Bionanotechnology: The Edge of Detection
The old adage that change is the only constant has been proven true once again at the UH Cullen College of Engineering. Over the past several months and years, the college has undertaken many changes, all in an effort to bring ourselves to new levels of excellence.

In research and resources, we are responding to the demands of industry and prospective students. While our established programs remain important to the college and community, we are encountering increased interest in programs that revolve around fields of growing importance and prominence, including petroleum engineering and nanotechnology. One of my goals over the coming months and years will be to adjust our offerings to meet these demands.

Fortunately, there are many individuals within the college who already have the expertise in these areas. In this issue of Parameters, in fact, you can read about some of the efforts of faculty members in the emerging field of bionanotechnology. The research performed by Richard Willson, Kirill Larin and Peter Vekilov, among others, could radically alter the way in which diseases are detected and diagnosed in the human body.

The makeup of the college’s faculty has changed, as well, growing significantly younger in recent years. In fact, about one-third of our faculty members joined the college within the last six years, for the most part replacing faculty who retired or left for other reasons. One of these individuals is Pradeep Sharma, assistant professor of mechanical engineering, whose theoretical research in the field of quantum dots is profiled in this issue. By adding outstanding young faculty like Sharma, the college has taken an important step in ensuring its continued excellence for years to come.

In addition to the faculty, the college is in the process of updating its infrastructure. The old Y-building was put up as a temporary structure more than 60 years ago and is well past its prime. I’m happy to report that we have contracted an architect to design plans for a new engineering building to be located in the Y-building’s place. This new facility will offer students and professors the most modern laboratories and classrooms available and will serve as home for the college’s many student organizations.

Of course having plans for a new building and having the means to make that building a reality are two distinct things. To that end, we are in the process of establishing a leadership committee to oversee the fundraising efforts for the construction of this new facility. I’d ask that you keep this in mind as you consider your charitable gifts over the coming months.

Finally, I want to note one change that leaves us with a little less than we had before. Frank Tiller, the first dean of the Cullen College of Engineering, passed away earlier this year at the age of 88. He was instrumental in establishing the conditions for the college’s future successes, including greatly upgrading the faculty’s educational levels and raising funds for the college’s first permanent building. He’ll be most missed for the impact he had on those who worked with him, though. When I was just an assistant professor at UH, Frank served as an unofficial mentor to me, giving generously of his time and wisdom, and I know he filled the same role with him, though. When I was just an assistant professor at UH, Frank served as an unofficial mentor to me, giving generously of his time and wisdom, and I know he filled the same role with many other faculty members and students over the years. He was a pillar of this college and he will be deeply missed.

Sincerely,

Raymond W. Flumerfelt
Elizabeth D. Rockwell Endowed Chair
While the finding will play a significant role in gaining a better understanding of diabetes, it is also the third mechanism of crystal formation ever discovered. The finding is significant enough, in fact, to have been showcased on the cover of the Feb. 7, 2006 issue of Proceedings of the National Academy of Sciences, one of the world’s leading scientific journals.

Since insufficient insulin production in the pancreas is one of the primary causes of adult-onset diabetes, Vekilov and Georgiou are studying the process of how insulin is produced. Understanding how the body creates this hormone, Vekilov said, will make it easier for researchers to discover why some individuals do not produce enough insulin and thus develop diabetes.

Specifically, the two have focused on the creation of insulin crystals, the form in which insulin is stored in the pancreas before it is released in the bloodstream.

“It is possible that the insulin deficiency happens when the crystals don’t form properly and then part of the insulin that is produced gets destroyed,” Vekilov said.

It has long been known that proinsulin, a molecular precursor to insulin itself, is the basis of these crystals. After an insulin molecule is produced from proinsulin, it attaches to an insulin crystal only in special locations where other insulin molecules have formed right angles, called kinks.

Using atomic force microscopy, Vekilov and Georgiou discovered a new mechanism by which insulin molecules attach themselves to crystals to form these kinks. Groups of insulin blocks, they found, create large protrusions, dubbed mounds by Vekilov and Georgiou.

The very nature of these mounds results in the creation of multiple kinks—far more, in fact, than the other methods of kink formation. By providing so many spaces where insulin molecules can attach to an insulin crystal, mounds allow for the rapid growth of that crystal.

Interestingly, these mounds only form when there is a surplus of insulin that allows for rapid crystal growth. This is noteworthy because, in addition to growing at kinks, insulin crystals dissolve at kinks. Since no mounds appear when there is a lack of insulin, mounds are, in effect, important sources of a crystal’s net growth.

“Typically in nature, [a mechanism that enables] fast growth also results in fast dissolution,” said Vekilov. “But this process keeps physics because when there isn’t a lot of insulin, mounds don’t form. It’s an asymmetric mechanism.”

While this discovery is important to the field of diabetes research, it should also have a major impact on the study of crystal formation. Before this finding there were only two known ways that crystals grow.

The first was proposed in the 1870s by Josiah Willard Gibbs, the father of modern physical chemistry and the first person to receive a doctorate in engineering in the United States. Russian Physicist V.V. Voronkov proposed the second mechanism in 1968. This is only the third mechanism ever discovered.

It is possible, said Vekilov, that crystals composed of materials other than insulin also grow in this manner. If so, this discovery could significantly impact any number of fields that deal with crystals.

“This is a new mechanism of crystal growth, which can help us understand all processes of crystal formation, including semiconductor and optical materials, geological crystal formation, ice formation, and the physiological and pathological crystallization of proteins and small molecules,” said Vekilov.

Assistant Professor Julie Tenor is pictured with several WELCOME students, including (front) Kristy Reddock, Sharon James, Jessica Mathias, Erna Holley, Texas Diet, Tanka Elzaki, Vanessa Arizan, Judy Rodriguez, Savita Ghetel, (back) Cris Cavazoz, Ciri Coccotto, Rachel Imers, Shatice Rupert, Akshaya Kady, Dllas Avakio, Althea Ohaka, Lauren Page, Andrea Valturewicz and Titi Ottum.
The world is shrinking. Telephones are carried in pockets or purses and thousands of songs can be squeezed onto an MP3 player the size of a deck of cards. For the most part, these technologies provide the same tools as before, just in more convenient packages.

This is not news. But there are areas where miniaturization still holds revolutionary potential; bionanotechnology is one of them. The medical application of nanotechnology promises to change the very nature of healthcare, largely through the creation of early diagnostic and detection systems that will alert doctors when potential dangers are found.

The source of this potential lies in the unimaginably small scale in which nanotechnology operates. Nanodevices typically range in size from just a few to several dozen nanometers, a nanometer being one-billionth of a meter. By operating at that size, biomedical nanodevices can alert people to the presence of disease on the molecular level, when it first appears in the human body. This can be long before a patient begins to show any symptoms of a disease and long before it can develop into a significant problem.

The sooner a disease is discovered and diagnosed, the sooner it can be eliminated. By addressing health concerns at this stage of development, nanotechnology provides patients with one of the biggest advantages in medicine: time. Since nanotechnology is an emerging field of science, many of its principals and possibilities are still being discovered, and the earliest efforts on the bionano front revolve around disease detection and diagnosis.

Like the Homeland Security Advisory System, the inspiration for this illustration, many advancements in bionanotechnology provide threat information to key decision makers. Researchers at the University of Houston Cullen College of Engineering are working toward developing technologies that will ultimately alert patients and doctors when dangers are detected within the human body.

Bionanotechnology: The Edge of Detection
Features by Toby Weber & Ann Pearson
Photos by Jeff Shaw

The world is shrinking. Telephones are carried in pockets or purses and thousands of songs can be squeezed onto an MP3 player the size of a deck of cards. For the most part, these technologies provide the same tools as before, just in more convenient packages.

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Researchers at the University of Houston Cullen College of Engineering are working on several bionanotechnology projects that will have major impacts on the areas of clinical diagnoses and biosafety. Such projects include the development of an extremely small chip that can be implanted under a patient’s skin that will alert doctors to the presence of any one of hundreds of thousands of diseases long before the first symptoms appear; a nearly foolproof tool that can remotely detect the presence of toxic gases or bioterrorism agents such as anthrax; and tests for cancer and other diseases that produce results in a matter of hours, not days.

While these technologies are not direct cures, the speed and accuracy with which they detect disease is astonishing. And until actual cures are found, scientists will continue to work diligently toward the fastest, most accurate means of detection, providing people the chance to live longer, healthier lives.
The vast scientific and medical knowledge accumulated in the last quarter century has opened new doors for disease diagnosis and control. Researchers now have the ability to work in the nano realm, a world so small that individual molecules can be manipulated not only to detect disease and other foreign agents immediately, but also to develop unprecedented measures for treatment and prevention. The ability to recognize the specific molecular structures of pathogens, viruses and DNA sequences is critical in this process.

Richard Willson, professor of chemical engineering and professor of biochemical and biophysical sciences at the University of Houston, has spent nearly two decades working to identify and analyze individual proteins, DNA molecules and disease organisms, a research area known as molecular recognition. For instance, Willson and his team are able to determine if a particular antibody or DNA molecule will consistently bond with a disease-causing virus or toxin, and to characterize the speed and energetics of the association. If the research can prove that this bond is formed on a regular basis, then scientists can harness the molecular recognition for diagnostic or treatment purposes.

In an application funded by the Homeland Security Advanced Research Projects Agency, Willson is working with Yuriy Fofanov, assistant professor of computer science at UH, (who Willson says has developed “the world’s best algorithms for exhaustive searching of genomes”) and George Fox, professor of biology and biochemistry and professor of chemical engineering, (who co-discovered the Archae, one of the three classes of living things on the Earth) to identify and validate specific DNA probes for organisms of biodefense interest. In other words, if the research identifies a specific DNA probe sequence that will bond to the anthrax virus, and officials fear anthrax is present in an area, researchers could use that DNA probe to verify or disprove the presence of the disease, enabling authorities to take appropriate measures quickly, if necessary.

“Biological molecules can be amazingly good detectors, capable of recognizing one type of bacterium or virus in the presence of its closely-related cousins, or a particular genetic sequence out of millions,” said Willson. “The air in Houston and every major U.S. city is routinely monitored for bioterror agents and a false alarm is just unacceptable in a civilian application.”

Willson and his team are working to understand the structural and energetic basis of specific interactions between molecules in order to make these interactions useful in medical diagnostics, purification and biodefense. Specifically, Willson’s research revolves around characterizing and improving the ways detector molecules, such as antibodies and DNA probes, recognize their targets, and using these interactions to purify biomolecules. He will also be working to improve ways in which a detector will recognize its target.
Because of their extremely high detectability, retroreflectors can be utilized as a low-cost diagnostic tool with many possible applications, such as the detection of antibody-targeted colon cancer markers and continuous glucose level monitoring in diabetic patients. Currently, typical diagnostic sensors and the equipment that read the output signals are relatively bulky and expensive, making continuous monitoring of biomarkers impractical outside a laboratory setting. Working in the nano realm allows researchers to produce a more readable, more accurate signal from an extremely small sensor, allowing doctors and patients to gain a more complete understanding of the disease or condition being treated.

In addition to retroreflectors, Willson is working with atomic lithography pioneer Wolfe and Dmitri Litvinov, associate professor of electrical and computer engineering, to develop a nanomagnetic sensor array capable of detecting single molecules using the sensor technology at the heart of high-density magnetic disk drives like that in the iPod. While the biomolecular recognition technologies today can carry out genome-wide profiling of clinical specimens, they require relatively large samples, which are often not readily available, especially in medical applications. Researchers currently have a critical need for new technologies that enable clinical specimen analysis of ultra-small samples.

The micro-retroreflectors designed by the team for biomedical purposes will be only a few micrometers wide (smaller than a red blood cell), which will allow the biological sample doctors need for analysis to be very small. For long-term monitoring uses, the micro-retroreflectors could be designed as a non-intrusive implant that displays the needed signals through the patient’s skin or in a pill form for ongoing diagnoses in real time.

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In a separate application funded by the Alliance for NanoHealth, Willson’s research is particularly focused on dramatic advancements in magnetic disk data storage technology, as represented by Litvinov, who has successfully implemented a number of nanomagnetic concepts in commercial magnetic data storage systems. These concepts can be integrated into a practical sensor array with extremely high densities of individually addressable sensors.

Specifically, the sensor array will be comprised of a million giant magnetoresistive (GMR) sensors, all housed in a single square millimeter of space. In a disk drive, one GMR sensor will scan the surface of a disk bearing tiny magnetic domains. In the biomedical sensor, the many GMR sensors detect magnetic nanoparticles that act as labels allowing detection of individually-labeled molecules. Between the nanoparticles and each GMR sensor, Willson’s group will incorporate biomolecular recognition molecules with specific binding capabilities.

In a specific application of NIH interest, the sensor can be used for massive screening of drug candidates for their ability to block interactions involved in disease processes. For example, the sensor array can be decorated with a cell surface protein known to be an entry receptor for a virus such as influenza or HIV. A magnetic nanoparticle bearing one or more copies of the virus’ cell-binding protein will bind to the cell protein and to the GMR sensor, producing a high-quality signal that informs researchers whether the molecules have associated. The sensor array allows the simultaneous testing of an enormous number of drug candidates for their ability to block virus/cell association.

In a separate application funded by the Alliance for NanoHealth, the magnetic nanosensor can be adapted to perform molecular diagnostic assays on clinical biopsy specimens, especially in the molecular diagnosis of cancer. A particular goal is to obtain more useful information from the standard “fine needle aspiration” procedure, which uses a fine gauge needle to sample fluid from a breast cyst or remove clusters of cells from a solid mass. This procedure is widely used in part because it is less invasive than many other methods, but the quantity of sample obtained is too small to be used in many of the most useful molecular diagnostic assays.

The nanosensor will be used to test breast cancer markers including the estrogen receptor (ER). The estrogen receptor is the most important growth factor identified for breast cancer, 50 percent of primary breast cancers in women are ER-positive, while most normal breast tissue and benign breast lesions lack the receptor protein. Hormonal therapies for breast cancer have had a bigger impact on recurrence and survival than any other treatment.

In addition to the National Institutes of Health and the Alliance for NanoHealth, Willson’s research is funded by the Welch Foundation and NASA. Willson’s team is especially well-prepared to capitalize on the synergy of recent advances in nanotechnology, the explosive growth in genomics and proteomics and the unique nanofabrication capabilities at UH. In addition, the college’s strategic location near the world-renowned Texas Medical Center allows further collaboration among the biosciences, engineering and medical disciplines, specifically between researchers at UH and M.D. Anderson Cancer Center, Baylor College of Medicine and the Methodist Hospital.

In addition to his work on magnetic disk data storage technology, as represented by Litvinov, who has successfully implemented a number of nanomagnetic concepts in commercial magnetic data storage systems, these concepts can be integrated into a practical sensor array with extremely high densities of individually addressable sensors.
Lasers and Nanocrystals to Detect Diseases

The system relies on the fact that certain diseases produce biological indicators, or biomarkers, that doctors can use to detect the presence and magnitude of disease. The technique is using laser-based sensing to identify protein biomarkers in human tissue that may identify cancers or bioterrorism agents within a patient's bloodstream in a matter of moments. Currently, doctors and their anxious patients wait up to 24 hours to evaluate cancer blood tests. This technology will initially rely on drawing blood samples from patients, Larin envisions an in vivo (totally inside the body) system to determine the presence or absence of very specific elements in the blood immediately.

The system falls under the field of Biomedical Optics, a fast-growing area of research in medicine. This particular optical method of diagnostic and functional imaging, detection, and manipulation of cells and tissues draws from the expertise of many disciplines. From the engineering side of the collaboration, the laser-based sensing technology works with specially tailored quantum dots, tiny crystals that glow when stimulated by light. The dots emit various light signals from which the researchers can determine the presence of different agents in a blood sample. Once the laser illuminates the dots, a computer generates something similar to a topographical map, indicating the locations of various quantum dots by sets of peaks. Quantum dots that bind to pathogens will emit a different signal than quantum dots that are unattached, allowing researchers to know whether a pathogen exists.

Generally speaking, the quantum dots are conjugated, or coupled with specific substances, to look for specific pathogens. If one of these pathogens is present, then the researchers will be able to tell based on the shape of the emission signal. These dots, which tell the researchers so much about the disease, are usually between 5−10 nanometers in width. In comparison, one human hair is about 80,000 nanometers in width (hair is considered huge in the nano world). Quantum dots are critical to this study because the researchers can conjugate the dots with specific antibodies that bind with certain proteins, such as a particular type of cancer. Sharma studies quantum dots, and his role on the project team is using laser-based sensing to develop methods that first identify and then attack diseases and toxins in the human body before they can even begin their destruction. The real-time, highly specific diagnoses these methods provide will allow doctors and their patients more time to prevent problems from fully emerging instead of trying to cure established disease. Pathogens that cannot establish a foothold cannot damage delicate, irreplaceable body systems. That is big news.

One biomedical and mechanical engineering collaborative research team at the University of Houston Cullen College of Engineering is currently working on a project to develop a highly sensitive, laser-based system that can detect the presence of specific disease biomarkers. The lead investigator on the project is Kirill Larin, director of the UH Biomedical Optics Laboratory and assistant professor of biomedical and mechanical engineering, who has a particular interest in diagnostic imaging, biosensing and microscopy. Larin is collaborating with Matthew Franchek, chair of the Department of Mechanical Engineering and director of the Biomedical Engineering Program, and Pradeep Sharma, assistant professor of mechanical engineering. The research team is confident that the combination of nanotechnology and engineering for biomedical research will result in faster and more reliable test results for doctors and patients trying to determine the next steps of keeping the human body working at its peak.

"This is our way to help people live longer and happier lives," said Larin. "It’s great to be a part of that."

Professor Kirill Larin uses a portable time-domain Optical Coherence Tomography system for spectroscopic imaging of quantum dots in tissue.
The new theory, then, is that processes in the body can be monitored and diagnosed before the first symptoms appear, allowing doctors to start treatment as early as possible and greatly increasing the odds of recovery.

These real-world applications might be the fruit of biomaterials sensing research conducted at the University of Houston Cullen College of Engineering by Peter Vekilov, associate professor of chemical engineering.

Much of Vekilov’s work builds on the efforts of researchers across the world who are cataloging the attributes of some 400,000 proteins, many of which are specific to diseases, or antibody proteins generated in response to disease pathogens: viruses, bacteria, etc. These antibodies are created by the human immune system to fight disease and each binds only with a single matching protein that is characteristic to the disease.

Researchers expect to utilize this information to develop tools that can detect, identify, analyze, catalog and diagnose the proteins in a human tissue or organ. Vekilov’s goal is to create an easily mass-producible tool that relies on the formation of protein/antibody bonds to diagnose hundreds of thousands of diseases. The description of each such tool provides a clear picture of how nanotechnology devices are built, as well as some of the challenges that can be inherent in building them.

Specifically, Vekilov’s diagnostic tool can be produced easily with available semiconductor technologies. Silicon wafers measuring 30 cm in diameter will be divided into up to 70,000 separate sections measuring one square millimeter each. On each section, researchers will place arrays of 100,000 to 500,000 electrodes. From there, the electrodes will allow them to bond with the solution, after which the solution will be rinsed from the arrays. The process will then be repeated hundreds of times using a different antibody each time.

While this general approach has been proven viable, says Vekilov, the real challenge is in making it practical. Dividing a silicon wafer into such small sections isn’t the problem; depositing hundreds of thousands of different protein solutions on a single wafer in a cost- and labor-efficient manner is where the challenge comes in. “We recently developed a procedure to deposit such attoliter droplets of a protein on sub-micron sized electrodes.”

However, with this recently developed procedure, researchers must customize the conditions of the liquid solution in which the antibody proteins will be mixed in order to detect them successfully. Different proteins require their solutions to have a specific temperature or acidity level, for example.

Determining the precise solution properties for each protein would require years of research and millions of dollars. And even if the exact solution for each protein were formulated, using hundreds of thousands of solutions to mass produce arrays would be practically impossible.

“Let’s face it. We can’t do that,” Vekilov states. “We have to develop a general procedure where even if you know nothing about the protein, you’ll still be able to deposit it.”

This problem, Vekilov says, can be overcome by creating a universal solution that can be used in conjunction with any protein.

Vekilov theorizes that this can be accomplished by creating a single solution that masks protein’s attributes that require specific solution properties. A search for suitable agents is underway.

If this theory proves correct, every protein could be mixed with a single solution. This one solution would result in the development and mass production of this diagnostic tool becoming much simpler and more cost-efficient.

The practical result is that even without knowing anything about a protein you’ll be able to deposit it. You won’t have to study it, you won’t have to use different conditions,” Vekilov says.

Once Vekilov devises a solution to mass-produce arrays efficiently, the next question becomes how to deliver them.

There are several possible ways to accomplish this, Vekilov says, each of which could be used for different purposes. For example, an array, which measures just one square millimeter, could be placed in a pill-sized capsule, which by practice measures up to nine square millimeters. The remaining space could be used to house data recording and transmission equipment. A patient would then simply swallow the capsule, which would radio information to a medical professional about any protein/antibody bonds that form.

Alternatively, individuals could have an array embedded underneath their skin that would constantly monitor for the presence of protein/antibody bonds and, in any number of ways, alert the individual should a bond be detected.

These different delivery methods demonstrate the advantages of such a diagnostic system. In pill form, patients experiencing symptoms of an unknown disease or condition can be diagnosed in minutes. An array embedded underneath the skin could serve as an early detection device, alerting at-risk individuals that a disease is present long before symptoms appear.

Will people be able to discover and fight illnesses before their effects are even felt? Is a “smart” pill capable of diagnosing practically any disease in minutes in the near future? Vekilov believes so and is developing tools that will make these seemingly futuristic technologies a reality.
Gerhard Paskusz RETIRES, LEAVES LEGACY IN PROMES

After an illustrious career in academia that spanned more than half a century, Gerhard Paskusz has retired from the Cullen College of Engineering faculty and as the director of PROMES (Program for Mastery in Engineering Studies), the program that has graduated minority students in engineering for more than 25 years.

Paskusz, who joined UH in 1961 after earning his Ph.D. from the University of California, Los Angeles, founded PROMES in 1974 after listening to an address from the then-CEO of General Electric, Reginald Jones.

[Jones] stressed that if we were going to get minorities into the economic mainstream, engineering is the way to go, and so we ought to have programs that get minorities into engineering,” Paskusz said. “Our goals were always to graduate minority students in engineering, and if not in engineering, to make sure they graduated from college because a degree in something was better than nothing.”

The problem was never that minority students were less capable of graduating, but that their prior academic experiences had not been sufficient.

The students who need PROMES come from inner-city schools where higher math courses are not offered,” Paskusz said. “They don’t have the academic background to have a good chance of succeeding.”

One of Paskusz’s remedies was to link PROMES students together through study groups and outside workshops. In addition, the students were grouped together in the same sections of their math, science, and freshman- and sophomore-level engineering classes.

The program, of course, has encountered challenges over the years. The 1996 court ruling on affirmative action in higher education could have spelled the end for PROMES, then called the Program for Minorities in Engineering Studies. Paskusz, however, merely changed “Minorities” to “Mastery” and used the Hopwood case as an occasion to expand the program’s scope.

“This affected the effectiveness of the program because now students were no longer confined to a minority group but are operating in an integrated group to start with, which is obviously helpful for when they go out in industry,” Paskusz said. “The Hopwood case, which was supposed to throw a monkey wrench into the program, has actually helped us.”

The court ruling and financial shortfalls from a lack of outside funding are obstacles that PROMES has overcome in its history and will continue to face. Paskusz said in spite of these ups and downs, PROMES has proven itself a hugely successful program.

“We have the same percentage of students as the College of Engineering on the Dean’s List,” Paskusz said. “Our graduation rates are comparable, and our four-year retention is usually slightly better than that of the college as a whole. Our major accomplishment is that we are able to use the PROMES program’s scope.

At a dinner in honor of his retirement, Gerhard Paskusz celebrated with co-workers and friends. Pictured are (from left to right) flavia Allen, Darwin Gales, Paskusz, Jenny Bennett, Morin Louchet, Manea Mina, Ikuel Deen Ward, Wabbarat, UH Vice President Dyna Lee, Ton Coffman, Richard Price and John Matthews.

(Continued on page 18)
John Lienhard celebrates 2,000 radio episodes, 17 years on the air

“Engineering is presented as detached objectivity; it isn’t,” Lienhard said. “It’s not a science. It’s a technology. Engineering is derived from the notion of using your ingenuity to create. I like to call science, on the other hand, the process of divining the set of matters of fact. One deals with the world as it is, and one deals with the world as it might be.”

Lienhard’s distinctive way of thinking has mesmerized audiences since the program’s inception in 1987. Then engineering dean Roger Echolsch suggested a radio program as a method of raising interest in the UH Cullen College of Engineering. Delighted at the idea, Lienhard immediately drafted three sample scripts and received a commitment from KUHF station manager John Proffitt to begin airing the daily featurettes at 7:35 a.m. and 3:55 p.m.

Since that initial broadcast on Jan. 4, 1988, over 2,080 episodes have aired and the show has been made available nationwide-wide. While Lienhard has invited 10 guests to share their ideas over more than 40 episodes, he has created the vast majority of these shows on his own. The topics have ranged from literature to the arts and to engineering and other technological advancements.

“There are two billion ideas to select from, and that’s probably an underestimate, we live in a very creative world,” Lienhard said. “What I do is float around ideas. I have all of these elements coming together in a funny way. We’ve got this puzzle, and I have to find the story that will pull the disparate items together.”

One of Lienhard’s frequent topics is technology, which he attributes to humankind’s dependence on the advancements it creates.

“We are the only species that cannot survive without technology,” Lienhard said. “We cannot eat meat that we have not killed without devices of some sort whether it be for the farming or hauling of animals. We are the only species that cannot survive the climate without clothing that we have manufactured or homes that are conditioned to be livable for us. We live and die by ‘techs’ (the art and skill of making things).”

Though the show’s subject matter caters to an academic audience, Lienhard said that his focus is to make it accessible for all listeners.

“I write my prose for a listening audience on the seventh grade level, and that makes it accessible,” Lienhard said. “Any number of young adults will say to me ‘my parents turned on the radio when I was a kid going to school and I loved it.’ There’s a difference between speaking a complex language and dealing in complex ideas. I’m not simplifying my ideas to the same level that other public media would, and my audience likes me for that.”

“Being a radio show director, you don’t do much technical writing, and I’m a mechanical engineer by training,” Lienhard said. “I’m more of a scientist, so I think a lot about the way the world works, but I don’t have that much time to think.”

Edward L. Michels, a former mechanical engineering student of Lienhard’s, said, “I enjoyed his stories and found them fascinating.”

“John Lienhard is an inspiration. His approach to teaching engineering is unique,” said Michael Fernandez, a former electrical engineering student of Lienhard’s. “His stories are captivating, and he has a way of connecting with his listeners.”

“John Lienhard is one of the best radio show hosts I’ve ever heard,” said Kevin Weaver, a former computer science student of Lienhard’s. “He has a way of making complex engineering concepts understandable to the average person.”

“John Lienhard is a true genius,” said Richard Willson, a former electrical engineering student of Lienhard’s. “His stories are always thought-provoking and inspire me to think differently about the world.”

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Setting the Stage for Nanotech Breakthroughs

UH Professor Conducts Theoretical Research that Advances Experimentation

By Toby Weber

Scientific breakthroughs are usually portrayed as being achieved by people conducting complicated experiments in equipment-filled labs. While this picture is certainly true at least part of the time, many of the most important discoveries are also made by individuals working with nothing but pencil and paper. These scientists use their knowledge in any number of fields (including mathematics, physics, mechanics and other disciplines) to uncover the nature and potential of new technologies and forms of matter. By revealing how something—from a naturally occurring chemical to a man-made machine—will behave under certain conditions, these individuals, known as theoreticians, provide a framework from which experiments can be designed and their results interpreted.

This is the role filled by Pradeep Sharma, assistant professor of mechanical engineering at the University of Houston Cullen College of Engineering. “For experimentalists, if you have theoretical work, you have a sense of what to expect,” he said. “Even if you get raw data, how are you going to interpret it without theoretical work? So instead of shooting in the dark, experimentalists often like to be guided by theories.”

One area Sharma and his research team are exploring is quantum dots. Quantum dots, which fall under the realm of nanotechnology, are tiny crystals made of semiconductor material that measure just a few nanometers wide (a nanometer is one-billionth of a meter). These dots can be constructed practically one atom at a time in highly specific formations, allowing scientists to tailor the amount of energy they produce and absorb or the wavelength of light they emit.

When used in different ways, quantum dots can impact everything from lighting systems, to medical diagnostics, to bioterrorism preparedness, to data storage for computers. For example, by manipulating the wavelengths of light quantum dots emit, scientists are constructing blue-light lasers that, by their very nature, have smaller wavelengths than standard red lasers. This smaller wavelength allows data on compact disks to be stored in spaces that are physically smaller than the amount of space required by red lasers, thus greatly increasing the capacity of CDs and DVDs.

Sharma and his research team are now using mathematical modeling to predict how quantum dots will react in particular situations and under particular conditions, thus providing other scientists with a framework for performing their own research.

In the case of quantum dots, experimentalists need some understanding of how these nanoparticles will (or, at least, should) behave in order to most efficiently design their experiments, analyze the results and eventually design products. Many times such analysis reveals properties that are not at all intuitive but are present naturally at nanoscales. Experiments are then designed to verify the existence of such characteristics, which might lead to some unconventional applications.

Indeed, Sharma’s theories are currently being applied in research conducted by other researchers at UH. A research team led by Kirill Larin, assistant professor of biomedical and mechanical engineering, is developing a laser-based medical diagnostic tool that utilizes specially tailored quantum dots that reflect light at a particular spectrum when they bond to particular disease proteins, thereby informing doctors of the presence of a disease. (See article on page 12).

Not surprisingly, the process of formulating theories on the behavior of quantum dots is not performed in a typical "lab." Rather, Sharma calls on the qualities he has crafted during his engineering career and his understanding of several different fields, including physics and mechanics, to devise these theories. He then works with his research team, comprised primarily of graduate students, to perform further calculations to determine the accuracy and implications of his ideas.

“Some part of (developing these theories) is creative, some part of it is mathematical knowledge, some part of it is your knowledge of the field. It’s a mixture of things. You have to be knowledgeable and aware of what other people are doing in order to keep up to date,” he said.

Currently, one of the areas Sharma is paying particular attention to is the effect of mechanical strain on quantum dots.

Mechanical strain is simply the physical deformation of an object. When you stretch a rubber band, you are subjecting it to mechanical strain.

In the bulk or macrostate, a material’s band structure is predetermined by nature. If researchers need a specific band structure to perform a task, then they must find another material that offers that property and hope that it meets their other needs, as well.

At the nanoscale, however, variations in size and mechanical strain can change a material’s band structure, in effect setting up a situation where scientists should be able to tune a bandgap to a specific frequency in order to meet their particular needs. This is where Sharma’s work is applied. His theories provide experimentalists with guidelines for applying mechanical strain to a quantum dot in order to attain a specific bandgap or more generally, a specific band structure.

With a tunable band structure, he says, researchers could construct more efficient and sensitive energy sensors that could be used to track missiles or make night-vision goggles, or more powerful lasers that improve data storage or act as tools for diagnosing diseases.

For any of these to become reality, though, the pioneers of experimental research need an idea of what’s possible in the nanorealm, and that is exactly what Sharma gives them.

“Hopefully my work provides some guidelines for experimenters,” said Sharma. “Theory and experiments have to go hand-in-hand.”

Traditionally,” Sharma said, “scientists have held that impact of mechanical strain on the mechanical properties of an object do not change as the size of the object changes.” New research by Sharma and his team, however, shows that mechanical strain impacts materials differently at the nanoscale versus the macrostate, the realm in which most of the world operates.

“In the bulk state, everything averages out,” said Sharma. “As you get smaller and smaller, though, the quantum effects become more prominent.”

These changes in mechanical properties, in turn, impact other attributes of materials. “How do changes in mechanical properties that occur with changes in size affect the electronic properties? That’s what we’re studying. We’re trying to come up with theories that predict those changes,” Sharma said. “More specifically, we are studying the impact of mechanical strain on quantum dots’ ‘bandgap,’ the property that dictates how much energy is needed to make a semiconductor conduct electricity.”

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An educator for more than 50 years, Tiller’s professional legacy alone is almost too full to chronicle. It includes important accomplishments as a professor, administrator, mentor, educational ambassador and researcher. Tying all these together was a man who was passionate about everything in which he was involved.

Tiller, who held a Ph.D. in chemical engineering from the University of Cincinnati, joined UH as engineering dean in 1955 and was instrumental in laying the groundwork for many of its future successes. Reflecting on Tiller’s impact, Raymond Flermeyer, dean of the Cullen College of Engineering, noted that “Frank was responsible for establishing the early leadership and educational foundations of the college, and was responsible for hiring the early department chairs and faculty who led us to emergence to excellence in the 1970s and 1980s.”

In 1955, the college of engineering was a relatively new institution—the college name had only been attached to it in part. As such, the college had only a few faculty members who held Ph.D.s. Remediying this situation became one of Tiller’s most important accomplishments as dean.

Stressing the importance of high-quality instructors and professors, Tiller’s tenure saw the addition of 14 Ph.D.s to the faculty, bringing the total number to 18. Of those 14, 12 Ph.D.s were earned by instructors who themselves went back to school for their terminal degrees, making Tiller’s faculty-improvement campaign a huge success.

Tiller was also instrumental in assembling the physical infrastructure necessary for the college to thrive. During his tenure, he attained the first large computer for the university. More importantly, he secured much of the funding for the first engineering building, which to this day serves as one of the college’s three primary structures.

In addition to helping establish the college as a whole, Tiller’s presence at UH contributed to the rise of the Department of Chemical Engineering.

As a professor, Tiller had an open-door policy, which would often lead to relationships with students that evolved from teacher and advisor to mentor and father figure.

This intense interest and concern Tiller held for those around them was most often applied to and appreciated by his graduate students from overseas. Many of these students would rely on Tiller’s generosity while they were adjusting to life in a new country, to the point that they would often, in fact, stay in Tiller’s home while they secured their own housing.

As Tiller progressed in life, his teaching, research and mentoring activities naturally slowed down. Even then, however, he made efforts to improve UH through financial support. He established an endowed scholarship, made a significant donation to the Juris Durr, Jr. Center for Students with DisABILITIES and established the first charitable gift annuity in the university’s history, which resulted in the Frank M. and Martha R. Tiller Scholarship Endowment supporting undergraduate chemical engineering students.

“Tiller had an extraordinary bond with the university,” said Tiller’s daughter, Fay Bryan. “It was his life, really. He was very committed to improving the quality of the Cullen College of Engineering.”

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“New students, especially foreign students who had just come to the U.S., who had a problem—family issues or financial issues—would be taken care of by Tiller,” said Wu Chen (1986 PhD ChE), who had Tiller as his mentor and father figure.

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UH Engineering Alumna Develops
HAND MIMETIC DEVICE For
Premature Babies, Mothers

BY PORTIA-ELAINÉ GANT

When YAMILE CENDALES JACKSON (1991 BSIE, 1994 MSIE, 2000 PhD IE) gave birth to her son Zachary, he was 12 weeks premature and weighed only one pound, 15 ounces. Now Zachary is a thriving five year old, and Jackson has used her experience to develop a hand mimetic device, the Zaky, which is named after her son, to help premature babies and their mothers feel protected and closer to each other. »
“When Zachary was hospitalized for five months it was devastating for us to see him suffer without being able to do anything. Sometimes he was so sick that we were not allowed to even touch him. We witnessed babies that were sick and not so sick, babies that died, and even babies that were never held or visited by their relatives. At the Neonatal Intensive Care Unit (NICU), I would notice items that were donated to the hospital ‘in memory of’ babies, and it saddened me that there were not many ‘on behalf of’ gifts. Did babies have to die for adults to help?” Jackson said. “So I prayed to God to make a pact with me: ‘If you let us take Zachary home, I’ll help babies.’ The Zaky is the way I found to keep my side of the bargain with God.”

Though the Zaky is not a medical device, Jackson said the idea for the innovative tool did originate with significant input from nurses, doctors, therapists and mothers in the NICU at Memorial Hermann Children’s Hospital in the Texas Medical Center, where the Zaky has been successfully used since 2001.

“There were times when the nurse would place a little beanie baby on top of my son’s back,” Jackson said. “NICU nurses explained to me that when babies are in the womb they stretch, kick and move, and the womb brings them back to the fetal position. That’s why when they are born full-term the mother is taught how to swaddle the baby using towels or blankets. When babies are born prematurely, they can’t be swaddled because they have tubes, IV needles and monitors, so when they stretch as they did in the womb, they are not able to return to that fetal position and it results in stress.”

“The nurses taught me how to reposition him and to place my hand on top to give him boundaries and allow him to feel close to me. It couldn’t be patting or rubbing because these provide too much stimulation. This method of comforting by touching him with my hands and giving him boundaries when I could not hold him on my chest was very effective; however, I was not allowed to stay every night, and the nurses were caring for other babies simultaneously. I had to find a way to help my son and help me with my feelings of separation when I could not be there,” said Jackson.

Jackson said she noticed that in the mother’s absence, nurses improvised with rolled up t-shirts or towels or even a beanie baby.

Currently, Jackson runs Zakeer from her home to maximize her time with Zachary. The Zaky can be found in baby stores, pediatrics offices and hospitals in the United States, Canada, Latin America and Europe, and Jackson and Zachary handle their web site sales personally.

“It try to involve Zachary as much as possible,” Jackson said. “When we get an online order, he goes and gets the Zaky. We package it together and he puts it in the mail. He understands that the Zaky is going to help a mother and her baby.”

For the work she is doing with babies, Texas Can, a non-profit organization that works with young mothers, presented Jackson with their Motherhood Lifetime Achievement Award in 2005. The Zaky also received the Gold Award from Family Review Center in 2006 for its distinct design, appeal and purpose.

In addition to spending time with Zachary, Jackson also maintains her first company, Ringstones Consulting International, Inc., offering project management, construction management services internationally in English and Spanish.

“I knew I wanted to be an industrial engineer since I was 14. My father was an engineer, my mother has a Ph.D. in history, and she taught me that I could be anything I wanted to be if I worked hard enough,” said Jackson, a native of Columbia. “I really liked science, but I also liked interacting and helping people on a human level, so industrial engineering was the perfect fit for me.”

Because there were no Ph.D. programs in engineering in Bogotá, Colombia, Jackson came to the United States with her uncle’s help and continued her education at the University of Houston. Studying engineering has allowed Jackson the professional mobility to engage in a number of projects.

“Being an industrial engineer has been instrumental in my ability to go from working at Fluor Corporation and Kvaerner in the construction field for almost 10 years to opening my own international project management firm to helping mothers and babies in what could very well be the most traumatic experience of their lives,” Jackson said.

Between her responsibilities as a mother and business owner, Jackson remains active in the academic side of the field. Since 2003 she has served as an adjunct professor in the MBA program at the University of Applied Sciences of Vorarlberg in Austria, which takes her (and sometimes her son and husband, Larry) to Europe for three weeks each winter and summer.

Jackson has also helped conduct a research study about risk assessment for international capital projects with the Construction Industry Institute (CII) and presented this research at the CII’s Annual Conference in Orlando, Florida, and Austin, Texas, as well as the Research Conference of the Project Management Institute in London and the Annual Congress of the Institute of Industrial Engineering in Houston. She is also on the board of directors for the Project Management Institute. In addition to her degrees from UH, Jackson also has a master’s degree in industrial engineering from Clemson University.

Jackson’s family experience and the Zaky have been featured in the health reports of the news programs on ABC, NBC, Univision, CNN and Fox as well as articles in the Houston Chronicle (July 2005), Star News Newspaper (Dec. 2005), Reader Digest (April 2002), Institute of Industrial Engineers Magazine (July 2004), and Physician’s Practice Magazine (Nov.–Dec. 2004). The Zaky was also featured in a CBS Special Report titled “Healing from the Storm” (June 2002) and the made-for-TV movie “14 Hours,” which aired on TNT (April 2005).

Of all her accomplishments and accolades, Jackson said her son, and the work she does with babies and kids with special needs, are her greatest achievements.

“The birth of Zachary definitely changed my life, both personally and professionally. I made a commitment to use my own experience and education to help improve the quality of life of premature babies,” Jackson said. “I want to do more research and product development to improve the lives of more babies, their mothers and their caregivers. I don’t want Zachary’s suffering to be in vain. I want him to know that he has helped thousands of babies, that we are very blessed for having him and that I am very grateful that he came home with us.”

“Being an industrial engineer and having a passion for product design and project management helped me understand and respond to the needs of babies to feel accompanied, secure and well positioned; the need of mothers to bond with their babies; and the need of nurses to comfort and care for multiple babies simultaneously,” Jackson said. “With immense help from nurses, doctors and mothers, the Zaky was born.”
are spent visiting art studios, reading art history, pursuing auction catalogs, updating the database of his collection of more than 1,400 objects, and buying works of art—especially contemporary Texas art and German Expressionism prints. He also collaborates with scholars and art of PDRA's World Propulsion Administration program. In addition, 70 German Expressionist prints from his collection has been on display at the Old Jail Art Center in Albay, Texas. He organized exhibitions of Texas art for the Arno Gallery in Leipzig, Germany, in 2002, and for Museo Humboldt during the 2003 World Food-for-nonprofit and university galleries in Lima, Peru, and in Beijing. He curated the exhibition for Lawndale Art Center's 25th anniversary exhibition fall last fall and, as a member of the Municipal Art Commission, appointed by Houston Mayor Bill White, has organized exhibitions of work by Houston artists for City Hall. Koppris has also organized and managed events for the American Red Cross, the non-profit Houston Arthritis Fund and the UH School of Art.

DAVID A. CASEY (1984 BSEE) was named vice president of worldwide sales at California Micro Devices. Previously, he was vice president of worldwide sales at Alliance Semiconductor and held a number of key management positions at Hitachi Semiconductor, including vice president of sales and marketing for their Memory and Mixed-signal Products and Unit. Earlier in his career, he also worked for Pioneer-Standard Elec-tronics and AMP Georgia.

PETER CHEUNG (1985 BSEE) and his wife Star opened a coffee shop, the Pearl Cafe, in Mountain View, California, offering homemade cookies and muffins, and the Vigil coffee brand roast in San Jose. They own two successful Chinese restaurants.

ANN WHITTON (1985 MSEE) opened Plano's Closet in Katy, which carries name brand, trendy clothes in good condition for teens and young adults. She spent 15 years in engineering with the Houston Metropolitan Transit Authority and was occasionally posted to an Alabama bus manufacturing plant to inspect new vehicles. The Whittons, who recently moved back to Houston, lived in Singapore for seven years, where Ann taught high school math and science.

VENKAT (SELVA) SELVANIMKAN (1998 MSSEE, 1992 PhD EE) was recently named Superconductor Person of the Year by SuperPower Inc. He has been a member of the U.S. government-funded Superconducting Science and Technology development. In 2005, he is one of the key figures behind Superconductor Inc.’s development of high-temperature superconducting wires, which dramatically reduced the cost of electric power transmission. In 1988, he created a new method to fabricate superconductors, setting internationally recognized design and performance marks. His master’s thesis on superconductivity became one of the more cited works on the subject. After receiving his degree, he worked at the Oak Ridge National Laboratory. In 1994, he joined International Magnetics General Corp., SuperPower’s parent company, where he was doing his own work on superconductive wires. After starting at International Magnetics, he left for three weeks to get married. His wife Kala now works as an advisory data engineer at MapR. He raised more than $10 million in external funding for the company and in 1996 was recognized by the White House for his discoveries. He has more than 20 patents or patents pending in his name. He used the $500,000 he received from the presidential award to develop a breakthrough superconductive wire at International Magnetics that was the impetus for the creation of SuperPower in 2000.

JEFFREY HANLEY (1993 BSEE) was appointed manager of NASA’s Constellation Program, based at Johnson Space Center. He leads the development of the nation’s new spaceflight launch system, including launch and transfer vehicles, landers and other systems designed to take astronauts to the moon, Mars and beyond as part of the Vision for Space Exploration. Previously, he was chief of the flight director’s office. From 1996 – 2005, he was flight director for space shuttle and international space station missions. typography
By Portia-Elaine Gant

Arnold-Rippey Company, he was the founder and Mickey Rester Arnold. During his lifetime, he completed 60 years, Alpha Jo, and daughters Penny White and Kristi Kainer.

Lloyd H. (Poppy) Luckow (1949 BSCE) died Jan. 3, 2006, at the age of 81. During his lifetime, he served in the U.S. Air Force as a first lieutenant and worked at the Goodyear Tire and Rubber Plant in Houston, from which he retired after 39 years of service. He is survived by his wife of 60 years, Alpha Jo, and daughters Penny White and Kristi Kainer.


Charles J. Tamborello (1961 BSCE) died Oct. 29, 2005. He was a well-known structural engineer who designed and built several concrete bridge structures in Harris County, as well as oil rig structures in the Gulf of Mexico and Puerto Rico. In 1994, he received the UH Distinguished Engineering Alumni Award. He is survived by his wife of 52 years, Margie Landry, whom he met while finishing his tour of duty in Korea as a U.S. marine, and by his four children, Tony, Tina, Charles and Toni. In his honor, fellow alumni, friends and colleagues established the Charles J. Tamborello Memorial Scholarship Endowment at UH.

Amanda Wilson (1991 BSEE) died Dec. 22, 2005, at the age of 49, with her fiancé, Joseph M. Lubbenus, age 43. She attended the Queens College in Lagos and the University of Ile in Nigeria before traveling to the United States to seek new opportunities. After graduating with honors from UH, she accepted a position at ExxonMobil, where she served as an asset portfolio manager at the time of her death.

Shawn E. Nowlin (1996 BSME) died May 6, 2005, after a brief battle with cancer, at the age of 34. Upon graduating from UH, he accepted a position at Baker Oil Tools, where he served as an engineer during the time of his death. He is survived by his wife Deneb and sons Noah and Lucas.

C. Rick Coneway (1973 BSCE, 1976 MSCE) always wanted to fly. After receiving his first bachelor's degree in psychology from Tulane University, the native Houstonian launched what is now a 32-year dual career in the U.S. military and in engineering.

Coneway's interest in the field of civil engineering was sparked by the Earth Day movement, which he encountered while serving in the U.S. Navy, "I saw that Earth Day was going to become a part of our culture, and somewhere along the line they would need experts," Coneway said. "I thought it would be my opportunity to participate in helping to solve problems in our environment."

Upon completion of his active-duty obligation with the Navy as a pilot, he returned to Houston to begin engineering studies at the University of Houston. After he completed his bachelor's degree in civil engineering, Coneway decided to pursue graduate studies in the field. It was during that time that his career in engineering began to take shape.

"At UH, I worked with professors who were outstanding and taught me a lot about the community and what I could do with my career," Coneway said. "My strongest influence was my advisor, former associate professor Jack Matson, PE, D.EE. His real professional and personal knowledge to use engineering knowledge to solve problems in a practical way."

Following the completion of his education, Coneway relocated to Austin, Texas, transferring his duty to the U.S. Air Force (USAF) Reserve to serve as a civil engineering officer. The highlight of his career in this position was returning to active duty to serve as the executive director/commander for the Air Force Center for Environmental Excellence.

Less than a decade after graduating, Coneway developed his own civil and environmental engineering and land surveying consulting firm, Coneway and Associates, Inc. His professional career earned recognition from many professional organizations, including the American Council of Engineering Companies and the Texas Society of Professional Engineers (TSPES). TSPES named him Young Engineer of the Year in 1979 and recognized him once again in 2000 as Texas Engineer of the Year.

Overall, Coneway's illustrious career includes over a decade of service to Naval Aviation and nine years of service as a pilot for the USAF. Coupled with many additional years as a civil engineering officer, a consultant and an entrepreneur, Coneway has found that the sky has no limit.
The Engineering Alumni Association honored Benton Baugh (1967 BSME) and Steven Simmons (1981 BSCE) as Distinguished Alumni at the Distinguished Engineering Alumni Awards Dinner in June 2005 at the Four Seasons Hotel.

Eray Aydil (1991 PhD ChE) received the Distinguished Young Engineering Alumni Award and Cheryl Thompson-Draper received the Roger Eichhorn Leadership Service Award.

Electrical and Computer Engineering Associate Professor Betty Barr received the Abraham E. Dukler Distinguished Engineering Faculty Award.

BENTON F. BAUGH
DISTINGUISHED ENGINEERING ALUMNI AWARD

Benton F. Baugh (1967 BSME) is a president and owner of Baugh, Inc., an oilfield engineering and manufacturing company. He also owns Baugh Consulting Engineers, Inc., an oilfield-related consulting and expert witness firm. Some of Baugh's significant product areas include reefs for deepwater control systems, 54-foot pipeline towers, arctic platforms and pipeline blockage remediation activities. Prior to starting his own business, he worked with the Beta Division of Brown Oil Tools, Vetco Valve Company, Vetco Offshore, Cameron Iron Works, Cameron and Bowes Tool Company. He is a member of the National Academy of Engineering, Fellow in the American Society of Mechanical Engineers, member of the Maritime Technology Society and a registered professional engineer. He has written numerous technical papers, holds 96 patents, and has served as chair of the ASME Petroleum Division, president of the UH Engineering Alumni Association, chair of the ASME/ UH OTC Cajun Crawford Bowl, on the board of directors of the Offshore Technology Conference and on the board of directors of the Offshore Energy Center. He received his M.S. and Ph.D. degrees from Kennedy Western University.

STEVEN E. SIMMONS
DISTINGUISHED ENGINEERING ALUMNI AWARD

Steven E. Simmons (1981 BSCE) has served as the deputy executive director of the Texas Department of Transportation (TxDOT) since November 2001. He oversees the daily administrative and engineering operations of an agency with more than 14,400 employees and a $6.7 billion annual budget. Steven also serves as TxDOT's principle Washington liaison, working closely with federal officials and Congress in the transportation funding reauthorization process. He recently headed efforts to produce the department's Texas Metropolitan Mobility Plan, a program designed to reduce traffic congestion in Texas. A native Houstonian, Steven joined TxDOT in 1982 as a project manager in the department's Northwest Harris-Waller Area Office. Earning his professional license in 1986, he progressed through several positions within the agency. He became deputy district engineer for the Houston District in 1993. Five years later, he was promoted to district engineer in Fort Worth. Under his leadership, the Fort Worth District received the TxDOT Design Excellence Award in 1999, 1999 and 2000. He also served on the civil engineering advisory boards for UH and The University of Texas at Arlington. In 1997, he received the UH Distinguished Young Engineering Alumni Award.

ERAY S. AYDIL
DISTINGUISHED YOUNG ENGINEERING ALUMNI AWARD

Eray S. Aydil (1991 PhD ChE) is a professor at the University of Minnesota Chemical Engineering and Materials Science Department. He received B.S. degrees in chemical engineering and materials science from the University of California (UC) Berkeley, both in 1986. He completed his graduate research at UC under the supervision of professor Demetre Economou. He joined the chemical engineering department at UC Santa Barbara in 1993 as an assistant professor, was promoted to associate professor with tenure in 1998, and was promoted to full professor and vice chair in 2001. Eray has authored and coauthored more than 110 papers and holds four patents in the field of plasma processing and diagnostics. He has received the Norman Hackerman Young Author Award from the Electrochemical Society, the National Young Investigator Award from the National Science Foundation and the Camille-Dreyfus Teacher-Scholar Award from the Dreyfus Foundation in 1993, 1994 and 1997, respectively. For his undergraduate teaching at UC Santa Barbara, he was selected by the students as the Professor of the Year in 1996, 1999 and 2003. He joined the University of Minnesota in April 2005.

CHERYL THOMPSON-DRAPER
ROGER EICHHORN LEADERSHIP SERVICE AWARD

Cheryl Thompson-Draper, a native Houstonian, was appointed as a commissioner of the Port of Houston Authority by Harris County Judge Robert Eckels and the Harris County Commissioners Court on June 27, 2000 and reappointed to her third term in 2004. Cheryl is only the third woman to be appointed to serve as a commissioner since the inception of the Ports and Harbors Board in 1909. She is the retired chief executive officer, chair of the board of directors and owner of Warren Electric Group, Ltd., an 83-year-old, $315 million enterprise. Warren Electric Group was the largest woman-owned and managed business in Houston for many years, as well as the third-largest in Texas. Cheryl has garnered several honors and awards of distinction. She has been named Texan of the Year by All Those Texans, honored as one of the Women on The Move by the Texas Executive Women and recognized by the Mayor of Houston, the U.S. Chamber of Commerce and the Port of Houston Authority as the Woman of the Century. Cheryl is also in the Ernst and Young Hall of Fame. Her UH endeavors include support of the Cullen College of Engineering and the Houston Alumni Organization, and she serves on the Chancellor's National Advisory Council.

BETTY J. BARR
ABRAHAM E. DUKLER DISTINGUISHED ENGINEERING FACULTY AWARD

Betty Barr is a native Houstonian who attended Houston public schools. She received her B.S., M. S. and Ph.D. in mathematics from UH. Not wanting to leave Houston, Betty was hired as an assistant professor in the Systems Engineering Program of the UH Cullen College of Engineering in 1971. When the systems program was moved from Industrial Engineering to Electrical Engineering, she became a member of that faculty. Betty became the director of undergraduate studies in the department in 1982. She was promoted to associate professor and named associate chair of the department in 2003. Betty has received commendations from the college for teaching excellence several times and has been given the Kilmer Teaching Excellence Award from the college twice. She received the university's George Magner Award for Excellence in academic advising, and the college's Career Teaching Award. She was elected to membership in Tau Beta Pi as an outstanding engineering educator. Betty has served as the engineering representative on the UH Undergraduate Council for more than a decade, currently serving on the Degree Programs Committee. She is chair of the College Undergraduate Curriculum Committee and the UH Department of Electrical and Computer Engineering's Academic Standards Committee. She is faculty advisor to the UH section of the Society of Women Engineers and one of the advisors to Tau Beta Pi. She also serves as treasurer of the UH Wesley Foundation.

International Executive of the Year. The Texas Women's Chamber of Commerce named her a Woman of the Century. Cheryl is also in the Ernst and Young Hall of Fame. Her UH endeavors include support of the Cullen College of Engineering and the Houston Alumni Organization, and she serves on the Chancellor's National Advisory Council.

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University of Houston Cullen College of Engineering

LAST WORD
2006 UH Cullen College of Engineering Events

May 13
Engineering Commencement
5 p.m.
Hofheinz Pavilion, UH Campus

May 18
Engineering Alumni Association Annual Meeting
6 p.m.
UH Hilton Hotel

June 2
Distinguished Engineering Alumni Awards Dinner
6 p.m.
Four Seasons Hotel, Downtown Houston
Honoring Michael Ervin, Michael Piwetz,
Bryan Kennedy, Larry Witte and Ernest Henley

June 4 – July 21
Summer Camps for High School Students
and Teachers
For a full listing of summer camps offered
to high school students and teachers by
the Cullen College of Engineering, visit
www.egr.uh.edu/news/?e=camps

June 20
4th Annual Civil and Environmental Engineering
Alumni Luncheon
12 p.m.
HESS Club

For more information about any of these events,
call 713-743-4200, e-mail alumni@egr.uh.edu,
or visit www.egr.uh.edu/events.

An atomic force microscope captures
thousands of insulin molecules, each
measuring 5 nanometers in diameter, in
the process of forming an insulin crystal.
The protruding mound in the center, recently
discovered by Peter Vekilov, associate professor
of chemical engineering, and chemical engineering
doctoral candidate Dmitra Georgiou indicates
rapid crystal growth. The finding is only
the third mechanism of crystal formation
ever discovered. (Learn more about this
discovery on page 4.)

Check out the UH Cullen College of Engineering online newsroom!
www.egr.uh.edu/news