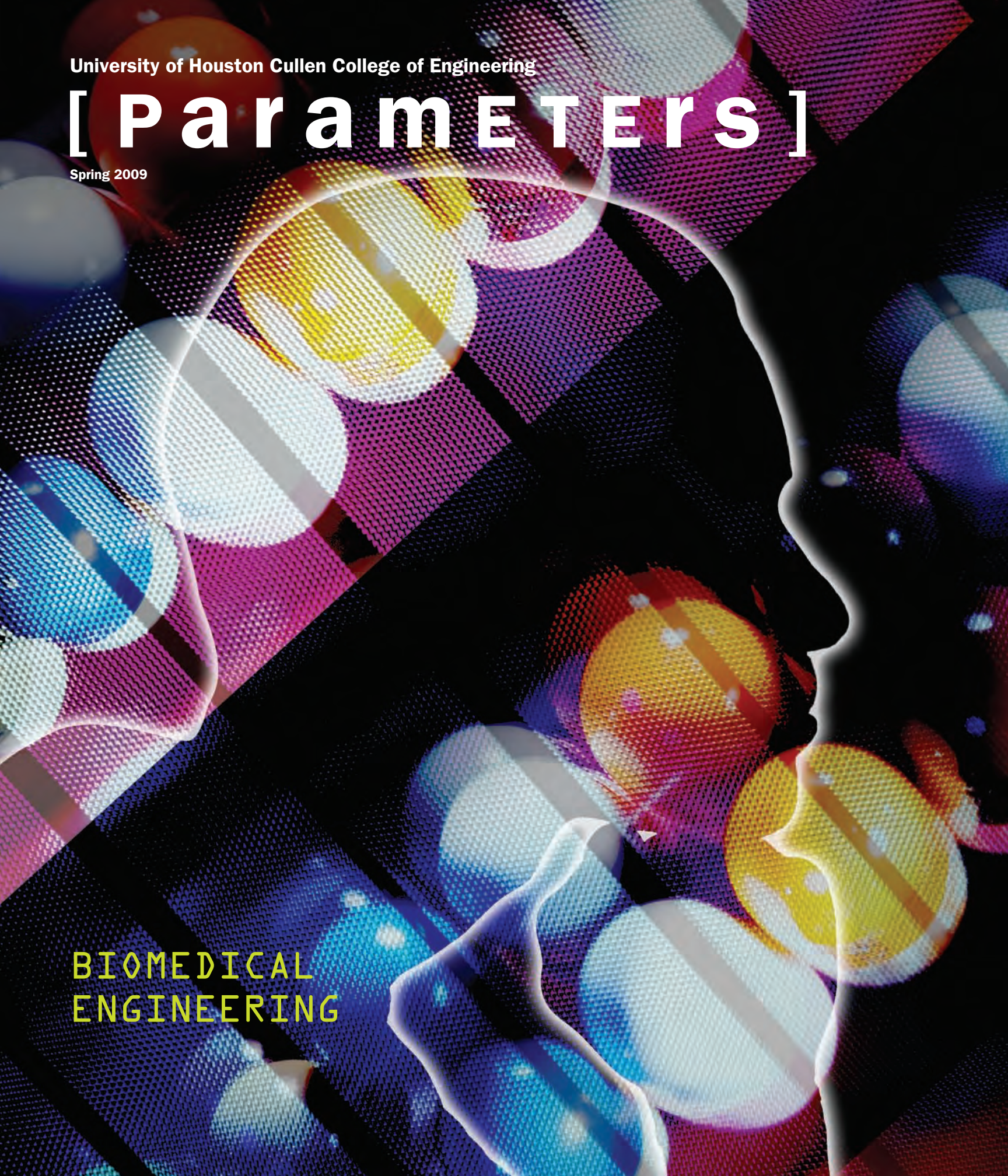
University of Houston Cullen College of Engineering

[ParamETERS]

Spring 2009



BIOMEDICAL ENGINEERING

PHOTO BY THOMAS SHEA

Biomedical research will undoubtedly be one of the core areas of scientific study and advancement in the foreseeable future. Until we fully understand the body—and how to engineer biological systems—medical researchers across the globe will continue working to uncover clues at the atomic and cellular levels to provide a roadmap for disease detection and treatment. Indeed, of the 14 areas awaiting engineering solutions in the 21st century—as identified by the National Academy of Engineering's Committee on Grand Challenges—three clearly fall in the purview of biomedical engineering: engineer better medicines, reverse-engineer the brain and advance health informatics.

Capitalizing on our proximity to the Texas Medical Center, the largest medical complex in the world, the University of Houston has launched a robust health initiative in an effort to generate widespread support for the biomedical sciences. In recent months, UH has made substantial progress toward this initiative through the formation of a new biomedical engineering department in the Cullen College of Engineering, and the appointment of world-renown hormones researcher Jan-Åke Gustafsson in the UH College of Natural Sciences and Mathematics. Both developments demonstrate the university's commitment to—and the state's support for—rapid growth in biomedical-related research and academic programs in Houston. We are excited to be part of this initiative.

Furthermore, this issue of *Parameters* explores some of the interdisciplinary biomedical engineering research projects currently underway at the college. Supported by research grants from the National Science Foundation and the National Institutes of Health, Cullen College researchers are developing technologies to better understand how to detect and treat a multiplicity of life threatening conditions in the human body. They are collaborating on these projects with scientists across campus and at the Texas Medical Center, further building research partnerships to engage some of the most challenging problems presented by medical science.

In this issue we also share stories on how some of our student organizations are reaching out to the community to make a difference. Whether mentoring high school students or working on initiatives for Third World countries, Cullen College students are actively involved in serving the needs of others and we are very proud!

Warm regards,

Joseph W. Tedesco

Joseph W. Tedesco, Ph.D., P.E.
Elizabeth D. Rockwell Endowed Chair and Dean

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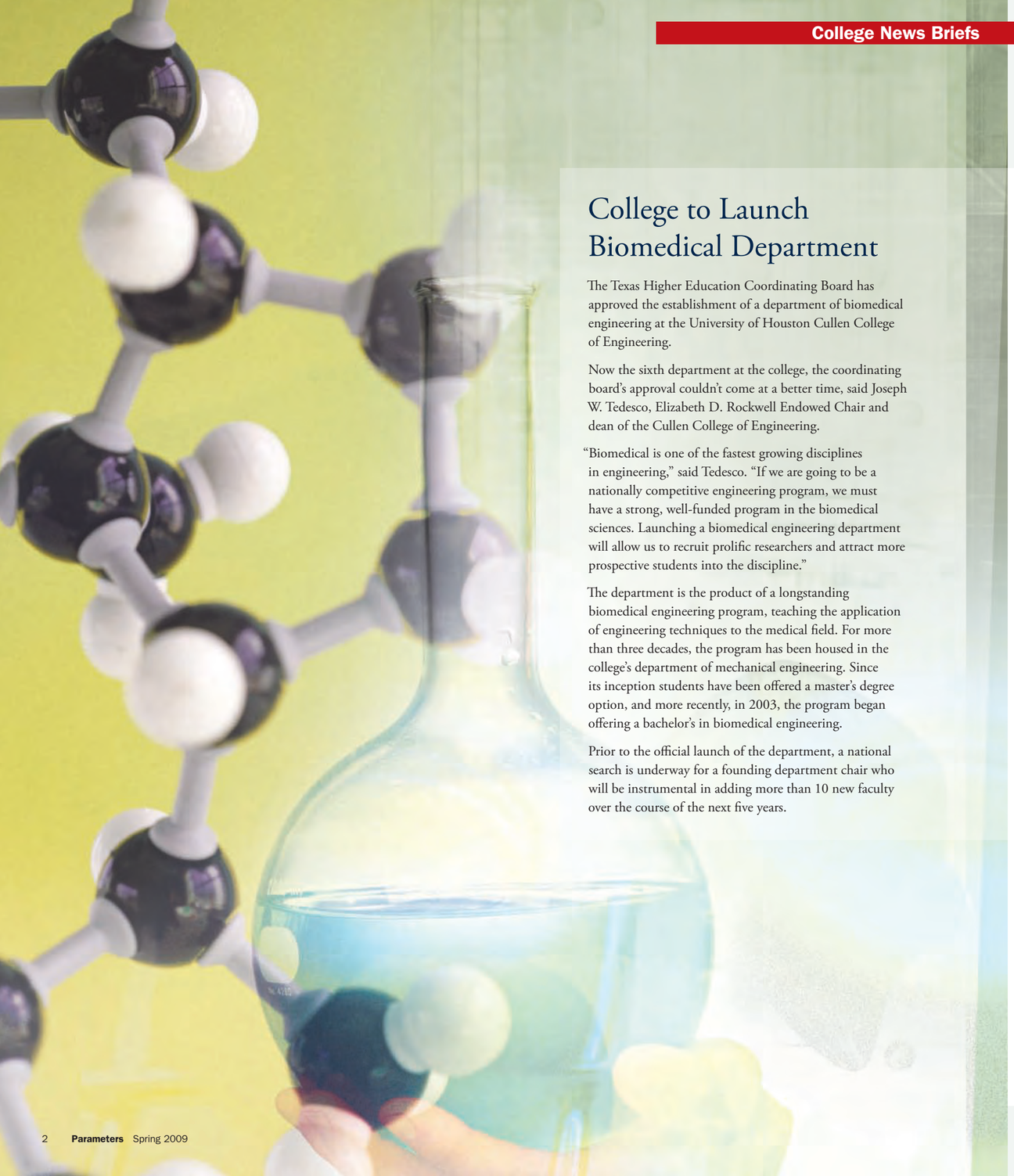
FEATURES

BIOMEDICAL: A BRIGHT FUTURE FOR ENGINEERING

ON THE COVER

Biomedical Engineering is advancing rapidly and producing important innovations that improve our quality of life. From drug delivery and biofiltration to tissue and neuro-engineering, UH engineers are committed to the advancement of education and research that will help unravel some of medicine's mysteries.



College to Launch Biomedical Department

The Texas Higher Education Coordinating Board has approved the establishment of a department of biomedical engineering at the University of Houston Cullen College of Engineering.

Now the sixth department at the college, the coordinating board's approval couldn't come at a better time, said Joseph W. Tedesco, Elizabeth D. Rockwell Endowed Chair and dean of the Cullen College of Engineering.

"Biomedical is one of the fastest growing disciplines in engineering," said Tedesco. "If we are going to be a nationally competitive engineering program, we must have a strong, well-funded program in the biomedical sciences. Launching a biomedical engineering department will allow us to recruit prolific researchers and attract more prospective students into the discipline."

The department is the product of a longstanding biomedical engineering program, teaching the application of engineering techniques to the medical field. For more than three decades, the program has been housed in the college's department of mechanical engineering. Since its inception students have been offered a master's degree option, and more recently, in 2003, the program began offering a bachelor's in biomedical engineering.

Prior to the official launch of the department, a national search is underway for a founding department chair who will be instrumental in adding more than 10 new faculty over the course of the next five years.

Multi-Million Dollar NSF Grant to Support Science Enrichment Program

University of Houston researchers received a nearly $3 million grant in March to support an initiative aimed not only at enriching the education of university graduate students, but engaging area schoolchildren and teachers in physical sciences.

Dubbed the Innovations in Nanotechnology and NanoSciences, the program is intended to address a lack of proficiency in the sciences among middle and high school students—a growing trend in the United States—by helping educators connect with their students. And the program, in part, will use UH engineering graduate students to do so—challenging them to learn ways to articulate their complex areas of study to larger audiences.

Launching this summer, the program will pair graduate students with teachers from nine schools across the Greater Houston area to teach nanotechnology and nanoscience topics using examples from popular culture. This will include the use of elements from the Harry Potter novel series.

"Electrical resistance, or lack of it, can be motivated by levitation scenarios in Harry Potter," said Pradeep Sharma, Bill D. Cook Associate Professor of Mechanical Engineering and lead investigator. "A simple demonstration of magnetic levitation is planned to illustrate the numerous flying apparatus—broomsticks, cars and buses—seen in Harry Potter."

Sharma is partnering with co-investigators Fritz Claydon, associate dean for administration and research; Stuart Long, professor of electrical and computer engineering; Hanadi Rifai, professor of civil and environmental engineering; and Eugene Chiappetta, UH professor of science education, on the five-year National Science Foundation grant.

Grant to Fund New Electromagnetic Compatibility Center

In an effort to reduce electromagnetic interference in electronic devices, engineering professors at UH and the Missouri University of Science and Technology are launching the Center for Electromagnetic Compatibility.

Through the center, researchers will assess the design of everything from wireless enabled laptops to pace makers—increasing their reliability and reducing susceptibility to interference. The center, with sites at both universities, will be funded with a five-year, $600,000 National Science Foundation grant as well as $300,000 added yearly support from industry for each university.

Nanoengineering Minor Proposed

To help facilitate a transition into the era of nanoscale-integrated systems, University of Houston professors are developing a nanoengineering (NEMO) minor slated to be an option at the college as early as this fall.

A $200,000 National Science Foundation grant is expected to fund the cost associated with the start of the program. The minor will integrate the three courses on nanoengineering already taught at the college with new courses in a structured nanoengineering curriculum.

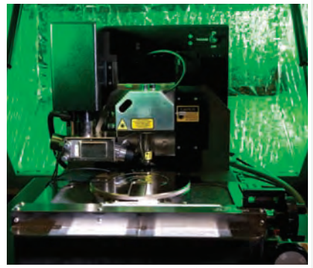


PHOTO BY THOMAS SHEA

ORIGINAL PHOTO BY THOMAS SHEA

Petroleum Undergraduate Degree Program Approved

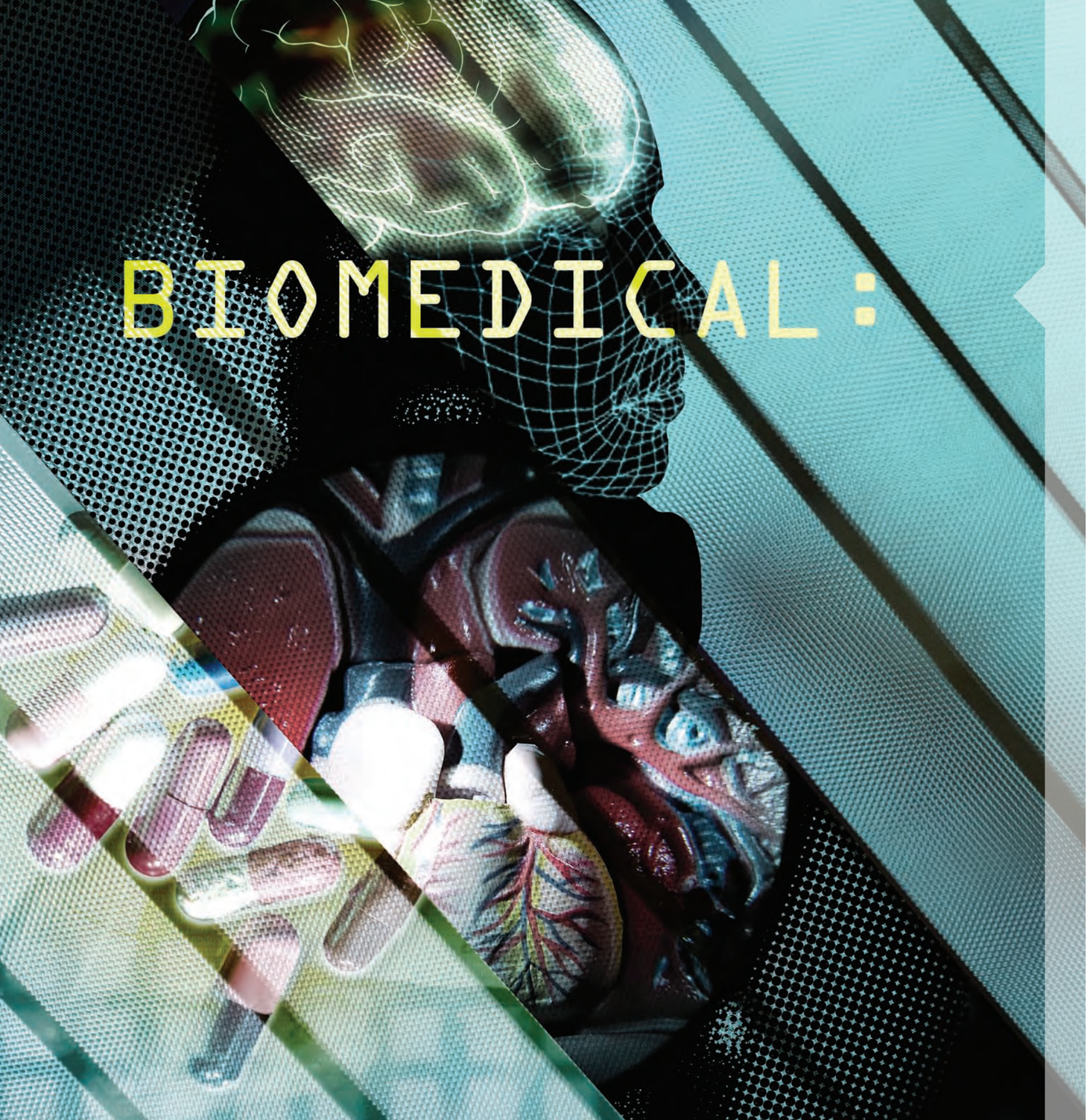
The Texas Higher Education Coordinating Board has approved an undergraduate degree option in petroleum engineering, which is slated to start this fall.

The program will focus on petroleum engineering and geosciences combining these fundamentals with economics, energy law and business.

"Launching an undergraduate program in petroleum engineering is a significant step toward meeting the workforce needs of the energy industry," said Joseph W. Tedesco, Elizabeth D. Rockwell Endowed Chair and dean. "The demand for the petroleum industry has never been greater, and we are now situated to better serve our energy-centered region as well as our nation."

The Society of Petroleum Engineers projects 40 percent of the industry's workforce will reach retirement age next year. That, coupled with growth in the industry and a national decline in the number of students pursuing degrees in technical fields, has businesses scrambling for talent.

The program, along with a pre-existing master's degree program, will not only work to fill the gaps in the workforce, but also arm graduates with the skills necessary to respond to the continually changing energy industry.



A Bright Future For ENGINEERING

Features by Erin D. McKenzie. Photos by Thomas Shea. Photo illustrations by Harriet Yim.

A need for more sophisticated medical technology and procedures to detect and treat diseases are among the factors attributing to what the U.S. Bureau of Labor Statistics calls a rise in demand for biomedical engineers. Second only to environmental engineering, the field is expected to see faster than average job growth—a 21 percent increase through 2016.*

The University of Houston Cullen College of Engineering is expanding to meet this demand by establishing a department of biomedical engineering. During the next five years, the college plans to hire more than 10 biomedical faculty and grow its graduate research program in the biomedical sciences.

An outgrowth of a longstanding biomedical engineering program, the department will continue to capitalize on college-wide biomedical research partnerships with researchers at the nearby Texas Medical Center, the largest medical complex in the world.

Through grants funded by the National Science Foundation and National Institutes of Health, UH researchers are taking on some of the biggest technological challenges related to the heart, mind and body.

What follows are just a few studies faculty from across disciplines and colleges at UH are collaborating on as they strive to create new technologies for the rapidly-developing field of biomedical research.

* U.S. Bureau of Labor Statistics

H E A R T

A University of Houston researcher is refining a testing method that may reduce the number of deaths attributed to cardiovascular disease.

The leading cause of death in the country, cardiovascular disease claimed one life every 37 seconds last year, according to the National Center for Health Statistics. The absence of an effective method for early diagnosis has made trimming the high number of fatalities daunting—allowing the disease to hold the top spot for years.

This could all change with an imaging tool Kirill Larin, assistant professor of biomedical and mechanical engineering, is developing to equip doctors with a better way of detecting the deadly disease at its onset.

"The objective is to develop a novel, functional imaging method for ex vivo (outside the body) assessment of molecular diffusion in vascular tissues," said Larin. "The application of this novel technique could make the early diagnosis of vascular abnormalities possible and bring us closer to fully understanding the pathology of major cardiovascular diseases."

As the lead investigator on the project, Larin is partnering with Joel Morrisett, the director of the Atherosclerosis and Vascular Biology Research Training Program at Baylor College of Medicine, and Alan Lumsden, professor and chair of The Methodist Hospital's Department of Cardiovascular Surgery. Their research is being funded by a one-year, $100,000 grant from the Institute for Biomedical Imaging Sciences.

Like many other studies underway, the team is working to clarify what exactly causes the disease. There is speculation a person's susceptibility to the ailment may not simply be an artery's degree of exposure to LDLs, or the bad cholesterol causing plaque to buildup on artery walls.

The makeup of the walls and the rate at which they are permeated, Larin said, may also play a role.

The study will look at the permeability rate in arterial walls, exploring whether molecular substances of varying weights have an influence. The researchers will monitor this in both healthy and diseased tissue, using a technique based on Optical Coherence Tomography (OCT).

Similar to an ultrasound, OCT uses infrared light rather than sound to create images. Light reflects off of tissue and is captured by a detector. Image analysis software then combines the signals from the reflected light to form an image in real time with a resolution up to a few micrometers.

"Since the OCT technique measures the in-depth light distribution with high resolution, changes in the in-depth distribution of tissues optical properties are reflected in changes in the OCT signal," Larin said. "Thus, one can monitor and quantify the diffusion process by analyzing the change in the OCT signal slope."

Unlike existing methods for detecting cardiovascular disease, such as ultrasound and MRIs, the higher resolution delivered by OCT allows for a deeper assessment of arterial permeability.

The study, he said, would alert doctors to the first signs of danger such as torn and weakening artery walls or beginning calcification.

"Functional images provided by OCT have enabled effective distinguishing of normal and abnormal tissue regions," Larin said. "If permeability could be reliably measured, it could potentially be a sensitive early marker of cardiovascular diseases. We hope this could push the limits of detection, identifying hot spots physicians may need to monitor, and ultimately reduce mortality."

Kirill Larin
Assistant Professor of Biomedical and Mechanical Engineering

M I N D

It is responsible for our every thought, action, feeling and memory.

Yet many things are still unknown about the three-pound mass unarguably labeled the most complex organ in the human body.

Three researchers at the University of Houston Cullen College of Engineering believe their noninvasive transcranial magnetic stimulation (TMS) device may offer the key to unlocking some of its secrets.

With support from a two-year, roughly $400,000 grant from the National Institutes of Health, electrical and computer engineering professors Ji Chen, Ben Jansen and Bhavin Sheth will work to construct a prototype of their TMS device—anticipated to permit more in-depth studies of the brain.

The researchers will adapt the TMS coil system, which has been commercially available for years, into a multi-channel, reconfigurable device. Unlike current models, which use a bulky figure-eight-shaped magnetic coil held over the scalp to stimulate a single area of the brain, their device will offer the ability to selectively target multiple areas of the brain, in rapid succession with short bursts of electrical current.

The focused, rapidly changing currents delivered by the device alter the activity of neural pathways, providing the ability to stimulate or inhibit choice parts of the brain—affecting such things as cognition and perception in a subject. It is used to let researchers probe corresponding changes in a person's behavior.

"The goal of the research is to develop a novel TMS system based on computer-controlled, multi-channel reconfigurable coils," said Chen, lead investigator and associate professor of electrical and computer engineering. "The reconfigurable and parallel nature of the proposed TMS system can flexibly knock out multiple brain regions allowing for novel studies of functional connectivity and network interaction in the brain."

The research team is in the process of filing a patent for the device, which operates as TMS systems to date by using magnetic fields created by the figure-eight-shaped coil to induce electrical currents inside the skull. The difference, however, is the new device will allow the operator to have complete control of the size, location and number of brain areas being stimulated.

"The dynamic, multi-channel TMS device also promises to revolutionize brain studies directed towards understanding behavior," said Jansen, professor of electrical and computer engineering. "And owing to its dynamic reconfigurable nature, may also prove to be more effective in the treatment of a variety of psychiatric and behavioral disorders than present TMS technology."

For years researchers studying treatments for brain injuries, stroke, psychiatric disorders and epilepsy, have used this technology. Late last year, the U.S. Food and Drug Administration approved TMS for use in treating depression.

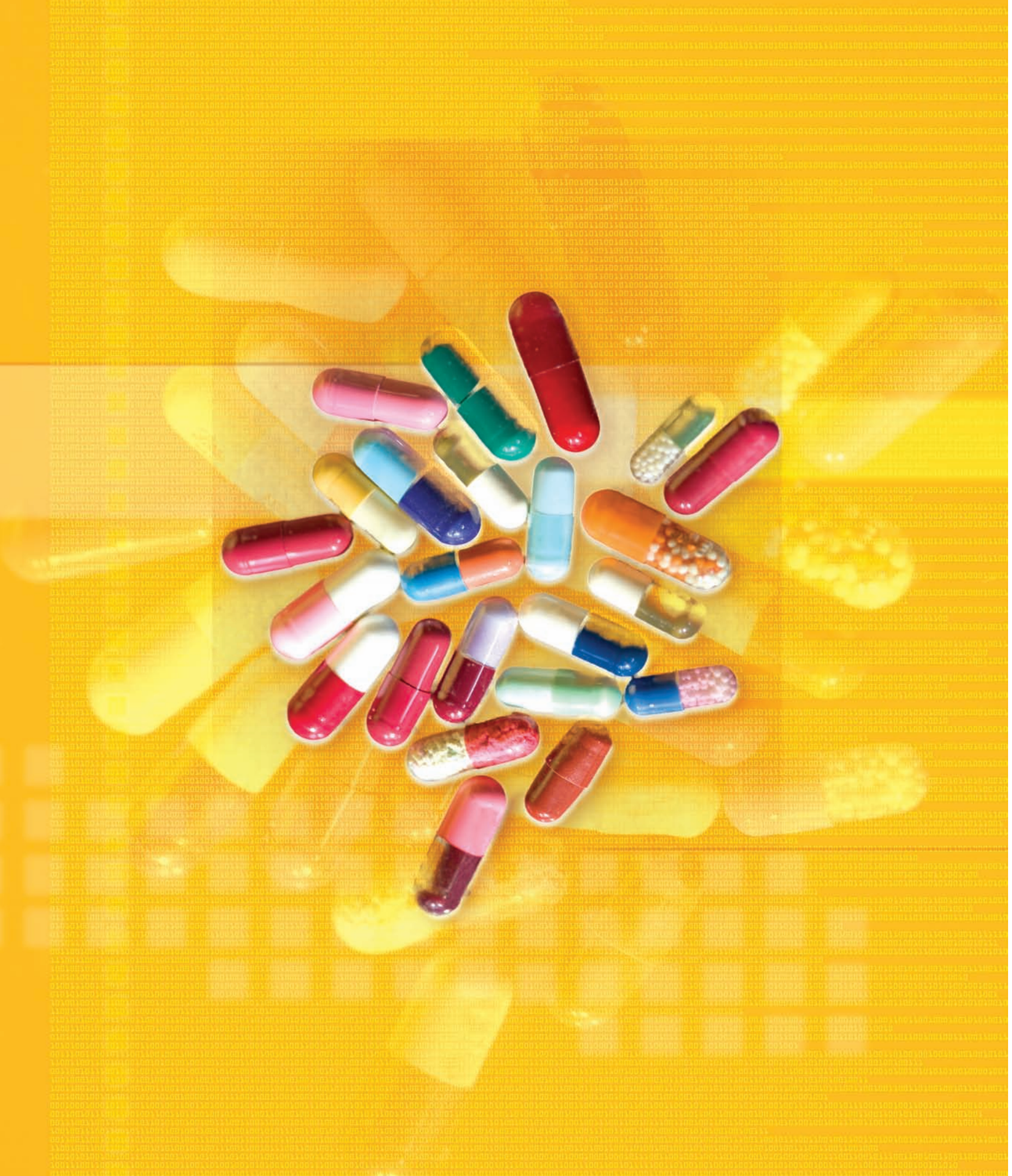
Introduction of the reconfigurable TMS device could further impact these studies, according to the researchers, by providing a better overall understanding of how the brain functions.

"There is simply not the equipment to study the brain in-depth in any sufficient way right now," said Sheth, assistant professor of electrical and computer engineering. "This device would allow us to look at function in a more detailed way, both spatially and temporally, and help determine how information flows to the brain. It could be very significant as far as understanding how the brain works."

Ji Chen
Associate Professor of Electrical and Computer Engineering

Ben Jansen
Professor of Electrical and Computer Engineering

Bhavin Sheth
Assistant Professor of Electrical and Computer Engineering



B O D Y

Bacteria best beware.

University of Houston researchers are developing a computer-modeling system expected to aid in the fight against bacteria's resistance to antibiotics.

Addressing one of the most pressing public health concerns, the tool would give the glory back to these once hailed miracle drugs by revolutionizing not only the speed new antibiotics are made, but also the way they are prescribed.

"All pathogens have developed resistant strains to practically all antibiotics," said Michael Nikolaou, professor of chemical and biomolecular engineering at the UH Cullen College of Engineering. "We are in a tight race with bacteria, and frankly they are winning. The computer-modeling system could help change all this."

Research by Nikolaou and Vincent Tam, associate professor in the UH College of Pharmacy, is supported by a three-year, $400,000 grant from the National Science Foundation. The pair is among researchers around the world exploring ways to stay one step ahead of these superbugs.

Not unlike how a computer model may help forecast a hurricane's path, their computer-modeling system would assist in predicting exactly how the infection-causing bacteria might respond to antibiotics.

The tool would allow scientists to input data from lab experiments into the system to be analyzed through the use of advanced algorithms that would ultimately offer them guidance about a drug's potential for success. The system would even provide information related to dosing regimen—the frequency, duration and amount that must be taken of a drug to achieve the best killing power.

"The need for accelerating the process of developing new medications is so dire that any help is going to be valuable," Nikolaou said, "so potentially cutting years off the development of an antibiotic is a huge step forward."

The rate at which new antibiotics are developed has declined significantly in recent years, making it harder to fight resistant strains. From 2003 to 2007, just four new antibiotics made it to market, according to the Infectious Diseases Society of America. That's down from 16 during the same time span 20 years earlier.

"The traditional testing of drugs is a very brutal, old-fashioned trial-and-error approach," said Tam of the process drugs must undergo before the U.S. Food and Drug Administration approves them to enter the market. "It can easily take a decade or more to develop."

The modeling system would reduce the number of real-world experiments necessary to test the effectiveness of new drugs, cutting years and millions off the cost of their development.

"The lower cost and accelerated process may be seen as an incentive by drug companies, and may make more of these companies take on developing antibiotics," Tam said. "Every year we can shave off this process, and make drugs available to the public, is a huge benefit."

Michael Nikolaou
Professor of Chemical and Biomolecular Engineering

Vincent Tam
Associate Professor in the UH College of Pharmacy

PHOTO BY THOMAS SHEA

Manolis Doxastakis

Title:
Assistant professor of chemical and biomolecular engineering

Education:
Ph.D., chemical engineering, University of Patras, Greece

Career Overview:
Doxastakis joined the UH Cullen College of Engineering in January 2008. Previously, he was a post-doctoral fellow at the University of Wisconsin-Madison where he built upon his doctoral research on polymer melts, blends and copolymers. Specifically, he studied polymer-colloid mixtures in the protein limit, and bilayers and liposomes as models of cell membranes. He investigated the dynamics and thermodynamics of the model systems by using a combination of molecular simulations and neutron scattering experiments to develop a better understanding of the complexity of polymer-induced protein aggregation and cryopreservation of biologicals.

Research Interests:
The study of equilibrium structures and dynamics of polymers, lipids and proteins using novel computational methods

Applications:
Drug delivery by designed nanoparticles, biosensors based on model lipid membranes, cryopreservation of biologicals

Current Research Projects:
He is evaluating the molecular factors controlling the association of protein molecules in lipid membranes, as well as designing multiscale simulation methods for free energy calculations in complex systems.

Laboratories:
The Research Computing Center and the Molecular Materials Science Laboratory at UH

CHEMICAL AND BIOMOLECULAR ENGINEERING

Demetre Economou was awarded the Plasma Prize from the Plasma Science and Technology Division of the American Vacuum Society.

Ramanan Krishnamoorti was named chair of the UH Department of Chemical and Biomolecular Engineering. He was also named a fellow of the American Physical Society.

Peter Strasser's fuel cell catalyst research was among less than a dozen highlighted as a CBET Nugget by the National Science Foundation.

CIVIL AND ENVIRONMENTAL ENGINEERING

Ashraf Ayoub was appointed chair of the ACI/ASCE 447 committee "Finite Element Analysis of Reinforced Concrete Structures," a joint committee between the American Concrete Institute and the American Society of Civil Engineers.

Shankar Chellam received a 2008 Excellence in Review Award from the *Environmental Science & Technology* journal.

Dennis Clifford has been selected to deliver the Association of Environmental Engineering and Science Professors lecture at the American Water Works Association's Annual Conference and Exposition in June.

ELECTRICAL AND COMPUTER ENGINEERING

Ji Chen's paper titled "Development of the First Chinese Electromagnetic Human Model and its use for SAR Calculations" received a best paper award at the 2008 Asia-Pacific Microwave Conference. He co-authored the paper with researchers from The Chinese University of Hong Kong.

Ovidiu Crisan was named a Life Senior Member of the Institute for Electrical and Electronics Engineers. He has been a senior member of the organization since 1973.

Stuart Long served as interim dean of The Honors College at the University of Houston for the fall 2008 semester. He now continues to serve as the associate dean of undergraduate research at UH and The Honors College in addition to faculty fellow at The Honors College.

Haluk Ogmen's book *Experimental Phenomena of Consciousness: A Brief Dictionary* received a Choice Outstanding Academic Title Award from the American Library Association. He co-authored the book with Bruno Breitmeyer, professor of psychology at UH, and Talis Bachman, professor of psychology at the University of Tartu, Estonia.

MECHANICAL ENGINEERING

Yi-Chao Chen was elected chair of the Society for Natural Philosophy, an organization that seeks to unify mathematical and physical science research.

Fazle Hussain was appointed China Ministry of Science Distinguished Visiting Professor at Peking University from 2008–11. He also gave the keynote lecture at the 12th Asian Congress of Fluid Mechanics in South Korea as well as the Fluid Mechanics Sectional Lecture at the 2008 International Congress of Theoretical and Applied Mechanics in Australia.

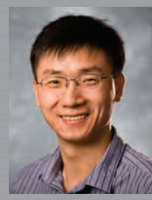
Karolos Grigoriadis was invited to speak at the International Workshop on Fixed-Point Methods for Inverse Problems in Science and Engineering at the University of Alberta, Canada. He was also an invited plenary speaker at the 6th International Congress on Mechatronics Engineering in Monterrey, Mexico.

Pradeep Sharma is the recipient of the 2009 Thomas J.R. Hughes Young Investigator Award from the American Society of Mechanical Engineers.

David Zimmerman was named by the French Government laboratory INRIA/IRISA to serve on their 2008 Habilitation a Diriger des Recherches board.

New Faculty

Liping Liu



Title:
Assistant professor of mechanical engineering

Previously:
Postdoctoral scholar, California Institute of Technology

Education:
Ph.D., aerospace engineering and mechanics, University of Minnesota

Research:
Computational methods for variational inequalities in multiscale problems, shape/structure optimizations, modeling of multifunctional and multiferroic materials

Yashashree Kulkarni

Title:
Assistant professor of mechanical engineering

Previously:
Postdoctoral researcher, University of California, San Diego

Education:
Ph.D., applied mechanics, California Institute of Technology

Research:
Multiscale simulations and micromechanics-based modeling

Gila Stein

Title:
Assistant professor of chemical and biomolecular engineering

Previously:
Postdoctoral researcher, National Institute of Standards and Technology

Education:
Ph.D., chemical engineering, University of California, Santa Barbara

Research:
Polymer thin films, self-assembly, dynamics at surfaces and interfaces, diffusion in polymer films, optical and electron-beam lithography, alternative nanofabrication techniques, x-ray scattering

In Print

Sickle Cell Anemia

Peter Vekilov, professor of chemical and biomolecular engineering, is attempting to uncover the fundamental mechanisms of sickle cell anemia. The goal of his studies is to highlight processes in the polymerization of sickle cell hemoglobin, the primary pathogenic event in the pathophysiology of the disease, which would act as targets of novel treatment strategies. Featured on the cover of the October 2008 issue of the *AIChE Journal*, Vekilov provides new insights into the nucleation and growth of sickle cell hemoglobin fibers.

How Invention Begins

John Lienhard's book *How Invention Begins* (Oxford, 2006) was recently published in a Japanese edition. In it, Lienhard tells the story of invention and how thousands have applied their collective genius to create many of the most well known technologies—the airplane, steam engine, printing press and even the doughnut. Lienhard is professor emeritus of mechanical engineering and history at UH, and he hosts the nationally recognized Engines of Our Ingenuity public radio program.

Distinguished Researcher Captures Prestigious Caltech Award

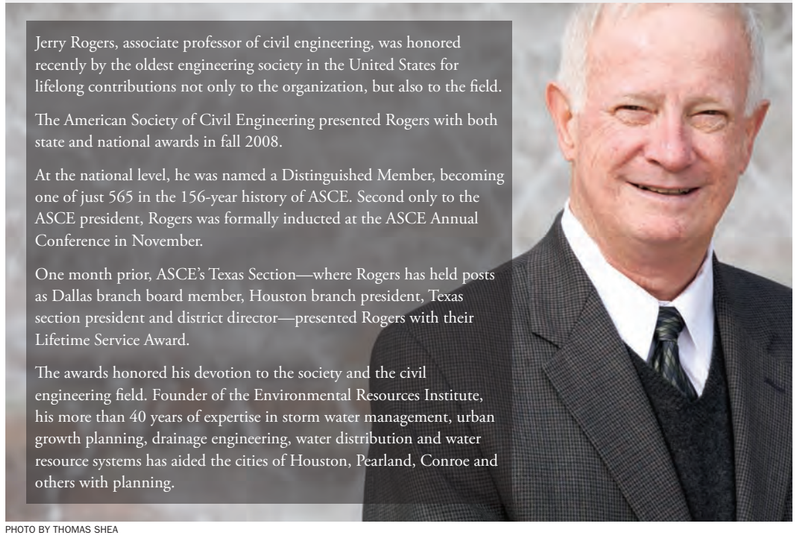
PHOTO BY THOMAS SHEA

For six months this year, Fazle Hussain will spend time giving seminars and aiding in research alongside California Institute of Technology faculty as a Moore Distinguished Scholar.

Hussain, the Hugh Roy and Lillie Cranz Cullen Distinguished Professor of Mechanical Engineering at UH, is the sole recipient of the Gordon and Betty Moore Distinguished Scholar Program appointment for the 2008-09 year in the division of engineering and applied sciences. The program invites researchers of exceptional quality, who are distinguished at both the national and international level, to visit Caltech to give seminars and collaborate on research.

Hussain has served the Cullen College for more than 35 years. During this time he has been recognized with four of the highest awards in fluid mechanics, named a member of the National Academy of Engineering and most recently was elected to the board of directors for The Academy of Medicine, Engineering and Science of Texas.

Professor Honored by ASCE



Jerry Rogers, associate professor of civil engineering, was honored recently by the oldest engineering society in the United States for lifelong contributions not only to the organization, but also to the field.

The American Society of Civil Engineering presented Rogers with both state and national awards in fall 2008.

At the national level, he was named a Distinguished Member, becoming one of just 565 in the 156-year history of ASCE. Second only to the ASCE president, Rogers was formally inducted at the ASCE Annual Conference in November.

One month prior, ASCE's Texas Section—where Rogers has held posts as Dallas branch board member, Houston branch president, Texas section president and district director—presented Rogers with their Lifetime Service Award.

The awards honored his devotion to the society and the civil engineering field. Founder of the Environmental Resources Institute, his more than 40 years of expertise in storm water management, urban growth planning, drainage engineering, water distribution and water resource systems has aided the cities of Houston, Pearland, Conroe and others with planning.

PHOTO BY THOMAS SHEA

NFL Supported Gene Therapy Study
Intended to Benefit Athletes

PHOTO BY THOMAS SHEA

A treatment being developed by two University of Houston researchers could allow athletes playing in the National Football League a faster return to the field after injury.

With the support of a $118,693 grant from the National Football League Charities, professors Daniel Martinez and David Zimmerman will investigate the use of gene therapy to repair the medial collateral ligament—one of four ligaments critical to the stability of the knee joint.

"The ultimate goal of gene-based delivery is to produce therapeutic protein in sufficient quantity at the appropriate site to promote a physiological response," said Martinez, lead investigator and associate professor in the UH Department of Health and Human Performance and the Cullen College's biomedical engineering program. "If ligament healing could be accelerated with a non-pathogenic IGF-1 gene therapy treatment in lieu of total reconstructive surgery, or used as a supplement to reconstructive surgeries, then the time to complete healing and tissue remodeling would reduce the time off the field for the athlete and prevent residual inflammatory tissue diseases."

Martinez is partnering with Zimmerman, professor of mechanical engineering, on the 18-month grant. It is among 17 projects funded with $1.5 million from NFL Charities, given last year, to support sports-related medical research.

The experimental therapy—expected to allow injuries to connective tissue to heal stronger, healthier and more rapidly—would combine the use of self-complementary adeno associate virus with insulin-like growth factor (IGF-1), a gene the body produces normally to heal wounds and grow tissue.

STUDENT ORGANIZATION SERVICE PROJECTS

Kevin Shih, a sophomore biomedical engineering major, sorts medical supplies for Project Cure.

PHOTO BY THOMAS SHEA

At the University of Houston Cullen College of Engineering, students are enriching their classroom experience through service work. From mentoring youth to promoting healthy lifestyles, these students are working with more than 20 professional organizations and student groups to impact communities nearby and across the globe. What follows are just a few examples of exactly how Cullen College students are making a difference.

Aiding Needy Hospitals Overseas

Sick people thousands of miles away, in part, have University of Houston engineers to thank for the sterile syringes delivering their medicine and the donated ultrasound machines allowing them to see their babies for the first time.

Through a partnership with Project Cure, a longtime nonprofit organization, students from the UH Biomedical Engineering Society have worked to improve medical care in Third World countries by better equipping health care providers overseas with the tools to fight disease.

"There are many ways of reaching out," said Dominique Lim, a junior biomedical engineering major and president of the Biomedical Engineering Society. "Project Cure is just one of them, but it's close to my heart."

Lim, a native of the Philippines, saw first hand the ill-equipped, understaffed hospitals that would sometimes go without water or electricity for weeks in her country, just southeast of mainland Asia.

"The destinations of Project Cure have the exact same hospital conditions I remember," she said. "Since I have seen these conditions, I very much understand the need and appreciation."

What started as a summer internship for Lim in 2008 quickly developed into regular trips to the Project Cure warehouse for the entire UH Biomedical Engineering Society.

Each month, the group devotes time to sort donated medical supplies and test equipment. One of four facilities operated by the charity, Project Cure ships two 40-foot containers of supplies weekly to hospitals and clinics in more than 120 of these needy countries.

For John Wilson, a junior biomedical engineering major, his experience with the charity has helped him learn a little more about life outside the Lone Star state.

"It has opened my eyes," Wilson said of the service work. "I never knew the conditions of hospitals in Third World countries. It's nothing like what's around here—some of the biggest and best medical facilities. It makes you realize how many things we take for granted in America."

Reaching Out to Hurricane Ike Victim

More than half a dozen volunteers from Women in Engineering-UH dedicated a day in October to gut the flood-ravaged home of a Galveston-area woman who lost almost everything to Hurricane Ike.

Wearing ventilator masks to protect them from mold that had begun to grow in the home a month after the storm's landfall, the UH volunteers scooped mud-soaked belongings and uprooted soggy carpet from the home overlooking Galveston Bay.

The group teamed with CORE Alliance, an organization formed three years ago by two Houston-based churches to aid in relief efforts following Hurricane Katrina. It was a partnership that allowed the woman, who could not afford to pay contractors, to return to her home.

PHOTO BY THOMAS SHEA

Educating Youth About Engineering

The University of Houston PROMES Action Committee (PAC) brought fun and games along with education to more than 60 juniors at Cesar E. Chavez High School.

In an all-day February outreach event, the UH group shared information about different engineering disciplines, applying for college and financial aid. Later in the day, these high school students' retention of the morning discussions were tested as teams of the teenagers were pitted against each other in games based on popular game shows such as Jeopardy and Hollywood Squares.

Connecting Students to Math, Science

With the aid of Shell Oil Company, members of the University of Houston Society of Hispanic Professional Engineers (SHPE) became one of almost 80 organizations across the nation to host the annual Jets TEAMS academic competition.

The event brought more than 100 students from nine area high schools to UH to take a test intended to help them make a real-world connection between math and science by discovering the engineering involved in designing, building and running America's theme parks. Between the tests, SHPE also sponsored an activity challenging them to construct a roller coaster.

Inspiring Future Generations

For the last three years, the University of Houston Chapter of the Society of Mexican American Engineers and Scientists (MAES) has devoted six weeks to teaching high school students to build a fully functional robot capable of competing with their peers as part of the national program FIRST Robotics.

This year, their efforts motivated two of the 18 high school seniors to pursue a UH engineering degree, and won MAES first place and a $1,000 prize in the Engineering Alumni Association's annual outreach competition. MAES plans to use the winnings to purchase laptops for the two upcoming UH students.

Rodrigo Feliu Outstanding Senior

Rodrigo Feliu (2008 BSME) packed for little more than a week when he made the decision to leave his New Orleans apartment in 2005 to flee any possible ill effects of Hurricane Katrina.

But just days after making it to Houston, the reality of the destruction in his city set in and the University of New Orleans sophomore was forced to make a tough decision. He could put his education on hold and try to pick up the pieces later in the Big Easy or rebuild his life in Houston.

"After evacuating to Houston, I learned the University of Houston was admitting displaced students without charging out-of-state fees," said Feliu, whose university back home remained closed weeks after the hurricane struck in August. "The city wasn't even open. The offer was pretty good and just a couple months after the move, I was hired by SBM Atlantia as an intern. Due to the internship and the vast amount of engineering opportunities in the area, I decided to stay in Houston."

One of more than 70 displaced students to enroll at the UH Cullen College of Engineering, it wasn't long before Feliu began standing out from the crowd—juggling internships while maintaining a perfect grade point average.

In January, Feliu was recognized by the college as one of two individuals who exemplify the model student—intellect, commitment and strong character. He joined a select few to be named the college's outstanding senior.

"I'm really honored to be chosen for this award," Feliu said. "It feels like a good payoff for all my hard work."

In his lifetime, the 29-year-old has had to overcome much more than a natural disaster to get his education.

At the age of 17, his family moved to Louisiana from Mexico City, Mexico. In an attempt to keep up in a high school educating students in a language foreign to him, Feliu worked long hours at night with his father to master English. Upon graduating, he spent several years waiting tables and bartending before he had the money and the mettle to pursue his college degree.

In December 2008, Feliu graduated summa cum laude with his bachelor's degree in mechanical engineering.

Now he's challenging himself again, honing in on completing his master's in mechanical engineering within a year. He is hopeful the two degrees, coupled with knowledge from internships at Baker Hughes and SBM Atlantia, will prepare him for a post in the growing petroleum industry and solidify his place in the city he has called home for more than three years.

Joshua Kovitz Outstanding Junior

Joshua Kovitz has been working to satisfy a curiosity to understand how things work nearly all his life.

As a young boy it is what fueled the hours he would spend tinkering with electronics, and later prompted him to learn to play both the bass and acoustic guitar in his early teens.

The fascination launched long sessions to grasp computer code and led him to offer technical support for a friend's web design business.

So at 18, when he was accepted to the University of Houston, it was only logical the Texas native would put his natural curiosity and problem solving skills to the test and pursue a degree in engineering.

Now three years into the program, he has no doubt he made the right choice and neither does the college.

Earlier this year, the UH Cullen College of Engineering named the electrical engineering major the outstanding junior for the 2008–09 academic year. He is one of two recognized for the award, given annually to a stand out junior and senior.

"I really enjoy what I do and put a lot of effort into school," said Kovitz. "I've kept on pushing, pushing, pushing and now it's kind of like I get the award I feel I worked really hard for."

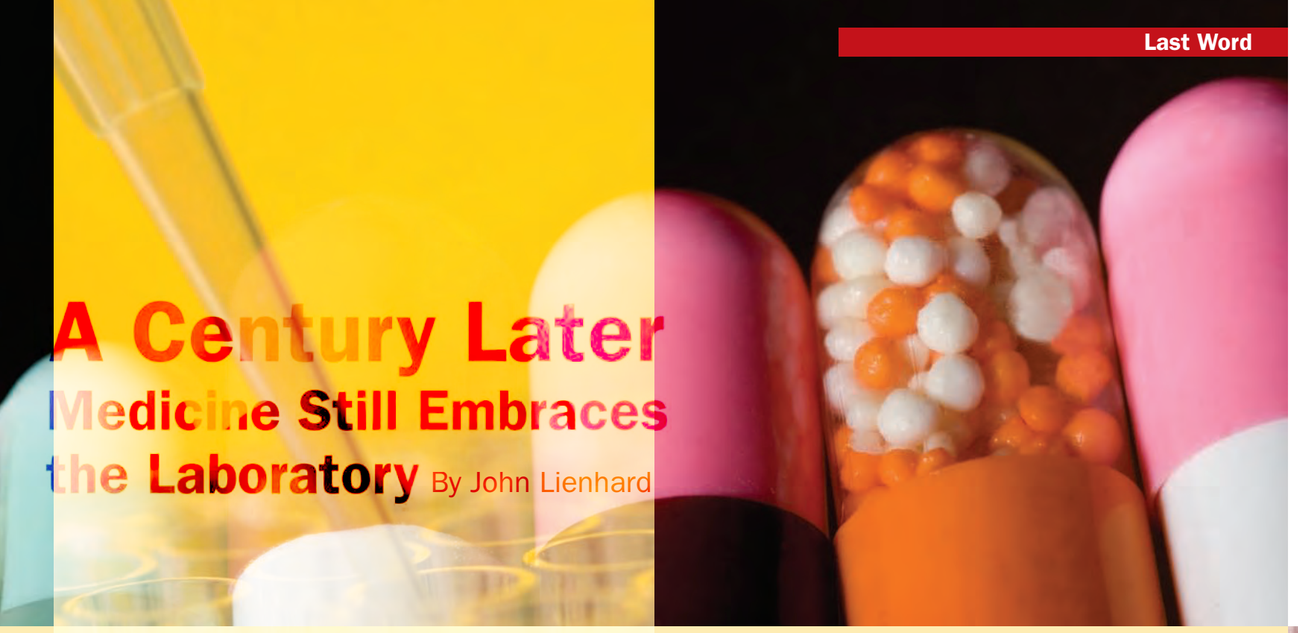
Kovitz has made the dean's list every semester and The Honors College dean's list twice. He's a member of Tau Beta Pi, the national engineering honor society; The Honor Society of Phi Kappa Phi, the nation's oldest, largest and most selective all-discipline honor society; InterVarsity Christian Fellowship and the Institute for Electrical and Electronics Engineers (IEEE). The 21-year-old, who serves as IT director for the UH IEEE student branch, redesigned the chapter's Web site last year winning the IEEE's regional web design contest.

"Besides an outstanding GPA, Joshua is an active officer in the student branch of IEEE," said Haluk Ogmen, chair of the college's department of electrical and computer engineering. "He also has been working as a proctor in ECE 1331, computers and problem solving, and in that capacity he has made several suggestions that lead to improvements in this undergraduate course."

It's an accomplishment not surprising to most who know Kovitz and the knack for computers and problem solving he has had much of his life. For Kovitz, these accomplishments reinforce just how passionate he is about his major.

"Ultimately, I feel engineering was perfect for me because it allows me to satisfy that desire to look at how, and understand why, things work," he said. "Many people look at their job and just see it as a job. I look at what I will be doing and see it as advancement and development of my knowledge and character."

PROFILES BY ERIN D. MCKENZIE. PHOTO BY THOMAS SHEA.



A Century Later
Medicine Still Embraces the Laboratory

By John Lienhard

The *Journal of Laboratory and Clinical Medicine* reaches its hundredth anniversary in October 2015. But let's look at the first volume of this century-old periodical; for in it lie the seeds of the medicine we've come to expect. The editor says that too many doctors think laboratory work comes from a world alien to good diagnosis. He hopes this journal will bridge that chasm. And as we think about our doctor's offices, we realize how well he succeeded. Here, in embryo, emerges the medicine we take for granted.

Take blood pressure: blood-pressure cuffs had been around for only five years, and they still had to be read with stethoscopes and manometers. Doctors didn't let assistants near them. Now the journal explains systolic and diastolic pressures, and gives only simple interpretations of those readings.

Still, we lay-people today know most of what was being explained to doctors in 1915 except for one interesting point—the blood pressures we talk about are for our arms. Their ranges would be much different if we got them from, say, our thighs.

Once your nurse has your blood-pressure, she'll often want an EKG. That stands for Elektrokardiogramm (as it's spelled in German.) The principle of measuring heart-beats electrically was known, but you didn't see it in a doctor's office. Nine years later Willem Einthoven got a Nobel Prize for making the first practical EKG machine. Its use wasn't commonplace until after World War II.

The journal offers a different method for tracing out the heart's pressure pulse. A mechanical microphone, placed over the jugular vein, yields a graph that resembles EKG traces. It's not as sharp and clear, it's limited to one location, but it does give similar information. And this is all about gathering and processing information—the issue that dominated twentieth century medicine.

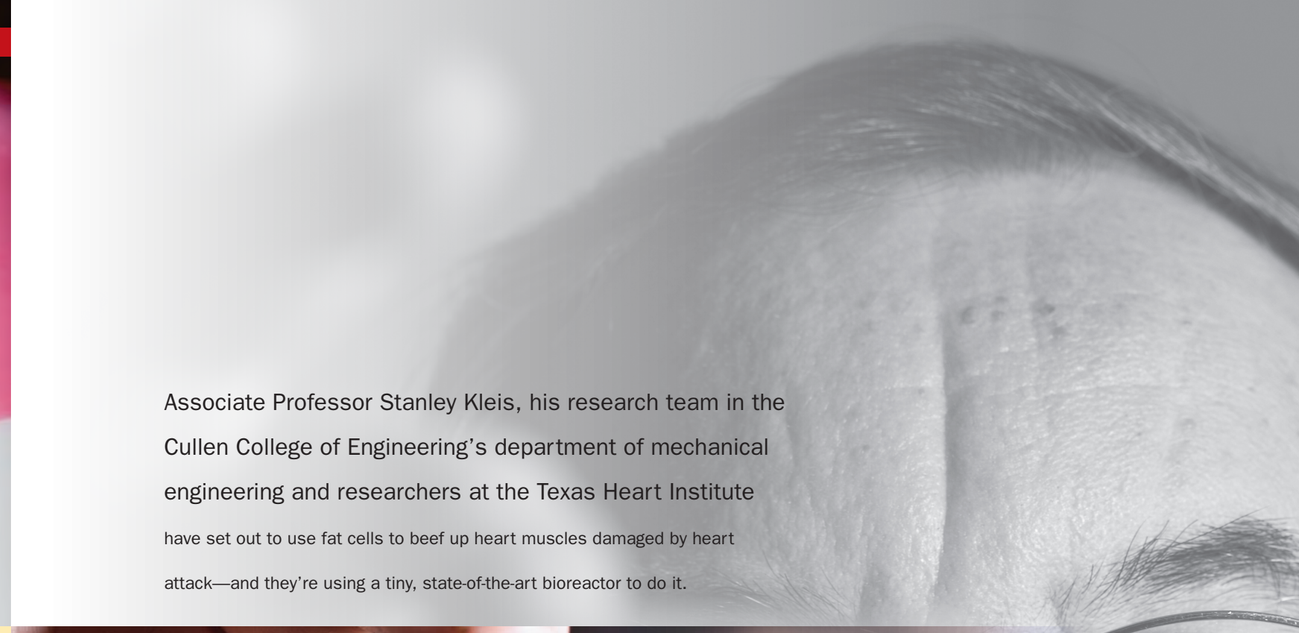
Two articles deal with a poorly understood molecule called cholesterin in Europe, and cholesterol in America. We learn that cholesterol is present in all our cells. It's obviously relevant to pathology, but how? One author notes that it's low in an anemic person's blood. He hints at factors related to arterial sclerosis and obesity. But he finishes by admitting that he cannot reach "any conclusions as to the exact action of cholesterol." In fact, that would take another half century.

Still, it all points out the direction medicine was headed. I suppose it's especially good news that many of these old articles address problems that we now know how to combat—chicken pox, small pox, syphilis, TB, typhoid fever…

Here we have a wonderful view of our world emerging from the studious, curiosity-driven work of so many doctors, a century ago. Why do these old articles seem so prescient? I think it's because their authors focused so clearly—so wisely—on identifying their own ignorance, not on displaying intellectual authority.

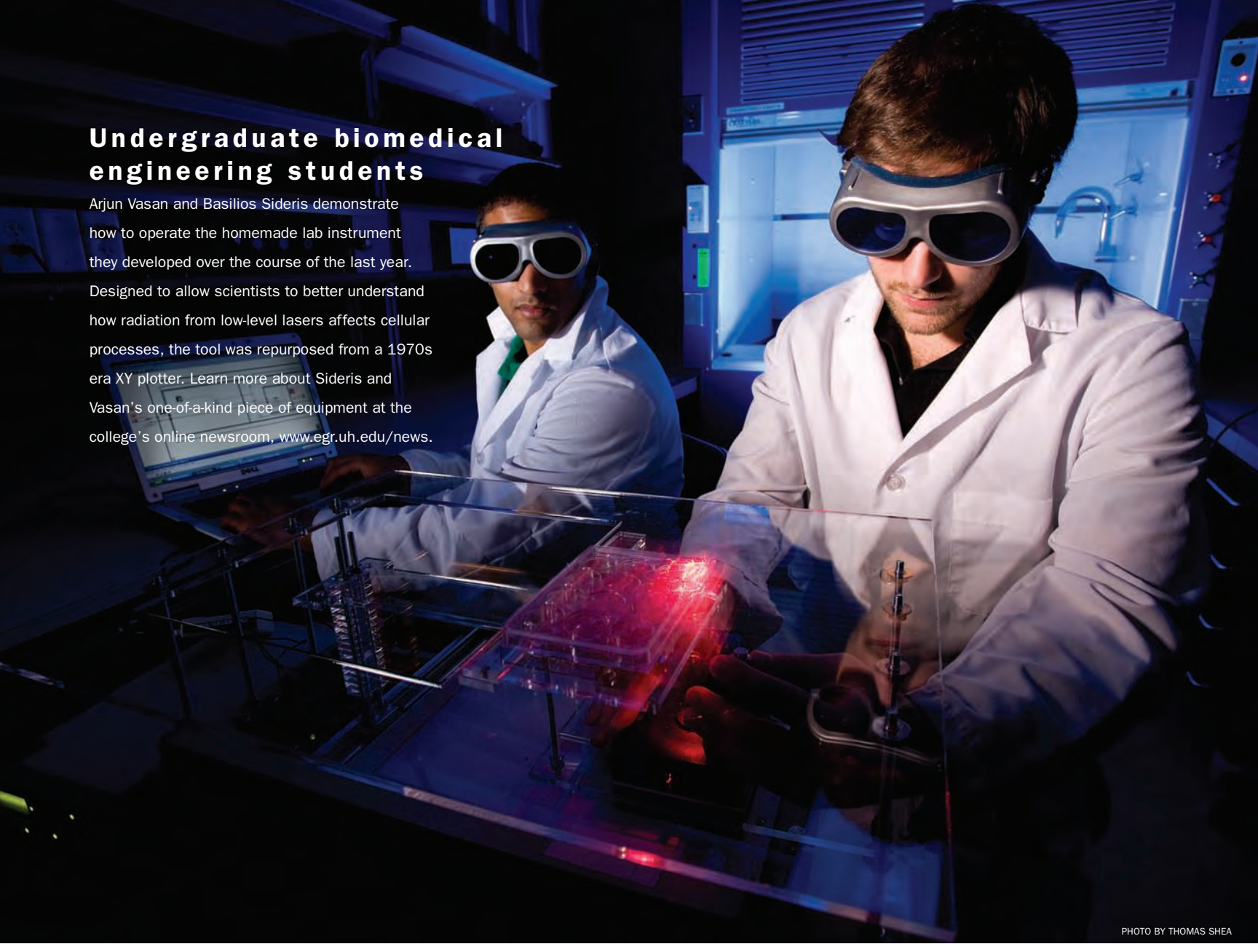
The Engines of Our Ingenuity *is a nationally recognized radio program authored and voiced by John Lienhard, professor emeritus of mechanical engineering and history at the University of Houston. After 20 years on the air, more than 2,450 episodes have run. The program airs at 7:35 a.m. and 7 p.m., Monday through Friday on KUHF-FM 88.7. For more information about the program, visit www.uh.edu/engines.*

PHOTOS BY THOMAS SHEA



Associate Professor Stanley Kleis, his research team in the Cullen College of Engineering's department of mechanical engineering and researchers at the Texas Heart Institute have set out to use fat cells to beef up heart muscles damaged by heart attack—and they're using a tiny, state-of-the-art bioreactor to do it.

Holding the culture chamber, a component of the bioreactor system developed in his lab, Kleis described how the team will use the technology to study how adipose-derived stromal cells (ADSCs), found in fatty tissues, could work as therapy for heart attack patients. A bit like stem cells, the ADSCs have the potential to develop different types of cells and produce chemicals that may protect or rejuvenate heart muscles.



Undergraduate biomedical engineering students

Arjun Vasan and Basilios Sideris demonstrate how to operate the homemade lab instrument they developed over the course of the last year. Designed to allow scientists to better understand how radiation from low-level lasers affects cellular processes, the tool was repurposed from a 1970s era XY plotter. Learn more about Sideris and Vasan's one-of-a-kind piece of equipment at the college's online newsroom, www.egr.uh.edu/news.

PHOTO BY THOMAS SHEA

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