innovative biotechnologies directed toward a diverse spectrum of application areas - prominently emphasizing medicine and human health, but also including other areas of societal importance.

On January 14, 2004, Dr. Tom Morrison, Senior Director of Genomics at Biotrove, introduced the audience to a novel microfluidic platform based on novel through-hole array technology, termed the Living Chip™, for nanoliter storage, retrieval and analysis of chemical and biological libraries.



Dr. **Tom Morrison**, Senior Director of Genomics at Biotrove, spoke at the IAP Distinguished Lecture Series on January 14. Morrison's talk described a massively parallel microfluidics platform for nanovolume storage and ultra-high throughput analysis of chemical and biological libraries.

The system calls for stacking two or more nanoliter plates with precisely co-aligned through-hole, resulting in mixing

of the liquids in opposing channels and subsequent parallel initiation of reactions in each through-hole across the array.

On February 17, 2004, Dr. W. Stephen Faraci, Senior Director of Discovery Technology at Pfizer Global R&D, zoomed in on the drug discovery process, from target identification to IND filing to NDA submission. Issues addressed include long-term safety studies, complex regulatory affairs, and the high level of attrition of drugs entering pre-clinical and clinical development.

Within this context Dr. Faraci suggested the possibility of new technologies that can aid in the drug discovery process by helping to reduce the attrition currently observed in the industry.

The next lecture will take place on Wednesday, March 17, with Dr. Paul Pyzowski, President of Network Biosystems, speaking on the topic of high-throughput genetic sequencing.

The EMBS-BMES Distinguished Lecture Series is a monthly event free and open to the public, held on Wednesday evenings at 7 pm in 66-110. Refreshments are served beginning at 6:30 pm.

### Interested in joining BMES?

Become a member by emailing  
bmes-request@mit.edu

### Interested in writing for The BioTECH?

Email us at  
TheBioTECH@mit.edu  
for more information

## The 2003-2004 EMBS-BMES Distinguished Lecture Series

### High-Throughput Genetic Sequencing

*Dr. Paul Pyzowski, President of Network Biosystems*

*Wednesday, March 17, 7 pm, Rm. 66-110*

*Refreshments Provided*

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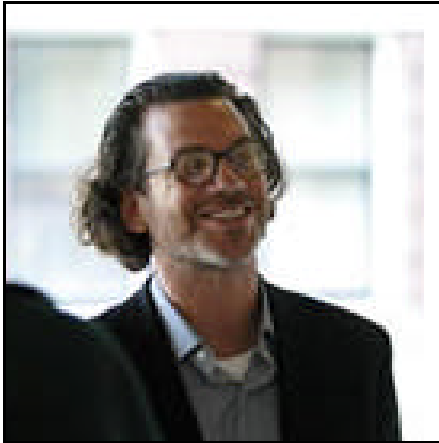
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## Conversation with a BME Leader in Academia and Industry



**David Edwards**, Gordon McKay Professor of the Practice of Biomedical Engineering at Harvard University, shares his perspective on technology development in the biomedical industry and academic preparation for a career in such field. Edwards is the co-founder (with MIT Professor Robert Langer) of Advanced Inhalation Research (AIR), now part of the publicly-traded Alkermes, among other biotech startups. Edwards' research and teaching at Harvard concern cellular engineering, drug delivery, and the translation of basic biomedical science to biotechnology.

*Interview By Meiling Gao, EDITOR*

**The BioTECH:** Could you describe your academic interests, research areas, and classes you teach at Harvard?

**Professor Edwards:** I began a startup with Robert Langer in 1997 after a few years on the faculty at Penn State. The startup was called Advanced Inhalation Research (AIR) and concerned research in aerosols, and it was sold to Alkermes, who is currently using our research. It was a great experience to start a company, and I wanted to allow students to have the same experience I did, so currently I'm teaching a class that, in short, is called Biomedical Startup.

The students are given a paper or patent and split into groups to focus on the idea they are given. Some will deal with the management issues and others the science side of the startup. Pulmatrix, another

startup I began with a few students, actually came from this course.

**BioTECH:** Is this class mostly geared towards undergrads with science backgrounds?

**Edwards:** What's great about the class is the diversity. About 75% of the class is undergrads. There are students majoring in econ to physics in this class.

**BioTECH:** So what made you interested in the biomedical sciences?

**Edwards:** I didn't know what I wanted to do in college so actually I just stumbled across chemical engineering. When I first began at Harvard, I was interested in macro-transport problems. One day, some student from Harvard's Public Health school came to me because they couldn't solve some aerosol problems. So I took my ideas and applied them to the lungs. The problem was, no one was thinking quantitatively and that's what they needed. In the 90's, chemical engineers were extremely well situated to have a serious impact on the new health sciences. Chemical engineering, transport, and mathematics are highly related to the life sciences, which

**"I would say to students:  
find a field of expertise and  
don't get too involved too  
soon with applications.  
Find your grounding first."**

**Prof. David Edwards**

demand quantitative analysis. And I think because of their background, chemical engineers have a huge advantage.

**BioTECH:** Tell me a little about your current research.

**Edwards:** I'm continuing my work on medical aerosols. I'm also interested in world health issues, so I combined the two interests. New aerosols are transported to lungs to target special tissues for tuberculosis (TB) or other airborne diseases. Medicine in Need (MEND), a non-profit group that I started with a few students, is trying to bring this new technology to Third World countries with TB problems.

**BioTECH:** With your experience, where do you see the BME or biotech fields in ten years?

**Edwards:** I think there will be a trend in the biomedical engineering field towards molecular engineering. Twenty years ago, everything was so macro, but now everything is at the micro level. Without question, the field will also continue to diversify and become integrated with other sciences.

**BioTECH:** You've often compared bioengineering to art. Could you explain that analogy a bit?

**Edwards:** There's an open-mindedness, a certain lack of rules, in abstract art that you can also find in the biomedical sciences. To go from an idea to an actual product, the thought process is extremely non-linear, unlike, for example, information technology fields where it's fairly linear. There's always a constant changing of ideas, and it's humbling and revealing like the arts.

**BioTECH:** Do you have advice for students who are interested in the bioengineering fields?

**Edwards:** I think in the field of bioengineering and biomedical engineering, it's extremely easy to get swept off your feet so it's important to gain fundamental expertise. The field itself is very competitive, and in order to have a career in it, you need expertise. So I would say to students: find a field of expertise and don't get too involved too soon with applications. Find your grounding first.

### Biosketch of Prof. David Edwards

#### Education

B.S. Michigan Technological U.  
Ph.D. Illinois Institute of Technology  
Both degrees in Chemical Engineering

#### Teaching Interests

Intro to Technology Development in the BME Industry (HST.571)  
BME Transport Phenomena as the Seed of a BME Start-Up

#### Biotechnology Activities

Advanced Inhalation Research (AIR)  
Medicine in Need (MEND)  
Pulmatrix  
14 patents registered, 10 more pending

## Curriculum Takes Shape for New BE Major and Updated BME Minor

(Continued from page 1)

MIT will continue to hire new faculty in bioengineering, and thus the number of class offerings in BE and in departments is expected to grow in the next few years.

Among the new core classes added to the BME Minor are *Statistical Thermodynamics of Biomolecular Systems* (BE.011/2.772J) and *Foundations of Computational and Systems Biology* (BE.490/7.36/7.91J). These two classes will be core subjects in the planned BE SB degree.

Classes not offered this year include *Introduction to Physiological Modeling* (BE.103) and *Cell and Tissue Engineering* (BE.360/10.449). The new BME Minor electives will also incorporate courses from the BE Major curriculum, including *Biomolecular Kinetics & Cell Dynamics* (BE.320) and *Fields, Forces, and Flow* (BE.330).

Unfortunately, some classes will have enrollment restrictions. Advice for students is to plan out a four-year plan to accommodate these classes since they are specifically intended to be taken certain years. Among these classes is *Laboratory Fundamentals in Biological Engineering*

(BE.109). This lab class, due to limited laboratory space, will be limited to 24 sophomores next spring, with some preference to students who plan to take the second BE lab (BE.309) subsequently. In the following years, enrollment is expected to be limited to BE majors and ~10 non-majors, due to constraints in space.

Also, the new *BioInstrumentation Lab* (BE.309) will be offered for the first time Fall '04 to students with junior standing and with introductory biology lab or equivalent experience. Enrollment may be limited to BE majors and 2/2A students beginning '06.

### Course Planning for BME Minor

For freshmen and sophomores interested in the BME minor, it is important that they begin completing the Science & Engineering Core requirements (5.12; 5.07/7.05; 18.03; Engineering Subject) early on.

Besides BE.011/2.772J, BE.109, BE.104, 7.02, and 7.03, students are strongly advised not to take any BME core subjects or electives until junior/senior year. Since these classes are all intended to be upper level classes, they draw from material taught in the Science & Engineering Core subjects.

Without prior preparation, students who took the BME subjects early found

them to be extremely challenging. If students have questions about course selection, they are encouraged to meet with a BME advisor in the department of their major in the beginning of their sophomore year.

The BME minor is becoming easier to implement with any engineering/science major. Many majors require departmental electives which can be completed by joint BE classes. In addition, BE.011/2.772J is now accepted by the Biology Department as a substitute for 5.60 in the Biology Undergraduate Curriculum.

Some courses are still in the midst of approval regarding which terms they will be taught or whether they will be taught in the future at all. Regular updates about the course offerings are posted on the Biological Engineering Division homepage at <<http://web.mit.edu/be/>>.

If you missed the information meetings on the biomedical engineering minor and major in the beginning of the semester, stay tuned for announcements for similar sessions at the end of the term. Should you have further questions, do not hesitate to contact Professor Linda Griffith, Chair of the BE Undergraduate Program Committee, or Professor David Schauer, Director of the BE Minor Degree Programs.

### Biological Engineering SB Curriculum

#### Science & Math Core

(Beyond GIR Chem, Biology, Physics, Calculus)

Differential Equation (18.03)

Organic Chemistry (5.12)

Biochemistry (5.07/7.05)

Molecular and Cell Biology (7.06)

\*\*Genetics & Genomics (BE.113)

\*\*BE Computation Tools (BE.180)

#### BE Core

Statistical Thermodynamics of Biomolecular Systems (BE.011/2.772J)

\*Biomolecular Kinetics & Cell Dynamics (BE.320)

Molecular, Cell, & Tissue Biomechanics (BE.310/2.797J)

Computational & Systems Biology (7.36/BE.490J)

\*Fields, Forces and Flows (BE.330)

Laboratory Fundamentals in Biological Engineering (BE.109)

\*Biological Instrumentation & Measurement Laboratory (BE.309)

#### Plus

2 BE Restricted Electives (Application Tracks)

Senior Design (BE.380)

### Biological Engineering SB Sample Roadmap

	Fall	IAP	Spring
Year 1	8.01 5.111 18.01 HASS		8.02 7.013 18.02 HASS
Year 2	*BE Stat Thermo 5.12 18.03 HASS	*BE Tools	*BE Genetics *BE Lab I 7.05 HASS
Year 3	*Biomechanics *Molecular & Cell Kinematics Elective Elective (6 units) HASS		*Fields, Forces, Flows *Computer Systems Biology 7.06 Elective (6 units) HASS
Year 4	*BioInstrumentation Lab *BE Restrictive Elective Elective HASS		*BE Design *BE Restricted Elective Elective HASS



# Master of Engineering in Biomedical Engineering (MEBE) FAQ

**Information compiled from handouts prepared by and correspondence with Prof. Roger Kamm and Prof. Roger Mark, Directors of MEBE Program.**

## Who should consider MEBE?

The goal of the MEBE is to educate students in the application of fundamental engineering principles to solve challenging problems in biology and medicine. This program will educate individuals prepared for leadership positions in the medical products, pharmaceutical or biotech industries. A secondary objective is to provide students who may be considering either a medical degree or a doctorate in biological engineering or medical engineering the opportunity to learn more about these fields.

Many students have to decide between a doctoral program and the MEBE program. You should assume that if you are admitted to MEBE, the chances are good you would also be admitted to a top doctoral program. Therefore, you should not consider the MEBE program as a “safety” application. On the other hand, if you are truly undecided about whether a Master’s degree or doctorate better meets your career objectives, then you should seriously consider applying. There is no penalty to changing your mind once admitted.

## What are the application requirements?

Student must submit the following items no later than the May of their junior year: MIT graduate application, statement of purpose, three letters of recommendation, and official transcript(s). Applicants are not expected to take the Graduate Record Exam (GRE). Applicants may apply to either the Bioengineering (BE) track or the Medical Engineering track (ME), but not to both. Completed applications should be returned to either the BEH Academic Office (56-651) or to the HST Academic Office (E25-518).

## What are your chances for admission?

Admission standards are high for both tracks of the MEBE program, comparable to the standards for our doctoral programs. Students typically have a GPA of about 4.5 or better. Other factors,

however, such as research experience and strong recommendation letters, can make a significant difference and compensate, in part, for a lower GPA.

In the most recent admission cycle, 12 out of the 13 applicants for the BE track were accepted (7 enrolled), and 6 out of the 8 applicants for the ME track were accepted (4 enrolled).

## What courses should you take?

The admissions committee looks for evidence of a strong interest in bioengineering (e.g., participation in the minor, bioengineering UROPs, coursework in

*“The MEBE program is operated on a different philosophy from other masters programs — say, for example, the EECS MEng program at MIT. Instead of a certain level of entering qualifications, we set the criteria really high - equivalent to that asked of our doctoral candidates.”*

**Prof. Roger Mark,**

*Director of MEBE Program,  
Professor of EECS and HST*

biology or biochemistry for an engineering major). Students majoring in biology should be sure to take (and do well in) at least one, and preferably more than one, engineering subject prior to applying, to demonstrate their ability to handle core engineering material.

Engineering majors applying for the Bioengineering Track would do well to take 7.02 since it can be quite time consuming and would take time away from your research during your 5<sup>th</sup> year. Also, seniors are advised to take one of the core subjects during their senior year, if possible, both so that they can get to know some of the BE or HST graduate students, and to get a taste of graduate coursework.

## Which track is best for me?

The bioengineering (BE) track merges biology and engineering, using biology as one of the foundational sci-

ences for engineering along with physics, chemistry and mathematics. The Medical Engineering (ME) track focuses on clinical medicine and includes the application of a variety of engineering disciplines to problems in medicine.

The BE track core focuses on bioengineering – subjects that consider biological systems from an engineering perspective. The ME core focuses on medical science taught from the point of view of medical and clinical science. Because the ME track requires fewer engineering courses, the admissions committee will look for well-developed engineering strength during the student’s undergraduate program.

There are no rigid boundaries in thesis research in either track. The BE faculty encompass a wide range of research topics in molecular, cellular and tissue bioengineering, many of which have medical implications, while the ME faculty provide opportunities for applications of engineering investigating basic and applied problems in medicine.

## Is funding available?

The simple answer is “no”, but there’s more to it than that. Most MEBE students have been able to find support as a Research Assistant that covers tuition plus a stipend. Keep in mind, though, that if you do obtain an RA, you are limited to no more than 24 units of coursework per term. That means that if you still want to finish in one calendar year, you must take one of the MEBE requirements during Spring Term senior year, 24 units both terms of your 5<sup>th</sup> year, and 6 units during IAP (HST.181 is one example).

## What are the research expectations?

While the fifth year may seem like an extension of your undergraduate education, the expectations of you in terms of research and commitment are very different from a UROP project. Students frequently work as many as 60 hours per week in the lab while taking two subjects, especially if they hope to finish in one calendar year. MIT undergrads often fail to make the transition to “serious” research quickly enough, and find that they cannot complete their thesis on time.



BMES Executive Board met with John Rondoni, Medtronic Software Engineer and MIT '02 alum, over dinner at Charlie's on February 3 to discuss the possibility of establishing a BMES-sponsored internship program with Medtronic. In addition to Rondoni, BMES Exec Board also met with Ahmed Elmouelhi, Medtronic Mechanical Design Engineer and MIT '01 alum. Members present (from left to right) were Alexis DeSieno, President, John Rondoni, Prachi Jain, VP of Campus Relations, Lili Peng, VP of Special Projects, and Rowena Mittal, VP of Industrial Relations.

## First BMES Meeting for the Spring Term Showcased Georgia Tech's BME Program

**By Judy Yeh, EDITOR**

Dr. Larry McIntire, Wallace H. Coulter Chair of Biomedical Engineering at Georgia Institute of Technology (GT) and Emory University, spoke to MIT students about the GT & Emory biomedical engineering graduate program on February 12.

The Biomedical Engineering Ph.D. is a degree conferred jointly by Georgia Tech and Emory University of School of Medicine. The curriculum is pre-set with courses in engineering sciences, life sciences, physiological systems, problem-based learning, bioethics, teaching practicum, and electives.

To the GT/Emory Biomedical Advisory Committee, graduate study in biomedical engineering for technologically oriented medical students with strong quantitative interests allows combining an understanding of advanced technology with direct patient care and/or clinical research.

Dr. McIntire is past President and Senior Member of the National Biomedical Engineering Society and recently appointed Editor-in-Chief of the *Annals of Biomedical Engineering*. He is also the 2003 recipient of the BMES Distinguished Service Award.

The presentation to general BMES membership was held at 4:30 pm in 56-114, following a BMES executive board luncheon with Dr. McIntire for a discussion on the future directions in biomedical engineering direction. Both events were sponsored by BMES, Biological Engineering (BE) Division, and Biotechnology Process Engineering Center (BPEC).



Joining the BMES Exec Board Luncheon with Dr. Larry McIntire was *Buzz*, the beloved mascot of the Georgia Tech (GT) Yellow Jackets and a fond memory of Prof. Linda Griffith, Faculty Advisor of BMES and 1982 GT alum.

## Internship Program Soon to be Developed

**By Judy Yeh, EDITOR**

A summer internship program targeted for BMES members, BME minors, and later BE majors is under development. The program is funded by the Cambridge-MIT Institute (CMI), Biotechnology Process Engineering Center (BPEC), and the Biological Engineering (BE) Division.

The program goal is more than simply connecting students with local (Cambridge/Boston) biotechnology companies for summer internship opportunities. More specifically, the aim is to establish path-breaking areas for engineers – those trained in the newly developed biological engineering discipline as well as those approaching bio/medical applications from a unique interdisciplinary lens.

"We want to enlighten the pharma industry with new blood," said Professor Linda Griffith, a driving force for the internship program, also Chair of the BE Undergraduate Program Committee and Director of BPEC.

As preparations are under way for launching the program, the objective is to achieve a 1-4 student placement this summer, 8-12 the next, and 40-50 the summer after next, said Daniel Darling, BPEC Event/Outreach Coordinator, soon to be fully dedicated to developing this program. The plan is to have full-fledged operation in 3 years. Internship opportunities over IAP or during fall/spring term are also considered.

Target companies under consideration include Medtronic, Guidant, Intel Biotech Division, BioProcessing, TKT, and Genzyme. Special emphasis will be placed on establishing strong ties not only with the research but also the human resources department of these companies, said Darling. The anticipated rate-limiting step will be the identification of internship positions.

Information on this program will be made available on the BMES, BME, and BPEC websites later this spring. Feedback and suggestions from the BMES membership are welcome, and all concerns should be directed to [bmes-exec@mit.edu](mailto:bmes-exec@mit.edu).

## BMES Membership

(Continued from page 1)

In the next few months, keep your eyes open for even more activities as we launch new programs geared towards helping you get involved. You can expect to see a full-fledged internship program that is exclusive for BMES members, a program that is not too late to apply for summer of 2004!

If you are interested in any of the events listed, be sure to check out our new, updated website at [web.mit.edu/bmes/www/](http://web.mit.edu/bmes/www/), where you can find more detailed information about all of our programs. Also be sure to check out our newly installed bulletin board by Building 4 Café in the Infinite Corridor.

Finally, please don't hesitate to email me - as my term of office is coming to an end, I am looking forward to more student input so that I can make your requests a reality.

Sincerely,

Alexis DeSieno <[alexisd@mit.edu](mailto:alexisd@mit.edu)>  
BMES President, MIT Chapter

## BioInstrumentation Lab to be Offered Fall '04

**Information compiled from "BME Minor Degree Updates, January 2004," prepared by Prof. Linda Griffith, Head of the BE Undergraduate Program Committee.**

A new laboratory on bioinstrumentation will be offered fall '04 as sequel to *Laboratory Fundamentals in Biological Engineering* (BE.109). The new class (BE.309) is expected to be a joint offering by the mechanical engineering department (course # TBA).

The lab will focus on sensing and measurement aimed at quantitative molecular/cell/tissue analysis in terms of genetic, biochemical, and biophysical properties. Methods include PCR, mass spectrometry, 2-D and 3D light and fluorescence microscopies, and electro-mechanical probes (atomic force microscopies, laser and magnetic traps, MEMS devices).

Methods of image and spectral analysis will be taught. Statistics, probability, and uncertainty analysis applications to

experimental data will be emphasized.

Planned course modules include Force Spectroscopy and Optical Tweezers (Prof. Matt Lang, Prof. Scott Manalis), Protein Analysis by Mass Spectrometry (Prof. Forest White, Prof. C. Forbes Dewey), Cell and Tissue Imaging for Tissue Engineering (Prof. Peter So, Prof. Linda Griffith).

This upper-level laboratory subject builds on both the science and engineering foundation of the BME core curriculum when an introductory biology lab is added. It will be a core upper level lab in the planned BE SB degree and an option for students fulfilling 2a requirements.

Prerequisites for the class include completion of BE.109, science and engineering core of the BME minor, introductory biology lab or equivalent, and at least junior standing status. Enrollment may be limited to BE majors and 2/2A students beginning Fall '06.

A complete course description will be available late spring term '04.

### RESEARCH PUBLICATION OPPORTUNITY Student Research Spotlight

**Why?** Share your research! Strike a conversation, spark some interests . . . It doesn't have to be ground-breaking, earth-shattering discoveries - just something cool you would like to share - simply because research is an ongoing dialogue, a work in progress fueled by interaction with fellow seekers of truth . . .

**How?** Consider publishing through the BioTECH, MIT's Biomedical Engineering Society (BMES) Newsletter. This could be a great opportunity to get feedback from faculty and peers with similar interests and pursuits. See page 8 for this issue's student research spotlight.

#### Guidelines for Submission:

1. Undergraduate research in a BME-related field.
2. A concise and informative description of research in ~250 words.
3. Include a brief blurb on the context of research (lab affiliation, mentor, how you got involved, degree and length of involvement, etc).
4. Jargon-free, reader-friendly language accessible to the general MIT community.
5. Approval from mentor if research is UROP-based, or clearance from employer if research is industry-based.

**When?** Contact us before spring break for publication in the next issue.

**Questions?** Email [TheBioTECH@mit.edu](mailto:TheBioTECH@mit.edu). We hope to hear from you soon!

### BMES Big-Sib Lil-Sib Program

**What:** Join the BMES Big-Sib Little-Sib Program! BMES Buddies is a new program which pairs upperclassmen with students looking for advice in biomedical engineering.

**Why:** For little-sibs, the program can help you with choosing classes, UROPs, internships, and jobs in biomedical engineering. Buddies are mentors and friends who are here to help you with the MIT experience. For Big Sibs, this is your chance to make a difference - by sharing your perspective with others of similar aspirations. Have fun and develop rewarding, lasting sibling-ships!

**How:** go to our website <http://web.mit.edu/bmes/www/>, click on Big-Lil Sib Program, and sign up today!

**When:** March 4, 2004 - come to the mixer and mingle with your buddy!

**Bottomline:** We hope you take this buddy relationship seriously and make time for your sibling - be it every week, twice a month, monthly, or once a semester - take the initiative to interact and take the time to show you care!

**Questions:** email [bmes-buddies@mit.edu](mailto:bmes-buddies@mit.edu)

## Student Research Spotlight:

### Kinase Activity Resulting from Media Stimulation or Replacement

**Brian Chase**, sophomore in Course 7, Biology, works on characterizing how cells respond to routine maintenance *in vitro*. This UROP project was offered to him after a discussion with Professor Douglas Lauffenburger at a student-faculty mixer run by the Biology Department. Brian started researching last summer and has been working closely with mentor and graduate student Kevin Janes on establishing a control for the large-scale experiments involving media replacement.

#### By Brian Chase

Computational and systems biology involve the application of computer analysis and modeling techniques to quantitative biological data. In this project, computer modeling is used to examine protein pathways that lead to apoptosis, or programmed cell death in cells.

An assay that measures the activity of five kinases (specialized proteins) that are implicated in apoptotic or survival

pathways has been developed by graduate student Kevin Janes. The assay involves stimulating cells over a 24-hour period with several different extracellular factors.

Modeling techniques are used to analyze the data quantitatively and look for important factors that might reveal novel relationships within the cell. My project involves running several smaller experiments for use with the kinase assays.

The cells in these assays are not stimulated except by changing the media in which they grow. I calculate the activity in the kinases under investigation to give an idea of how much of the protein activity observed in the larger experiments is the result of controlled stimulation, and how much results from earlier steps of the assay, which involve changing the media several times.

I am performing these assays on two types of cancer cells, HT-29 and HeLa, for two different treatments, one in which fresh media is added to the cells, and one in which the depleted media is

removed and added again. Results will identify pathway responses from media stimulation and from the stress of changing the media.

This work provides a control for the large-scale experiments performed by Kevin Janes and characterizes how cells respond to routine maintenance *in vitro*. Janes and Dr. Lauffenburger are advising me on the project, however I perform all procedures not involving radiation, and all calculation steps. Results should be ready to present before the end of the spring semester.

// I was very lucky to get a UROP in this lab, because Kevin really emphasizes my learning process, and makes sure I understand what it is I am doing in the bigger picture of his project. Kevin's attention and respect have made working with him a very rewarding experience for me.

**Brian Chase,**

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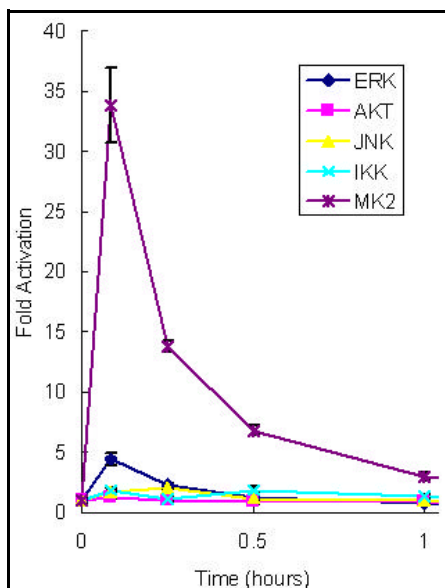
Course 7, Class of 2006

#### Feedback from Brian's Mentor, Kevin Janes

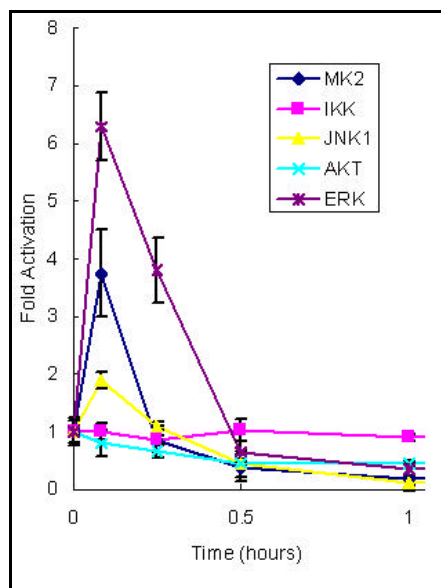
Brian has made a very positive contribution to the lab in the nine months since he began working. From the start, he made it clear that research was a priority to him through his carefulness in performing experiments and his willingness to devote the time necessary to see experiments through to completion.

After Brian had learned a core set of lab skills for our field, we made sure to promptly reward his dedication with a project of his own. The independent research project that Brian describes here stems from an interesting observation we made over the summer during a set of experiments that were particularly critical for my thesis.

Although we are only about halfway through this project, Brian is making real headway in completing the necessary experiments, and I would expect a manuscript-caliber data set within the next several months.



**Figure 1. Normalized Activity After Serum Stimulation.** Relative activation of five kinases reported by radioactive assay after stimulation with a fresh media change. Results show relative activation in response to mechanical stress of media change and in response to nutrients in media.



**Figure 2. Normalized Kinase Activity After Depleted Media Change.** Relative activation of five kinases reported by radioactive assay after stimulating with media that has already been depleted by the cells. Results show activation only in response to the mechanical stress of replacing media.