

Tufts University

# The BME Bulletin

## Special points of interest:

- **Professor David Kaplan**, BME, named the first holder of the recently endowed Dean's Professorship in Bioengineering
- **Professor Georgakoudi**, BME, won 1st annual Sturge Prize in August 2005 for her contributions to spectral diagnosis of biological materials
- **Olena Rabotyagova**, Chemistry, PhD student, received a [Graduate Women in Science Award](#) during the 8th Annual NESACS conference

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## Welcome from the Chair

This is an exciting time in our Department. Over the past four years, since we officially became a separate department, we have seen the implementation of our PhD program and first major in Biomedical Engineering. In both cases, we have a strong underpinning of research that drives the overall program, the teaching and our impact on the medical community.

We are led by a dedicated and collegial group of faculty and staff that do not feel constrained along department lines, allowing us to build many bridges among other faculty throughout the Tufts system, as

well as with the broader academic and industrial community.

Our programs are being led by our outstanding faculty and their strong commitment to excellence in research and teaching, while our base remains the talented post doctoral fellows, graduate students and undergraduate students that conduct the research, experience the courses and work to continuously improve both the programs and environment in the department and at Tufts.

We look forward to continued productivity in our educational pursuits in the coming years and invite you to join us in regular



**Professor David L. Kaplan, Chair**

communication and participation. Please stay involved with us to help in the process and together we anticipate a strong and lasting presence for our efforts for our students, the field and the broader community.

## A Lot of Bright Light...

Recent results on the properties of a new kind of optical fiber from the Ultrafast Nonlinear Optics and Biophotonics group led by **Professor Fio Omenetto** were featured as one of the most significant achievements in optics for the year 2006 by *Optics and Photonics News*, the Optical Society of America's monthly news magazine.

Omenetto's group has been

collaborating closely with the group that first developed photonic crystal fibers (PCFs) at the University of Bath for over five years. Recently, they have jointly manufactured a high-nonlinearity photonic crystal fiber that is very promising for spectroscopy and imaging applications offering a new, fiber-based light source of unprecedented bandwidth and brightness.

This PCF has the right combination of geometry, material and physical properties to transform low spectral bandwidth (10 nm) laser pulses that propagate in it into a burst of white laser light extending from the ultraviolet (350 nm) all the way to the mid infrared (>3000 nm). This process, called supercontinuum (SC) generation, is a very active area of research because of the (cont. pg. 2, *PCFs*)

## ... From a Tiny Fiber

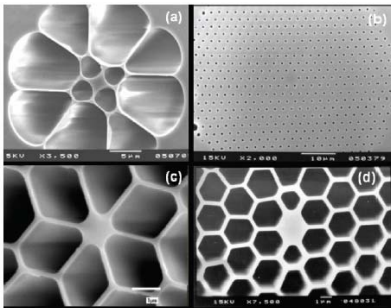
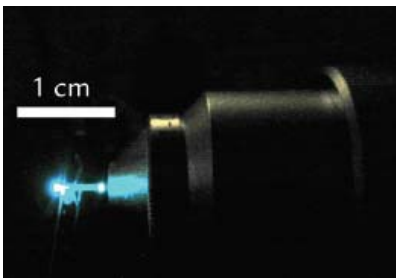


Figure 1. Above—(a), (b), (c), (d) Scanning electron microscope images of the cross section of various PCF samples that show the air-glass microstructure (photos: University of Bath). Below—Small segment of PCF generating broadband continuum.



(PCFs, cont. from pg. 1) - opportunity offered by the availability of such a spectrally broad, coherent light source (notably, SC has enabled research rewarded with the Nobel prize for Physics in 2005).

This research has been published in *Optics Express* (1) and two oral presentations on the subject have been presented at the Conference on Lasers and Electro-Optics. One of these talks was delivered by **Natalie Wolchover**, a Tufts sophomore conducting research in the group, who is also co-author of the above journal publication.

In less than a decade, PCFs have become one of the success stories of modern photonics:

1. Starting as a highly speculative idea in 1991, first realized in 2000, it is now possible to obtain PCFs in different varieties with specifically tailored features.

2. In contrast to regular optical fiber with a solid guiding core and a solid cladding, a PCF consists of an array of microscopic holes (hollow capillaries with diameters precisely controllable in the range ~25 nm to ~ 50 nm) running along the fiber length (Figure 1). These holes act

optical barriers or scatterers which, suitably arranged, can trap light within a central core (either hollow or made of solid glass). The very large air-glass refractive index difference opens up many new possibilities not available in standard fibers. For example, light can be guided in a hollow core by photonic bandgap (PBG) effect. The revolutionary nature of the waveguides and their very high performance measured in terms of loss, nonlinearity, and dispersion control means that applications are emerging in many diverse areas of science and technology.

## Meet & Greet: At the Second Annual BME Retreat

The Second Annual BME Department retreat took place during the second weekend of September at the Tufts Loj in Woodstock, NH.

Approximately 50 graduate students, post doctoral fellows, staff, faculty and family members participated. There was plenty of food and the glorious weather allowed us to enjoy games of Frisbee,

football and soccer.

All the fun and play on Saturday afternoon was followed by a poster session with over twenty posters presented by graduate students and postdocs. Tapas talks (short oral presentations) by graduate students interspersed throughout the session introduced some of the exciting research going on in

each of the faculty members' groups.

It was a great opportunity, especially for the new crop of graduate students to hear from their peers about what everyone is doing. Even more importantly, it was a time to get to know each other on a more personal level and have fun as a team.



Annual BME Retreat in Woodstock, NH: September 9-10, 2006



## Critical Thinking Program Enhances BME Design Course

Faculty member **Mark Cronin-Golomb** received a summer grant from the Critical Thinking Program to revise the course "Design of Medical Instrumentation." Students were required to form teams to carry out design projects sponsored by Tufts faculty, as they would for regular senior design projects, but with the added component of peer review. This included peer feedback on the groups' oral presentations. These evaluations matched

the professor's evaluations closely and were used to determine the presentation component of the course grades.

Each student was also asked to provide an anonymous review of a randomly selected project on the basis of its final written report. The review was to be a page or two long including questions and comments about the project and the approach being taken, and written tactfully with the aim of providing positive feed-

back to improve the project. Each project received two anonymous reviews, just as a real-life paper or proposal might, in addition to a review by the professor.

Again, in the vein of simulation professional peer review, the teams were asked to provide responses to the reviews, and to revise their final reports accordingly to be presented for final grades.

Inclusion of the peer review

proved to be very much appreciated by the students. It enabled them to show that they could make well considered and helpful suggestions for other teams and to feel that they were an important part of the learning process.

A list of this year's projects follows. With the approval of Professor Lasser of the Department of Electrical and Computer Engineering, some of these projects are to be continued as (cont. pg 4; *Critical*)

## BME Welcomes New Staff

The Department welcomes its newest technical staff members: **Carmen Preda** and **Martin Hunter**.

Carmen grew up in Bucharest, Romania, and graduated from the University "POLITEHNICA" Bucharest with a M.Sc. In organic chemistry. She worked for several years at the Massachusetts Institute of Technology on a NASA-funded project in the area of cell culture bioreactors. The research focused on the design and optimization of experiments to be conducted in the science laboratory aboard the International Space Station. Carmen joined Tufts in 2006 where she is currently working on biopolymer tissue engineering projects in the Tissue Engineering Resource Center.

Carmen enjoys spending

her free time with her family: her daughter Andra and husband Dorin. They like to spend time outdoors on the beaches of New England during the summer, and on the ski slopes or skating rinks in the winter. She also loves reading good books and enjoys cooking her favorite Romanian dishes.

Martin grew up in Argentina and Brazil, and came to the United States for college. He got his BS in chemistry from MIT in 1987, and his PhD in physical chemistry from the University of Southern California.

Martin has always been fascinated by the science of light, and how it interacts with matter. In grad school he they used lasers to study how

molecules store and transfer energy when collide with each other.

He later applied that knowledge to studying the photochemistry of the atmosphere, related to the ozone hole formation and global warming.

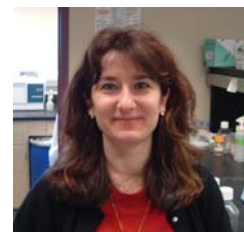
More recently, Martin has become more involved with the use of light as a diagnostic tool in medicine. For the past five years he has worked at MIT's Spectroscopy Laboratory developing optical instruments for monitoring sugar levels in diabetics, and for detecting the onset of pre-cancer in human epithelia.

Outside of work, Martin finds fun and joy in his awesome family: his wife Sierra, and their children Ian (12), and Rio (2).

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*"I look forward to contributing what I know to the students, both technically and in enthusiasm for the wonderful creative potential of science."*  
- Martin Hunter

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Carmen Preda



Martin Hunter

(cont. from pg. 3; *Critical*) - senior design projects in that department.

- *Computerized Microscope Stage*, sponsored by **Fio Omenetto**, BME;

- *Modeling a Fluid Drug Delivery System*, sponsored by Helbling Precision Engineering;

- *Microscopic Electronic Stimulation Monitor*, sponsored by **Vo Van Toi**, BME;

- *Electromagnetic and Radio Frequency Field Compatible Precision Grip Force Measurement*, sponsored by **Giorgio Bonmassar & Thomas Zefiro**, Massachusetts General Hosp.;

- *Improved Single Emitter Near Infrared Spectroscopy Probe*, sponsored by **Sergio Fantini**, BME;

- *Micro-force Beam Array for*

*Assessing Caterpillar Locomotor Dynamics*, sponsored by **Barry Trimmer**, Biology;

- *Microwave Probe for Detecting Cancer Cells*, sponsored by **Mohammed Afsar**, ECE;

- *Heart and Mitral Valve Modeling System*, sponsored by **Carl Kirker-Head**, Cummings School of Veterinary Medicine;

- *Non-invasive Blood Iron Detector*, sponsored by Vo Van

Toi, BME;

- *Development of a Confocal Laser Scanning Microscope*, sponsored by **Irene Georgakoudi**, BME;

- *Designing an Orthogonal Polarization Spectral Imaging Device*, sponsored by Irene Georgakoudi, BME;

- *Fall Detector*, sponsored by **Chorn Hwa Chang**, ECE.

## Adjunct Faculty News

**David Walt**, Chemistry, Tufts—Named Howard Hughes Medical Institute Professor (one of twenty awards in the US)

**Krishna Kumar**, Chemistry, Tufts—Received Global Innovator Award, MIT IBC (one of ten in the world)

**Barry Trimmer**, Biology, Tufts—Co-director, with **D. Kaplan**, of a W.M. Keck award for Biomimetic Technologies for Soft-bodied Robots.

**Pam Yelick**, Craniofacial & Molecular Genetics—Awarded NIH R01, titled “Novel screen for mineralized craniofacial and tooth mutants in zebrafish.”

## BME Intensifies Outreach To Vietnam

The Biomedical Engineering Department has intensified its international outreach in recent years. As part of this effort, relationships with Vietnamese Universities have flourished, thanks to **Professor Vo Van Toi**.



Clockwise from top left: An Dinh, Trang Nguyen, Sergio Fantini, Anh Nguyen, Vo Van Toi, and David Kaplan

Under NSF sponsorship, Professor Vo led a delegation of biomedical engineering faculty to Vietnam in January of 2004. Their mission: to develop a collaborative research and education plan in biomedical engineering between the United States and Vietnam. Two Vietnamese universities, Ho Chi Minh City University of Technology and Can Tho University, signed MOUs with Tufts as a result.

Later that year President **George W. Bush** appointed Professor Vo to the Board of Directors of the Vietnam Education Foundation, an institution established by Congress to foster collaborations between the two nations. In February 2007, he was named Executive Director of VEF.

In 2005, Professor Vo was a co-organizer of the First Interna-

tional Conference on Biomedical Engineering in Vietnam, which was sponsored by the National Science Foundation (US), the Vietnam Education Foundation (US), Vietnam National University at Ho Chi Minh City (VN), and the National Center of Laser Technology (VN). The conference drew more than 200 participants, consisting of researchers, educators, students, and representatives from the private sector. More than sixty oral and poster presentations by authors from Vietnam, the United States, France, the United Kingdom, Switzerland, Belgium, Ukraine, Bulgaria, Australia, China, and Thailand were made.

**Don Giddons**; Dean, College of Engineering at the Georgia Institute of Technology was the keynote speaker.

Other U.S. speakers included: **Tom DeMarse**, University of Florida; **Semehat Demir**, NSF & the University of Memphis; **William Ditto**, University of Florida; **Tim Duong**, Emory University; **Sergio Fantini**, Tufts; **David Kaplan**, Tufts; **Mailen Kootsey**, Loma Linda University; **Matthew Loeb**, IEEE; **Alan Macy**, BIOPAC Systems; **Sheryl Pruksa**, Pruksa Engineering; **Jianguo Sun**, Vitalog, Inc.; **Roger Tran Son Tay**, University of Florida; **Bruce Wheeler**, University of Illinois; and Arthur **Winston**, IEEE.

The Second Conference will be held this summer in collaboration with the Vietnamese Ministry of Sciences & Technology in Hanoi.

For more information, visit: <http://www.cs.tufts.edu/~vanvo/VN/BME>.



From left: Sergio Fantini, Vo Van Toi, and David Kaplan

## Featured Publications

Several faculty had manuscripts published in prominent journals this year:

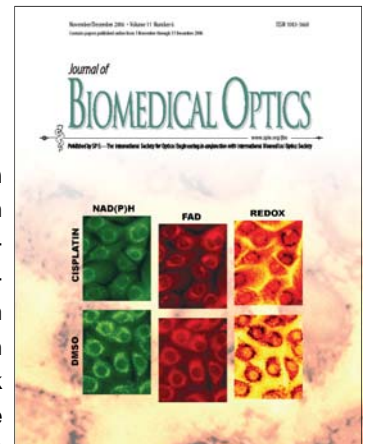
**Professor Fio Omenetto** had “Supercontinuum generation from 350 nm to beyond 3 μm in sub-centimeter lengths of high-nonlinearity photonic crystal fibers” published in *Optics and Photonics News’ Optics in 2006* special issue, which highlighted the most exciting re-

search to emerge during the year. **Natalie Wolchover**, a Tufts physics undergraduate co-authored.

**Professor Irene Georgakoudi** had “Intrinsic fluorescence and redox changes associated with apoptosis of primary human epithelial cells” published in the *Journal of Biomedical Optics*. BME Ph.D. candidate **Jonathan Levitt** is

first author of the publication.

**Professor David Kaplan** had a recent paper published in PNAS on the topic of novel chimeric silk-silica proteins, entitled, “Novel composites from spider silk-silica fusion (chimeric) proteins. This work was in collaboration with **Carole Perry**, from Nottingham Trent University, in the UK.



Professor Georgakoudi’s publication was featured on the cover of the Nov./Dec. issue of *JBO*.

## BMES—Biomedical Engineering Society

The Biomedical Engineering Society (BMES) chapter at Tufts has been approved by the national BMES organization, and is the department-affiliated student organization that helps members pursue interests in the field of biomedical engineering. It sponsors events and promotes networking opportunities with industry through site tours and seminars.

Some of this year’s activities include a trip to see the Body Works exhibit at the Museum of Science, Faculty Research Presentations, attendance at the BMES National Conference in Chicago, and the establishment of an official BMES Chapter at Tufts.

This year’s officers are: **Alexander Antoniou**, President; **Ximena Sosa**, Vice

President; **Alissa Brandon**, Treasurer; **Sam Quintero**, Secretary; **Glenn Ferreira**, Communications Officer; and **Teddy O’Brien** as the First Year Representative.

The organization’s website is:

<http://ase.tufts.edu/bmes>

## Being a STOMP Scholar

As told by **Jennifer Kang**, BME Ph.D. candidate.

Every week, I go to a tenth/eleventh grade chemistry classroom at Malden High School where **Dr. Perito**, the chemistry teacher, dynamically transforms chemistry concepts to reality. My role as a Student Teacher Outreach Mentorship Program (STOMP) scholar is to introduce core engineering concepts into the curriculum by which students are actively engaging in the engineering design process. One of the

many motivations of bringing engineering to the classroom is so that students are exposed to different ways of solving problems—it is often the case that you’ll find students that struggle academically excel in hands-on engineering projects. One activity involved testing the insulation capabilities of different materials such as cardboard, Styrofoam, and aluminum foil. Students under-



Jen Kang

went a design phase, testing phase, and a re-design phase—simulating the basic engineering design process. During this, it was evident that in some cases, students who were not as strong in test-taking, for example, showed strengths in thinking critically about reasons for why certain materials were better than others. As the year progresses, it is my hope, together with Dr. Perito, to continue opening their eyes to the creativity that can be used in solving a prob-

lem, and more specifically, introducing tissue engineering—a field that on day one in the classroom, no student had heard of. This is exciting for me as I will hopefully be able to take part in exposing them to this growing discipline.

The STOMP program is run through the Center for Engineering Education Outreach at Tufts, and directed by **Chris Rogers**. For more information: <http://www.stompnetwork.org/tufts>

## Recent Graduates

**Professor Kaplan** had four Ph.D. students complete their programs this year:

(a) **Cheryl Wong**, a joint Biotechnology/Chemistry major, completed her studies on silk protein designs related to novel biomaterials and has begun her post doctoral fellowship at Stanford University.

(b) **Jia Huang** completed her Ph.D. in biotechnology engineering in the study of protein self-assembly and began a position in industry with Serica, Inc.

(c) **Peng Xu** majored in Chemical &

Biological Engineering, and studied enzymatic polymerization related to conducting polymer surface patterning, and began a post doctoral fellowship at Tulane University.

(d) **William Wang**, a Chemical & Biological Engineering major, completed his studies on the control of stem cell biology through matrix designs and cell to cell signaling. He is now working at Genzyme.

Professor Kaplan also had four MS

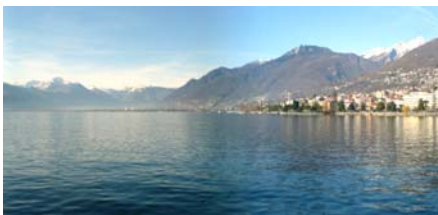
students complete their programs: **Jordy DeFelice**, **Meredith Kolpak**, **Emilia Bora**, and **Marielle Pleasant**; all are working in industry.

**Professor Fantini** had two students complete Masters programs: **Jeffrey Martin** (MS), and **David Lin** (ME).

**Professor Georgakoudi** had two students complete their MS: **Lee Stucenski**, who is now at Boston Biomedical Consultants, and **Steve Boutrus** is now a student at Tufts School of Medicine.

## International Collaborations

**Sergio Fantini** has been collaborating with **Marco Ferrari** and **Valentina Quaresima** at the University of



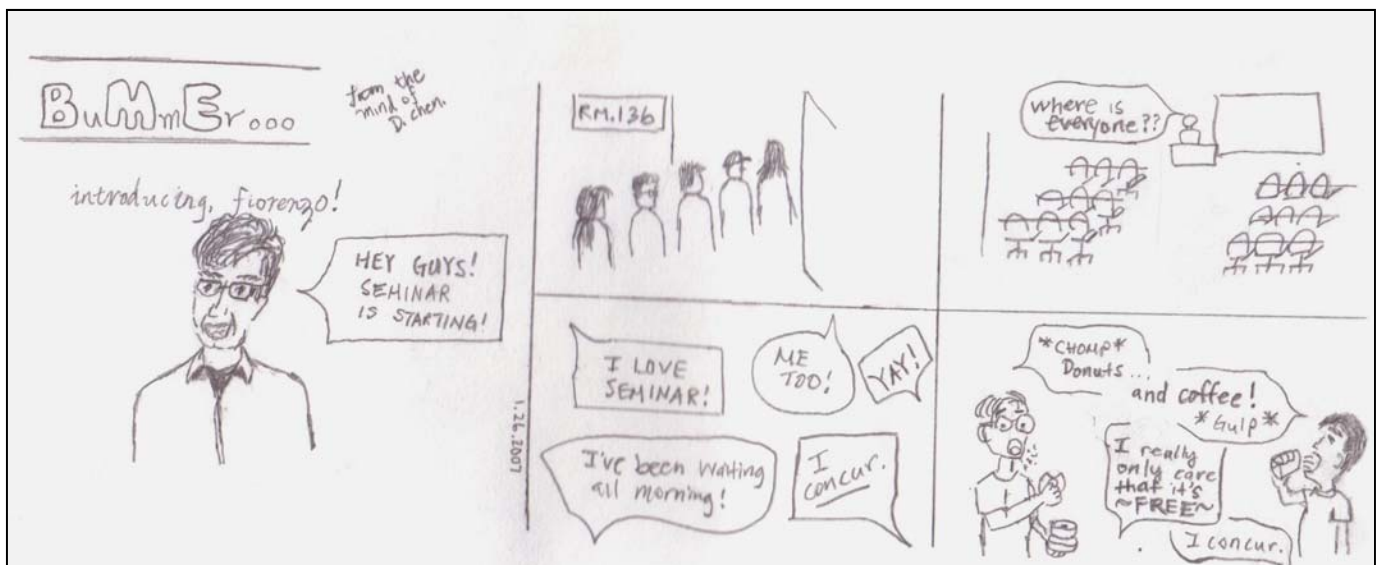
Switzerland; taken by **Dean Glettig**, a student in the ETH Zurich collaboration

L'Aquila, Italy on the study of spatially resolved blood flow and oxygen consumption in skeletal muscles using near-infrared spectroscopy. This collaboration also touches on functional near-infrared imaging of the brain. Collaborative and exchange programs involving BME graduate students, postdocs, and faculty mem-

bers are also being explored with the University of Pavia, under the umbrella of a formal agreement in place with Tufts University for collaborative and joint programs between the two institutions.

**David Kaplan** has a long standing collaboration covering novel biomaterials, be-

tween the ETH, Zurich Switzerland, and the BME department at Tufts, which has been fostered via exchanges of graduate students and post doctoral fellows between the two programs, joint research grants, and continued research collaborations.



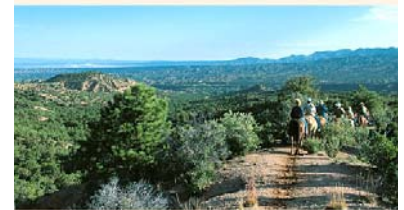
## Ultrafast Optics/High Field Short Wavelength 2007

**Professor Omenetto** will be co-organizing the Ultrafast Optics and High field short Wavelength meetings with **Todd Ditmire** from the University of Texas Austin; **Daniel Kane** of Southwest Sciences; and **Jorge Rocca** from Colorado State University. The meetings will be co-located September 2–7, 2007 in Santa Fe, NM at Bishop's Lodge.

Ultrafast Optics has traditionally been a meeting centered on applied ultrafast science with emphasis on the latest technology, instrumentation and methods. Ultrafast optics is ideally co-located with the topic meeting on High Field and Short Wavelengths, where themes of high intensities and ultrafast timescales are central. HFSW centers on the scientific ad-

vances in high field phenomena and in the generation of intense coherent short wavelength light including, but not limited to, XUV and X-ray sources, attosecond science, and coherent optics.

For more information on registration and deadlines, please see: <http://ase.tufts.edu/biomedical/unolab/UFO/UFOhome.html>



Bishop's Lodge: [www.bishopslodge.com](http://www.bishopslodge.com)

## Tissue Engineering: The Next Generation



**Professor David Kaplan**, and **Adjunct Professor Gordana Vunjak-Novakovic** co-organized, "Tissue Engineering: The Next Generation," in May of 2005. Nearly 250 investigators and representatives of the National Institutes of Health and industry, gathered in Cambridge, MA, at the workshop that was sponsored by the NIH to rethink directions in the field. The theme of the workshop was bridging the

gap between developmental biology and tissue engineering, as developmental biology might help in the understanding of how tissues develop, and thus how to predictably form functional tissues of various kinds. The need to provide cells with the right cues to predictably form functional tissues of various kinds may be the fundamental challenge of the next generation of tissue engineering.

As a follow up to the workshop, a "Tissue Engineering and Developmental Biology" meeting is planned for April 12th-17th, 2007 in Snowbird, Utah as a Keystone Meeting. The meeting is co-organized by Gordana Vunjak-Novakovic (Columbia), David Kaplan, and **Randall Moon** (U. of Washington, Seattle).

## Positions Available

The BME Department is seeking candidates for a faculty appointment; rank will be determined by experience and accomplishments. Preference will be given to candidates whose research interests involve regenerative medicine. For more information, see: <http://ase.tufts.edu/biomedical/events/facPosition.asp>

A post-doctoral fellowship and Ph.D. fellowship are available beginning Feb. 1, 2007 in the departments of mechanical engineering and biomedical engineering at Tufts. Funding for six months is guaranteed, with subsequent six months renewal contingent upon satisfactory progress. We expect further extramural funding for the following years. Primary post-doctoral responsibilities: conduct a survey of likely

fluorophores and model, using Code V, their responsivity. PhD fellow responsibilities: determine the relationship between emission intensity and bending radius for each fluorophore and construct a working prototype of the shape tracker with multiple fluorophores. Please contact **Caroline Cao** for more information: [caroline.cao@tufts.edu](mailto:caroline.cao@tufts.edu)

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Upcoming Events

- The School of Engineering will be hosting it's annual Open House March 9th-10th, 2007.
- Spring Break is March 19th-23rd, 2007.
- Ski Weekend, March 30th-April 1st. STS will provide more details soon.
- STS (Sci-Tech Society) Luncheon, April 13th, 2007
- STS Luncheon, May 4th, 2007
- Commencement: May 20th, 2007

We Want Your News!

We would like to feature alumni news in future issues of our newsletter. Please provide the following information for the purposes of updating our alumni database and informing your classmates of news you would like to share.

Name: \_\_\_\_\_ Tufts degree(s)/Year: \_\_\_\_\_

Email: \_\_\_\_\_ Phone: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Current Employer: \_\_\_\_\_

News you'd like to share:  
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