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COLUMBIA ENGINEERING NEWS

MAKING AN IMPACT ON HEALTH

contents

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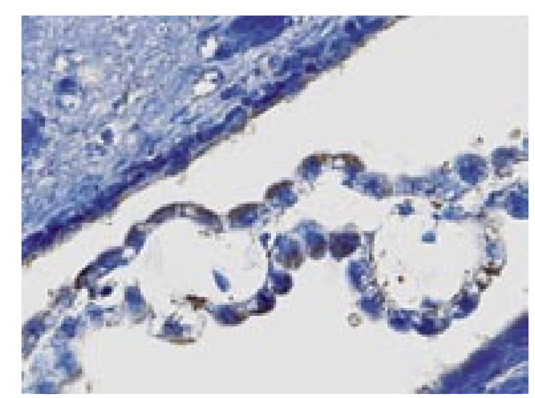
MAKING AN IMPACT ON HEALTH



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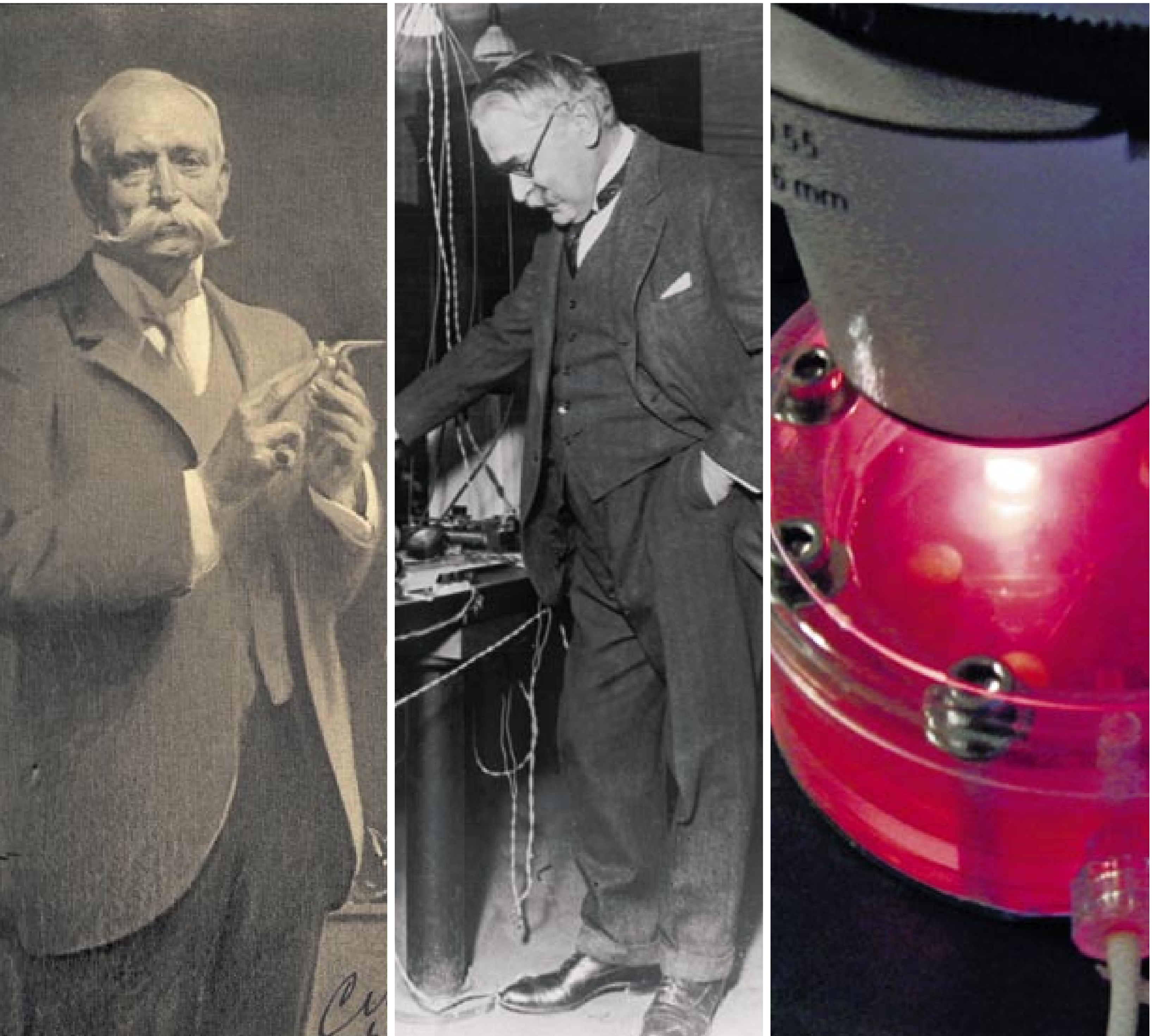
MAKING AN IMPACT ON HEALTH



l to r: Charles Fredrick Chandler, Michael I. Pupin, bioreactor on microscope stage (courtesy of Gordana Vunjak-Novokovic)

Columbia Engineering has had a significant impact on bettering the human condition since its founding in 1864. The School's first dean, Charles Frederick Chandler, a chemist, improved safety standards in New York City for milk and water, regulated gas companies and slaughterhouses, supported compulsory smallpox vaccinations for children, and invented the flush toilet.

While Chandler was still dean, Michael I. Pupin, an 1883 graduate who became a professor of electrical engineering, created an X-ray tube that produced an image after only a few seconds of exposure. Pupin's 1896 discovery was only weeks after Wilhelm Roentgen found that X-rays would produce an image after several hours of exposure. The first use of the Pupin X-ray tube was medical: he helped a surgeon determine where buckshot was imbedded in a patient's hand.

As more became known about fighting disease, biochemical engineering emerged as a promising field. Elmer L. Gaden, a chemical engineer, received his BS in 1944 and, after serving in the Navy, returned to Columbia for graduate work. His doctoral thesis contained a process for mass production of antibiotics by supplying the optimum amount of oxygen for the rapid growth of penicillin mold. This discovery earned him the title "father of biochemical engineering."

Gaden was a professor at Columbia for 26 years. In 1962, he headed the Committee on Bioengineering, with faculty members from the College of Physicians and Surgeons (P&S) and Engineering. It provided an early forum for interdisciplinary cooperation. For many years, it was chaired by Edward F. Leonard, professor of chemical engineering.

In 1974, a University-wide Bioengineering Institute was established under William Nastuk, M.D., professor of physiology at P&S. Four years later, Richard Skalak '43, '46, '54, a professor in the Department of Civil Engineering and Engineering Mechanics, became director. Skalak applied his knowledge of hydraulics to microcirculation, developing new approaches to cellular and molecular engineering, tissue engineering, and orthopedic biomechanics. His discoveries on blood cell mechanics, pulmonary circulation, and tissue growth have been applied to research on cancer, sickle cell disease, hypertension, atherosclerosis, and other diseases.

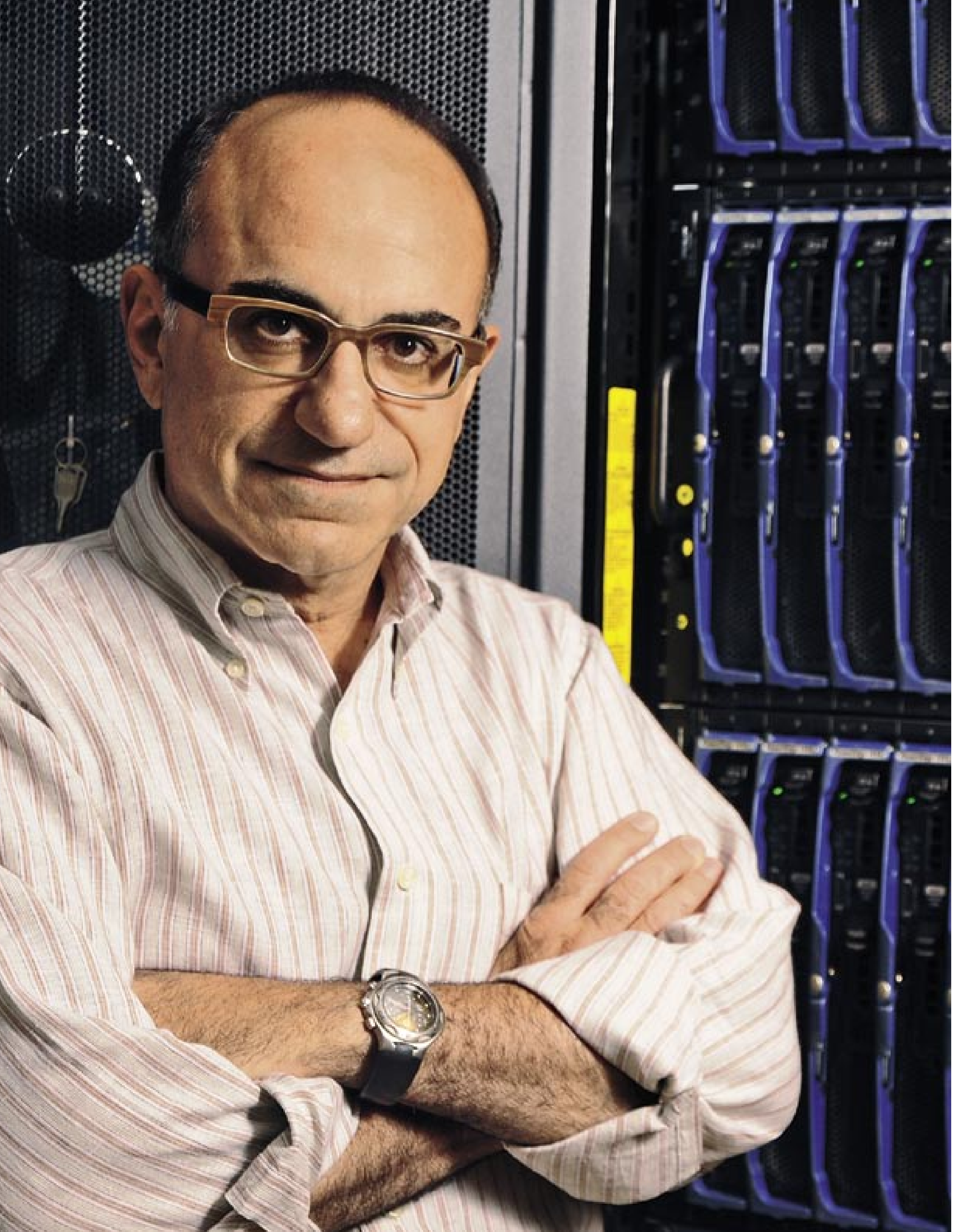
By the mid-1980s, Columbia boasted one of the largest orthopaedics research labs in the country, following the recruitment of Van C. Mow and W. Michael Lai. Both held joint appointments, the first of their kind at Columbia, as professors of mechanical engineering (SEAS) and orthopaedic bioengineering (P&S).

In 1995, a Whitaker Foundation grant spurred the creation of the Center for Biomedical Engineering. Mow was named director of the Center and Leonard became associate director of academic affairs. A second Whitaker grant, supplemented by significant funds from The Fu Foundation School of Engineering and Applied Science (SEAS) and the University, transformed the center into a full-fledged department. The department was launched on January 1, 2000, with Mow, who now holds the Stanley Dicker Professorship in Biomedical Engineering, as founding chair. Today it is one of the most popular majors in the School, leveraging the School's historic strengths in biomechanics, biomedical imaging, and cell and tissue engineering.

As you will see in the following pages, the scope of health-related research at Columbia Engineering involves almost every department. Amazing breakthroughs have happened or are about to happen as our faculty fight diseases and conditions, bringing to bear their exceptional and unique talents to chip away at problems that affect the quality of life and, indeed, life itself.

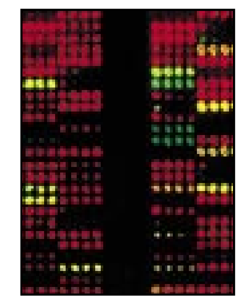
Feniosky

Feniosky Peña-Mora
Dean



the biology of psychiatric disorders

DIMITRIS ANASTASSIOU | ELECTRICAL ENGINEERING



detection of single nucleotide polymorphisms

Little is known about the biological causes for psychiatric disorders like schizophrenia and bipolar, which combined afflict an estimated 10 million people nationwide. Columbia researchers are working hard to change that by exploring the role of genetics from a multidisciplinary approach.

Electrical engineering professor Dimitris Anastassiou's aim is to discover novel biological mechanisms responsible for psychiatric disorders. Given the limited success of identifying significant individual risk-conferring genetic variants, such as single mutations in DNA, Anastassiou says discovery of responsible interactions among multiple genetic variants may reveal new disease mechanisms.

Anastassiou and Maria Karayiorgou, professor of psychiatry and medical genetics at the Columbia University Medical Center, are principal investigators on a project that will identify single nucleotide polymorphisms (SNPs, pronounced "snips") that are jointly, rather than individually, associated with disease.

A SNP is a small genetic change that can occur within a person's DNA sequence. The genetic code is specified by the four nucleotide "letters" A (adenine), C (cytosine), T (thymine), and G (guanine). SNP variation occurs when a single nucleotide, such as an A, replaces one of the other three nucleotide letters—in this case C, T, or G.

An example of a SNP is the alteration of the DNA segment AAGGTTA to AAGTTTA, where the fourth letter in the first snippet, G, is replaced with a T. On average, SNPs occur in the human population more than one percent of the time, but, because neighboring SNPs are statistically linked, researchers only need about one million of them to analyze our genomes.

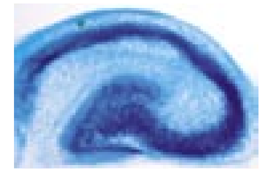
The traditional approach looked only at individual SNPs. Anastassiou's research investigates the possibility that a person may be predisposed to a disease if two SNPs at different locations in the genome have the unusual letter combinations, rather than each one of them alone, a phenomenon called "synergy." There is a huge number (about a million squared) of "synergy" pairs of SNPs, resulting in significant computational and statistical challenges for this project. To perform this research, Anastassiou has a high-performance computer cluster containing 800 processors at his disposal.

Karayiorgou and her team biologically interpret Anastassiou's resulting computational outputs and attempt to genetically validate the identified interactions. If the resulting biological hypotheses involving two genes are deemed promising, they will test those using in vitro neurobiological experiments.

"The aim is to discover the biological mechanisms responsible for psychiatric disorders," says Anastassiou. "Once such mechanisms are discovered, the ultimate vision is to develop drugs that would interfere with these mechanisms."

Anastassiou, who received his PhD from the University of California, Berkeley, is a prominent leader in digital technology. His research has resulted in Columbia being the only university in a consortium that licenses MPEG-2, the technique used in all forms of digital television transmission, including DVDs, direct satellite TV, HDTV, digital cable systems, personal computer video, and interactive media.

An IEEE Fellow, he is also the recipient of an IBM Outstanding Innovation Award, a National Science Foundation Presidential Young Investigator Award, and a Columbia University Great Teacher Award, and he holds 11 U.S. and 8 international patents, which combined have so far brought close to $100 million in revenues to Columbia University.



brain-slice culture of the hippocampus showing neuronal cell bodies

preventing traumatic brain injury

BARCLAY MORRISON
BIOMEDICAL ENGINEERING

Motor vehicle accidents account for more than half of the 1.5 million traumatic brain injuries (TBIs) that occur each year. Finding ways to prevent, treat, and repair TBIs is the basis for the research of Barclay Morrison, associate professor of biomedical engineering, and his Neurotrauma and Repair Laboratory team.

At the moment of injury, some brain tissue is instantaneously destroyed and can never be saved by post-injury treatment, so prevention becomes all the more important. Using an atomic force microscope, Morrison is measuring material properties of anatomical structures within the brain that can be used by the National Highway Traffic Safety Administration to set standards for automotive manufacturers.

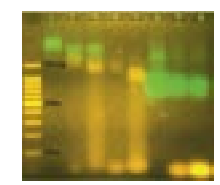
"We're determining the safe limits of brain deformation, which is the underlying cause of TBI, to learn what the brain can withstand, so safety systems can be designed to minimize the trauma," says Morrison.

Morrison's group is also working with the aftermath of TBIs. One approach investigates the brain's own initial response, which is an attempt to repair the damaged neural connections and replace lost tissue. For reasons yet unknown, this repair process is aborted. If Morrison can find a way to short-circuit this response, it may be possible to harness and control the brain's innate potential for repair. It may even be possible to grow replacement neural tissue from a patient's own stem cells via neural tissue engineering.

In a scenario directly from *The Six Million Dollar Man* or *The Bionic Woman,* Morrison sees the possibility of interfacing neurons directly onto silicone circuitry to control a prosthesis. While this technology is now only imagined, he continues to investigate the factors that influence the ability of neurons to form connections with silicone circuitry, hoping for a breakthrough that can immediately impact the lives of thousands.

After receiving his PhD at the University of Pennsylvania, Morrison was a postdoctoral researcher in TBI there and later at the University of Southampton, U.K.

delivering drugs faster



engineered fluorescent proteins (green) interacting with DNA molecules (orange)

SCOTT BANTA | CHEMICAL ENGINEERING

People suffering from brain diseases and conditions ranging from traumatic brain injuries to brain cancer to progressive brain diseases could be helped if therapeutic drugs could be delivered to the affected area. The blood-brain barrier (BBB), composed of high-density cells, acts as part of the body's defense system to block bacteria and other substances carried in the blood from invading the brain. It is so effective that it makes it all but impossible to deliver important diagnostic and therapeutic agents to the brain also.

Scott Banta has had significant success in solving this problem by using a biochemical approach, creating specific cell penetrating peptides (SCPPs) that can cross the BBB and target specific brain cell populations. Banta, an associate professor of chemical engineering, and his research group are engineering new peptides that are specific for different cell and tissue types. The plasma membrane protects cells by regulating the access of molecules to the cellular cytoplasm. Only compounds within a narrow range of size, charge, and polarity are able to cross the membrane.

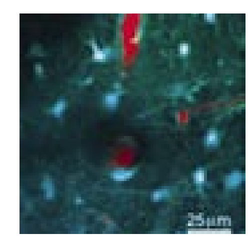
Using the process Directed Evolution, the Banta group is creating new SCPPs that are able to both target and penetrate specific cells. These peptide sequences can deliver therapeutic cargos, such as DNA, proteins, drugs, or other exogenous materials, to the targeted cellular cytoplasms.

Collaborating with Barclay Morrison of the Department of Biomedical Engineering, Banta is seeking to create SCPPs that are specific for different brain cell types. There is a narrow window of time following a brain injury where the targeted delivery of neurotrophic agents to injured cells could provide a significant benefit to the head-injured patient. In addition, delivery of neurotrophic factors via SCPPs could be beneficial in slowing down the progress of diseases such as Parkinson's, Alzheimer's, and Huntington's.

Before joining Columbia SEAS, Banta, who received his PhD from Rutgers University, was a postdoctoral researcher at Harvard Medical School's Center for Engineering in Medicine, and at Shriners and Massachusetts General Hospitals.

unlocking the brain's secrets

ELIZABETH HILLMAN | BIOMEDICAL ENGINEERING



astrocytes (cyan) interacting with blood vessels (red) in the living brain

Walk into any clinical research lab and you will undoubtedly find one or more microscopes. The problem with conventional microscopes, however, is they can only show images of thin slices of dead tissue or cells in a dish. It takes a special kind of instrument to produce images from inside the living body, which is exactly the kind that Elizabeth Hillman is building.

"It is a significant technical challenge to build imaging systems capable of studying cellular or molecular processes in living organisms," says Hillman, assistant professor of biomedical engineering and radiology. "You need devices that can image very fast and in 3D and that show you lots of different things at once. It's a complex problem, one that forces you to think about physiology and physics at the same time."

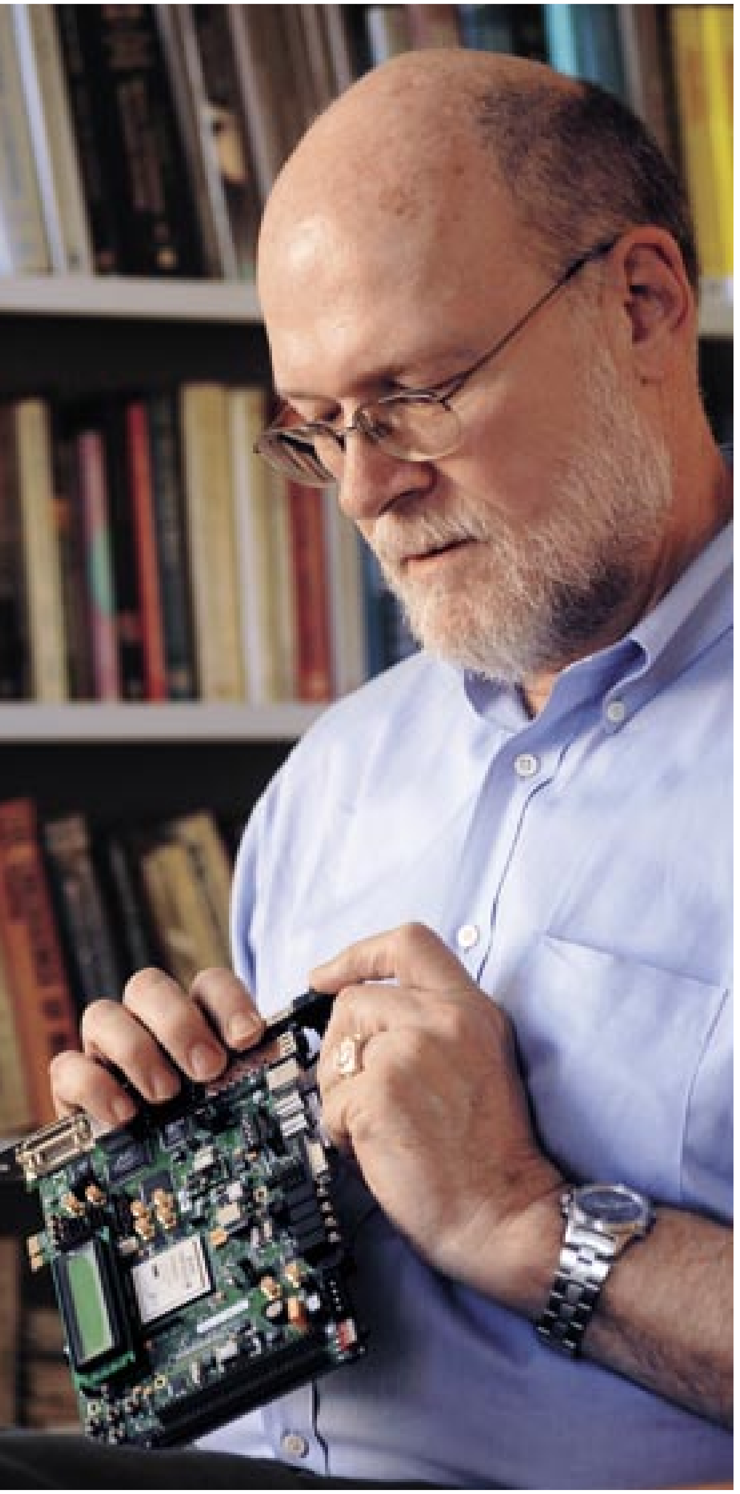
One of the primary areas of focus in Hillman's lab is using optical imaging techniques such as microscopy to investigate the brain, particularly the relationship between blood flow and neuronal activity. Functional magnetic resonance imaging (fMRI), one of the most ubiquitous tools used to investigate neuronal activity, relies on detecting subtle changes in blood flow in the brain. "The problem is, we really don't understand why these changes in blood flow occur," says Hillman. "Even the best neuroscience textbooks only devote a page or so to blood flow in the brain."

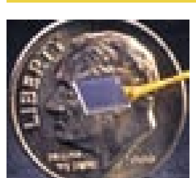
Hillman's work is beginning to tease out this complex process, improving our fundamental understanding of how the brain functions, and also raising the possibility that fMRIs will one day prove even more useful and revealing. In another project, she is developing a technique that permits her to create images of the organs in live lab mice, which she hopes will allow pharmaceutical companies and researchers to study diseases and treatments without sacrificing large numbers of animals. She has also developed techniques to make images of living human skin, resulting in an imaging system that shows promise as a way to minimize excision while removing skin cancers from the face, and she is using optical imaging to investigate how the electrical activity in cardiac tissue changes during a heart attack.

Because all of these measure different wavelengths of light, none require the heavy shielding or careful dose monitoring necessary in radiologic imaging. Moreover, almost all take advantage of existing contrast agents, such as blood, which changes color as its oxygenation level changes, or green fluorescent protein (GFP), which can be modified to label specific types of cells.

Hillman hopes that ultimately many of her imaging tools will prove useful in the clinic and as laboratory research tools, where they can be used to improve fundamental understanding of both physiology and disease. She is quick to point out, however, that although optical methods are extremely well suited to clinical application, she does not expect her techniques to entirely replace MRIs. "Optical imaging isn't going to be the next MRI," she says. "MRIs do some things well, but they can't tell you things like how bad the burn on your arm is or whether you have good blood flow in the back of your eye. Our systems can."

Hillman, who received her PhD from University College, London, did postdoctoral research at Massachusetts General Hospital's Center for Biomedical Imaging before coming to Columbia.





an implantable 96-pin electrode array, used for Columbia's seizure prediction project, from Blackrock Microsystems, Inc.

early warning for seizures

DAVID WALTZ
CENTER FOR COMPUTATIONAL LEARNING SYSTEMS

Epilepsy and seizures affect almost 3 million Americans of all ages, with approximately 200,000 new cases occurring each year. Recently, new cases have developed as a result of traumatic brain injury to soldiers in the aftermath of IED attacks in Iraq and Afghanistan. For 25 percent of these people, neither medication nor surgery can control their seizures.

Working with neuroscientists at Columbia University Medical Center, SEAS senior research scientist David Waltz, director of the Center for Computational Learning Systems, is developing a wearable "early warning" device to give epilepsy patients enough time to prepare for a seizure.

This warning device will use detector software based on advanced machine learning technology to detect an impending seizure. Co-PI Columbia neurophysiologist Catherine Schevon is collecting data via microelectrodes implanted in patients' heads that supply the sample data at a rate of 30,000 times per second. This faster sample means higher-frequency brain waves can be detected, and these may play a pivotal role in seizures.

Once the software is developed, a patient would carry a small computer that monitors brain activity. The system would then reliably warn the patient in advance of seizures. Such a system would allow patients who cannot be treated successfully today to live a fuller and more active life.

The researchers' long-term goal is to design machine-learning interfaces that could learn what brain-wave features predict seizures in individual patients. Hypothetically, this system could eventually take the form of an implanted "brain pacemaker," stimulating the brain to prevent the seizure from happening in the first place.

Waltz received his PhD from the Massachusetts Institute of Technology, where his thesis on computer vision originated the field of constraint propagation. Along with Craig Stanfill, he also is well known as the originator of the memory-based reasoning branch of Case-Based Reasoning.

enhancing quality of life

ANDREAS HIELSCHER
BIOMEDICAL ENGINEERING

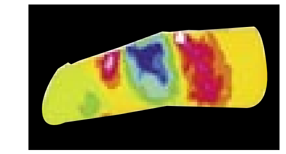
Rheumatoid arthritis (RA) is an autoimmune disease that affects nearly 20 million people worldwide, striking young people as well as old, causing pain, stiffness, and swelling of the joints. Early diagnosis and treatment can slow or prevent joint damage and increase the likelihood of leading an active and full life.

Leading an international team of engineers, scientists, and physicians from Germany and the U.S., Andreas Hielscher, associate professor of biomedical engineering and radiology, has developed a 3D optical tomographic (OT) imaging system that displays disease activity in joints. Results from recent clinical trials indicate that his system can identify affected joints earlier than any other method.

In another project, members of his Biophotonics and Optical Radiology Laboratory are completing a dynamic optical imaging system for the diagnosis of breast cancer. Breast cancer afflicts one in nine women during their lifetime and is the second leading cause of cancer deaths in women. Hielscher's patented imaging technology has been licensed by a New York company and clinical pilot studies using the new imager are underway.

Hielscher also employs OT imaging to localize green fluorescent proteins (GFPs), developed by Columbia's 2009 Nobel laureate Martin Chalfie. GFPs and their derivatives make it possible to see and monitor cell and tissue behaviors during development, including observation of cancerous tumors in vivo. Hielscher and his colleagues use GFP to study the growth of cancers in the stomach, liver, and brain. Most recently, he is applying this technology to monitor drug effects in difficult-to-treat early childhood cancers, such as neuroblastoma and Wilms tumors.

He received his PhD degree in electrical and computer engineering from Rice University, was a postdoctoral fellow at Los Alamos National Laboratory, and was on the faculty at State University of New York Downstate Medical Center prior to coming to SEAS in 2001.



cross section of a finger joint as seen by the optical tomographic imager

capturing the "aha!" moment

PAUL SAJDA | BIOMEDICAL ENGINEERING

EEG image as the brain processes visual stimuli (orange)

It is very difficult to ask a computer to find something that is funny to a particular person on the Internet. It is even more difficult to build a computerized vision system that can find something that is funny or suspicious or interesting—and find its way around a room.

Yet, countless times a day—often without realizing it—humans make split-second decisions based on what we see and on our subjective knowledge. It might be as simple as clicking a link that catches our interest online, or recognizing a friend from a 50-millisecond glimpse of their face across a crowded room. But no matter how effortless the decision-making process may seem, the effort to translate that into an automated system has proved daunting.

"We can build a computer that's good at very constrained decision-making, but general purpose, rapid decision-making is difficult," says Paul Sajda, associate professor of biomedical engineering and radiology. "It might be able to detect what is interesting or novel, but it doesn't always know what's interesting or novel to you."

Those two tasks—rapid decision-making and identifying subjective interests—are, however, exactly what Sajda (SHY-da) and his team are succeeding in building. At the same time, Sajda is attempting to reveal the most basic neural structures in the brain that process visual information.

In his Laboratory for Intelligent Imaging and Neural Computing (LIINC), Sajda connects subjects to an EEG and flashes a series of images on a computer screen to record the neurological equivalent of the "Aha!" moment signaling interest or recognition. Once the "cortically coupled computer vision system" is calibrated to recognize the things that interest an individual, it can present more images that are likely to pique that person's interest.

His work has drawn the attention of the Defense Advanced Research Projects Agency (DARPA) for its potential to help conduct a sort of visual triage by sifting quickly through petabytes (that's a million gigabytes) of satellite imagery or hours of surveillance tapes. At the same time, he is also working with researchers at Columbia University Medical Center on techniques that enhance the brain's ability to make quick decisions. But the question that most fascinates Sajda is what his studies of the brain's visual recognition networks can do to reveal the organ's fundamental ability to process massive amounts of information.

"It's still unclear at what scale the brain processes information," says Sajda. "It could be groups of neurons, it could be the whole brain. We don't know."

Growing up on Long Island, Sajda knew he wanted to be an engineer, but said he was also fascinated by the anatomy and physiology of living things and the fact that a collection of ions and some sugars can band together to form a living organism. At the same time, helping his father deal with multiple sclerosis focused Sajda's interest on the brain. That fascination with living systems continues to infuse his work, at the same time that his engineering perspective is helping redefine what we know—and what may be knowable—about the human brain.

Sajda, who received his PhD from the University of Pennsylvania, was head of adaptive image and signal processing at Sarnoff Research Center prior to joining the SEAS faculty in 2000.

repairing torn ligaments

HELEN H. LU | BIOMEDICAL ENGINEERING

Many sports-related injuries involve soft tissues such as ligaments, which connect bone with bone, and tendons, which join muscle to bone. Each year, more than 200,000 people suffer damage to their anterior cruciate ligament (ACL), the primary ligament that stabilizes the knee joint. Tears of the ACL are especially common in professional football players. But ACL tears are not just an injury for the guys. Statistics show that ACL tears have become a mini-epidemic for young women playing soccer or any other sport with lateral motion.

With the rate of ACL tears and other soft tissue injuries increasing in all segments of the population, it is a hopeful sign that Professor Helen H. Lu has developed a new approach to help the body heal after these debilitating soft tissue injuries. One of the major hurdles preventing healing lies in integrating soft tissue grafts with the body, and Lu's group has focused on engineering the interface that connects soft tissue to bone. While tissue engineering has traditionally involved a single-tissue approach, Lu is growing multiple tissues to build functional organ systems that will integrate with the body.

"With the ACL-bone interface, we see three distinct yet continuous tissue regions—ligament, fibrocartilage, and bone," says Lu. "As we understand how the biological interfaces between these different types of tissues are formed and how to reestablish these distinct tissue-to-tissue boundaries post-injury, we can regenerate the native soft tissue-to-bone interface and promote integration."

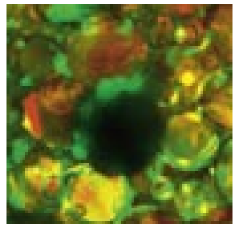
Lu has developed a novel "scaffolding" to grow these three different tissue types within one functional system. This interface scaffold is stratified, with each layer differing in architecture, porosity, and composition to best nurture each particular cell type, while integrating seamlessly with the adjacent tissue. Each portion of the scaffold is biocompatible and biodegradable, and will ultimately be replaced by living tissue, thus becoming part of the body.

In collaboration with Dr. Scott Rodeo, an orthopaedic surgeon from the Hospital for Special Surgery, Lu and her research group are working on the design of an integrative interference screw. The interference screw, used to fix an ACL graft in place, is usually made of titanium alloys, but a tissue-engineered screw has none of the drawbacks of a permanent metallic implant and promotes integrative repair.

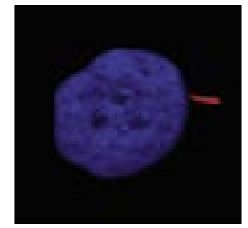
This new method will move ACL repair from traditional mechanical fixation to biological fixation, resulting in longer-lasting and stronger repair. Lu's pioneering work on the ligament-bone interface was recently recognized when she received the Presidential Early Career Award for Scientists and Engineers (PECASE), the nation's highest honor for young scientists.

Lu's group is extending the interface tissue engineering approach to the repair of another critical soft tissue-to-bone transition area, the rotator cuff. The rotator cuff is where four delicate muscles and tendons hug or "cuff" the shoulder's ball and socket. Tears in the rotator cuff are one of the most debilitating and common injuries of the shoulder, and similar to the ACL, integration of the tendon and bone remains a critical challenge.

In collaboration with Dr. William Levine, a shoulder surgeon at Columbia, Lu is developing special nanofiber-based scaffolds that mimic the native tissue in organization as well as functionality for integrative rotator cuff repair. This work is funded by the NIH and a recent grant from the New York State Stem Cell Science (NYSTEM) Initiative.



osteoblast-fibroblast co-culture on the interface region of triphasic scaffold



bone marrow stem cell with the primary cilia stained in red

combating bone loss

CHRISTOPHER R. JACOBS
BIOMEDICAL ENGINEERING

Osteoporosis is a major public health threat for more than half of all Americans. An estimated 10 million already have the disease and another 34 million are at high risk of developing porous bones, shortening lives and increasing health care costs.

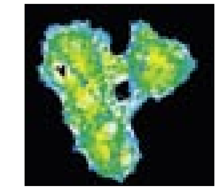
Christopher Jacobs, associate professor of biomedical engineering, is working to unlock a stem cell mystery that could provide significant advances in the treatment for osteoporosis. He has received a $1 million New York State grant to research stem cell behavior related to the condition. Osteoporosis occurs when bone marrow stem cells fail to produce bone-forming osteoblasts in sufficient numbers. Very little is known, however, about the cellular mechanism by which bone marrow stem cells sense and respond to changes in their mechanical loading environment.

Jacobs' Cell and Molecular Biomechanics Laboratory will determine whether a novel cellular sensor, the primary cilium, is responsible for the stem cell's ability to sense mechanical loading. His lab was one of the first to show that primary cilia act as mechanical sensors in bone cells. The project will characterize the ability of transplanted stem cells to home in on sites of bone loading and form new bone and then determine whether the stem cells retain this ability if their primary cilia are first disrupted.

"If the hypothesis is proven to be true, it will be a breakthrough in skeletal mechanobiology and suggest approaches for new anti-osteoporosis drugs," Jacobs says. "It will also be a significant advance in relating primary cilia dysfunction to human disease."

Jacobs, who earned his PhD from Stanford University, was an assistant professor in the Department of Orthopaedic Surgery at Pennsylvania State University before coming to SEAS.

elastic network model of hepatitis C virus NS3 helicase



neutralizing hepatitis C

JUNG-CHI LIAO
MECHANICAL ENGINEERING

Nearly 3 million people in the U.S. are infected each year with the hepatitis C virus, the major cause of liver cancer. Worldwide, roughly 3 percent of the population is infected.

Mechanical engineering assistant professor Jung-Chi Liao is making progress toward the effort to find an effective treatment for the virus. He has focused his research on exploring the DNA helicase—or enzymes—of the hepatitis C virus.

Liao's work is related to the recent discovery of a peptide that inhibits the functioning of the hepatitis C virus enzyme NS3 helicase, providing new insights. Specifically, several hot-spot residues have been identified to convert ATP energy to separate the virus's DNA. Liao is currently conducting comparative studies among different helicases to better understand the variations of coupling mechanisms.

Based on his discovery of dynamical coupling mechanisms and the resulting different conformations, pharmaceutical companies may now be able to identify better drug candidates to inhibit ATP binding sites of hepatitis C virus NS3 helicase. Liao has been invited by InterMune Inc., one of the major biotechnology companies focusing on drug development for hepatitis C virus infections, to give a seminar presentation of this work.

Liao joined Columbia SEAS in 2008 after posts as a research associate in the Department of Bioengineering at Stanford and as a postdoctoral fellow in molecular and cell biology at the University of California, Berkeley. He earned his PhD from the Massachusetts Institute of Technology.

fixing broken hearts and bones

GORDANA VUNJAK-NOVAKOVIC | BIOMEDICAL ENGINEERING

A bioreactor on microscope stage: observing human tissue growth as it happens

In 2009, an estimated 785,000 Americans will have a new coronary attack, and about 470,000 will have a recurrent attack, while more than 35 million Americans suffer from TMJ—temporomandibular joint disorders. What is the connection? The work of Professor Gordana Vunjak-Novakovic of the Department of Biomedical Engineering, who is building complex human tissues that may help resolve both these debilitating conditions.

"As a biomedical engineer actively involved in this field, I look forward to unlocking the full regenerative potential of human stem cells, so we can cure disease and live longer than our failing organs," she says.

Whether it is bone or muscle, the fundamental engineering and developmental biology principles are the same. As director of Columbia's Laboratory for Stem Cells and Tissue Engineering, Vunjak-Novakovic uses biomimetics, "the science of imitating nature," to create environments promoting tissue development or regeneration.

Each tissue should ideally receive its own kind of scaffolding and its own culture environment. To engineer thick, vascularized, and electromechanically functional cardiac tissue, Vunjak-Novakovic cultures stem cells, the actual "tissue engineers," on a channeled elastomer scaffold perfused with culture medium containing oxygen carriers, to mimic blood flow. Electrical field stimulation is applied during culture to mimic electrical pacing within the heart.

This research may lead to a heart patch that could be laid over injured heart tissue to restore normal function in someone who has suffered a heart attack. Another promising application for engineered cardiac tissue is drug testing. The use of patient-specific engineered human tissues, instead of cells alone or in animal models, may be a way to determine the drug's actual effect on the ultimate user.

Vunjak-Novakovic's work in craniofacial tissues is now concentrated on the human mandibular condyle, the end of the lower jaw. This only moving part in the head has a complex structure and function, and is not easy to restore. Her goal is to produce a fully functional, anatomically shaped vascularized graft to replace a worn TMJ.

When she came to SEAS in 2005, Vunjak-Novakovic helped design her own top-of-the-line lab for human stem cells and functional tissue engineering in the Vanderbilt Clinic on the University Heights campus. Her lab hosts the Bioreactor Core of the National Institutes of Health (NIH) Tissue Engineering Resource Center, just renewed for another five years. With its "bioreactor shop," and a group of 25 talented students and postdocs, the lab is the place to go if you need an advanced culture system. Last year she led the team of 26 investigators to bring to SEAS a new Stem Cell Functional Imaging Core, established through a grant awarded by New York State's Stem Cell Board.

"This sophisticated bioreactor and imaging instrumentation has moved stem cell research from the 'flat biology' of petri dishes to controllable models of high biological fidelity, which can be studied in real time to observe the interacting factors mediating self-renewal and differentiation of stem cells," she says. "We now have the capacity to develop entirely new research paradigms and approaches to engineering human tissues."

Vunjak-Novakovic is one of the country's leading tissue engineers. She received her PhD degree in chemical engineering from the University of Belgrade, and was at the Harvard-MIT Division for Health Sciences and Technology for 12 years before coming to SEAS. She is a fellow of the American Institute for Medical and Biological Engineering, one of 70 women in the Women in Technology International Hall of Fame, the chair of her NIH study section, and a highly cited author of more than 240 scientific articles and two textbooks.

treating tumors in children

MARK BORDEN
CHEMICAL ENGINEERING

Each year in the U.S., approximately 650 children are diagnosed with neuroblastoma, a cancerous tumor in nerve tissue, most often in the adrenal glands in the abdomen. For this, and for many other childhood cancers, surgery is not an option.

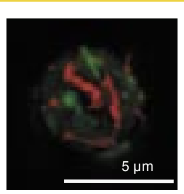
At Columbia's Pediatric Tumor Biology Laboratory, a new way to deliver tumor-killing gene therapy is being developed by Mark Borden, assistant professor of chemical engineering, and his pediatric oncology colleagues. The vehicle is microbubbles, tiny gas bubbles—about 100 times smaller than the width of a human hair—that can be safely injected into the bloodstream without the danger of forming emboli.

In groundbreaking research sponsored by St. Baldrick's Foundation, which supports research of childhood cancers, Borden has shown that microbubbles can encapsulate tumor-killing gene therapy, protecting the cargo in the bloodstream. When the bubbles are at the tumor site, he uses ultrasound to release the genes into the tumor cells.

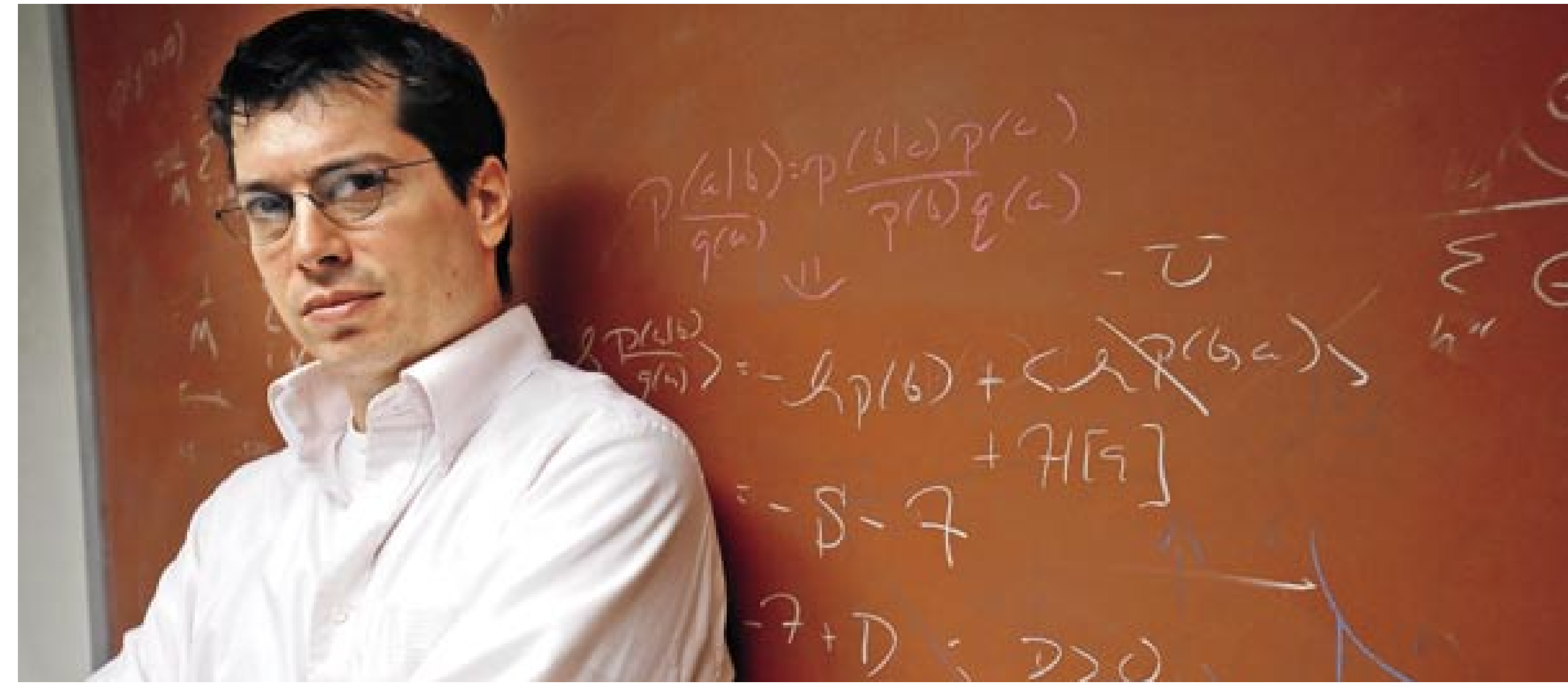
"The microbubbles oscillate strongly with ultrasound," says Borden, "and the bubbles implode, causing holes in the tumor walls. The genes enter the tumor and repair the defective cancer-causing cells." This methodology is much safer than using viruses to carry the gene therapy to the tumors. Viruses often trigger the body's natural defenses, including anaphylactic shock, resulting in patient death.

Borden also uses microbubbles to create clearer images of pediatric tumors and assess the efficacy of treatment. Using a contrast medium carried by the microbubbles, high frequency ultrasound can show changes in tumor growth to evaluate how well treatment is working.

After receiving his PhD from the University of California, Davis, Borden was a postdoctoral researcher there in biomedical engineering and in radiology at the Arizona Cancer Center.



fluorescence microscopy images of microbubbles



"turning off" cancer genes

CHRIS WIGGINS
APPLIED PHYSICS AND
APPLIED MATHEMATICS

The key to unlocking complex problems like the biological cause of cancer—the second-leading cause of all deaths—may lay in the fundamental building blocks of life.

How genes control each other—and how to predict that activity—is a research focus of Chris Wiggins, associate professor in the Department of Applied Physics and Applied Mathematics. He is working to develop models that predict how genes behave to explain how some cells become cancerous.

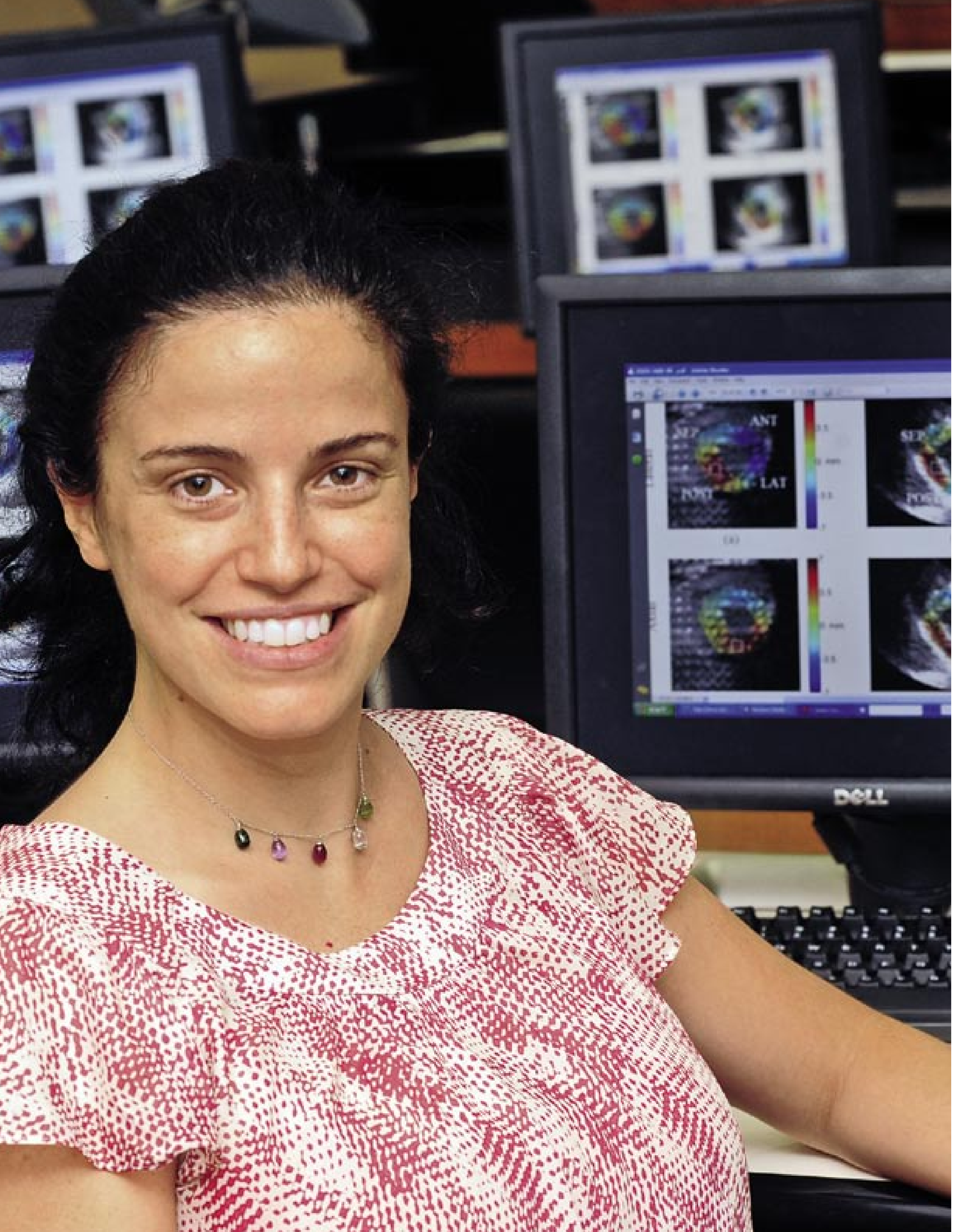
"The relationship between biology and mathematics has completely changed in the last decade," Wiggins explains. "New technologies have transformed biology into a data-rich science, and advances in algorithms have made possible data-driven predictive modeling in biology. At the same time, the World Wide Web made it possible for any biologists to share their data with the entire mathematical community with the click of a mouse."

Wiggins and his collaborators have shown how one can use these data, along with the appropriate math, to learn which genes are controlling which other genes and why. "The problem is a bit like watching stocks go up and down, and trying to predict which stocks are driving each other," he says.

While the architecture of the underlying genetic network is a basic biological topic, Wiggins says "it is at the root of numerous biological diseases, including cancer, and we are now on the threshold of finding more of those genetic links."

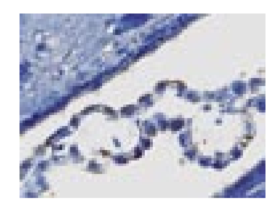
Wiggins, who earned his PhD in theoretical physics from Princeton and was an NSF postdoctoral research fellow in biomathematics at the Courant Institute, has had his work profiled in *Scientific American*.

functional modules in a protein-protein interaction network



radiation-free tumor treatment

ELISA KONOFAGOU | BIOMEDICAL ENGINEERING



neurotrophic factors (brown stain) after ultra-sound-induced opening

A recent study in the New England Journal of Medicine showed that two-thirds of adults underwent medical tests in the last few years that exposed them to radiation and, in some cases, a higher risk of cancer. Elisa Konofagou, an associate professor of biomedical engineering and radiology, is pioneering new uses for an imaging technology that is radiation free, less expensive than CT scans and MRIs, yet just as effective: ultrasound. Moreover, she is going beyond ultrasound's traditional application as a diagnostic tool, using it to treat diseases like cancer, Alzheimer's, and Parkinson's.

In the area of oncology, Konofagou is developing a tool that could identify and destroy tumors without the need for surgery. Her technology, called harmonic motion imaging, uses ultrasound to probe soft tissue in search of abnormal growths. "You're basically knocking on different parts of the organ until you detect a different amplitude in one particular location," she says. She has found that ultrasound can distinguish benign from cancerous tumors and that its beam can be aimed with extreme precision to detect and ablate, or destroy, the abnormality.

If proven effective, the technique could be used in inoperable cancers of the brain, prostate, pancreas, and kidneys. She and Columbia breast surgeon Kathie-Ann Joseph plan to test harmonic motion imaging and ablation within the next five years in patients with benign breast tumors who would otherwise have to undergo painful surgery.

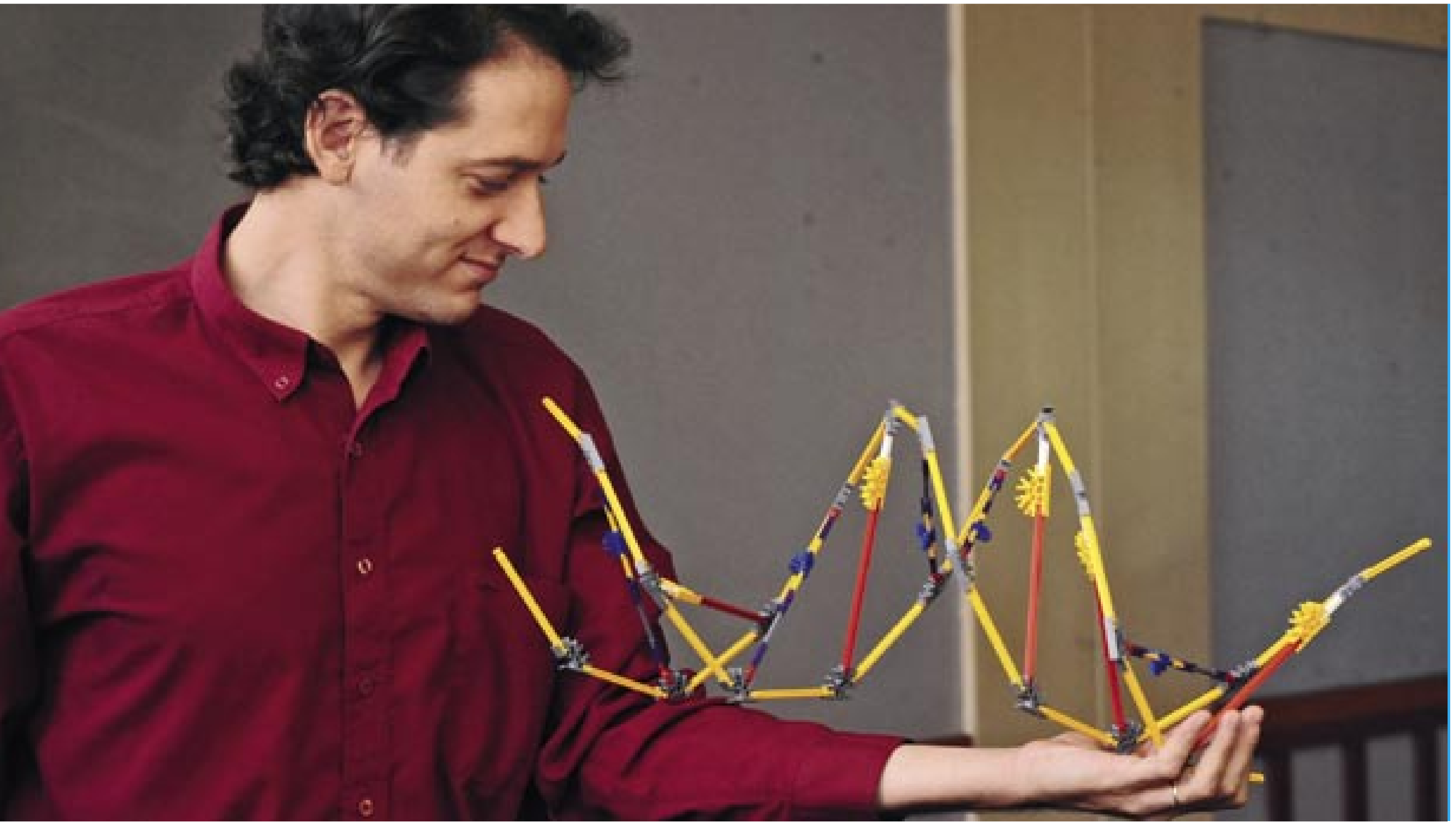
In the area of neurology, Konofagou is deploying ultrasound to temporarily open the blood-brain barrier to help treat patients with diseases like Alzheimer's, Parkinson's, and ALS. Currently, physicians have few good options when it comes to treating these patients. Their choices include direct injection—taking a needle and sticking it deep into the brain to deliver medicine—or IV drugs. While a small percentage of the latter can cross the blood-brain barrier, they flow across the entire brain, not just the diseased areas, causing, in some cases, severe side effects.

The technique Konofagou has pioneered sends ultrasound waves through a millimeter-specific brain region and the intact skull, causing that part of the blood-brain barrier to open. Medicine would be injected by IV and would reach only its intended target. "The idea is to use this in conjunction with systemically administered drugs that have been shown to work yet have been shelved because of the fact that they are not passing through," says Konofagou.

Konofagou has also deployed ultrasound in the field of cardiology. As patients, especially men, age, their risk of developing an irregular heartbeat, called atrial fibrillation, grows. The arrhythmia originates in the upper chambers of the heart, which begin sending rapid, disorganized electrical signals to the rest of the organ. Konofagou's myocardial elastography can identify and localize the culprit portions of the heart.

Following diagnosis, the same technique can be used to evaluate treatment, such as after using radiation-free ablation to restore the heart's natural rhythm. In the future, she hopes her innovations may allow for an inexpensive, noninvasive screening test for heart disease. "I believe ultrasound can do anything," she says. Each day, her research is bringing that statement closer and closer to reality.

A PhD graduate of a joint program of the University of Houston and the University of Texas Medical School, Konofagou was a research fellow at Brigham and Women's Hospital and Harvard Medical School prior to joining the SEAS faculty.



discovering origins of diabetes

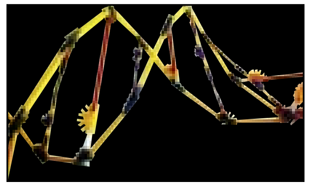
ITSIK PE'ER
COMPUTER SCIENCE

Nearly 50 million people nationwide struggle with type 2 diabetes or high cholesterol, and rates are increasing annually. The clues to why some people are more susceptible than others are being discovered on a small Pacific Island, where SEAS researchers are discovering new genetic variation and associating it with metabolic disease.

Itsik Pe'er, an assistant professor of computer science, is developing analytical methods for analysis of DNA sequence variants. Recent technological breakthroughs now allow high-throughput observation of these genetic alterations along the genome (an individual's collection of genetic material). Such heritable changes are thought to be responsible for 40 to 90 percent of population risk to a wide variety of health conditions, from diabetes to schizophrenia. The Pe'er group is studying a population from the Pacific Island of Kosrae, in the Federated States of Micronesia, which suffers from increased rates of metabolic disorders, such as obesity, type 2 diabetes, and high cholesterol. The unique genetic makeup of the islanders, who have been isolated for thousands of years, makes them ideal for genetic studies, but their interrelatedness makes analysis of their DNA extremely complex.

The Pe'er group has developed computational tools to decipher remote family ties between individuals based on identity of genomic segments inherited by descent from a recent unknown ancestor. These analytical methods enabled examination of 500,000 polymorphic sites along the genomes of 3,000 Kosraeans, representing most of the adult population. The lab was thus able to discover multiple new disease genes for health traits. Based on these disease associations, the researchers were able to sequence the entire genome of representatives of the Kosraean population, resulting in discoveries that have broad implications for anyone with these metabolic diseases.

Pe'er earned a PhD from Tel Aviv University and was a postdoctoral researcher at several institutions, including the Weizmann Institute of Science and Massachusetts General Hospital.



model of DNA

streamlining blood testing

SAMUEL K. SIA
BIOMEDICAL ENGINEERING

Doctors in developing countries will soon be able to use handheld devices to collect and analyze blood tests at a patient's bedside to diagnose infectious and other diseases, thanks to research by Samuel K. Sia, assistant professor of biomedical engineering at Columbia SEAS.

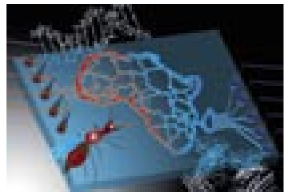
The devices, now undergoing field tests in Rwanda, require only a finger prick of blood and provide quantitative results in less than 20 minutes. The aim of the new technology is to significantly reduce the time between testing patients and treating them, without increasing costs or regulatory burdens.

"Nowhere is the need for new diagnostic technologies greater than in developing countries, where people suffer disproportionately from infectious disease compared to the U.S. and Europe," says Sia.

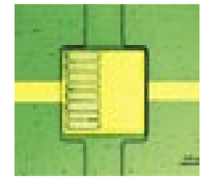
The "lab-on-a-chip" technology uses microfluidics—the manipulation of small amounts of fluids—to miniaturize and automate routine laboratory tests onto a handheld microchip. The devices are being developed in a collaboration between Sia's lab and Claros Diagnostics Inc., a venture capital-backed startup company that Sia co-founded in 2004.

Sia, who holds a PhD from Harvard University, received a CAREER Award from the National Science Foundation that supports his work in developing biocompatible microelectromechanical systems and implantable medical devices, such as glucose sensors.

A recipient of the Walter H. Coulter Early Career Award in 2008, Sia participated in the National Academy of Engineering's U.S. Frontiers of Engineering symposium for the nation's brightest young engineers in 2007.



imagery of a microfluidic chip for global health diagnostics



implantable glucose microsensor: a freestanding polymer diaphragm with embedded permalloy actuation strips and a gold capacitive sensing electrode.

bloodless glucose monitoring

QIAO LIN | MECHANICAL ENGINEERING

More than a million people with type 1 diabetes—an autoimmune disease that is life-threatening unless treated with frequent doses of insulin—will soon be able to check their blood sugar levels without the daily drawing of their own blood.

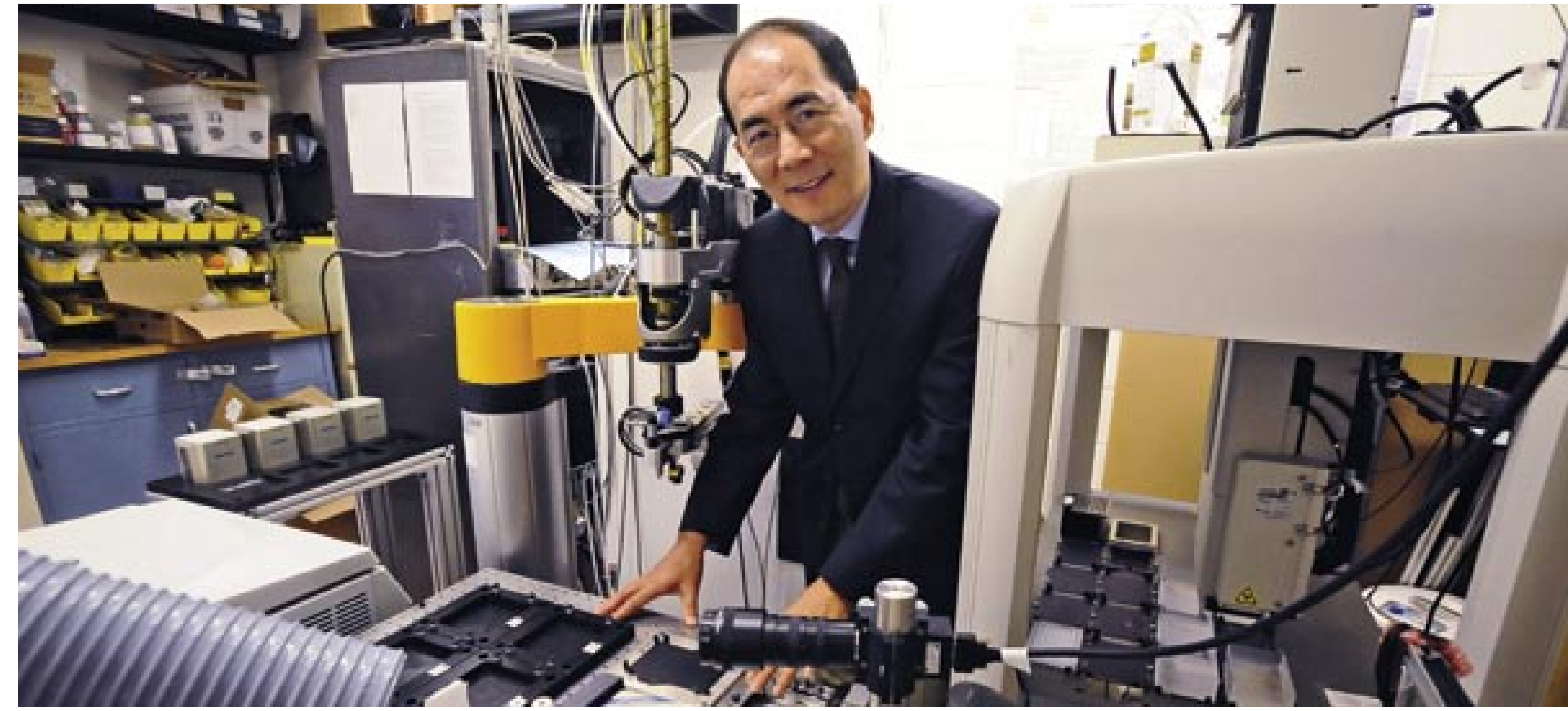
A team of researchers, led by mechanical engineering associate professor Qiao Lin, has invented a microfabricated, miniature sensor that can eventually be implanted in a patient's body for long-term, continuous glucose monitoring. It will be part of a closed-loop system that will automatically deliver insulin to diabetic patients based on blood sugar levels.

Lin's glucose sensor consists of a microscopic diaphragm (or cantilever), which vibrates under remote magnetic excitation in a microchamber filled with a glucose-sensitive polymer solution. When glucose enters the chamber through a semipermeable membrane, it binds reversibly with the polymer, changing the viscosity of the solution. As the viscous damping on the diaphragm vibration directly depends on the viscosity, the glucose concentration can be determined by wireless vibration measurements. Depending on the result, insulin can be injected to maintain a normal glucose level.

The reversible binding of glucose to the polymer is key.

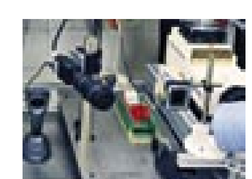
"It is a physical process and so the glucose is not consumed," says Lin. This is a key difference between his device and current, less reliable, sensors that use an irreversible electrochemical reaction of glucose with an enzyme.

Lin, who earned his PhD from the California Institute of Technology, was a postdoctoral scholar in Caltech's Electrical Engineering Department and an assistant professor of mechanical engineering at Carnegie Mellon University prior to joining the SEAS faculty.



detecting "dirty bomb" radiation

Y. LAWRENCE YAO
MECHANICAL ENGINEERING



cell harvest module, a key component of the biodosimetry system

In the realm of national preparedness, few scenarios are as scary as the possibility of a "dirty bomb." The National Institutes of Health (NIH) is funding a $25 million grant to find new technologies that will provide rapid mass-screening of radiation exposure.

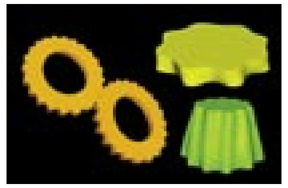
Professor Y. Lawrence Yao, chair of the Department of Mechanical Engineering, together with researchers from Columbia University Medical Center and department colleagues, are part of a multi-institute consortium that, among other tasks, is charged with developing a high-throughput "biodosimetry" device capable of rapidly testing a large swath of the population in the event that an RDD (radioactive dispersal device), commonly called a "dirty bomb," is detonated in a major metropolitan area.

This group is collaborating on an effort to design the most effective and quickest technologies that involve advanced imaging, lasers, and robotics. Radiation affects cell division. When cells divide under normal conditions, the break is clean, with no extraneous cellular material. After radiation exposure, however, pieces of damaged chromosomes, micronuclei, appear along with divided cells and can be tested for DNA breaks.

The advances in these technologies being pioneered by Yao and his colleagues will accelerate the screening process based on blood from a finger stick. With the help of a highly automated, efficient, and eventually portable device—a prototype of which is already whirring in Mudd's basement—doctors can quickly determine the scope of radiation exposure and whether medical treatment is needed by processing tens of thousands of samples per day, instead of only a few hundred.

Yao and his colleagues, and the NIH, are confident that this device can operate at high volume and full throttle, with the hope that it is never needed.

Yao, who received his PhD from the University of Wisconsin, Madison, engages in multidisciplinary research that includes nontraditional manufacturing, laser materials processing, and robotics in industry and health care.



self-assembled gears with two-dimensional and three-dimensional pattern features

growing gears for surgical robots

XI CHEN
EARTH AND ENVIRONMENTAL ENGINEERING

Not everyone who looks at red bell peppers immediately sees the solution to the manufacture of biocompatible, microrobotic gears, but SEAS associate professor Xi Chen did. Chen, who first explained why some fruits and vegetables have ridges, has applied these same buckling principles of engineering mechanics to the creation of small gears that can be used in surgical robots.

Today, creating gears requires a complicated and time-consuming lithography process, and the resulting pattern features are essentially two-dimensional. "Our breakthrough involves self-assembly created by mismatched deformation," says Chen. "If we bond a thin film to a compliant cylinder substrate, upon relative shrinking of the substrate, the only way the system can handle the extra film surface is to buckle the film and form structures like teeth on a gear."

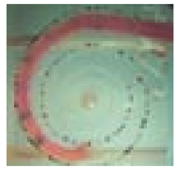
This methodology can create three-dimensional biocompatible structures that are impossible to make with current lithography techniques. Chen and his team have shown they can predict the number and depth of the teeth, as well as create inclined and zigzag gears.

"Our goal is to find ways to manipulate patterns by playing with different geometrical and material parameters to force the substrate to make the pattern we want," he says. "Our approach is quick, simple, and the cost is very low. We are now working to reduce the size of these gears to micrometer scale for use in surgical robots."

Chen, who received his PhD and postdoctoral training at Harvard, received a Presidential Early Career Award for Scientists and Engineers (PECASE) last year for his outstanding research in mismatch damages in thin-film and nanoscale self-assembly.

using robots for surgical implants

NABIL SIMAAN
MECHANICAL ENGINEERING



insertion of a mock-up steerable electrode array inside a 3D model of the cochlea

Even in the steadiest of surgeons' hands, placing cochlear implants in patients can be tricky and the risks of trauma are high. Help is on the way for surgeons to implant such electronic devices, which provide a sense of sound to a person who is profoundly deaf or severely hard of hearing due to damaged neuroepithelial (hair) cells.

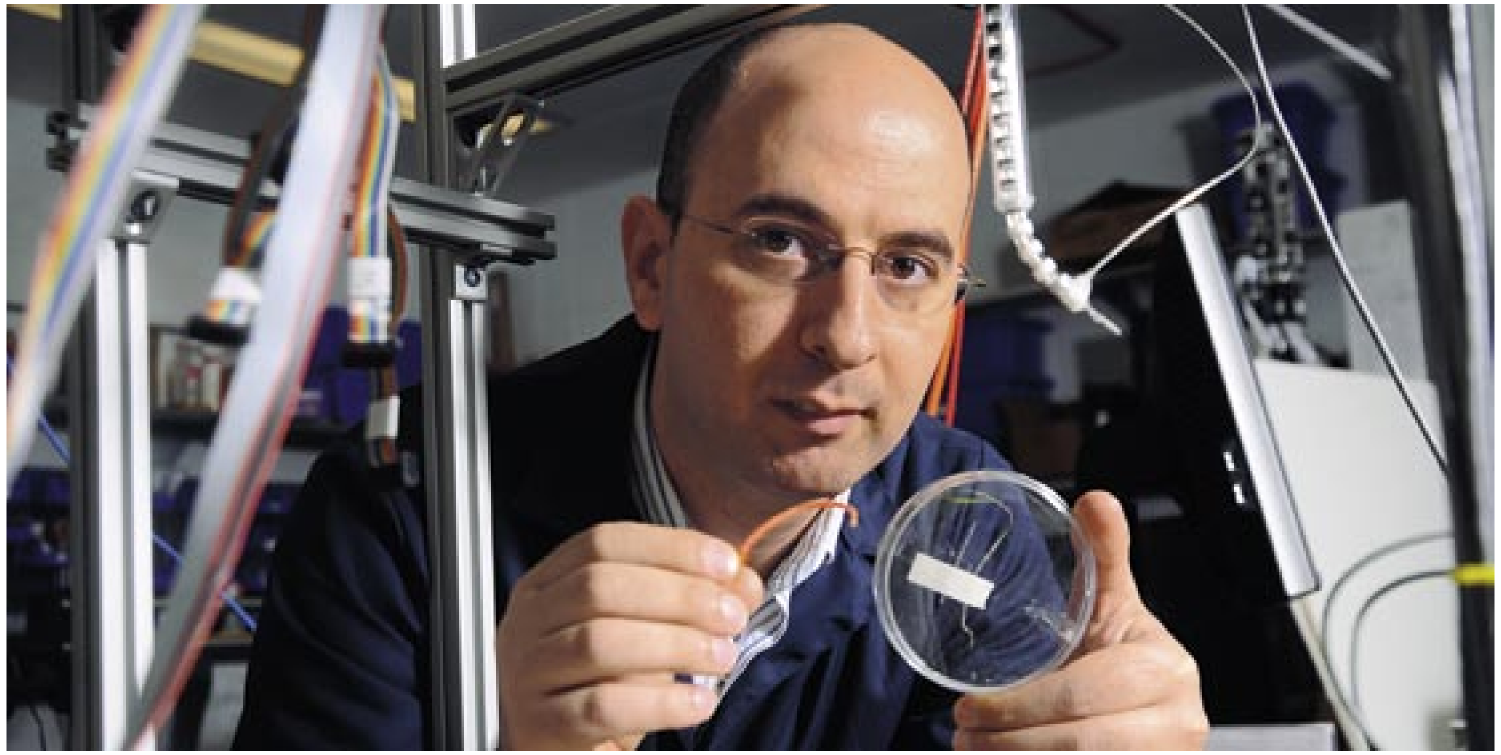
Assistant Professor Nabil Simaan and his team have developed a steerable, snake-like electrode array for implant surgery that helps surgeons install cochlear implants safely and trauma free. Otolaryngologists at the Columbia University Medical Center have taken an active interest in his lab's development of a robot-assisted system for such surgeries.

Simaan says it will be a big step forward from the existing implantation procedure, in which surgeons must manually thread long, flimsy electrodes into the cochlea, carefully navigating its delicate passageways with extreme precision. The slightest wrong move or force can damage the delicate structures of the cochlea and may even cause additional hearing loss beyond what the surgery is trying to correct.

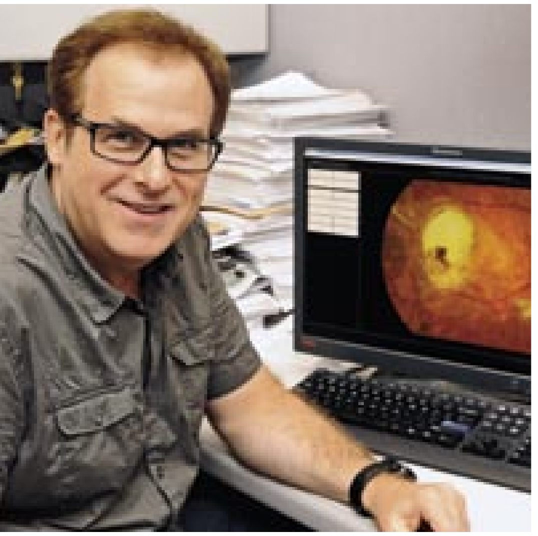
He is also developing other surgical robots, including one that will both filter a surgeon's hand tremor as well as keep the surgeon from moving the surgical tool into the wrong area. This will be especially useful for minimally invasive surgery performed through the abdomen.

"Designing new mechanical architectures for robots geared for surgery is my passion," Simaan says, "and my hope is that Columbia's novel work in robotics finds its way into operating rooms everywhere."

Simaan received his PhD from the Israel Institute of Technology and was a postdoctoral research scientist at Johns Hopkins University's National Science Foundation (NSF) Engineering Research Center for Computer-Integrated Surgical Systems and Technology prior to coming to SEAS. He recently received an NSF CAREER Award to support his research.



MAKING AN IMPACT



analyzing 3D video ultrasounds of the heart

ANDREW F. LAINE
BIOMEDICAL ENGINEERING

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relief for aching joints

CLARK T. HUNG
BIOMEDICAL ENGINEERING

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figuring out how viruses invade cells

BEN O'SHAUGHNESSY
CHEMICAL ENGINEERING

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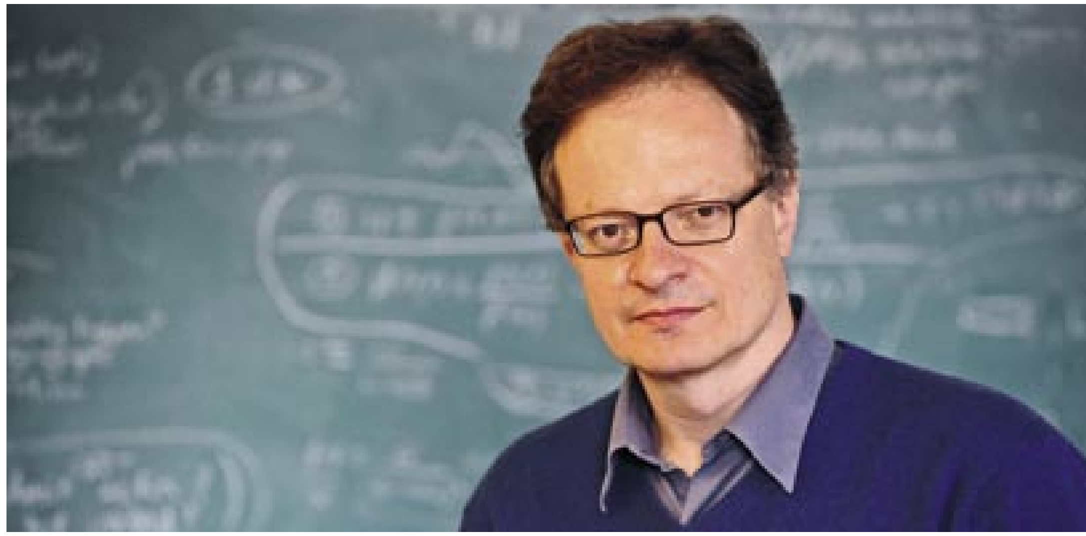

personal diseases, personal cures

DANA PE'ER
COMPUTER SCIENCE

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untangling the mystery of Alzheimer's plaque

SANAT KUMAR
CHEMICAL ENGINEERING

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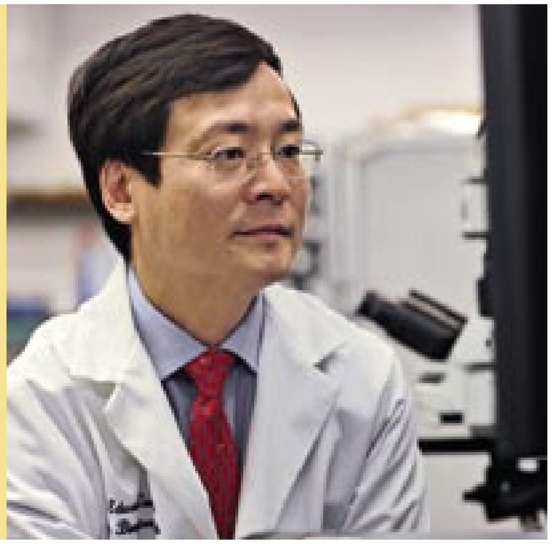

predicting bone strength, preventing osteoporosis

X. EDWARD GUO
BIOMEDICAL ENGINEERING

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delivering drugs to the right place

JEFFREY T. KOBERSTEIN
CHEMICAL ENGINEERING

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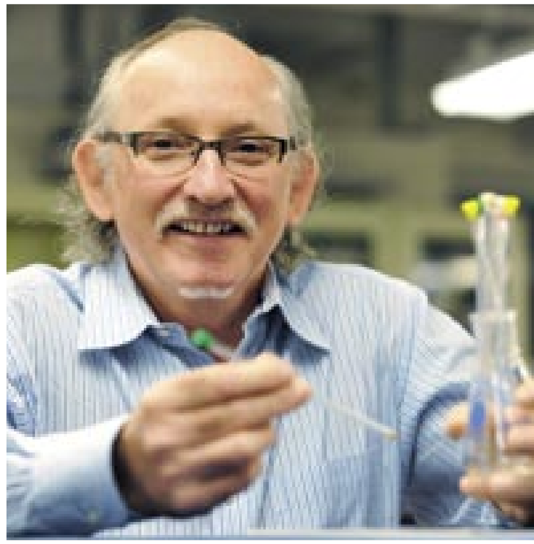

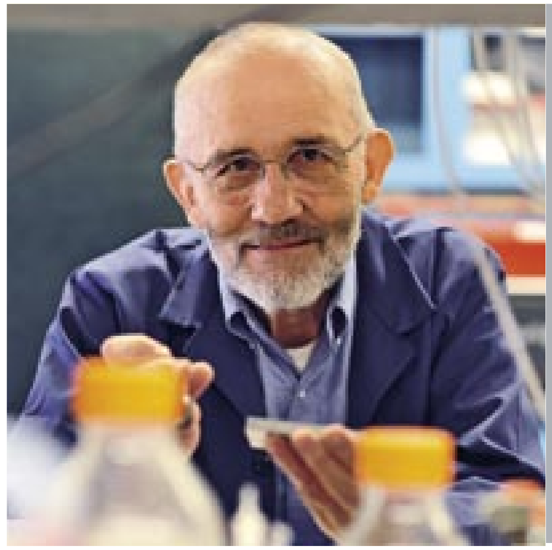

developing an artificial kidney

EDWARD F. LEONARD
CHEMICAL ENGINEERING

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trying to grow strong cartilage

GERARD A. ATESHIAN
BIOMEDICAL ENGINEERING

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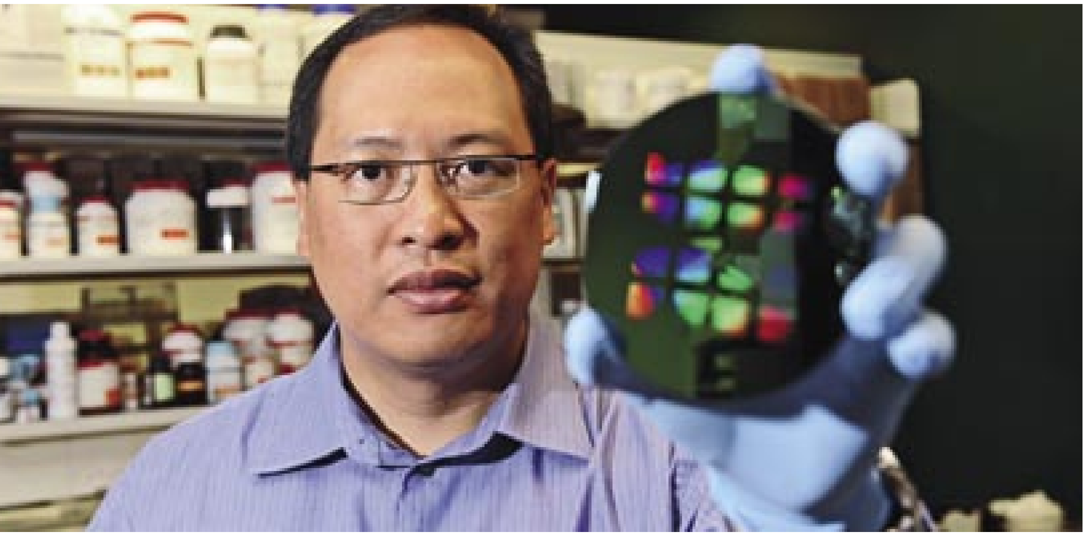
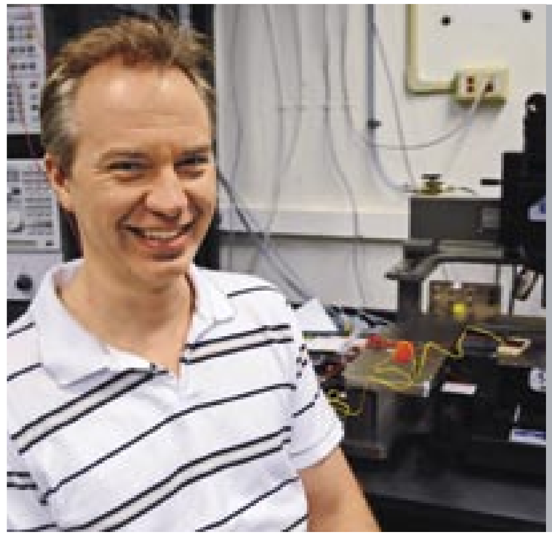




biology on a chip: big changes writ small

KEN SHEPARD
ELECTRICAL ENGINEERING

cartilage destruction and reconstruction

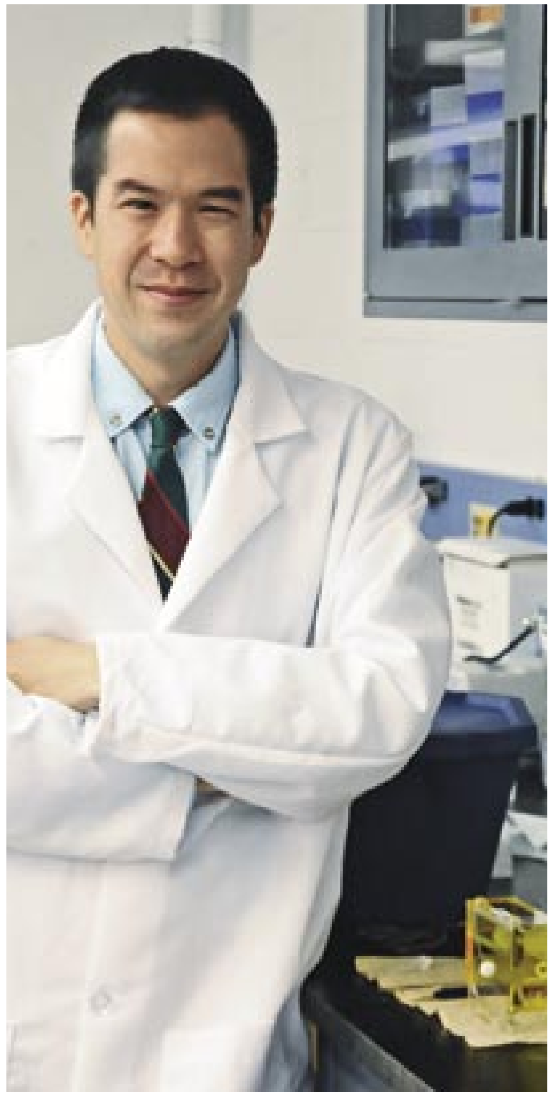
VAN C. MOW
BIOMEDICAL ENGINEERING

engineering the body's defenses

LANCE KAM
BIOMEDICAL ENGINEERING

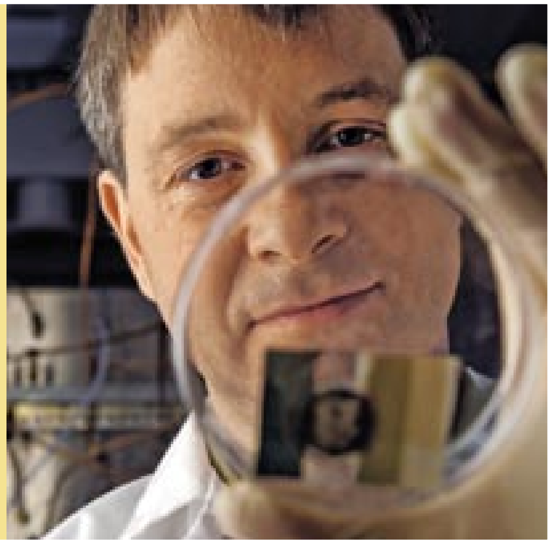
creating personalized DNA chips for everyone

JINGYUE JU
CHEMICAL ENGINEERING



measuring how heart cells work

HAYDEN HUANG
BIOMEDICAL ENGINEERING

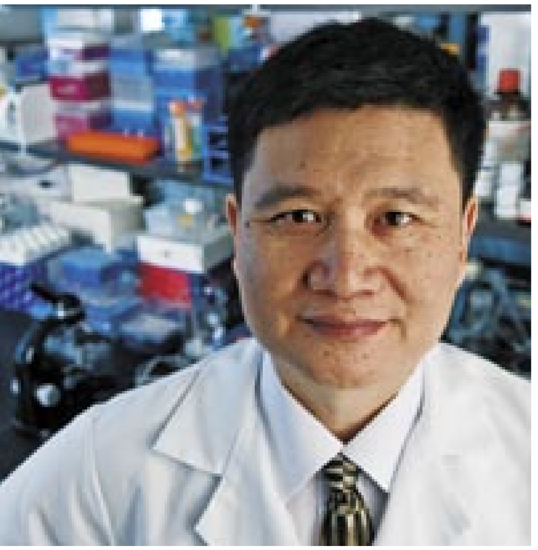


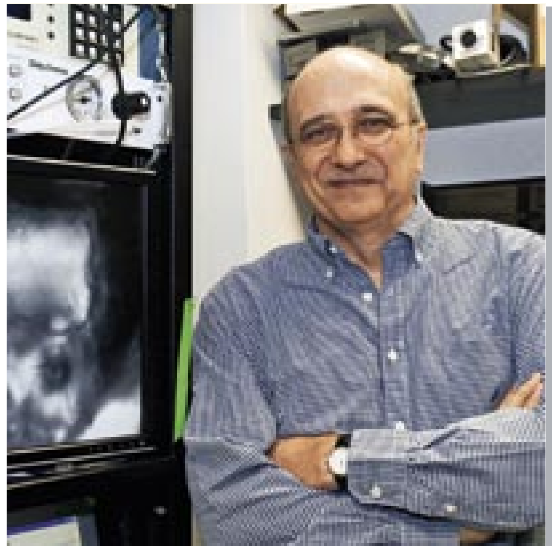
reprogramming cells to boost immunity

JAMES HONE
MECHANICAL ENGINEERING

building tiny muscle-like engines

HENRY HESS
BIOMEDICAL ENGINEERING



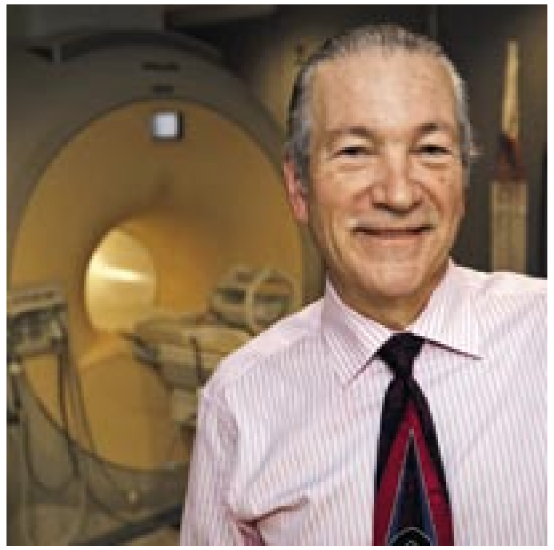


treating non-Hodgkins lymphoma

TRUMAN R. BROWN
BIOMEDICAL ENGINEERING

how flies' brains identify odors

AUREL A. LAZAR
ELECTRICAL ENGINEERING



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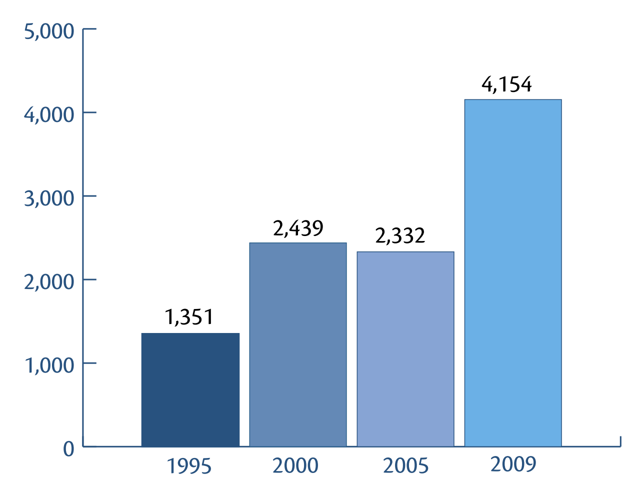
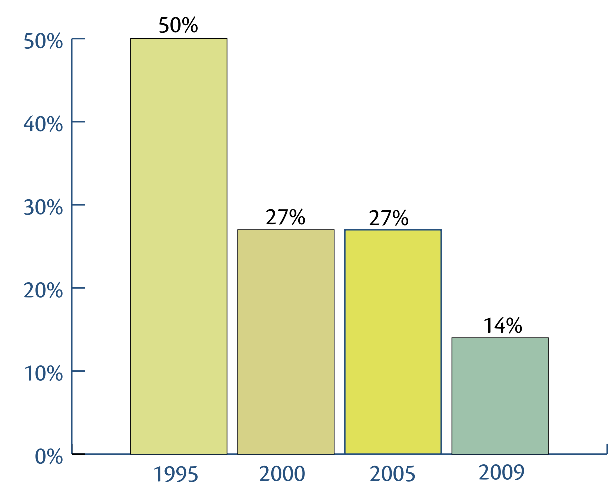
engineering.columbia.edu

SEAS BY THE NUMBERS

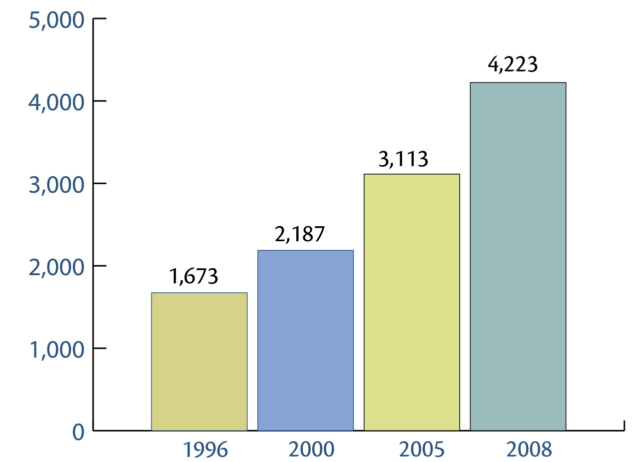
SEAS Undergraduate Applications



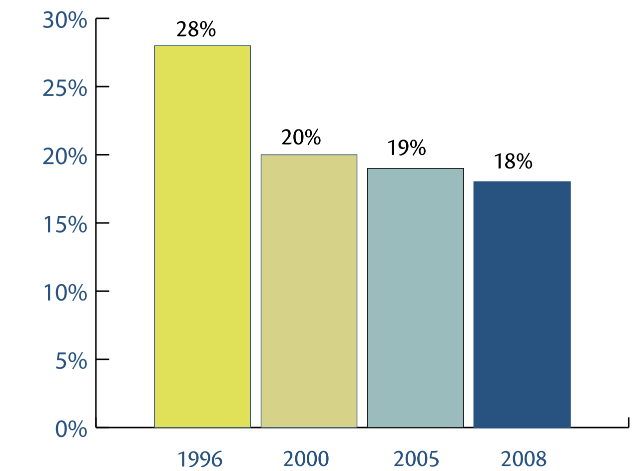
Selectivity Rate for First-Year Classes



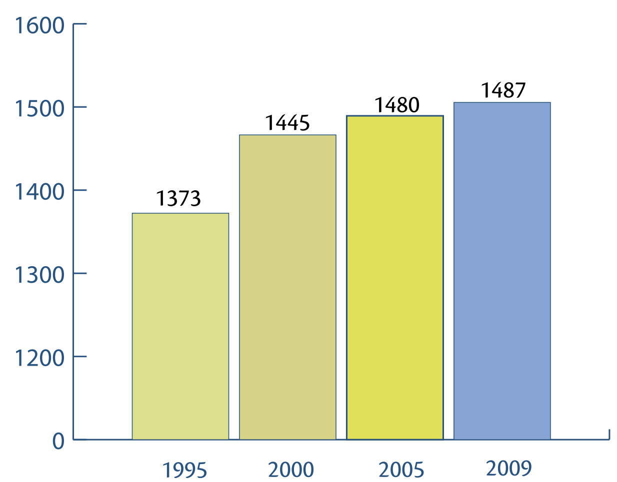
Number of Applications for Graduate Programs



PhD Acceptance Rate



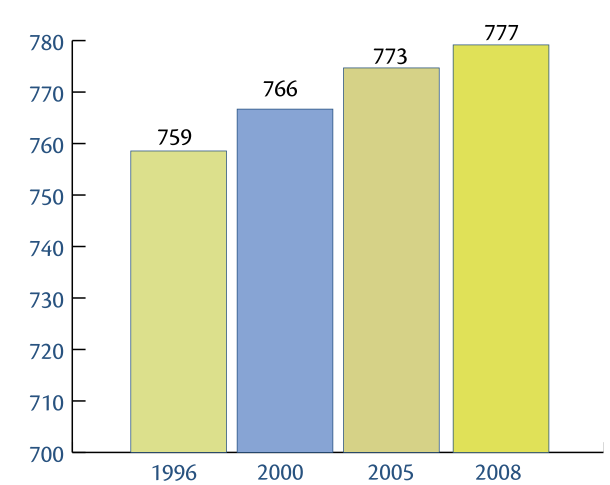
Average SAT Scores for SEAS Admitted Classes



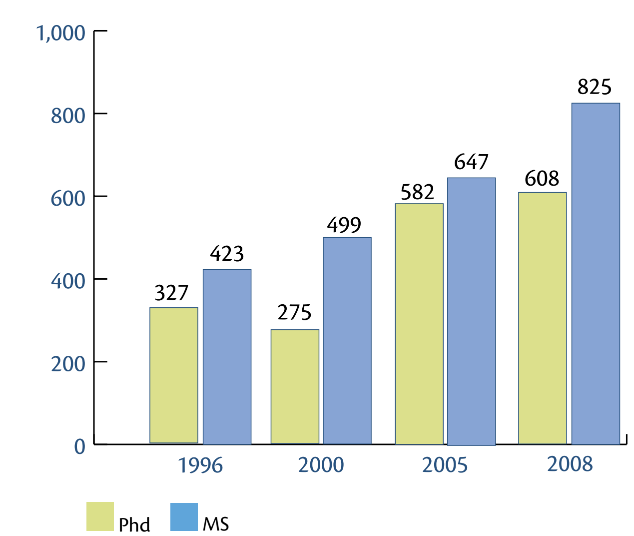
to read more about Columbia Engineering, go to

engineering.columbia.edu

Mean GRE Quantitative Scores of New Entrants in Doctoral Program

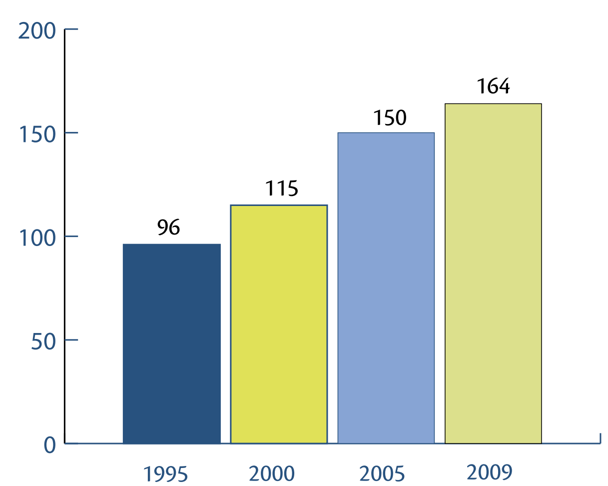


Number of PhD and Master's Students

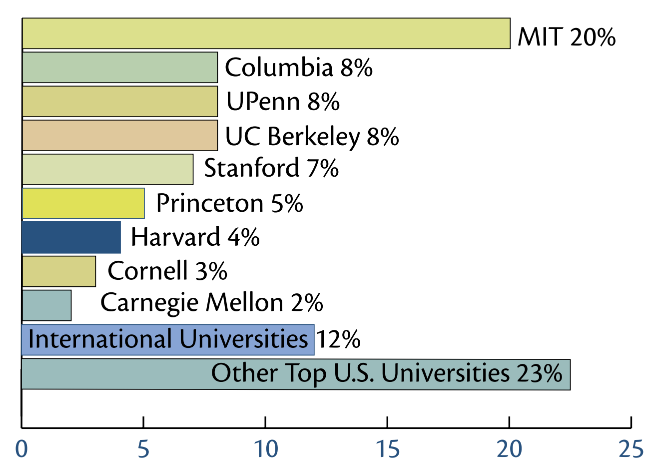


SEAS BY THE NUMBERS

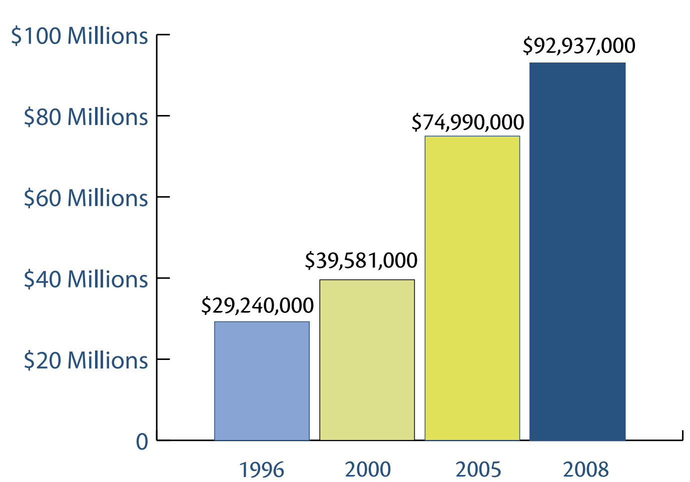
SEAS Faculty Growth 1995–2009



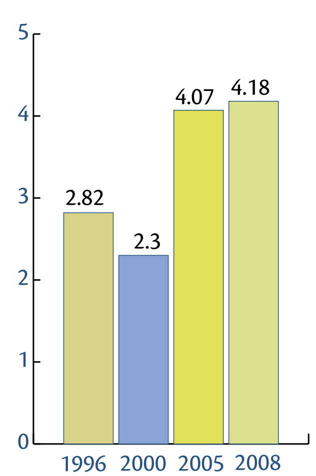
Doctorate-Granting Institutions of Current Faculty



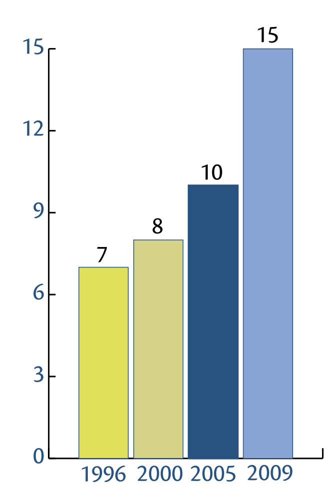
Research Expenditures



PhD Students per Faculty



Number of Faculty in NAE



MS Students Gain Global Advantage

Columbia Engineering has taken a historic step in its globalization initiatives by signing a dual certification agreement with the University of Bologna that provides an opportunity for students from both universities to obtain a master's degree in civil engineering from each institution with only one additional year of study. Academicians and cultural representatives from Italy joined with their Columbia counterparts to celebrate the new program that, beginning in the fall of 2010, will train SEAS students to work anywhere in Europe.

Shown here during ceremonies at Low Library are (front row, left) Pier Paulo Diotallevi, dean of the University of Bologna's faculty of engineering, and Columbia University's Feniosky Peña-Mora, dean of The Fu Foundation School of Engineering and Applied Science. Back row, from left: University of Bologna Professor Francesco Ubertini; SEAS Civil Engineering Professor Raimondo Betti; Professor Marco Savoia, chair of the Department of Civil Engineering at the University of Bologna; Columbia University Vice Provost Roxie Smith; Régine Lambrech, director of global initiatives and education at SEAS; and the Hon. Francesco M. Talò, consul general of Italy.

—Photo by Eileen Barroso

SEAS Parents Council

The SEAS Parents Council continues to build momentum as it enters its second year. The Parents Council is the principal connection between the dean and the parent body as a whole, advising the dean on ways to strengthen the student experience and acting as liaisons with other parents. Members also serve as informed ambassadors for SEAS in their community and country. A key focus of the Council is advancing the goals and vision of the School through supporting the Parents Fund. Last year, the Parents Fund raised $348,582 from 320 families, both of which were new records.

This year, the Parents Council will be led by Chairs William '81, '86 and Mary Haney (above) parents of Nora '12. The Parents of Alumni chairs will be Mark and Angela Arnold, parents of Andrew '09. They are joined by 23 couples from all over the U.S. as well as Hong Kong, South Korea, Switzerland, Finland, and Taiwan.

Bill Haney, who earned his bachelor's and master's degrees in operations research from SEAS, said, "I could not have attended Columbia without the financial aid I received while an undergraduate student. I believe that the investment that Columbia makes in enabling the very best students to matriculate benefits everyone associated with the Columbia community. Current students are direct beneficiaries of an enhanced academic experience, and alumni and current and future students are beneficiaries of an enhanced overall reputation for academic excellence at Columbia. Mary and I are thrilled to be leading the Parents Council this year and continuing its efforts to assist SEAS and its students in achieving their fullest aspirations."

For more information about the Parents Council or the Parents Program, contact Ryan Carmichael, Parents Program Officer, at *seasparents@columbia.edu* or 212-851-7891.

IN MEMORIAM

1937

Jerome S. (Jerry) Schaul, Jr. '35CC, an enthusiastic supporter of SEAS and Reunions, died on Nov. 30, 2008. He was a retired plastics engineer and prominent amateur cellist who began his career with General Cigar in Hartford. He then moved to a WWII defense plant in DesMoines. The family moved to suburban Boston in 1944 and then to Essex County, N.J., in 1946, where he and Ruth lived the rest of his life. His last home was Winchester Gardens in Maplewood, NJ.

He received his BA in 1935, and BS in ChE in 1937 from Columbia, and his MS in chemical engineering in 1968 from the Stevens Institute of Technology.

Following World War II, he became involved with plastics and produced the first experimental length of polyethylene-covered telephone cable for Western Electric, which eventually terminated him for attempting to organize engineers.

He subsequently developed and manufactured early examples of glass-reinforced products and, later, fluorocarbon extrusions before concentrating on another new product, PVC pipe. Although he was the only technical person at Alpha Plastics, he took an active role in convincing public authorities of the viability and safety of PVC pipe. He then returned to the lab as the plastic pipe expert in a group of concrete-oriented civil engineers at Lock Joint Pipe Company, later Interpace. He wrote a chapter for *Plastics in Building*, edited by Irving Skeist, 1966.

Schaul joined Celanese in 1966. He was involved with several projects and was a pioneer in creating PET bottles (Pepsi, Palmolive dish liquid) for which he received his second patent, "Process for preparing polyethylene terephthalate useful for beverage containers." He also contributed innovations to milk bottle blow molding. Schaul retired in 1980 from the Celanese Corporation.

For more than 20 years, Jerry was an instructor in what he referred to as "pragmatically oriented plastics courses" for the Center for Professional Advancement, teaching in New Jersey and Amsterdam. He was a volunteer executive for the International Executive Service Corps in Jamaica and Costa Rica and was listed in the first edition of *Who's Who in Plastics & Polymers*, published by the Society of Plastics Engineers. He was recognized for 70 years of membership in the American Chemical Society.

Schaul was first chair cellist in the Montclair State University Orchestra and the Livingston Symphony. He performed frequently with the Society of Musical Arts and the Montclair Music Club, as well as at Winchester Gardens. He also played with the New Jersey Symphony and the Irvington Symphony. One of his favorite pieces was Ravel's *Kaddish*, which he performed most effectively for at least a dozen Holocaust and Kristallnacht commemorations in Passaic and Montclair. His early musical training benefited from absolute pitch and a piano teacher whose teacher's teacher's teacher was Ludwig von Beethoven.

At 13, he attended a New York Philharmonic Young People's concert in Carnegie Hall with Walter Damrosch as conductor. "I sat in the balcony with my mother," he said, remembering how clearly every instrument could be heard in the acoustically superb hall. "When the orchestra played the second movement of Brahms' Second Symphony, the cello section solo sounded so rich, bursting in tone, I decided I had found my instrument." He made his own Carnegie Hall debut with one of his many amateur groups in 1995.

Schaul attended his 70th year Columbia College reunion, together with his son Michael '65CC, and grandson Nissim '00CC. His father Jerome S. Schaul, Sr., was a member of the Columbia College class of 1909.

He received his Golden Lions Society pin at his 70th year Engineering reunion in 2007. He is survived by Ruth, his wife of 69 years (now living in Raleigh, N.C.), his sister Betty Lefferts of New York City, and sons Dan of Long Beach, N.Y., and Michael and his wife Miriam, of Raleigh, and their son Nissim, of Paris.

1948

Leon Seldin (MS) died on Aug. 8, 2009, at The Chilton Hospital in Pompton Plains, N.J. Seldin lived in River Edge for 58 years before moving to Cedar Crest Village in 2006. A graduate of De Witt Clinton High School, he received his BS degree from CCNY in 1943, and went on to earn his master's degree in electrical engineering from Columbia University. As a student at City College, he was awarded membership in Eta Kappa Nu and Tau Beta Pi, as well as Sigma Kappa Tau.

Seldin pioneered in the early days of television with Dumont TV. He continued on with a number of engineering firms, and eventually became a well-known and respected consultant in the industry and a member of the New Jersey Society of Electrical Engineers. He also was an adjunct professor of electrical engineering for 40 years at CCNY and Fairleigh Dickinson University in Teaneck.

Always active in the River Edge community, he was a past-president of the Lions Club of River Edge, a founding member of The River Edge Swim Club in 1960, a Boy Scout troop leader, and a coach and manager in the River Edge Little League for a number of years.

He enjoyed golf and tennis and had a special gift for helping others with his electrical and jewelry-making skills. Additionally, he was an active volunteer of Chore of Bergen County, an organization of seniors sponsored by Hackensack Hospital which helps seniors with household repairs. He was the loving husband of Betty (Kownatzky) for 65 years, and devoted father of Eric of Morris Plains and Peter of New Canaan, Conn. He also leaves Eric's daughter, Alexandra, and Peter's wife, Carol, and their two sons, Matthew and Douglas, all of whom he enjoyed and loved so much.

1949

Dr. Charles Edward (Charlie) Aull died on July 4, 2009. After brief service with the U.S. Navy at the close of World War II, he went on to earn a BS degree in chemical engineering at Columbia, a master's degree at the University of Oregon and a PhD at the University of Colorado in mathematics.

After teaching assignments in several schools, including the University of Wisconsin and Kent State University, Aull came to the Mathematics Department at Virginia Tech in 1965. He taught Mathematics at Virginia Tech until his retirement in 1992.

Aull published more than 50 papers in his field of Topology and edited two larger works. But most people knew him through his activities with the NAACP and Virginians Against the Death Penalty, through his regular commitment to visiting those in prison at Fairlawn and at the Juvenile Detention Home in Christiansburg, and through his love for and commitment to St. Mary's Catholic Church in Blacksburg and the Newman Community, the Catholic Campus Ministry at Virginia Tech.

Frederick J. Michel (MS), 87, passed away on May 30, 2009. Born in Landau, Germany, to Richard and Lilly Brunner Michel, he immigrated to the United States with his parents and brother, Rudolph, in 1936 due to the Holocaust.

After graduating from Brooklyn Technical High School and City College of New York with a bachelor's degree in mechanical engineering, he entered the Army during World War II and was assigned to Military Intelligence at Fort Hunt, Va. After the war, he earned a master's degree in mechanical engineering at Columbia. Michel worked at Melpar Inc. in Alexandria and Arlington, Va., and later for Westinghouse Electric Co. as director at the research laboratory in Churchill, Pa. He returned to Northern Virginia to work for the U.S. Army, retiring as deputy chief of manufacturing. Among the many awards he received are two medals from the Army for Meritorious Civilian Service and a Gold Medal and recognition as a Fellow of the Society of Manufacturing Engineers. He co-authored two textbooks on manufacturing engineering. Michel's favorite hobby was working in his azalea gardens. He is survived by his wife of 62 years, Lucille Berryman Michel, formerly of Alexandria, Va.; two daughters, Deanna Michel Orendorf and Cynthia Michel; and son-in-law, Robert I. Orendorf, all of Louisville, Ky.; three grandchildren; and four great-granddaughters.

1950

Lambert Prettyman Jr., 82, of Sarasota, died May 20, 2009. Born in New York City to Lambert and Ruth Prettyman, he attended Horace Mann School in Riverdale and served in the U.S. Navy from 1944 to 1946. After he received a BS in industrial engineering from Columbia Engineering in 1950, he joined the General Foods Corporation at its Maxwell House Division coffee plant in Hoboken, N.J. During his career with General Foods, Prettyman worked in San Leandro, Calif., Hoboken, N.J., and White Plains, N.Y.

In 1971, he was vice president of operations at Kohner Toys. He completed his career as plant manager of the Maxwell House facility in San Leandro and retired in 1985. He is survived by Kathleen, his wife of 57 years; a daughter, Linda, her husband, Chester Fream, and their children Courtney, Scott, Jessica and Sean; a son, Robert, his wife, Pamela, and their children Ryan, Meghan and Kelly; a son, Kevin, his wife, Julie, and their children Jackson and Samuel; and a great-grandson, Grant, son of Courtney and husband Neil Carignan. The family gives special thanks to the 1986 anonymous donor of his life-giving kidney. A private family memorial service was held in Orfordville, N.H., where he enjoyed the summers of his youth at Camp Moosilauke.

Nicholas Rahal died in February while on a cruise. He was buried at Arlington National Cemetery with full military honors in May. His wife wrote to his classmates, "He always had such fond memories of his days at Columbia and I am so glad we were able to meet with you and all his classmates at the two reunions. He even wrote about his days at Columbia in a book he was writing."

George Wunderlin (MS), 92, of Simi Valley, passed away peacefully Friday Apr. 17, 2009. He was born in Bayonne, N.J., graduated from Brooklyn Polytechnic with a BS degree in aeronautical engineering, and an MS from Columbia. He started his career in aerospace with Wright Aeronautics in New Jersey. He soon met and married Mildred, and they had two children, Nancy and George Jr. He worked with Rocketdyne on the West Coast for many years.

When Wunderlin left Rocketdyne, he started a new career with the City of Simi Valley in administration in the early 1970's. At the time, Simi Valley was becoming a city. He finished his career as Finance Director with the city of Rancho Palos Verdes. After retirement, Wunderlin remained very active in many areas including serving on the board and as President of the Retired Public Employee Association of California. He was predeceased by his wife Mildred in 1996. He is survived by his daughter Nancy and her husband Jim Martz of Simi Valley, his son George Wunderlin Jr. of Minneapolis and brother Charles of Ohio, 5 grandchildren and 7 great grandchildren. The family would like to extend a special thank you to Simi Valley Residential Care.

1951

Leslie R. Abbott Jr., 83, of The Pier condominium in Norfolk, Va., died June 17 in Norfolk. He was born and reared on South Street in Portsmouth. He was a graduate of Columbia with a BS and was a U.S. Army veteran of World War II. He fought in Eastern France and Germany and was a Purple Heart recipient. Abbott retired from the Norfolk Naval Shipyard in 1975 as a metallurgical engineer. He was preceded in death by his loving wife of 42 years, Nan Sykes Abbott, and later by his beloved companion, Betty A. Davis, who died in 2004.

1952

James Abner Bloom Sr. (MS) died on Apr. 21, 2009. Bloom grew up a small town boy, delivering papers, working odd jobs, and becoming an Eagle Scout. Upon turning 18, he was drafted into the Army at the close of World War II, prior to VJ Day. He served in the supply area in Occupied Germany as well as being in the Corps of Engineers. Upon discharge, Jim entered West Virginia University and graduated as a mining engineer in 1951. He continued his education by obtaining a master's in mining engineering from Columbia University in 1952. Bloom's career included working for Union Carbide, Monterey Coal Company, and Y & O Coal Company. He spent most of his time with his best friend, his wife Jean. He enjoyed traveling, square dancing, and round dancing. He taught 55 Alive driving courses, and was an AARP Area Coordinator, in Myrtle Beach, S.C. On Aug. 16, 2009, Jean and James would have celebrated their 57th year of marriage.

1954

Robert J. Breza of Conyers, died Mar. 23, 2009. Born in New Brunswick, N.J., he attended Rahway High, in Rahway, N.J. Upon graduation, he attended Columbia where he received a BA in chemistry and a BS in engineering. He worked for General Foods for 33 years in various locations, including Dover, Del., and Hoboken, N.J. He began playing the violin at the age of three, and was an accomplished violinist, playing in various community orchestras, including the Summit Symphony, Hilton Head Orchestra, and the Conyers-Covington Orchestra. Breza enjoyed researching family genealogy, cooking, traveling, collecting stamps and visiting relatives. He is survived by his wife, Betty Jean Breza; daughters and sons-in-law, Marika and Randy Kanipe of Covington, Barbara and Brian Coyne of Larchmont, N.Y.; grandchildren, James R. Kanipe, Rebekah A. Kanipe, and Elizabeth R. Coyne.

John I. Glucksman, a former president of the Columbia Engineering Alumni Association, died Oct. 28, 2008. His wife, Paula Greene, writes:

"John didn't get to Engineering School at Columbia on some pre-ordained path. There were a lot of zigs and zags along the way. It was a path of constant exploration and experience and what made him a thinking, humane practitioner of the art and science of engineering, even when he wasn't practicing engineering.

"John was a New Yorker through and through. He was born in Manhattan, grew up on the Upper West Side, went to PS 165, and spent his high school years at Stuyvesant High School, where he not only was expected to excel in academics, but also to learn and respect shop skills and the people who made their livings using them. John was on a scientific path, leading him to NYU where he earned his first BS, in geology.

"It was in the days just before WWII and John found his first real job, one that made practical use of his training, in Mississippi, teaching aviation mechanics at Keesler Field. A year later, as a GI himself in the Army Air Force, he was returned to Biloxi once again teaching aviation mechanics. But there was an unexpected turn to his Army career; he qualified for the Army Specialist Training Corp (ASTP) a program designed to put language-trained American troops behind enemy lines. For John, it meant studying Chinese at the University of California Berkeley where he earned a Certificate of Excellence in Chinese studies.

"He came to Columbia on the GI Bill, spent a year fulfilling pre-engineering studies, studying while working part-time as a ribbon salesmen, and finally in 1954 graduating with a BS in mechanical engineering.

"That same year, the year of Columbia's Bicentennial, he became president of the Columbia student body. Presiding over Bicentennial activities included the honor of hosting Eleanor Roosevelt in her visit and address to the student body. He considered it one of the great moments in his life.

"He went to work for Norden-Ketay on the Norden bomb-sight, then to Mergenthaler Linotype, working on this famous typesetting machine that revolutionized newspaper production where his design improvements brought him several patents. John then moved on to PRD Electronics where he was engaged in the design and manufacture of microwave antennas, as well as overseeing the production of prototype and final products.

"His work and life took another turn: he joined his wife, Paula Green, in establishing and running an advertising agency in New York, where his engineering background contributed to the agency's growth and success, figuring importantly in the agency's campaign that introduced the Subaru to the U.S.

"John did more than attend school at Columbia. As an alumnus John sat on the Board of Managers of the Engineering Alumni Association for several terms, and in 1986 was elected president. John's story is a Columbia family story; he saw his son, Joel, a member of the championship Columbia fencing team, graduate from Columbia in 1970. Joel then spent several years as assistant fencing coach at Columbia, received his master's degree from Teachers' College, and was a member of the U.S. Olympics Fencing team at Los Angeles.

"The constant in John's life, the thread that ran through it all, was learning. John possessed the incredible ability to impart knowledge to others. He was a first-class explainer, a born teacher, and a very funny man. John was warm, witty and wise, unfettered in mind and spirit. He was what every school would be proud to claim as its own: a loving, caring man who brought his best to his profession, his family, and his friends."

1953

Fernando Saenz Leon was born in Larache, Morocco, then a Spanish territory. A beloved husband, father, grandfather, sailor, orator in five languages, mesmeric singer of Spanish folk and Civil War songs, amateur historian, art collector, trout fisherman, duck hunter, lover of music, literature and the forest and crafty chess player, he died peacefully amid his family in his Ann Arbor home on June 8.

Leon attended the Instituto Escuela in Madrid and was a veteran, fighting with the Republican forces during the Spanish Civil War. After escaping to France and then from the internment camp in Argels-sur-Mer, he immigrated to New York. Soon after arriving, he received a scholarship to attend Black Mountain College in North Carolina and transferred to Columbia Engineering, where he was elected a member of Tau Beta Pi. He earned a master's degree in automotive engineering from the Chrysler Institute and worked at Chrysler in the late stages of the development of the XIV-2220 experimental high-speed aircraft engine to which Chrysler was contracted by the U.S. Army Air Corps during the war.

This was the first engine using Chrysler's "hemi" technology. When the contract finished, Fernando served in the U.S. Navy in Baltimore, Md., until the end of WWII. He co-founded the FOREL Equipment Co. in New York City with two brothers and a friend. The firm exported steel-making and metalworking equipment and helped set up many industrial plants in Latin America and Europe for the Marshall Plan after WWII.

He later founded Om-El Corporation in Bay City, MI, to pursue similar activities, enabling him to travel Europe, Latin America and behind the Iron Curtain extensively. Additional entrepreneurial ventures in Bay City included the co-founding of AcraCast and Lake Huron Sailboats. Mr. Leon was selected by the U.S. Department of Commerce to serve in the U.S. Trade and Investment Mission to Columbia in 1965. He served as a trustee for Marlboro College in Vermont.

Reflecting a lifelong interest in global issues, Fernando was energetically involved in the presidential campaigns of Stevenson, McCarthy and McGovern. He established the first teen crisis drop-in center in Bay City, Mich. His large collection of books reflect his interest in Spanish and American history and politics, modern art, dance and literature. His historical monograph "Cuatro Vientos" on his father's service as an air base commander in the early days of the Spanish Civil War is in the collections of seven rare book libraries, including the Houghton Library at Harvard and the Geisel Library at UCSD.

He married Eleanor Robson Smith and they just marked their 63rd wedding anniversary. He is survived by two brothers, his wife, six children and fifteen grandchildren.

1956

Victor V. Mion Jr. ('56CC) of Saratoga Springs, N.Y., died on Mar. 7, 2009, from complication of ALS (Lou Gehrig's Disease). Born in Schenectady, he was a graduate of Mont Pleasant High School and Columbia Engineering in 1956. He was president and owner of Anthony Mion & Son in Schenectady for the past 50 years.

Mion was a member and instructor with Lake George Power Squadron; past president of Local Sigma Chi Chapter; past president of Niskayuna Kiwanis; co-president of Niskayuna High School PTA; assistant Boy Scout Leader Troop 31; past president Eastern New York Contractors Association; past board member Lake George Opera; volunteer with SICM for abused children; past board member for Habitat for Humanity; trustee of Local 2 and an active member of Our Lady of Fatima Church in Schenectady. He is survived by his loving wife of 52 years, Patricia Sweeney Mion; three sons, six grandchildren a sister and nephew.

1958

Arthur "Art" Fein (MS), a native of New York, longtime resident of Palos Verdes, Calif., and resident of Fairhope, Ala. for the past two years since his retirement, died June 13, 2009, in a local hospital. Fein received his BS in engineering from New York University in 1956 and his master's degree in 1958 from Columbia. He retired from Northrop Grumman with over 40 years of service.

1959

James Hamilton Scott Jr. (MS), died at home on Apr. 26, 2009. Born in Richmond, Va., Scott attended St. Christopher's School, and graduated from Woodberry Forest School in 1947. He went on to the University of Virginia in 1951 where he was captain of the swim team. He served in the U.S. Coast Guard from 1951 to 1953 and received an MS from Columbia University in 1959. He retired as a Vice President of Scott and Stringfellow in 1992.

Jim's first concern was always for his family and those in the community who needed support. He served on the boards of many community organizations including WorkSource Enterprises where he served for over 20 years. He was a founding member of NAMI Blue Ridge where he was Treasurer for 30 years. Jim also served on the vestry of St. Paul's Memorial Church and on the Charlottesville Albemarle Airport Commission. He also enjoyed anything involving planes and boats.

He is survived by Shelah, his wife of 56 years; his daughter Lee; his sons Keith and Jay; daughter-in-law Sarah Bedford; and grandchildren Ford, Alden, and Elisabeth. He is also survived by his sisters, Alice Nalle of Philadelphia and Polly Cardozo and her husband, Randolph of Richmond; and his brother Walter, also of Richmond; as well as 15 nieces and nephews and a large extended family.

1963

Galen Robert Plummer '62CC died on Mar. 24, 2009, in his home. He graduated from Robert W. Traip Academy, Kittery Point, in 1958. He earned a bachelor of arts degree from Columbia in 1962 and, in 1963, a bachelor of science degree in mechanical engineering.

After college, he received a commission in the U.S. Navy and was accepted for duty in the Navy's nuclear propulsion program and submarines. He served in seven submarines, culminating with commands of the nuclear attack USS Archerfish, SSN 678, and nuclear attack Submarine Squadron Seven in Hawaii; program manager of nuclear propulsion program and submarine detailer; and chief of Strategic Command and Control Division for the Chairman of The Joint Chiefs of Staff.

He retired from the Navy in 1992 as a captain after 36 years of service. In May, 1994, he married Barbara (English) Murray in Alexandria, Va. They moved with his daughter, Rebecca, to Northport. Moving into his dream home overlooking Penobscot Bay brought him full circle to the time he first saw the water as a child in Searsport. Capt. Plummer began his second career after retirement through church and community service, specifically with various outreach projects with Belfast United Methodist Church, board member of Camden Conference and Penobscot Marine Museum, supporting roles in the Belfast Game Loft, teaching and attending Senior College at the Hutchinson Center, and substitute teaching in the Belfast school system. Friends and neighbors could always count on him to lend a helping hand. He was predeceased by his first wife, Regina (Conklin) Plummer, the mother of his three children; and one brother, Gerald L. Plummer. Surviving are his wife, Barbara Plummer of Northport; his three children, David Plummer of Berryville, Va., Sandy Stroud of Honolulu and Rebecca Plummer of New York City; his stepchildren, Juanita Rogers of Alexandria, Va., and Kevin Fletcher of Jacksonville, Fla.; five grandchildren; two sisters, Sandra Plummer Hooper of Kittery Point and Shirley Johnson of Stafford, Va.; many nieces and nephews.

1965

Ronald James Griffith (MS '65, PhD '69) died on Mar. 12, 2009, from pancreatic cancer. His brilliant and inquiring intellect, commitment to family and community, outstanding professional leadership, and generous heart will be missed by the many people he touched in Northfield and around the world.

Born in Harlan, Iowa, he grew up in Cherokee, Iowa, recalling his idyllic childhood with devoted parents, who encouraged his stimulation to learn and support for his interests. He was engaged in Cub Scouts, 4-H, Methodist Youth Fellowship, varsity athletics and numerous school-related clubs and activities. Griffith worked continually from age 14 doing either store or farm work until he completed high school. Before graduating from high school in 1960, Griffith married Linda Joy Sagness in 1959, welcoming their children Dana and Brian in 1960 and 1961.

In 1960, Griffith entered Iowa State University with the dream of designing nuclear reactors. His vocational objective evolved into biomedical engineering when he had the opportunity to produce a prototype medical device for which he was awarded a patent. His time at ISU included programming the Cyclone digital computer, a copy of the first digital computer — the Illiac — that introduced Griffith's generation to computing. He graduated in 1963 with a BS in electrical engineering, an interest in all aspects of physics, mathematics and science and membership in numerous honor societies.

At age 20, he accepted a job at Bell Telephone Laboratories, commonly thought of as the most prestigious private research and development organization in the world. His work motivated his graduate studies at Columbia where he earned MS and PhD degrees in electrical engineering in 1965 and 1969.

In the late 1960s, Griffith became involved in the civil rights movement, local politics, and the United Methodist Church in Morristown, N.J. He took on his first management position at Bell Labs and attended a course titled "The Theological Revolution of the 20th Century." His commitment to social change through church renewal became the primary focus of his life. As his commitment to community and service deepened, the early marriage to Linda ended in 1972.

He became a member of the residential staff of Ecumenical Institute/Institute of Cultural Affairs (ICA) residing in New York City. In 1974, Bell Labs transferred him to Naperville, Ill., where he also lived and worked at the global headquarters of the EI/ICA in Chicago. Even more importantly, it set up the circumstances in which he met Beret, who was working with the ICA. They were married Apr. 28, 1976, creating a combined family of five children.

He moved back to New Jersey with Bell Labs in 1978. Ten years later, in 1988, he was invited to open a new Bell Labs location in Menlo Park, Calif. California proved to be even more exciting than he and Beret hoped it would be. Bell Labs became the first of a series of demanding positions in Silicon Valley where he served as senior executive.

After diagnosis and treatment of prostate cancer, Ron and Beret faced a crossroads. He was again being pursued by the start-up which would mean a return to the lifestyle of the past 11 years. A trip to Minneapolis in 2001 and a series of fortuitous events changed things forever. Over three days, they visited Northfield, signed a purchase agreement on a town home and returned to their California home. They soon set off across the country with two cats and never looked back. Retiring to the Midwest allowed them to be near family, longtime friends and simplify their life.

Griffith was enthusiastically and passionately involved in many community projects. He was totally engaged in launching Just Food Northfield Community Co-op, working nearly full-time for four years with an outstanding team of volunteers, and finally as a board member. Just Food opened in December, 2004. Other engaging pursuits included serving on the Planning Commission and the Northfield Energy Task Force's Wind Turbine Working Group. It was the community feeling of Morristown and Northfield, not Bell Labs or Silicon Valley, which allowed him to most deeply experience the meaning and relationships that were most important in his life. Perhaps in the end it was "spirit-filled adventurer" and not "engineer" that best describes his essence. Community brought meaning to his life. Engineering is how he made his choices. Relationships are what he most cherished.

He is survived by his wife, Beret Elizabeth (Brown, Hanson) Griffith of Northfield; daughter, Dana Erin Griffith of Clarkesville, Ga., and grandchildren, Evea Dinorah Kaldas and Andrew Samir Kaldas of Cumming, Ga.; son, Brian Andrew Griffith (Lani Kian) of San Diego, Calif.; daughter, Greta Elizabeth Hanson, (Rogelio Gaytan Silva), and grandchildren Gonzalo Samuel Pirela Hanson and Manola Francesca Silva Hanson of Minneapolis, Minn.; daughter, Chrystina Ellen Hanson of New York City; son, Benjamin Daniel Hanson (Cassandra Miles Hanson), and grandchildren, Camille Adia Hanson, Isabelle Danielle Hanson, Lillian Margaret Hanson and Gabrielle Rose Hanson of Richfield, Minn.; mother-in-law, Elizabeth Krause Brown of Eau Claire, Wis.; brother-in-law, William John Woodall of Cherokee, Iowa; nieces, Gayle Rae (Woodall) Gustafson (Steven Gustafson) and their family; and Gwen Leigh (Woodall) Voss (Hank Albert Voss) and their family.

1968

Paul A. Gattini (MS) of North Hanover Township died Apr. 29, 2009, at University Medical Center at Princeton. Born in Brooklyn, Gattini was a resident of the area for 30 years. A U.S. Merchant Marine veteran, Gattini graduated from Kings Point Merchant Marine Academy on Long Island. He earned his master's degree from Columbia. He was employed at McGuire Air Force Base as a mechanical engineer, retiring in 2002.

He was an avid horseman, who raised and trained standard bred horses on his farm. He was a talented man who was up for any challenge. He is survived by his wife of 43 years, Julia Gattini; two sons, Anthony and Paul Gattini; two grandsons, Ryan and Dylan Gattini; sisters, Prudence Johnson and MaryAnne Vogt and her husband, David, as well as three brothers-in-law and their families.

1974

Dr. James Willis Hare (MS) of Mequon, Wis. passed away unexpectedly on Aug. 10, 2009 while on vacation at his beloved family summer home in East Orleans on Cape Cod, Mass. Hare was born in Middletown, N.Y. and graduated in 1964 from Middletown High School, where he was a National Merit Scholar. After graduating from Colgate University in 1968, he was drafted into the United States Army.

Although strenuously opposed to war on moral grounds, Jim nonetheless felt obligated to serve his country when called upon. He was granted official government status as a non-combatant conscientious objector and served nine months under fire in Vietnam as medic with an infantry company.

Upon discharge from the Army, he enrolled at Columbia Engineering, where he met Karla Pinson. They married on Aug. 21, 1971. He received his master's degree in biomedical engineering in 1972. In 1976, he received his MD degree from Cornell University Medical College. He moved to Milwaukee in 1976, where he was in the family practice residency training program at St. Michael Hospital, becoming chief resident during his final year of training.

From 1976 to 1988, Hare was in private family practice in Mequon. In 1988, he joined the Family Health Plan Cooperative where he became clinic director and served on the organization's board. After receiving further training through the American Academy of Physician Executives, he continued his medical career as a Medical Director for several nationwide health insurers. His most recent occupation was clinic director and physician at the Milwaukee clinic of Concentra Occupational Health.

Hare's personal interests included extensive involvement with Mequon's Weyenberg Public Library Board, preceding and including the library's addition and expansion. As a former Eagle Scout, Jim also was deeply involved in local Boy Scout Troop 865 where he served several years as Scoutmaster. He enjoyed nothing more than being with his sons and their friends on camping trips and expeditions. Jim was an active member of Crossroads Presbyterian Church since 1981. His fondest church memory was a medical mission trip to Honduras in 1995, where he treated thousands of poor people with significant medical needs.

He is survived by his wife of 37 years, Karla Hare, and their children, all of whom reside in New York City: Jordan Hare and his fiancé Helen O'Reilly, Nathaniel Hare and his girlfriend Emily Fisher, and Lauren Hare and her girlfriend Jess Lopez. He is also survived by his sisters Pamela and Jane, and brother Jonathon.

OTHER DEATHS REPORTED

Emanuel L. Brancato '37,'38,'36CC
Bernard Jaffe '38, '39
Walter F. Bohm '41
Ronald A. Graham '44
Richard Kates '45,'47
Noubar Markarian '45
Arthur E. Raque Jr. '46
Dr. Arthur S. Robinson '48,'57
Stanley R. Sobel '48
Dr. Mohamed A. Adibi '49,'55
John J. Van Venrooy '50
B. Weston Morosco '51,'50CC
William J. Hanlon '52
Aaron Kirpich '52
Dr. Robert J. Spinrad '53,'54
Robert J. Breza '54,'49CC
Jesse L. Acker '55
John A. McCague '57,'56CC
John Scribano '57
Arthur Kotopoules '58,'69,'53CC
Dr. Himan Sternlicht '58,'57CC
James H. Scott Jr. '59
Dr. Albert C. Frost, '61,'67
Gerald G. Sills, '61
George V. Bates III '64
Joshua Dybnis '03

Family members may e-mail *mk321@columbia.edu* with information for this section.

New Dean Welcomes New Students

New SEAS Dean Feniosky Peña-Mora welcomed more than 1,500 new students and their parents, family, and friends as part of Convocation for Columbia College and The Fu Foundation School of Engineering and Applied Science. Peña-Mora (right) joined University President Lee C. Bollinger and new Columbia College Dean Michele M. Moody-Adams at the August 31 ceremony on South Lawn.

"Like all of you new first-years sitting out there, I'm a first-year," he said. "Like you, I am thrilled to be here and to be part of this great institution that traces its roots back to 1754.

"You are following in the tradition of the classes that have preceded you. You are becoming part of an academic lineage that goes back to the founding of the University. King's College, as Columbia was known then, in its founding mission in 1754, was charged to 'enlarge the Mind, improve the Understanding, polish the whole Man [and today, also women], and qualify them to support the brightest Characters in all the elevated stations in life.'

"To complement the teaching of what we now know as liberal arts, the mission of King's College was also to teach 'the arts of Number and Measuring, of Surveying and Navigation . . . the knowledge of . . . various kinds of Meteors, Stones, Mines and Minerals, Plants and Animals, and everything useful for the Comfort, the Convenience and Elegance of Life.'

". . . [F]rom the beginning, Columbia has been an institution of and for engineers, and, as such, our School has had a long history of educating engineering leaders whose contributions have influenced the lives of the world's citizens." Calling them the future of the School, he told the assembled students that they can impact lives as significantly as such famous alumni as Pupin, Parsons, Armstrong, and others who have preceded them. Go to *www.engineering.columbia.edu* to read the speech and see the video of Dean Peña-Mora's remarks.

PHOTO BY EILEEN BARROSO

The Return of the First-Year Beanie

Dean Feniosky Peña-Mora reestablished the tradition of the first-year beanie as he stood at the door of Havemeyer Hall and personally welcomed each of the 315 members of the SEAS Class of 2013 to their first 9 a.m. orientation session. The first-years were surprised, and delighted, by the warm greeting, firm handshake, and gift of the first-year beanie. Noting that wearing a beanie was a return to a tradition going back to the late 1800s, Peña-Mora told the students it was no longer a "requirement," but he hoped students would use it as an opportunity to build community among class members.

In the spirit of the welcome, the students doffed their beanies for a photograph and enthusiastically applauded the dean as he unexpectedly leapt into the air.

Jocelyn Wilk of Columbia University Archives says that beanies were proudly worn as symbols of a first-year's distinctive position on campus. "At one time, the wearing of the beanies was mandatory," she notes. "The 1927-28 Columbia Blue Book contained rules: the requirement to wear the first-year cap at all times, and a notation that rule-breakers would be 'summarily dealt with.'"

PHOTO BY EILEEN BARROSO

Giving Back: Stanley Dicker, EngScD '61

Dr. Stanley Dicker received his EngScD in mechanical engineering from Columbia SEAS in 1961. Shortly thereafter he began his long and varied career in the health care field. Presently, he owns and operates two nursing homes, a health homecare business, an adult day care center, an ambulatory surgical care center, and a comprehensive care center. He has dedicated his philanthropy to combining his interests in engineering and health care.

In 1996, he endowed the Stanley Dicker Professorship in Biomedical Engineering, held by Van C. Mow, founding chair of SEAS's Department of Biomedical Engineering. He later established two scholarships for undergraduates majoring in biomedical engineering in honor of his father and mother, the Jack Dicker Scholarship and the Freda Dicker Scholarship.

Dr. Dicker explains his strong connection to Columbia SEAS, noting, "When I became a graduate student at SEAS, I had a family with two young daughters that I needed to support. SEAS helped me find a position as a research engineer at Columbia which allowed me to complete my doctoral studies.

"When I became able to do so, I decided to give back to the School that had made my education possible. I first created a professorship in biomedical engineering and later two scholarships for undergraduates. I am very proud to hear Dr. Mow introduced as the Stanley Dicker Professor of Biomedical Engineering; and I am always happy to meet and speak to the very talented students that my scholarships support. I am overwhelmed with the depth of knowledge the students possess and how well they articulate themselves to explain their interests in pursuing their careers.

I am very grateful to Columbia for helping me and affording me the opportunity to create the professorship and scholarships."