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Understanding Mechanisms of Disease

www.bme.cornell.edu
Greetings and best wishes to our alumni and friends. Cornell BME has had a great year.

In this issue we focus on some of our recent successes both as a department and as individuals. Our external recognition is increasing as measured by external rankings where we have just entered the top 20 in US News & World Report rankings of graduate BME programs. Our young faculty continue to mature and win recognition for themselves and the department. Chris Schaffer and Jonathan Butcher won NSF CAREER awards. We now have four of our faculty with CAREER Awards (King and Putnam are prior recipients). Cindy Reinhart-King received the World Congress of Biomechanics Young Investigator Award (silver). We are very proud of Cindy Reinhart-King, who will receive the BMES 2010 Rita Schaffer Young Investigator Award. This is the second year in a row that this national award has gone to a Cornell BME faculty member, after Jonathan Butcher in 2009. Jonathan Butcher was also selected for a Hartwell Foundation Individual Biomedical Research Award. Chris Schaffer received the 2009 Biomedical Engineering Teaching Award from ASEE. Dave Putnam was elected as a Fellow of AIMBE (five of our 12 primary faculty are AIMBE fellows).

At the next level, we note that Larry Bonassar and Roger Hartl (Neurological Surgery at Weill Cornell Medical College) received the Hansjörg Wyss Research Award at the World Forum for Spine Research. The award provides 360,000 Swiss francs for continuation of their pioneering work on tissue-engineered discs that will be tested for treating spine disease. This work resulted from a seed grant to promote joint research between the Ithaca and Weill campuses.

We also received two awards that confirm the success we have had in building cross-campus interactions. All of our faculty have at least one joint project with colleagues at Weill Cornell Medical College, but we now have a significant center grant between the two campuses. This NIH/NCI funded Physical Sciences-Oncology Center grant (Center for Microenvironment and Metastasis) has a strong BME presence with all three of the research thrusts and education and training component led by BME faculty (see page 7). We also received a Howard Hughes Medical Investigator “Med into Grad” training grant (see page 4) that builds on our cross campus activities and further strengthens the training of students. We are only the second engineering department (of the 22 awards) to receive such a grant.

Our graduate students have also demonstrated their ability to compete nationally. This factor is probably most clearly demonstrated by the fact that eight of our current first- and second-year Ph.D. students won NSF Fellowships and six more received Honorable Mentions. We believe that this level of success is greater than in
any other engineering department, even those that are much larger.

We are excited to welcome Professor Chris Hernandez into the department. While his primary appointment is in Mechanical and Aerospace Engineering, he has a secondary appointment in Biomedical Engineering. Chris was an assistant professor at Case Western before moving to Cornell (July 2010). His area of research is orthopedic biomechanics with an emphasis on bone mechanics and adaptation.

We’ve had another great year in recruitment of M.Eng. students (we anticipate about 75 students this Fall) and an incoming class of 22 Ph.D. students. Our Ph.D. class has good diversity with 45 percent female students and 35 percent of the U.S. citizens are from groups considered to be underrepresented. We are very pleased with the quality of these students.

We received a gift from Neal Douglas to establish over the next three years five fellowships for BME students doing work focused on cancer which complements our PS-OC and HHMI training grant. David Fischell provided a gift for seed grants (matched by the provost in Ithaca and the executive vice dean at WCMC) for projects developed at a joint retreat with Neurological Surgery and other WCMC and Ithaca participants on the blood brain barrier and ways to circumvent it for treatment of brain cancer and other neurological impairments.

We also are sad to lose our administrative director, Colleen McClanahan, who moves to Mechanical and Aerospace Engineering. We wish Colleen the best and thank her for her dedication and the tremendous job she did in helping BME become an effective department. We are fortunate that Dawn Esposito will join us as our administrative director. We will share Dawn with Applied and Engineering Physics. Dawn brings with her 12 years of academic administrative experience (and a degree in chemical engineering). We are pleased that Dawn has agreed to join us.

Overall, the 2009–2010 academic year treated BME well in spite of the economic downturn. The 2010–2011 academic year promises to be an exciting one as we pursue additional faculty hires and the possibility of establishing an undergraduate program.

Best wishes to all of you and thanks for your interest in Cornell BME.

Sincerely,

Michael L. Shuler
Professor and Chair
This past year, eight Cornell Biomedical Engineering Ph.D. students received fellowships from the National Science Foundation (NSF) to support their graduate work. The NSF Graduate Research Fellowship program “recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines.” As fellows, students are awarded a $10,500 cost of education allowance for tuition and fees, a three-year annual stipend of $30,000, and a one-time $1,000 international travel allowance. It is widely regarded as one of the premier fellowships to be awarded as a graduate student in engineering or science.

Cornell is honored to have eight current Ph.D. students as recipients of the prestigious award this past year. To our knowledge, based on available data from the NSF, this represents the most awards given to current Ph.D. students in any engineering department in the country. Moreover, in just this past cycle, 6 of our current students were awarded Honorable Mention.

Cornell has had tremendous success over the past several years within the NSF graduate research fellows program. An impressive 23 percent of our current 70 graduate students (listed by name, with their advisors, below) have been awarded the NSF graduate research fellowship. We attribute our success to the dedication our students have shown in both the intellectual merits and broader impacts criterion of the NSF review criteria. The NSF states that they expect recipients to be “future leaders.” Based on our firsthand knowledge of these excellent students, we are confident they will exceed the NSF’s expectations!

Current NSF Graduate Fellows in Cornell BME:

EMILY BROOKS, Advisor: Claudia Fischbach-Teschl
BAILEY COOPER, Advisor: David Putnam
MITCHELL COOPER, Advisor: Yi Wang
DARVIN GRIFFIN, Advisor: Lawrence Bonassar
BEN HAWKINS, Advisor: Brian Kirby
CHAO HUANG, Advisor: Brian Kirby
LAURA HOCKADAY, Advisor: Jonathan Butcher
CASEY KRANING, Advisor: Cynthia Reinhart-King
GEORGE LEWIS, Advisor: William Olbricht
MICHAEL MAK, Advisor: David Erickson
ROBERT MOZIA, Advisor: Lawrence Bonassar
SIDDHARTH PATHI, Advisor: Claudia Fischbach-Teschl
KATHERINE POVIRK, Advisor: Marjolein van der Meulen
ERICA PRATT, Advisor: Brian Kirby
JENNIFER Pluetzer, Advisor: Lawrence Bonassar
BROOKE SMITH, Advisor: Cynthia Reinhart-King

Honorable Mention:

CARISSA BALL, Advisor: Michael King
JEFFREY BALLYNS, Advisor: Lawrence Bonassar
SHAWN CAREY, Advisor: Cynthia Reinhart-King
JONATHAN CHAREST, Advisor: Cynthia Reinhart-King
JOHN HUYNH, Advisor: Cynthia Reinhart-King
MICHAEL MITCHELL, Advisor: Michael King
JOHN PELOQUIN (M.Eng.), Advisor, Cynthia Reinhart-King
ALYSE PORTNOFF, Advisor: Matt DeLisa
ROANNA RUIZ, Advisor: Dan Luo
CHING-PING SHEN, Advisor: Amit Lal
The Cornell Department of Biomedical Engineering has received a new grant to help train Ph.D. biomedical engineers who can work effectively at the interface between engineering science and medicine. The four-year, $700,000 grant was awarded to Cornell by the Howard Hughes Medical Institute as part of its “Med-into-Grad Initiative,” which is intended to help future biomedical researchers in science and engineering develop an appreciation of medicine. Cornell is one of 12 new awardees and is the only engineering department to receive one of the new grants.

“Providing a time and setting for BME students to learn firsthand how clinical medicine is practiced is a challenge for many BME departments, whether their medical school is across the street or across the state,” said William Olbricht, the program’s director. Other faculty members leading the program are co-director Peter Doerschuk, Chris Schaffer, and Shivaun Archer.

Cornell’s program addresses this challenge in several ways, all of which involve close collaborations with clinical faculty members at Weill Cornell Medical College (WCMC).

The BME department is developing a new course for first-year graduate students titled “Core Concepts in Disease.” The goal of the course is to help students understand that most diseases result from a relatively small number of biological mechanisms such as infection, inflammation, genetic mutation, protein misfolding, metabolic disregulation, and cancer. The course is organized into modules that teach the underlying biology of each mechanism, the clinical management of related diseases, and the technology involved in various therapies. Each module is co-taught by Ithaca-based and Weill-based faculty members from a variety of departments on the two campuses.

The new grant also supports the BME department’s Summer Immersion Term, which has been a hallmark of BME education at Cornell for more than a decade. BME students live and work at WCMC and New York–Presbyterian Hospital for seven weeks during their first summer at Cornell. Students are assigned a clinical faculty mentor at WCMC who provides clinical shadowing and an introduction to clinical research in the form of a mini-research project based on their clinical practice. HHMI support will be used to increase the number of students in the Summer Immersion Term, which is a timely development in view of the increasing enrollment in the BME Ph.D. program.

To promote collaborative research and to sustain connections made during the Summer Immersion Term, the HHMI grant also supports four one-year fellowships for students whose doctoral research is co-mentored by Ithaca and WCMC faculty members. The first four HHMI Med-into-Grad Scholars are Bo Xu, co-mentored by Yi Wang (BME and Radiology) and Martin Prince (Radiology); Shawn Carey, co-mentored by Cynthia Reinhart-King (BME) and Sandra Shin (Pathology); Puifai Santisakultrarm, co-mentored by Chris Schaffer (BME) and Richard Silver (Medicine); and Yue Geng, co-mentored by Michael King (BME) and David Nanus (Urology).

**BMES Wins Cornell Engineering Alumni Association Student Award**

The Biomedical Engineering Society was awarded the exemplary student organization of the year at the Cornell Engineering Alumni Association’s annual meeting and awards luncheon held on April 16. Students and student groups are recommended by the college’s faculty and staff, and the final selection is made by the Office of the Associate Dean for Engineering Undergraduate Programs. Each winning organization was awarded $750. These awards are made possible by an endowment created with the CEAA lifetime membership dues.
The Cornell Learning Initiative in Medicine and Bioengineering (CLIMB) program is an NSF GK–12 funded partnership between the Biomedical Engineering department at Cornell University and the science teachers of local-area middle and high schools. Graduate students from the BME department are paired with science teachers for a full academic year and spend about one day per week in their teacher’s classroom, serving as a “resident scientist” and working to improve the quality of science education. Each graduate fellow/teacher team also develops and implements new, discovery-driven approaches to teach specific science topics. The $3 million grant from NSF provides support for ten graduate fellows per year for five years. The program recently completed its first year. These graduate students helped make science come to life for students in underserved rural and urban schools that surround Ithaca, New York, while simultaneously learning to become better teachers and scientific thinkers themselves.

Visualizing enzyme function: Jeisa Pelet worked with Carolyn Wilczynski, a biology teacher in Binghamton High School, who teaches 9th and 10th grade. They developed a lesson plan entitled “Enzymes and Their Functions” that was implemented in mid-spring. They were inspired by the fact that enzymes and enzyme activity are difficult concepts for students to visualize, and Wilczynski was seeking a new way of teaching these ideas. The lesson plan they designed included an introductory activity where students used real locks and keys as an analogy to gain an understanding what enzymes and substrates are and how they work. Next, the students studied enzyme action by quantifying the production of glucose by amylase activity on starch over time using a spectrophotometer. The final part was an inquiry-based lesson in which the students designed their own experiment to explore enzyme activity. By changing some variable in their experiment (for example, temperature or pH) students looked at what effect this factor had on amylase activity on starch. Students were excited with these activities and made creative use of the freedom to analyze any factor affecting enzyme activity that they were curious about, with all groups of students exploring something different. This lesson plan was presented to other biology teachers in the area through the Cornell Institute for Biology Teachers and Boyce Thompson Institute at Cornell, and was warmly received.

A resident scientist in the classroom: In addition to designing a curriculum activity centered on casting and mechanically testing alginate gels to learn about tissue engineering, Jeff Ballyns served as a source of a diverse range of student activities and science perspectives in Rob Doran’s middle-school science class in Newfield, New York. The curriculum they developed gave students a unique opportunity to learn and participate in an activity based on university level research in the field of tissue engineering, and allowed them to replicate experiments, with their own hypotheses and design ideas, being done in university laboratories utilizing alginate hydrogels. In addition, Ballyns participated and led a diverse range of activities in the classroom during the academic year, including lecturing and leading experimental lab sessions. Some highlights included a Mentos® candy and coke experiment to teach the scientific method, a density lab using density cubes to practice measuring volume and mass to calculate an object’s density, a roller coaster lab to teach students about momentum, and an optics lab to teach students about light properties and fiber optics. Doran and Ballyns also designed a forensic investigation lab where the class was set up as a crime scene and students acted as the detectives to solve the murder of Timmy the baby seal. The students determined who committed the crime based on some clues and a gun shot residue kit. The teaching team also provided class demonstrations, which included a dry ice day to teach students about sublimation and phase changes of matter as well as a vacuum demonstration so students could visualize Boyle’s Law. The dry ice demo included floating soap bubbles on a CO2 cloud, exploding film canisters, a shivering quarter, a screeching quarter, and a CO2 magnesium sandwich fire. The vacuum demo allowed students to observe pressure changes in the classroom.

Philip Buskohl works with students to visualize cardiac structure. Zooming in on the heart histology sections with an optical microscope was a student favorite.
volume relationships by watching balloons and marshmallows expand under a vacuum as well as altering the boiling point of water. The NSF GK–12 program gave Ballyns an opportunity to get involved with young students and convince them that science class can be a fun subject that extends well beyond the classroom.

Mechanics of biology to teach the passion of science: Philip Buskohl spent the year working with Anne Brittenham, a teacher in a Syracuse school for at-risk youths. Encouraging science passion in any student group is difficult, and requires techniques to assist students in identifying themselves as science learners. Buskohl helped these at-risk students to gain an appreciation of the role of science in their own lives by serving as a teaching assistant, mentor, and “resident scientist” in their classroom. Focusing primarily on his research area of heart development, Buskohl engaged the students through interactive lectures, extensive question-and-answer sessions, and a hands-on curriculum involving data sets from his lab. The question-and-answer times revolved around Buskohl’s research experiments, the importance of animal models in discovering medicinal therapies, the role of cross-discipline corroboration in research, and other topics initiated by students. For the curriculum module, Buskohl deputized the students to serve as teams of research scientists with the mission to describe early heart development. To capture student interest, he demonstrated his lab’s ex-vivo embryo culture system that enables real-time observation of embryonic development. Using images of avian embryos from this system, each team quantified changes in embryo features over time, and made comparisons with histology slides and micro-CT images. Most students expressed great interest in the subject matter, embodied by this 7th grader’s comment, “I like science now!”

M.Eng. graduate students from the Department of Biomedical Engineering, along with undergraduate seniors from several departments within the College of Engineering have worked with Dr. Eli Einbinder, Clinical Associate Professor of Psychiatry, Weill Cornell Medical College and NewYork–Presbyterian Hospital, on developing an electronic braking device for walkers. Dr. David Lipson, program coordinator for BME master of engineering projects, supervised the project.

The students have designed an electronic braking system containing buttons located on the handlebar grips. The walker is designed to engage when the buttons are depressed and disengage when the user lets go of the handlebar grips. The braking system, which can be easily operated, will help to prevent slips and falls of an elderly user by adding stability to the walker.
Cornell has recently been awarded a $13–million grant from the National Cancer Institute (NCI) to establish a Center on the Microenvironment and Metastasis, led by BME faculty with collaborators across the Ithaca campus and Weill Cornell Medical College. The Center is part of a collaborative network that consists of 12 Physical Sciences-Oncology Centers (PSOCs) across the country including Johns Hopkins, MIT, Princeton, Berkeley and Northwestern, and is now directed by Michael Shuler of BME. The goal of this network is to take non-traditional approaches to address major questions and barriers in cancer research by revolutionizing the way physical scientists and engineers collaborate with cancer biologists and clinical oncologists.

BME faculty Claudia Fischbach-Teschl, Cynthia Reinhart-King, and Michael King lead three cross-disciplinary project teams that currently involve 27 investigators from Cornell University in Ithaca, the Weill Cornell Medical School in New York City, and the University at Buffalo. These teams are collaborating in an unprecedented manner to deconvolve cancer’s complexity over the next five years by converging the fields of cancer biology and physical sciences:

**Project 1**, led by Fischbach-Teschl integrates tissue engineering, microfluidics, and mathematical modeling to study the role of physicochemical transducers in tumor angiogenesis.

**Project 2**, led by Reinhart-King, applies new methodologies from the physical sciences to study the spatial and temporal regulation of metastatic cell migration in 3-D culture systems.

**Project 3**, led by King, focuses on understanding the fundamental physical mechanisms of circulating tumor cell adhesion to inflamed endothelium under flow, as a critical step in the hematologic spread of metastatic cancers.

Together, this work will result in important quantitative information and the elucidation of new signaling pathways that may be used to therapeutically intervene in the progression of cancer.

By building on the BME department’s strength in interdisciplinary and multi-campus education, the Cornell-PSOC also includes cancer-focused education and outreach opportunities. These components will provide students, as well as the general public, with training opportunities at the interface of physics, engineering, and cancer biology. For example, a cancer-focused course on Nanobiotechnology (BME 6670), which is video-conferenced to multiple sites, not only teaches students important aspects of nano- and
microfabrication, but also enables them to interact with students, teachers, researchers, and clinicians in other PSOCs. Additionally, a cancer-specific clinical immersion term is being developed, based on successful Weill immersion term for BME Ph.D. students, for PSOC-associated graduate students and postdocs to gain exposure to clinical oncology and cancer patients.

Ultimately, through coordinated development and testing of novel approaches to studying cancer processes, the center is expected to generate new bodies of knowledge, and identify and define critical aspects of physics, chemistry, and engineering that operate at all levels in cancer processes. Integrating these research activities with education and outreach is expected to increase public awareness and to provide students with excellent professional development opportunities that will help them in their future academic or industrial careers.
Student society builds community among BME grad students

By Katie Povirk (Secretary), Casey Kraning (Treasurer), Brooke Smith (President)

The Cornell University Biomedical Engineering Society promotes the profession of biomedical engineering through research, educational outreach, and advocacy of engineering approaches to biology and human health. The Cornell Chapter of BMES has worked to promote personal growth and development of its 75 doctoral students and 76 masters of engineering students by expanding existing programs and implementing new initiatives during the 2009–2010 academic year. Some of our new activities include organizing a seminar speaker for the BME weekly seminar series, having a food drive for the American Red Cross, organizing a relief benefit for Haiti, expanding our elementary school outreach program, and creating intramural sports teams. Recently, Cornell BMES was chosen by the Cornell Engineering Alumni Association to receive the Best Student Organization Award for the programs and opportunities the society offers to its members.

Last September, BMES was honored to sponsor a BME 7900 Seminar speaker, Dr. Robert Langer, one of the pioneers and constant innovators of tissue engineering. Students were asked to submit names of different prominent members of the field, and these names were submitted to a general vote. Students voted to invite Langer to Cornell, and he graciously accepted. Langer, a Cornell alum, is currently an Institute Professor at MIT (the highest honor that can be bestowed on an MIT faculty member), and is well-known across the engineering community for his invaluable work in drug delivery, anti-angiogenesis factors, and biomaterials. During his visit, BMES also organized and led a roundtable discussion between Langer and a small group of students (no faculty), allowing them to interact and ask questions in a more intimate forum.

The BMES outreach committee has also been very active in the Ithaca community with a number of projects. During the holiday season, BMES hosted a food drive for the Red Cross. To encourage friendly competition, the department was divided into “teams” grouped by labs. Non-perishable food, toiletries, stuffed animals, and more flooded the collection boxes over the two short weeks of the drive. When Red Cross came to pick up the donations, they were very impressed when they found over 1,200 items for the holiday season, which is approximately six items per student.

Additionally, in the aftermath of the devastating earthquake in Haiti in January, the Outreach committee quickly responded by hosting a relief event. A benefit was organized with a donated dinner, poker tournament, and prizes all provided from local businesses, including: Taste of Thai, Wings Over Ithaca, Ithaca Bakery, Domino’s Pizza, Insomnia Cookies, Starbucks Coffee, Rulloff’s Restaurant, Six Mile Creek Vineyard, The Pita Pit, the Cornell University Department of Biomedical Engineering and Synapsis Cafe. Donations collected during and after the event amounted to $2,052 (approximately $25 per student who attended the event), all of which was sent directly to Gheskio, a Weill Cornell Medical College–associated medical clinic in Port-au-Prince, to provide the Haitian people with medical care and relief.

In the spring, the outreach committee expanded a series of workshops at a local elementary school. In the past, BMES has taught a one-week workshop titled “Optics and Morse Code” that teaches students about basic optical concepts while introducing them to possible applications in science and engineering. For the coming year, we will additionally be presenting a week-long module on polymers and ferrofluids. These fun, instructional, and motivational demonstrations are designed to engender excitement and interest in science and engineering in younger students who may not have a substantial curriculum in this area.

If you are interested in joining the Cornell Biomedical Engineering Society, please visit our website at http://www.rso.cornell.edu/bmes/.
Persistent pain is the number one reason that patients access the healthcare system according to the National Institutes of Health. Pain seriously affects patients’ quality of life and is associated with secondary morbidities such as depression, anxiety, and sleep disturbance. Medications are often the first-line treatment for pain relief, but they are not without serious side effects.

George K. Lewis Jr. Senior Presidential and National Science Foundation Fellow in the Department of Biomedical Engineering and his cross campus multifaceted team received $500k in grant support from the Clinical Translational Science Center, New York, and Center for the Integration of Medicine and Innovative Technology, Boston, to clinically evaluate his wearable therapeutic ultrasound technology to relieve pain.

Ultrasound has been used safely and effectively for years to provide pain relief. Additionally, the mechanical and thermal mechanisms of action in ultrasound have been shown to facilitate wound and bone-fracture healing, to promote the penetration of topical ointments into the skin, and to enhance a variety of healthcare applications. Despite the potential of ultrasound therapy, the size, price, and mode of delivery has prohibited its broad translation.

Lewis has developed a series of new ultrasound devices that form a unique platform solution for ultrasound in frontline medicine. They rely on aggressive miniaturization and integration of the ultrasound transducer, electronics, and power supply to produce palm- and coin-sized ultrasound systems that can deliver portable, convenient, and effective therapy. The devices, which are rechargeable and deliver pain-relieving ultrasound therapy for over six hours on a single charge, have been successfully tested for safety and pain therapy on 35 patients and are now in full clinical evaluation at Weill Cornell Medical College and Cayuga Medical Center. The fully integrated ultrasound systems point toward a primary healthcare revolution in ultrasound-based treatment strategies.

BME Associate Professor Mike King published two new books this year: an undergraduate textbook, and a graduate-level research monograph. Both books, described below, feature Mike’s original photography on their covers.


The first MATLAB-based numerical methods textbook for bioengineers that uniquely integrates modeling concepts with statistical analysis, while maintaining a focus on enabling the user to report the error or uncertainty in their result. Between traditional numerical method topics of linear modeling concepts, nonlinear root finding, and numerical integration, chapters on hypothesis testing, data regression and probability are interwove. A unique feature of the book is the inclusion of examples from clinical trials and bioinformatics, which are not found in other numerical methods textbooks for engineers.

With a wealth of biomedical engineering examples, case studies on topical biomedical research, and the inclusion of end of chapter problems, this is a perfect core text for a one-semester undergraduate course.


With this book as their guide, readers will gain a new appreciation of the critical role that particle interactions play in advancing research and developing new applications in the biological sciences, chemical engineering, toxicology, medicine, and manufacturing technology. The book explores particles ranging in size from cations to whole cells to tissues and processed materials. A focus on recreating complex, real-world dynamical systems helps readers gain a deeper understanding of cell and tissue mechanics, theoretical aspects of multiscale modeling, and the latest applications in biology and nanotechnology.
The Center for Integration of Medicine & Innovative Technology (CIMIT—www.cimit.org) awarded Michael Campolongo and his student team led by Mark Hartman from Biological and Environmental Engineering under Professor Dan Luo, the $150,000 top honor in the 2010 CIMIT Prize in Primary Healthcare competition. The team developed a test that would allow primary-care physicians to more rapidly and accurately determine the cause of acute pharyngitis. Using a novel DNA-based technique developed by their lab called “fluorescence nanobarcodes,” this point-of-care platform could test for the presence of several probable pathogens at once, thus distinguishing between bacterial (such as strep) or viral infections. Such timely and accurate detection will greatly reduce the chances of misdiagnosis, allowing physicians to determine the most appropriate treatment while preventing the misuse of antibiotics.

George Lewis, student in the lab of Professor William Olbricht in Chemical and Biomolecular Engineering, and his team received the second place prize of $100,000 for wearable ultrasound technology being tested at Weill Cornell Medical College and Cayuga Medical Center. They have developed a series of new ultrasound devices that form a unique platform solution for ultrasound in frontline medicine. They rely on aggressive miniaturization and integration of the ultrasound transducer, electronics, and power supply to produce palm- and coin-sized ultrasound systems that can deliver portable, convenient, and effective therapy. The devices have been successfully tested for safety and pain therapy on 35 patients and are now in full clinical evaluation.

The prize will be matched by the Department of Biomedical Engineering (www.bme.cornell.edu), College of Engineering (www.engineering.cornell.edu), Cornell Center for Advanced Technology (www.biotech.cornell.edu), Clinical Translational Science Center (www.med.cornell.edu/ctsc/), Entrepreneurship at Cornell (eship.cornell.edu/), Translational Research Institute on Pain in Later Life (www.tripll.org) and the Cornell Center for Materials Research (www.ccmr.cornell.edu) totaling an amazing research grant/support value at the NIH R01 funding level.

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**Resident Scientist Matching Funds**

As part of a four-year NSF grant for integrating graduate education with science education, 10 graduate students per year are paired with 10 teachers in nearby middle and high schools. In the summer, students and teachers do a joint research project that leads to the development of a related curriculum project. During the school year, the graduate students serve as “resident scientists” spending one day a week in the classroom on this project. Annual gifts help defray the costs of the summer research project/curriculum development and provide for travel costs for participants to national meetings.

**BME Society Meeting**

The Biomedical Engineering Society Meeting is a critical venue for sharing research insights, meeting colleagues, and recruiting new graduate students and faculty. Annual gifts help support travel costs for each graduate student participant.

**Master of Engineering Student Projects**

Student projects are capstone activities that challenge students to apply the breadth of their training in a team-based setting. Annual giving helps offset project costs thereby impacting every BME master’s program graduate.

Gifts of all levels help make these programs possible. Please consider making a gift to Cornell BME today.
Staff News

Cornell BME teams take first and second place in healthcare competition

Neal Douglas ’80 EE, B.S. has generously provided a three-year grant to support fellowships for up to five Ph.D. graduate students working in the field of cancer. This gift complements our efforts with our new NIH Physical Sciences-Oncology Center (see p. 7) and our HHMI “Med into Grad” project (see p. 4). Graduate student fellowships are among the department’s highest priorities, and we very much appreciate Neal’s support of students and their research that we expect to help in the battle on cancer.

David Fischell ’75 EP, M.S. ’78 AP, Ph.D. ’80 provided funds for Seed Grants for joint Ithaca-Weill projects based on our Blood Brain Barrier summit in May. Both Cornell Provost, Kent Fuchs, and Weill Cornell Medical College Executive Vice Dean, David Hajjar, matched David’s gift. The BME department is grateful for David’s continuing support of cross campus research. These projects will build stronger inter campus bridges as well as addressing critical medical problems in treating brain cancer and neurological diseases more effectively.

Colleen McClenahan left the Department of Biomedical Engineering and the School of Chemical and Biomolecular Engineering to become the director of administration for the Sibley School of Mechanical and Aerospace Engineering in July. She was instrumental in helping to create the Department of Biomedical Engineering in 2004, the first new department in the college in almost 40 years. Colleen has been at Cornell since 1989 and with the College of Engineering since 1996. We appreciate all of the efforts she has made in helping BME to become a viable department. Her knowledge, professionalism, insights into Cornell, and personal skills have been extraordinarily important to us. BME owes much to Colleen. We have certainly enjoyed working with Colleen and wish her the best in her new position in MAE.

We are also delighted to announce that on July 1, Dawn Esposito, administrative director for Applied and Engineering Physics, will become administrative director for Biomedical Engineering as well, succeeding Colleen McClenahan. Dawn has been with the college since 1997 as AEP Administrative Director. She holds a degree in chemical engineering from Clarkson University, and prior to coming to Cornell, she worked for nine years at Grumman Aerospace on Long Island writing proposals for changes to military aircraft. Dawn has been involved in the planning of the physical sciences building for the past eight years and will continue to play a key role in that project. She will continue to be the admin director for AEP, so this will be a shared position as we have done previously with CBE.

We are also pleased to announce that Sue Payne became the assistant to the chair, Mike Shuler, in October 2009. Sue comes to us from the Cornell’s Division of Financial Affairs.

Congratulations to the following BME staff members for their years of service to Cornell:

Paula Miller, Research Support Specialist (Shuler Lab)---20 years

Sue Payne, Assistant to the Chair---25 years

Carol Casler, BME Minor---20 years

New gifts support fellowships and seed grants

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Carol Casler, BME Minor---20 years
Andrea Ippolito, M.Eng. ’07 BME
Research Scientist, Boston Scientific Corporation

As a research scientist at Boston Scientific Corporation in Massachusetts, I design experimental assays to further understand the effects of drugs and materials from medical devices on cardiovascular cells. Recently, I helped lead a cross-disciplinary effort to develop a collaboration network across a $1 billion R&D organization to reduce inefficiencies in the product development process. At Boston Scientific, I helped launch and co-lead the women’s network at the corporate headquarters. Outside of work, I serve as the first vice president for Society of Women Engineers Boston section, and I helped found one of the first Biomedical Engineering Society industry chapters in Boston in 2008. In addition, I serve as a member of the board of the Cornell Club of Boston.

Michelle Lee, M.Eng. ’06 BME
Biomedical Engineering Ph.D. program at UC Los Angeles

The Cornell BME M.Eng. program was critical in my preparation for both industry and my current research as Ph.D. student. While at Cornell, under the guidance of Professor Michael Shuler, my research focused on polymeric microfluidic device systems. Along with this opportunity to work in depth on a fascinating project, the M.Eng. program also ensured a solid, diversified knowledge base that allowed me to adjust smoothly into a professional career. Following my graduation in 2006, I worked as a process development engineer at Abbott Vascular, a division of Abbott Laboratories in California, where I optimized the drug release profile for their flagship drug-eluting stent system, Xience V. After further consideration of my career goals, I chose to reenter school in order to strengthen my foundation in R&D. I am currently in the Biomedical Engineering Ph.D. program at UCLA, and my research experience in microfluidics at Cornell was especially helpful in my transition back to graduate education. Under Professor Robin Carroll, I am now working to develop novel droplet-based digital microfluidic systems that are able to transport and manipulate discrete volumes of liquid.

Grant Meyer, Ph.D. ’08 BME
Senior Research Engineer, SRI International

Since 2008, I have worked at SRI International (formerly the Stanford Research Institute). SRI is a private research institute conducting contract research in collaboration with business and government clients. Notable institute achievements include the computer mouse, the first transmission on ARPANET, Intuitive Surgical®, and Siri® (recently acquired by Apple®). Cornell prepared me well for SRI’s multi-disciplinary, team-centered programs. I fit well in the entrepreneurial, client-driven environment at SRI.

My current work focuses on integrated devices for medical diagnostics. Specific concerns include traumatic brain injury and infectious diseases common in still developing countries.

Residing in San Francisco, I enjoy running to Coit Tower, cycling in Marin, and skiing in Lake Tahoe.

Rebecca Moy, M.Eng. ’07 BME
Field Clinical Engineer for St. Jude Medical

I began working for the atrial fibrillation division at St. Jude Medical shortly after graduating with my BME M.Eng. in 2007. I went from an intensive year of learning about cardiology and reading EKGs to supporting clinical research trials for FDA submission. In my spare time I lead in-services and heart dissections aimed toward a range of hospital staff to doctors and supporting cases.

I have found the education I have obtained from my BME M.Eng. invaluable and relevant in my everyday professional life. This ranges from learning the basics about cardiac anatomy and function in BME 401 to stages of FDA approval in BME 550. My experience as a TA for BME 30 laid the building blocks for presenting in-services and interacting with physicians. The M.Eng. program allowed me the opportunity to explore the different aspects of BME, from tissue engineering and drug delivery to entrepreneurship and leadership skills.

Sustaining Engineer, Covidien Respiratory and Monitoring Solutions, Boulder, Colorado

I am a sustaining engineer at a medical device company called Covidien Respiratory and Monitoring Solutions. My primary responsibility is verification testing for design changes and enhancements on existing tracheostomy and endotracheal tube products.

My daily challenges include working with international manufacturing sites, interpreting device standards, and balancing product risk. I have also been working with Dr. David Lipson and Richard Newman in an effort to create a Covidien-sponsored M.Eng. project.

While the transition from research and academics at Cornell to Covidien was not trivial, I have certainly noticed that many of my experiences in the M.Eng. program directly apply to my current role. The lessons I learned in BME 550 about product development formed a strong foundation for understanding the processes and rigorous documentation practices required for the highly regulated medical device industry. In addition, the various group projects helped me to develop the necessary skills to communicate and ultimately succeed while working with international cross-functional teams.

Anna Varlese, M.Eng. ’05 BME
Biomedical Engineering Manager, ConMed Corporation

I graduated from Cornell BME’s first Master of Engineering program year (2005) with an Instrumentation focus and special thanks to Dr. Lipson and Dr. Zipfel. After graduating, I worked as a medical technician at Cornell’s Animal Health Diagnostic Center studying Avian Influenza and monitoring US markets for the virus. The next year I spent in China learning Mandarin and teaching English.

Since 2007, I have been working at ConMed Corporation as a biomedical engineering manager. ConMed is a medical device manufacturer with 8 divisions specializing in particular families of products such as electrosurgery, endosurgery, or general patient care. I am part of an experimental and dynamic new product realization team, whose role is to bring new products through the entire product development process from conception to shelf in the hospital. The team has only four people, including myself, a physicist (M.S., Cornell), an R&D engineer (B.S., Mohawk Valley Community College), and the director (B.A. in music). The team is small, but we are able to navigate the design control process and facilitate project completion by being able to fulfill all functional areas of a project team as needed, such as R&D, regulatory, purchasing/procurement, quality, engineering, graphic design, drafting, clinical, marketing, and manufacturing. I have also continued my education, taking classes to become a lean six-sigma blackbelt for designing and manufacturing medical devices that do not fail and help the company save money. I was also an invited panelist at the Upstate New York Biomedical Engineering Career Conference this year.

Cornell’s M.Eng. program added a lot of knowledge and a variety of new skills to my already multidisciplinary background. The skill most valued by my colleagues is that I am a resource to everyone who asks. In addition to performing my job duties, I find information so others can get their jobs done; if I do not know the answer to a question, I know where to look to find it. That skill and willingness to share knowledge came largely out of my “jack of all trades” BME background and education. As a result, my career in the medical industry advanced rapidly, and I still have a lot of upward mobility and momentum allowing my career to continue to progress, even in these times of economic instability.
ATTJE BAEUMNER, BME field member and professor in the Department of Biological and Environmental Engineering, was elected chair of the 2010 Gordon Research Conference on Bioanalytical Sensors, June 20–25, New London, NH. She also was named the 2010/2011 Cornell Faculty Fellow for Undergraduate Information Competency. In addition, Baueumner is a member of the Cornell team receiving the 2010 Grocery Manufacturers Association Food Safety Award.

LARRY BONASSAR, associate professor, received the Hansjörg Wyss Research Award at the World Forum for Spine Research in Montreal. This award is given out to only one person/group per year based on an application documenting past achievements and plans for future work. The award recognizes his work in the area of “Intervertebral Disc Replacement Using Tissue Engineered Composites,” a project on which his lab has been collaborating with Roger Hartl, a neurological surgeon at WCMC. This is the third award that the project has won this year. Bonassar was also a co-recipient of the best poster award at the American College of Spine Surgery and the best paper award at the American Association of Neurological Surgeons/Congress of Neurological Surgeons.

Assistant Professor JONATHAN BUTCHER was awarded a National Science Foundation CAREER Award for his project entitled, “Engineering Functional Tissue Assembly and Remodeling through Developmental Biology.” He also had the honor of receiving The Hartwell Foundation Individual Biomedical Research Award in 2010. Additionally, Professor Butcher won the $10,000 Public Engagement and Science Communication Symposium poster competition for a second year in a row. He was awarded for his poster and project on “Smart Nanoparticles for Detailed Imaging in Live Embryos.”

ANTJE BAEUMNER, BME field member and professor in the Department of Chemical and Biomolecular Engineering, was awarded the 2010 American Chemical Society Biochemical Technology Division Young Investigator Award. This award recognizes DeLisa’s contributions to the field of biochemical technology and his participation in the division programs.

CLAUDIA FISCHBACH-TESCHL, assistant professor, received the NIH Challenge Grant in Health and Science Research (RC1) for “Microfluidic tumor models to analyze the role of physicochemical cues in the angiogenic switch.” The major goal of this project is to develop and utilize vascularized microfluidic tumor models to experimentally and numerically study the role of microenvironmenal conditions in tumor angiogenesis.

Assistant Professor MOONSOO JIN has been awarded the American Recovery & Reinvestment Act (ARRA) research award from the National Institutes of Health. He also won a 2009 NIH Transformative Grant Award. The title of the project is “Development of High Throughput Aptamer-Based Protein Capture/Detection Assays towards Comprehensive Analysis of Human Proteome.” Jin is working on this project along with Professor John Lis and Professor Harold Craighead (BME field member). Jin has also been approved as an adjunct professor in the radiology department at Weill Cornell Medical College.

Associate Professor DAVID PUTNAM, was elected as a Fellow of AIMBE (American Institute of Medical and Biological Engineers). This is a significant honor and recognizes Putnam’s outstanding contributions. He was cited for the conception and implementation of high throughput pharmaceutical formulation and development of novel biomaterials used both for controlled release of therapeutic compounds and for prevention of postoperative seromas. Putnam received the honor of Coulter Foundation Fellow 2010 and became a permanent member of the NIH Study Section for Biomaterials and Biointerfaces Study Section 2010. Putnam also received the Fiona Ip Li ’78 Teaching Award from the College of Engineering.

CYNTHIA REINHART-KING has been selected to receive the BMES 2010 Rita Schaffer Young Investigator Award. The award is given to a young investigator whose originality and ingenuity is demonstrated in a published work (in this case, for a study performed at Cornell University under Reinhart-King’s supervision), and comes with a cash prize and travel expenses. She will give the Rita Schaffer Memorial Lecture on October 9, 2010 at the BMES annual meeting.

HAROLD CRAIGHEAD, BME field member, professor of Applied and Engineering Physics and director of the Nanobiotechnology Center, was awarded the 2009 NBIC Award for Research Excellence in Nanotechnology by the University of Pennsylvania.

MATTHEW DELISA, BME field member and associate professor in the School of Chemical and Biomolecular Engineering, was awarded the 2010 American Chemical Society Biochemical Technology Division Young Investigator Award. This award recognizes DeLisa’s contributions to the field of biochemical technology and his participation in the division programs.

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CYNTHIA REINHART-KING, assistant professor, has been awarded the World Congress of Biomechanics Young Investigator Award (silver). The award was conferred at the Congress, which is held once every four years and was in Singapore in August 2010. The Young Investigator Award recognizes “excellent contributions whose primary authors are young investigators; based on originality, clarity, scientific merit and potential impact.” This award is being given based on her work in cellular mechanics and international peer review of a manuscript titled, “Self-assembly of stable cell-cell contacts through substrate mechanics,” co-authored with her graduate student, Joseph Califano. Reinhart-King also received the Sonny Yau ’72 Teaching Award from the College of Engineering.

Assistant Professor CHRIS SCHAEFFER won the faculty Zellman Warhaft Commitment to Diversity award from the College of Engineering for his involvement and support of diversity initiatives at Cornell University.

MARJOLEIN VAN DER MEULEN, field member of BME and Professor in the Sibley School of Mechanical and Aerospace Engineering, was elected a Fellow of the American Society of Mechanical Engineers. Her group’s abstract won a 2009 Young Investigator Award from the American Society of Bone and Mineral Research; Ko F., Willie B., Bostrom M., van der Meulen MCH (2009) Role of interferon-6 in the adaptive response of cancellous bone to in vivo mechanical loading in the mouse tibia, Amer Soc Bone Miner Res, 1140.

Associate Professor WARREN ZIPFEL received an NSF Major Research Instrumentation development grant. The NSF development grant supports his work to develop a new type of fluorescence lifetime imaging microscope. He also received a renewal of his P41 center grant which supports the bioimaging development center, DRBIC, and received a renewal of the Bill and Melinda Gates Foundation grant on developing monkey models of tuberculosis.

Hartwell Foundation recognizes Butcher and Cornell BME

In April 2010 The Hartwell Foundation officially announced the recipients of the 2009 Hartwell Individual Biomedical Research Awards, which offer support for three years at $100,000 direct cost per year. Assistant Professor Jonathan Butcher was among ten individuals, representing nine institutions, who were selected as Hartwell Investigators. He received this award for his project, “Anatomically Precise Engineered Living Valved Conduits for Pediatric Applications.” The Hartwell Foundation also named Cornell University as a 2010 Top Ten Center of Biomedical Research.
Lulu Bai, an undergraduate student in the lab of Assistant Professor Cynthia Reinhart-King, received the Cornell Engineering Alumni Association Outstanding Undergraduate Research Award. Lulu also had the honor of being appointed a Cornell Hughes Scholar.

Ph.D. student, Robby Bowles, won the Best Poster Award from the World Forum for Spine Research for his work, “Annulus fibrosus composition regulates pressurization and mechanical properties of tissue engineered intervertebral discs.” He was also a co-recipient of the best poster award at the American College of Spine Surgery and the best paper award at the American Association of Neurological Surgeons/Congress of Neurological Sciences. Robby is a member in the lab of Larry Bonassar.

Ph.D. student, Michael Campolongo, received Best Poster out of about 53 others at the CHESS User’s Meeting, and his poster was selected as the award for “Best Scientific Achievement.” Michael and his research team won the first place Center for Integration of Medicine & Innovative Technology CIMIT award ($150,000) for a proposed research on using DNA nanobarcodes in primary care medicine. Michael is a student in the lab of field member Dan Luo.

Shawn Carey had the honor of being elected to the National BMES Board. He is a Ph.D. student in the lab of Cynthia Reinhart-King.

Emily Chandler received the Student Travel Achievement Recognition from the Society for Biomaterials, 2010 Annual Meeting. Emily is a Ph.D. student in the lab of Assistant Professor Claudia Fischbach-Teschi.

Tracy Cheung, was awarded a National Science Foundation (NSF) Graduate Fellowship. Tracy is an undergraduate student in the lab of Cynthia Reinhart-King.

Fior Giancchetti, Ph.D. student in the lab of Assistant Professor Chris Schaffer, won an award for best poster at the Optical Society of America Biomedical Optics meeting for her work, “Stimulus-Evoked Calcium Transients in Somatosensory Cortex are Inhibited After a Nearby Microhemorrhage.”

Nichita Ciapurin won a Cornell Stern Cell Scholarship (2010). Nichita is an undergraduate student in the lab of Assistant Professor Jonathan Butcher.

Nick Colangelo won first place at the 24th Annual Spring Research Forum (2009). Nick is an undergraduate student in the lab of Assistant Professor Jonathan Butcher.

Bailey Cooper, Ph.D. student in the lab of Associate Professor David Pulham, was awarded a Presidential Life Sciences Fellowship. This program is intended to help form integrative new disciplines within the life sciences and to expand and support students’ interdisciplinary interests. The program is part of the New Life Sciences initiative, a university-wide collaboration aimed at enhancing and supporting life sciences research and education.

Yue Geng was awarded a Presidential Life Sciences Fellowship. Yue is a Ph.D. student in the lab of Associate Professor Mike King.

Ph.D. student, Laura Hockaday, received a National Science Foundation Graduate Fellowship. Laura is a member in the lab of Jonathan Butcher.

Chao “Charlie” Huang, Ph.D. student in the lab of BME field member, Assistant Professor Brian Kirby (MAE), was awarded a National Science Foundation Fellowship in 2010.

Sungkwon Kang (Goose), a third year Ph.D. student in the laboratory of Professor Moonsoo Jin, has been awarded an AHA Predoctoral Fellowship for his project titled, “Immuno-modulatory treatment for inflamed vasculatures via targeted delivery of drug-loaded liposomes to ICAM-1.” His proposal aims to contribute a potential therapeutic intervention against atherosclerosis by specifically targeting immuno-modulatory drug-loaded liposomes to inflamed vasculatures and alleviating the degree of pro-inflammatory responses.

Ph.D. student Casey Kranning won a Physical Sciences Oncology Young Investigator Award. Casey is a member in the lab of Cynthia Reinhart-King. She also received an extended abstract award at the 2010 BMES conference for a work titled “Metastatic Cells from Breast and Prostate Generate Increased Force Compared to Non-Metastatic Cells.”

George Lewis, Ph.D. student in the lab of Professor William Olbricht, and his team from Cornell University received the second place prize of $100,000 in the Center for Integration of Medicine & Innovative Technology CIMIT competition for wearable ultrasound technology being tested at Weill Cornell Medical College and Cayuga Medical Center.

Gretchen Mahler, postdoc in the lab of Jonathan Butcher, won 1st place poster presentation at the 4th Biennial Heart Valve Biology and Tissue Engineering Meeting.

John Nguyen won an award for best paper on surgical applications at the American Society for Laser Medicine and Surgery annual meeting for his work on “Femtosecond Laser Ablation as a Subsurface Light Scalpel to Alter Seizure Propagation Dynamics.” John is a Ph.D. student in the lab of Chris Schaffer.

Dr. Nozomi Nishimura was awarded a Ruth L. Kirshstein National Research Service post-doctoral fellowship from the National Institutes for Health for her work investigating the links between microvascular disorders in the brain and Alzheimer’s disease. She also won an award for best poster at the NIC Physical Sciences-Oncology annual meeting for her poster, “In vivo two-photon excited fluorescence imaging as a tool for visualizing metastatic processes in the cortical microcirculation.” Nozomi is a postdoc in the lab of Chris Schaffer.

John Pelouquin, M.Eng. student in the lab of Cynthia Reinhart-King, was awarded an Honorable Mention Olympus Bioscapes Microscopy Award.

Alyse Portnoi, Ph.D. student in the Delija research group, has been awarded the BMES Student Speaker of the Year for her talk entitled, “Redirecting Ubiquitin Ligases.” This award was determined through peer evaluation of all the speakers who participated in the Work in Progress seminars throughout the 2009-2010 academic year.

Erica Pratt won second place poster in the Sibley Research Conference 2010. Erica is a Ph.D. student in the lab of Assistant Professor Brian Kirby (MAE).

Michelle Sun won a Whitaker International Fellowship for study abroad in biomedical research (2010). Michelle is a student in the lab of Assistant Professor Jonathan Butcher.

M.Eng. student Alina Starchenko was awarded the honor of National Science Foundation (NSF) Fellow to the 9th International Summer School on “Biocomplexity from Gene to System” at Bogazici University in Istanbul, Turkey.

Christine Tan was awarded the Graduate Excellence in Mentoring Award by the College of Engineering. Christine is a Ph.D. student in the lab of Professor Harold Craighead. (AEP).