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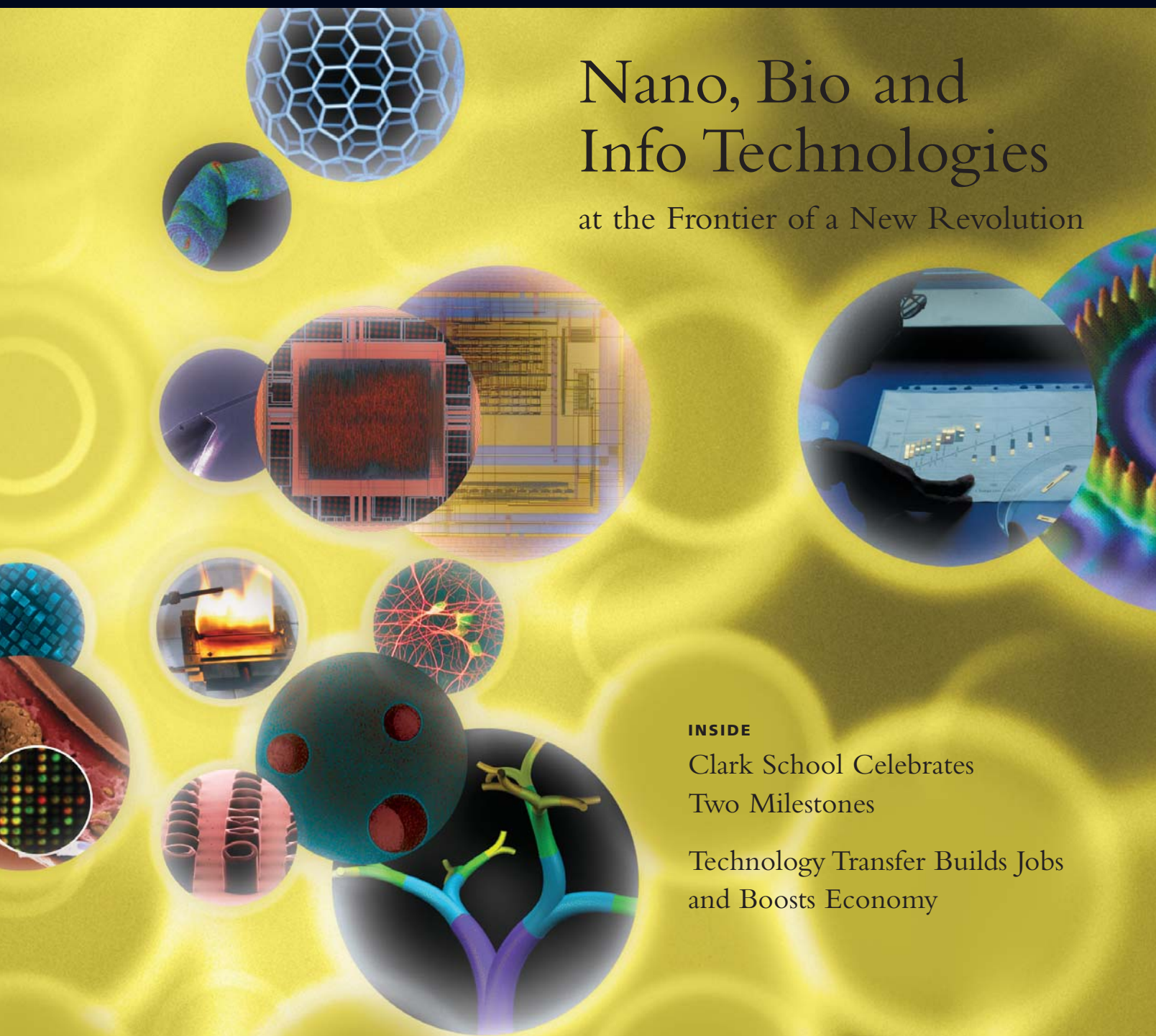

Nano, Bio and Info Technologies

at the Frontier of a New Revolution

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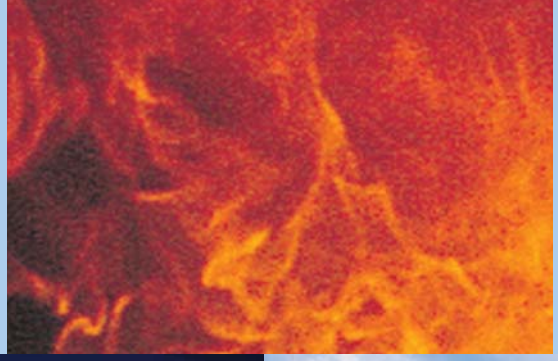
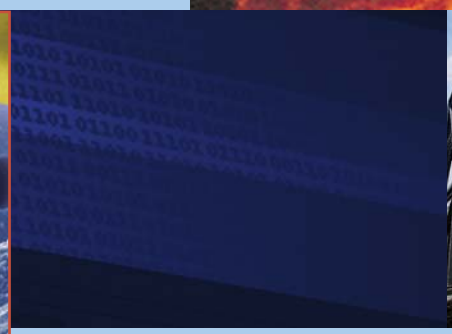
Clark School Celebrates Two Milestones

Technology Transfer Builds Jobs and Boosts Economy

A. JAMES CLARK SCHOOL OF ENGINEERING ▪ University of Maryland





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Dear Alumni and Friends:

THESE ARE DIFFICULT FINANCIAL times for most businesses and industries, and higher education is no exception. The University of Maryland, like most other public higher education institutions across the nation, is dealing with these fiscal issues through a variety of belt-tightening measures, combined with tuition increases and initiatives aimed at increasing the efficiency of our operations. At the Clark School of Engineering, our primary goal is to deal with these fiscal difficulties with minimal impact on the quality of education we provide our students and without compromising the principles that guide our commitment to excellence.

The University of Maryland is exceedingly successful in removing boundaries between departments, which gives our faculty, staff and students greater flexibility in working together on cross-disciplinary efforts at the forefront of technology. We expect this trend to increase in the coming years. In continuing to advance the Clark School to higher levels of excellence, we will continue our emphasis on our cross-disciplinary initiatives in smart small systems, information technology, transportation systems, nanotechnology and bioengineering. In fact, the Jeong H. Kim Engineering Building, currently under construction, is designed to support these programs. The completion of this state-of-the-art facility will accelerate the advancement of our efforts in these important areas.

Many of our innovative educational programs are stimulated not only by our cross-disciplinary approach, but also by a culture of entrepreneurship that is nurtured at all levels of our organization. Programs such as Gemstone and the award winning Hinman Campus Entrepreneurship Opportunities (CEOs) Program, coupled with our extensive and growing undergraduate research programs, encourage the exploration of new ideas, support our students' leadership abilities, and foster interaction in a team environment with individuals of different technical and cultural backgrounds.

In order for us to protect our tradition of excellence, the Clark School cannot rely on state support alone. We must call upon all of our friends for philanthropic support to ensure that we have the resources to continue to build an engineering school of national stature.

On behalf of the entire Clark School family, please accept our gratitude and appreciation for your involvement in our school and our programs. We are grateful to all of our honor roll donors, recognized in this issue of E@M, for their investments in our vision.

Nariman Farvardin, *Professor and Dean*

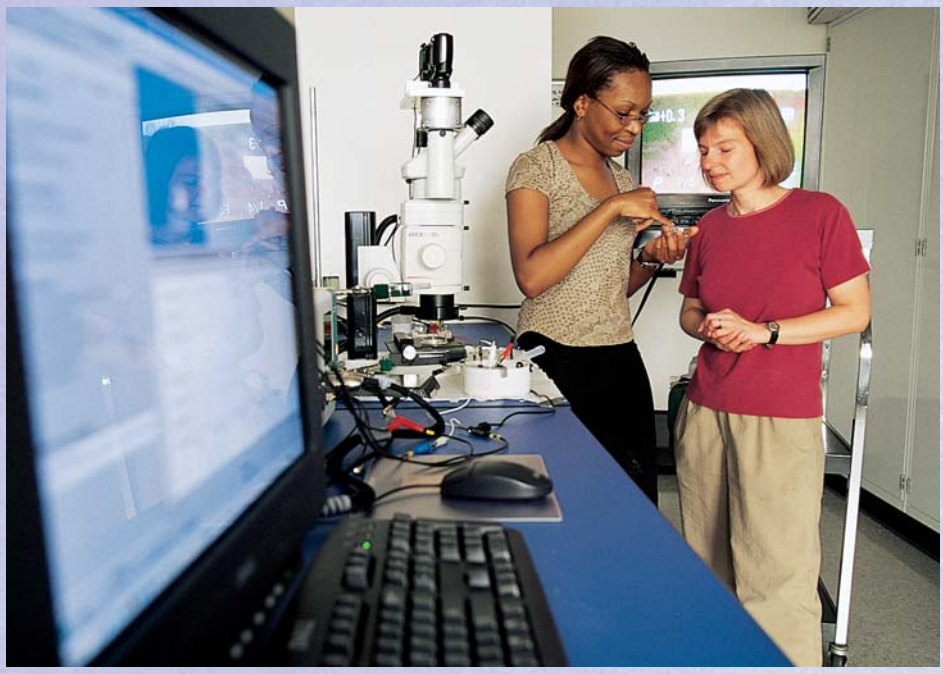


PHOTO BY JOHN T. CONSOLI

Oluwatosin Ogunsola, a graduate student in chemical engineering, works with Professor Elisabeth Smela, mechanical engineering, exploring the use of nanoparticles to improve the speed of polymeric artificial muscles.

Clark School Receives Funding for Clare Boothe Luce Professorship

The A. James Clark School of Engineering and the College of Computer, Mathematical and Physical Sciences (CMPS) have received a grant to hire two new female faculty from the Henry Luce Foundation under the Clare Boothe Luce Program. The award recognizes the University of Maryland's longstanding commitment to increasing the number of women on the faculty and building an inclusive and equitable community.

"The recruitment and retention of more women faculty are important components of the Clark School's strategic plan," says Engineering Dean and Professor Nariman Farvardin. "The Clare Booth Luce Program provides additional resources to attract an outstanding female faculty member and to support her research and professional development in a collegial environment."

The Clark School will use its portion of the five-year, $688,769 award to fund a new faculty position in the electrical and computer engineering department. A selection committee will be formed in the fall to review and identify strong candidates for the professorship.

CMPS will fund a new position in the computer science department. "The award of the Luce Professorship is a major step forward in achieving one of the college's fundamental objectives—to become a school of choice for women and minority students in our disciplines," says CMPS Dean Steve Halperin, who notes that the award recognizes the outstanding record of support for women faculty and students in the department.

The Clare Boothe Luce Program is the single most significant source of private support for women in science, engineering and mathematics. Clare Boothe Luce, the widow of Henry R. Luce, was a playwright, journalist, U. S. Ambassador to Italy, and the first woman elected to Congress from Connecticut. She understood the obstacles many women face in pursuing their careers, particularly those in the sciences, engineering and mathematics. The program promotes the advancement of women through higher education in those areas. Since its inception in 1989, the program has supported scholarships and fellowships for more than 700 undergraduate and 350 graduate students and has funded more than 100 Clare Booth Luce Professorships.

With more than $700 million in assets, the Henry Luce Foundation was established by Henry R. Luce in 1936. The foundation's program areas reflect the interests of the Luce family, including American art, higher education, the environment, public policy, and women in science and engineering.

"The Clare Boothe Luce Program is pleased to partner with the University of Maryland in our efforts to increase the participation and advancement of women in the sciences and engineering," says Jane Daniels, program director. "The University of Maryland was invited to participate in the program based on the strength of its reputation in the sciences and engineering and its extraordinary commitment to the success of women in those fields."

Currently, the electrical and computer engineering department has 77 regular and affiliate faculty members, of which six percent are women. Of the department's 1,149 undergraduate students, 14 percent are women and of its 562 graduate students, 23 percent are women.

"Four of the six new faculty recently hired in the electrical and computer engineering department are women," states Steve Marcus, department chair and professor. "We welcome the opportunity to further expand the depth and breadth of the department and strengthen our commitment to develop the academic talents of our female faculty members and students."

The Clark School also received funding from the National Science Foundation last year to support Research Internships in Science and Engineering (RISE). Women faculty are funded each summer to conduct research with teams of four to five undergraduate students and supported by a graduate student. The RISE program provides team skills and mentoring training for faculty and students in an effort to boost female representation in fields in which women have typically been under-represented, including math, physical and computer sciences and engineering.

Earn a Master of Engineering in Fire Protection—Online

The Clark School of Engineering's internationally acclaimed fire protection engineering department has launched a web-based, graduate-level program designed for the working engineer. This 30-credit-hour degree program allows fire protection professionals, as well as those who have earned a B.S. in engineering and who need to meet new safety demands, to focus on the latest performance-based building fire safety analysis and design.

The Master of Engineering in Fire Protection curriculum supports a performance-based approach to fire safety analysis and design, including evaluation and integration of fire protection systems for high-rise structures and industrial complexes; analysis of the level of fire protection applicable to commercial and residential buildings, nuclear power plants and aerospace vehicles; research of fire propagation, detection and suppression; and the physiological and psychological effects on humans.

The degree can be completed in two years on a part-time basis. Graduate record scores are not required for admission to the program and there is no research component. The online program features full access to the University of Maryland library service with two-day turnarounds for document delivery, technical services support, chat rooms and threaded discussions, in addition to asynchronous lessons taught by renowned experts in the field of fire protection engineering. ■

For more information, please visit www.e-learning.umd.edu/fire or call the Professional Master of Engineering Program at 301.405.0362.

Clark School Receives Funding for Three REUs

The Clark School's commitment to undergraduate research continues to grow with funding from the National Science Foundation for Research Experiences for Undergraduates (REU).

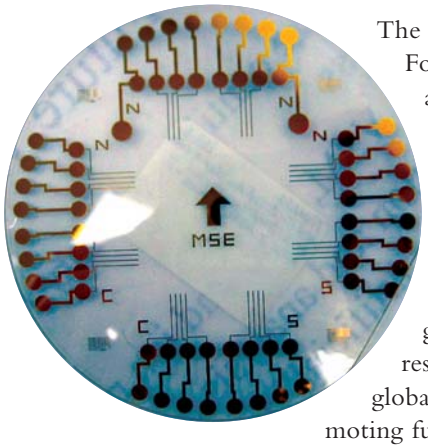
REU sites and other programs focusing on telecommunications, power and energy, computer engineering, and biomolecular engineering and materials research make the Clark School one of the strongest in the nation in promoting undergraduate research.

Satyandra K. Gupta, assistant professor of mechanical engineering, is the principal investigator for the REU on "Introducing the Systems Engineering Paradigm to Young Researchers and Future Leaders." Coordinated with the Institute for Systems Research (ISR), this project is funded for $688,000 over five years to support research opportunities for 15 students for 12 weeks each summer. Students will be recruited from the Clark School as well as other engineering programs.

Wesley G. Lawson, professor of electrical and computer engineering and the Institute for Research in Electronics and Applied Physics (IREAP), and Patrick O'Shea, professor of electrical and computer engineering and director of IREAP, are principal investigators for the REU on "Training and Research Experience in Nonlinear Dynamics."

An existing REU site at the Clark School received additional funding. The Research Internships in Science and Engineering (RISE) has received $322,000 over three years. Principal investigators are Linda Schmidt, professor of mechanical engineering, and Janet Schmidt, director of student research. The RISE program offers summer research opportunities for teams of undergraduate engineering students led by women faculty.

NSF Grant to Advance Materials Development



The National Science Foundation (NSF) has awarded a five-year, $3.5 million grant to Rensselaer Polytechnic Institute, the University of Maryland and Florida International University for an integrated program of research, education and global outreach aimed at promoting fundamental changes in the practice of materials discovery and development.

The Combinatorial Sciences and Materials Informatics Collaboratory, an NSF International Materials Institute, will provide a globally connected environment of international collaborators to pursue systematic approaches based on combinatorial experimentation, materials databases and modeling. Clark School's Ichiro Takeuchi, assistant professor of materials science and engineering, will lead research on combinatorial experimentation, and Professor Gary W. Rubloff, of materials science and engineering, with a joint appointment to the Institute for Systems Research, will lead work on education and research integration.

Faculty Selected for NSF Early CAREER Awards

This spring, four junior faculty members were recognized for their research with the prestigious National Science Foundation Early CAREER Development Award. The CAREER award recognizes and supports the activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. Awardees are selected on the basis of creative, career development plans that effectively integrate research and education within the context of the mission of their respective institutions. This year's awardees include:

From left, Elisabeth Smela, assistant professor of mechanical engineering; Pamela Abshire, professor of electrical and computer engineering; and Richard La, assistant professor of electrical and computer engineering are among the Clark School's most recent NSF Early CAREER Award winners.

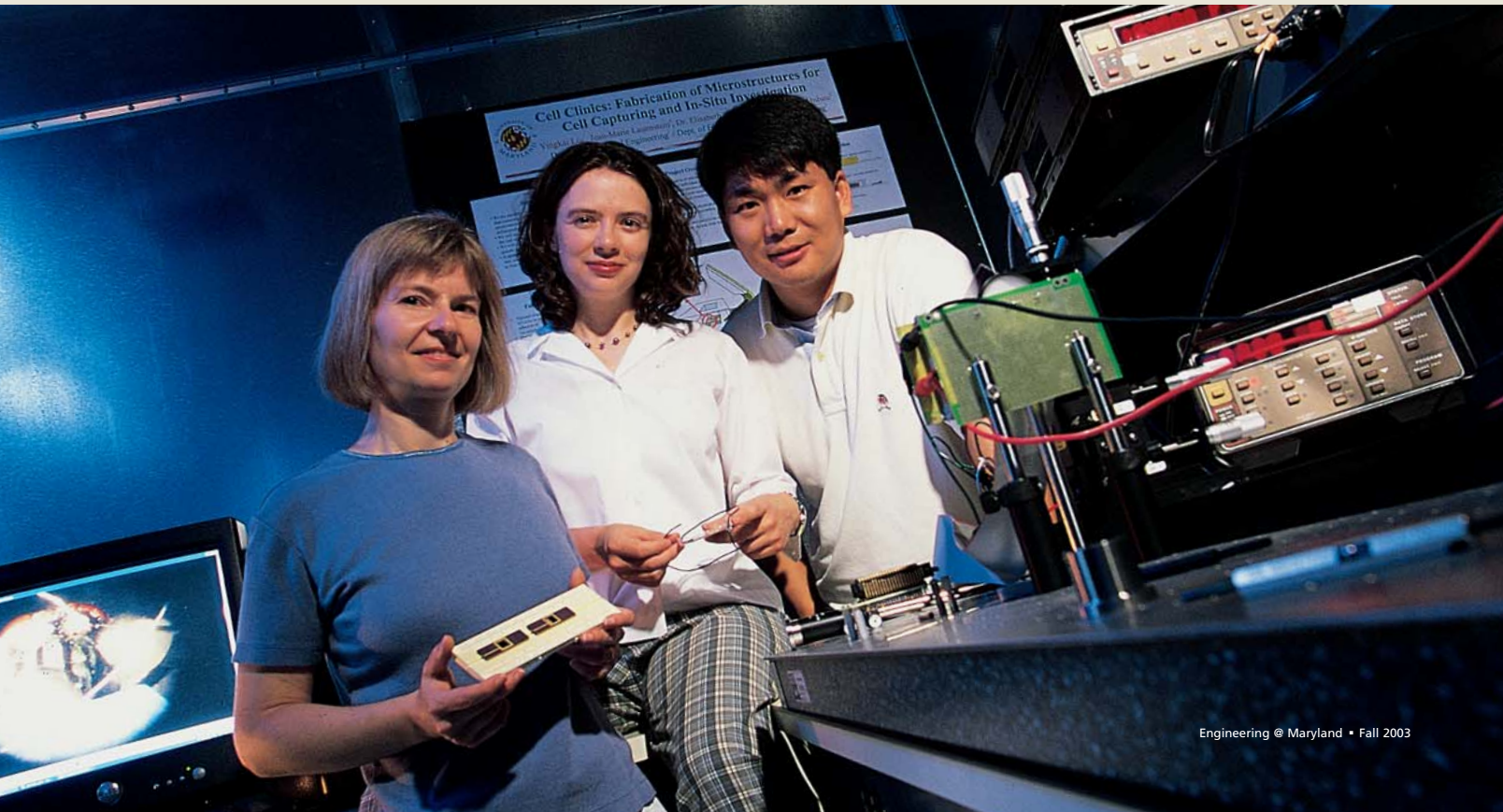
PAMELA ABSHIRE, assistant professor of electrical and computer engineering, was chosen for her project on physical information efficiency for sensing, communicating and computing. She is studying the blowfly, an insect marvel that uses minimal energy to maximal advantage in an autonomous system of precious resources. Her work is at the forefront of devising the rigorous methodology and data necessary to analyze fundamental limits in performance and efficiency while at the same time tackling practical innovative microelectronic system design that uses the analysis to push limits as far as possible.

MICHEL CUKIER, assistant professor of mechanical engineering, was selected for his work in evaluating the security of a computer network based on experimental data such as vulnerability and attacker data collections. His research will benefit the security community by providing a measure that is probabilistically quantified and is based on previous data collections of vulnerabilities (system, network, and application vulnerabilities) and attacks to assess the security of a computer network.

RICHARD LA, assistant professor in electrical and computer engineering, was selected for his research on network modeling and resource allocation. La is building an integrated networking research and education program focusing on network modeling, performance evaluation and algorithm designs.

ELISABETH SMELA, assistant professor of mechanical engineering, was recognized for her work on the development of a new microactuator technology that can be used in micro-electromechanical systems (MEMS). Smela develops fabrication methods for these electroactive polymer devices that allow them to be produced using conventional microfabrication techniques and to be integrated with other MEMS systems.

PHOTO BY JOHN T. CONSOLI



Haghani and Briber Named Department Chairs

Ali Haghani
Civil and Environmental Engineering

Professor Ali Haghani has assumed the position of chair of the Department of Civil and Environmental Engineering. Haghani has a strong record of scholarly accomplishments in the area of transportation systems with a special focus on developing large scale network models and decision support systems for commercial and transit fleet management, public service fleet management and real-time network traffic control.

Haghani joined the University of Maryland in 1990 and served as a professor and coordinator of the graduate program in transportation systems engineering and planning, which is one of the premier transportation programs in the nation. He is chair of the Transportation Network Modeling Committee of the Transportation Research Board and a member of the Joint Publication Committee for Highway Engineering and Urban Transportation, the American Society of Civil Engineers and the Bus Transit Committee of the Transportation Research Board.

Prior to joining the university, Haghani was an assistant professor of civil engineering and transportation at the University of Pittsburgh. He received both his Ph.D. and M.S. from Northwestern University and his B.S. from Shirez University in Iran—all in civil engineering.

Robert M. Briber
Materials Science and Engineering

Professor Robert M. Briber is the new chair of the Department of Materials Science and Engineering. He joined the university in 1992 and has an outstanding record of scholarly accomplishments in the areas of materials science and polymer physics. His research accomplishments in the areas of neutron and x-ray scattering of soft materials have brought national recognition to the Clark School.

Briber currently serves as editor of the *Journal of Polymer Science – Polymer Physics* edition and as president of the Neutron Scattering Society of America. He is also a fellow of the American Physical Society.

Briber received his Ph.D. and M.S. in polymer science and engineering from the University of Massachusetts, Amherst and his B. S. in materials science and engineering from Cornell University.

Welcome New Faculty

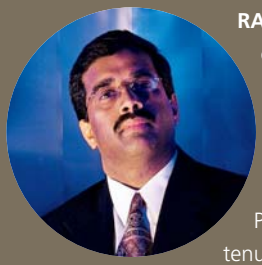
ALEXANDER BARG joins the Department of Electrical and Computer Engineering as a research professor. He received his Ph.D. in electrical engineering from the Institute of Information Transmission Problems in Moscow (Russia) and his M.Sc. in applied mathematics from the Moscow Institute of Transportation Engineering. Previously, he served as a member of the technical staff in mathematical research at Bell Laboratories/ Lucent Technologies. His primary research area is in coding theory and applications, information theory, cryptography and combinatorics.

JOHN FISHER joins the Clark School as an assistant professor of chemical engineering. He received his Ph.D. in bioengineering from Rice University and a B.S. in both chemical engineering and biomedical engineering from Johns Hopkins University. His research interests focus on tissue engineering and biomaterials, a rapidly developing area within bioengineering that uses degradable polymers as scaffolds on which cells can be grown for tissue replacements. This area is critical to the school's graduate program in bioengineering.

BAO YANG joins the mechanical engineering department as an assistant professor. He received a Ph.D. in mechanical engineering from the University of California, Los Angeles and a Ph.D. in physics from the University of Science and Technology of China. His primary interests are in micro/nanoscale thermal transport and energy conversion thermal science and its applications in electrical engineering and materials science, micro/nano devices, MEMS, and nanotechnology.

MICHAEL ZACHARIAH joins the mechanical engineering department as a professor. He will spearhead the Clark School's efforts in nanomanufacturing while serving as the coordinator of the University of Maryland/National Institute of Standards and Technology (NIST) Research Collaboration in Nanometrology and Manufacturing. Previously, Zachariah was a professor of mechanical engineering at the University of Minnesota, where he directed the Army-funded, multi-university Center for NanoEnergetics Research and the Reacting Flows. He also served as director of the Nanoparticle Laboratory. He received his Ph.D. and M.S. in chemical engineering and his B.S. in biochemistry, all from the University of California, Los Angeles. A former group leader and staff scientist at NIST, Zachariah has published some 120 archival papers and is on the editorial board of two journals. He is internationally recognized as a leader in the nanoparticle community.

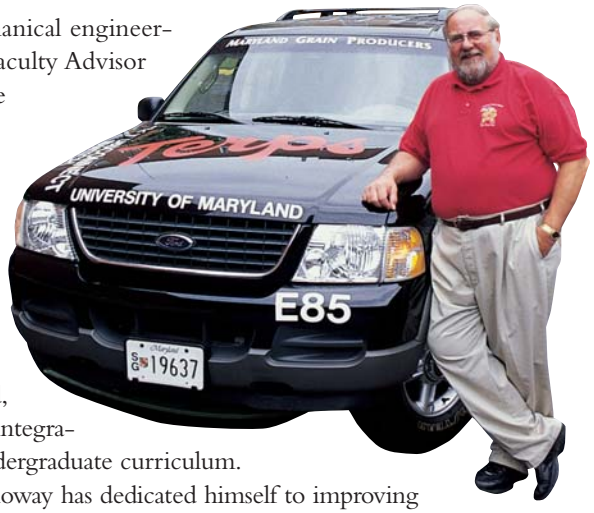
Ramesh Selected as Distinguished University Professor



RAMAMOORTHY RAMESH, of materials science and engineering and physics, was recently selected to the rank of Distinguished University Professor. During his tenure at Maryland, he has made significant and fundamental contributions to the area of functional materials, which have brought recognition to his department, the college and the university.

Only a small percentage of faculty achieve this level of recognition. Ed Ott, professor of electrical and computer engineering and physics, and Jan Sengers, professor emeritus of chemical engineering and the Institute of Physical Science and Technology, also hold this title.

National Science Foundation Honors Holloway



David Holloway, professor of mechanical engineering, was named the Outstanding Faculty Advisor of the Year by the National Science Foundation (NSF).

Holloway received the award for his outstanding work in incorporating the Advanced Vehicle Technology Competition (AVTC) activities into the classroom and for his significant impact on the engineering education of his students. The award carries a $20,000 stipend, which will be used to enhance the integration of AVTC activities into the undergraduate curriculum.

Over the past three decades, Holloway has dedicated himself to improving the educational experience of Clark School students with significant contributions to integrating automotive technology into the curriculum. He has engaged hundreds of students in real-world projects aimed at advancements in vehicle technology, including lower fuel consumption, improved performance, better environmental characteristics and enhanced functionality.

NSF has supported this award since 1997 and recognizes the enormous investment of time and energy required by a faculty advisor to recruit and manage a team of students and professors committed to undertaking a time-intensive project such as FutureTruck, a component of AVTC.

Professional Recognition and Honors

JOHN ANDERSON, professor emeritus of aerospace engineering, was named an honorary fellow of the American Institute of Aeronautics and Astronautics (AIAA). The honor is the highest bestowed by the Institute. Anderson is currently the curator for aerodynamics at the National Air and Space Museum in Washington, DC.

BALAKUMAR BALACHANDRAN, professor of mechanical engineering, was named a fellow of the American Society of Mechanical Engineers.

RAMA CHELLAPPA, professor of electrical and computer engineering and UMIACS, was named the University of Maryland 2003-2004 Distinguished Scholar-Teacher. The Distinguished Scholar-Teacher program honors faculty members who have demonstrated outstanding scholarly achievement along with equally outstanding accomplishments as teachers.

INDER CHOPRA, Alfred Gessow Chair in Aerospace Engineering, was elected as a fellow in the American Society of Mechanical Engineers.

JAMES H. DUNCAN, professor of mechanical engineering, was selected for the 2003 Poole and Kent Company Senior Faculty Teaching Award for his dedication to teaching, his encouragement of students to master course topics and his creativity in developing new approaches to traditional coursework.

ASHWANI K. GUPTA, professor of mechanical engineering, was selected for the 2003 Kirwan Faculty Research and Scholarship Prize. This award, established in 1998 by University System of Maryland Chancellor and former President William E. Kirwan and his wife, Patricia, recognizes a faculty member for a highly significant work of research and scholarship within the last three years.

JEFFREY HERRMANN, associate professor of mechanical engineering, received the Society of Mechanical Engineer's Outstanding Young Manufacturing Engineer Award. The award, one of 12 presented this year, was established in 1979 and honors the accomplishments of individuals 35 years of age or younger who demonstrate outstanding leadership and achievements in manufacturing engineering.

MARINO DI MARZO, professor and chair of fire protection engineering, was elected a fellow of the American Institute of Chemical Engineers.

R. J. SANFORD, professor emeritus of mechanical engineering, was elected a fellow of the American Society of Mechanical Engineers.

LINDA SCHMIDT, associate professor of mechanical engineering, was awarded the Engineering Dissertation Fellowship from the American Association of University Women. She receives an award of $20,000. She also received the 2002 Engineering Faculty Service Award in recognition of her outstanding service, dedication and commitment to the Clark School.

Ephremides Named Cynthia H. Kim Professor In Information Technology

Anthony Ephremides

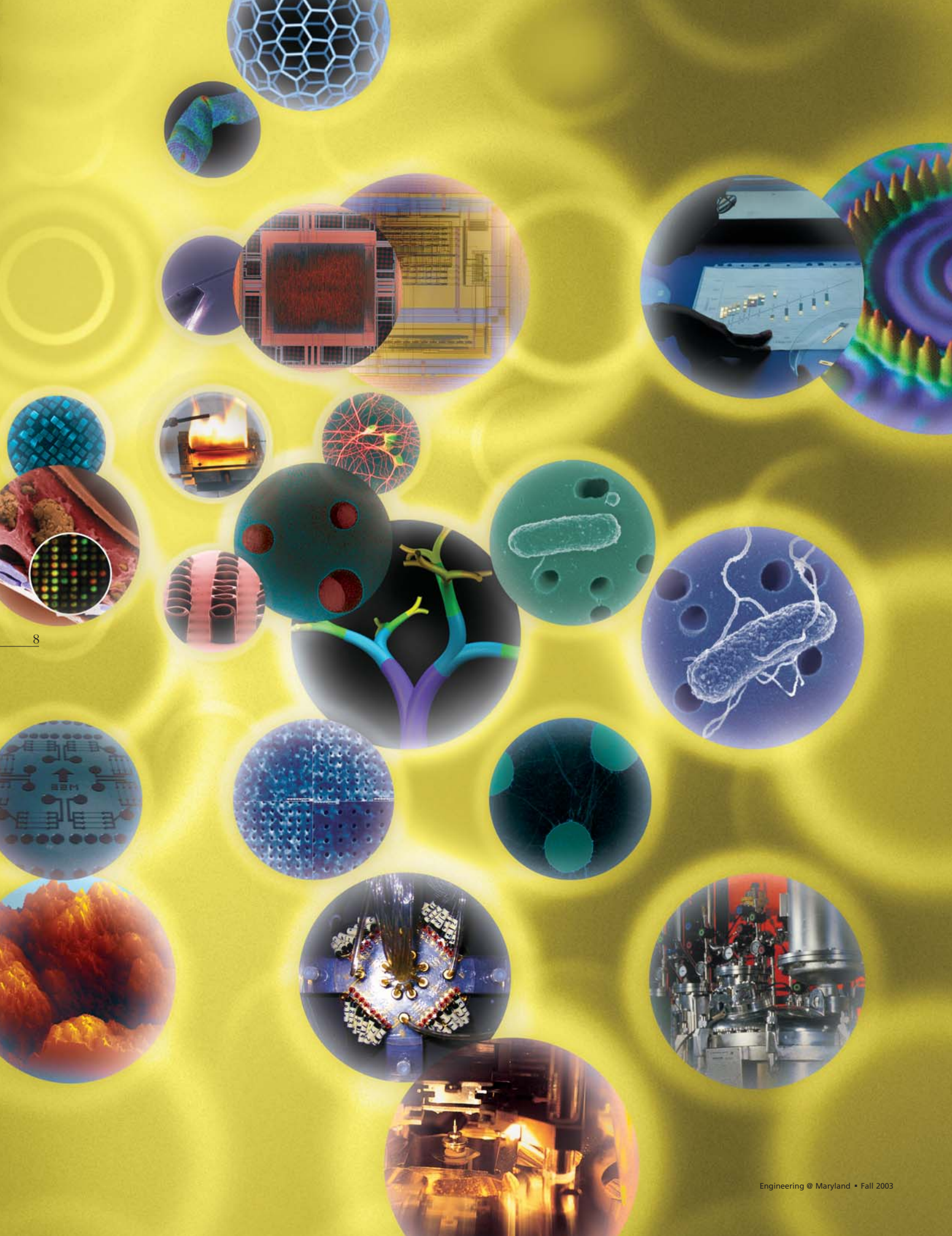
Anthony Ephremides, professor of electrical and computer engineering, is appointed the Cynthia H. Kim Eminent Professor in Information Technology.

A pioneer in the study of wireless communication networks, Ephremides was the first to propose and study ad hoc multihop wireless networks and has made major contributions to the field since that time. He also was the first to identify the role of higher layer protocols in conserving energy and the need to exploit the coupling between layers in the design of wireless networks. His work has launched new tracks of research that are now standard components of all journals and conferences in the area of wireless networking. He also has made significant contributions to classical communication theory, stochastic systems and in several application areas.

After obtaining his Ph.D. in electrical engineering from Princeton University in 1971, Ephremides joined the faculty of the electrical and computer engineering department. He is a founding member of the Institute for Systems Research. He also co-founded and co-directed the Center for Hybrid and Satellite Communications Networks in 1991.

Ephremides was the first recipient of the Association for Computing Machinery Sigmobile Award for Outstanding Contributions to Research on Mobility of Systems, Users, Data and Computers in 1996. He is a Fellow of the Institute of Electrical and Electronics Engineers and has served on its Board of Directors. He also is a fellow of the Institute of Electrical and Electronics Engineers. Ephremides received his bachelor's degree in mechanical and electrical engineering from the National Technical University of Athens (Greece) and his master of arts degree in electrical engineering from Princeton.

The Cynthia H. Kim Eminent Professorship in Information Technology was funded by Jeong H. Kim in honor of his wife. Kim received a Ph.D. from the Clark School in 1991, and joined the school in 2002 as a professor of the practice with a joint appointment in electrical and computer engineering and in mechanical engineering, complementing his distinguished career in business and engineering.



Nano, Bio and Info Technologies at the Forefront of a New Revolution

By Tom Waldron

A graduate student waits for a powerful vacuum pump to clear a test chamber in the second floor lab of Distinguished University Professor Ramamoorthy Ramesh. When the chamber is ready, he flips a switch and a powerful excimer laser pulses for a split second, evaporating a metal oxide film and splashing atoms onto a surface where they can be analyzed.

In a chemical engineering lab supervised by William E. Bentley, Herbert Rabin Distinguished Professor in Engineering, researchers work with a polymer solution derived from crustacean shells, an early step in creating a microscopic sensor that could someday perform complex genetic analyses of organisms.

And in the A.V. Williams Building, a dozen engineers strategize how to build a new generation of embedded computing systems that could someday control atomic-scale tools and the tiniest of bio-machines that could change the face of manufacturing.

These activities in various corners of the A. James Clark School of Engineering may at first glance seem unrelated. But in many ways they are part of an increasingly overlapping and inter-connected world of research and product development in the fields of nanotechnology, bioengineering, and information technology.

Along with counterparts in academia and industry around the world, Clark School faculty, staff researchers and students are partnering in new and diverse collaborations to explore the most basic structures of both living organisms and man-made structures. Their research, focused predominantly on the ability to manipulate individual atoms and molecules, is blurring the lines between the traditional disciplines of physics, chemistry and biology and traditional departments within the Clark School of Engineering and the Glenn L. Martin Institute of Technology.

The study and design of systems at the nanoscale—the scale of an atom—will make it possible to build machines on the scale of human cells or totally construct materials and structures with unique properties. Nanotechnology could change the way almost every product is designed and produced, from automobile tires to vaccines to objects far beyond our imaginations.

Clearly, within this realm, it is imperative for mechanical engineers to understand the rules of quantum physics that control atomic activity; for chemical engineers to comprehend the behavior of genes and other biological building blocks; for biochemists to partner with engineers to translate their findings beyond the laboratory; and for electrical and computer engineers to cross all disciplines to analyze and develop new systems.

"We're entering a world where the neat boundaries between technologies disappear," says Arno A. Penzias, the 1978 Nobel Laureate in physics who was the keynote speaker at the School of Engineering's 2003 Inaugural Charles and Helen White Symposium. "It's crucial for people to get in the habit of looking at things outside their silo. The ability to look sideways and see what's coming from other disciplines will become more and more important in the future."

Penzias, who with a partner earned the Nobel Prize for discovering cosmic microwave background radiation and providing compelling evidence and support of the "Big Bang" theory, points out that important scientific advancements often occur when researchers in different fields bump into each other.

"The collision of disparate technologies is usually the locus of great breakthroughs," explains Penzias. "Unexpectedly, you discover something totally different."

While in many cases commercial applications resulting from these inter-related technologies may be years away, the Clark School is a significant contributor to this new technological frontier.

"It's a long path to the design and manufacturing of new devices, " Professor John S. Baras, the Lockheed Martin Chair in Systems Engineering, shared with the audience at the White Symposium. The ultimate development of those devices, such as embedded computers, will reflect a melding of the physics of the theories and the functionality of the systems.

"At the Clark School, we have the vision and we have the right community—a culture of collaboration and support backed by strong research funding," adds Baras, who holds joint appointments in the Institute for Systems Research and in the electrical and computer engineering department. Baras also directs the Center for Satellite and Hybrid Communication Networks.

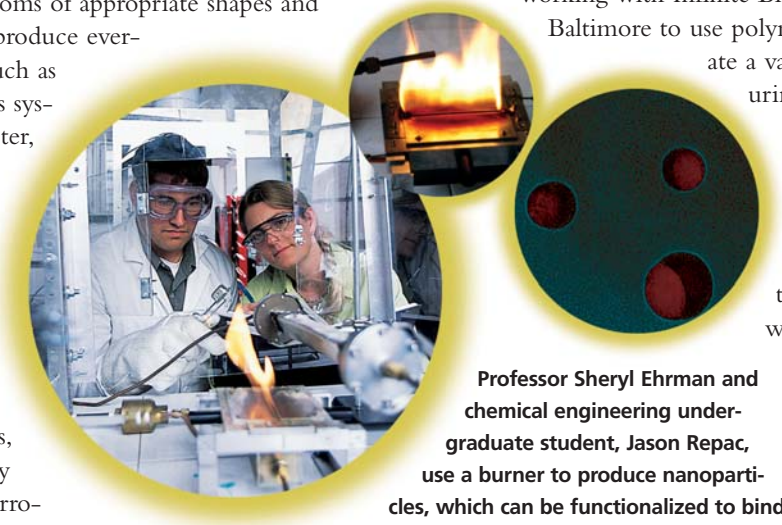
Nanotechnology is the Driver

Current research involves designing and building nanostructures by combining molecules and atoms of appropriate shapes and sizes into the right patterns to produce ever-shrinking engineered devices such as computers and communications systems that are lighter, smaller, faster, and more cost efficient.

Ramesh, who is also the associate director for the Materials Science and Engineering Center, is measuring how atoms within certain materials respond to real-world conditions. Using sophisticated lasers fired for only nanoseconds, Ramesh and his students literally evaporate materials known as ferro-oxides, the atoms of which can be observed and measured in different conditions.

"We want to understand how materials behave at very small dimensions and what happens when we make them only a few atoms wide," Ramesh explains. He and his students hope to develop a better understanding of these properties so that they can transfer this information and use the materials to create new memory devices, nanoscale sensors or microscale communication filters similar to those used in cell phones.

Elisabeth Smela, assistant professor of mechanical engineering, and Sheryl H. Ehrman, assistant professor of chemical engineering, both recipients of the National Science Foundation Early CAREER Award, are finding ways to use nanoparticles to improve the response time of conjugated polymer films. The films may be used to make tiny moving devices called microactuators. By introducing nanoparticles and etching them out of film, the researchers hope to create pores or channels to speed the materials' chemical response times. In one project, Smela is working with Infinite Biomedical Technologies in Baltimore to use polymer-based materials to create a valve that could help control urinary incontinence.



Professor Sheryl Ehrman and chemical engineering undergraduate student, Jason Repac, use a burner to produce nanoparticles, which can be functionalized to bind with specific biomolecules for magnetic separations and sensing applications.

Along with her research into polymers, Smela and colleagues are working on an optical interface that someday may help prosthetic devices communicate with the brain if, among other things, the nanoscale interactions between the nervous system and the optical system can be mastered.

Smela has no illusions about the complexity of the problem. "We are looking at a 50-year project," she says. "This research is the first step of many."

Electrical and Computer Engineering Professor Christopher C. Davis and Assistant Research Scientist Igor Smolyaninov are studying the properties of arrays of very tiny holes in thin metal films. In one study they observed light passing through holes less than 20 nanometers in diameter—much smaller than the wavelength of light. The amount of light that passes through the holes is surprising, Davis says. He notes the optical field in the holes is so large that these holes may be used to make light interact with itself.

Davis' research could ultimately help engineers control photons used in nanotechnology-dependent signaling devices or

Clark School Marks Two Milestones

On May 14, Clark School faculty, staff, students, alumni, and friends gathered at the Clarice Smith Performing Arts Center to inaugurate the Charles and Helen White Symposium and to participate in the virtual groundbreaking of the Jeong H. Kim Engineering Building.

"This is a significant and historic day for the school," Engineering Dean and Professor Nariman Farvardin told the audience. "These milestones are symbolic of the intellectual promise of engineering at the University of Maryland," he added.

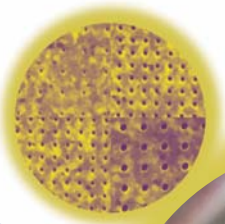
The day began with the inaugural symposium, made possible through a generous endowment by the late distinguished alumnus Charles White and his wife, Helen. White received his bachelors degree in mechanical engineering in 1913 and it was at Maryland that he met Helen Bradley, who he married five years later. White served in many leadership positions as a student and began a long and distinguished career in the steel industry upon graduation. In 1930, he joined Republic Steel Corporation as assistant vice president of operations and was elected chairman and chief executive officer in 1956, after serving 11 years as president.

He is credited for many improvements in steel manufacturing and received numerous awards.

He also served both as a civic leader and as a trustee to many organizations. White received an honorary doctorate in engineering from the University of Maryland in 1949.

The White's only child, Jean Moseley, and her husband, Tom, attended the symposium. "My

computers. "The photon-control technology could lead to new uses in quantum cryptology or the development of tiny sensing devices," adds Davis.



Professor Christopher Davis and Dr. Igor Smolyaninov have discovered surprising behavior in the way light passes through special nanoholes in thin gold metal films, which may lead to a new class of tiny sensors, switches, and signal processing devices.

Biology Provides the Model

Researchers in the field of bioengineering, including those at the Clark School, are looking at the functional molecular components of living cells to more fully understand the chemical reactions that govern how cells communicate with each other. Their work could lead to improved drug delivery systems, biocompatible materials for implants and sensors for disease detection.

Bentley, who is also director of the bioengineering graduate program, is studying how the malignant properties of pathogens are called into action within the body, a trigger that is related to the development of a "quorum" of the pathogenic cells. Bentley's study, now in its third year, is funded in part by the Army, which is interested in finding biological responses to pathogens and insights into the mechanisms and the effects of pathogens that could be the source of bioterrorist threats.

"The goal is to find a way to influence these cells so that they don't turn pathogenic. The research has some strong potential applications," says James J. Valdes, an Army scientific advisor in biotechnology at the Edgewood Chemical Biological Center in Maryland. Beyond the applications in biodefense, Valdes says the Army will develop new materials for lightweight ballistics protection, long-lasting and environmentally-safe biologically-based batteries to replace traditional chemical batteries and fuel cells, adaptive camouflage and a host of other products.

"Biotechnology will be to the 21st century what information technology was to the 20th century," says Valdes. "The Army is seriously studying, along with leaders in academia and industry, how it can leverage its investments in this growing field."

Bentley's work also uses a broad range of tools from traditional microbiology and biochemistry to genomic approaches to study both intra- and inter-cellular communication. He is working with a cross-disciplinary team from materials science and engineering and the University of Maryland Biotechnology Institute to develop a highly sophisticated sensing device capable of identifying genetic and metabolic information of samples. Such a sensor, which could incorporate polymers taken from crustacean shells, would utilize complex communication patterns to translate different kinds of inputs in different formats at different frequencies with enhanced abilities to sense contaminants, diagnose diseases and screen drugs.

In addition, Maria I. Klapa, assistant professor of chemical engineering, is looking to integrate new computing tools in her work in the emerging field of systems biology – an effort to chart the complex system of pathways and networks that govern cellular activity. Among other things, the research promises to provide a more complete understanding of how cancer or disease cells spread in the human body, which could ultimately lead to new and improved therapies.

This research demands the storage and analysis of immense amounts of data about cellular activity. As Klapa and a colleague

Keynote speaker Arno Penzias engages the audience at the Clark School's 2003 Inaugural Charles and Helen White Symposium.

father was always interested in new things and he always wanted to make things better," says Moseley. "He had the foresight to see the role of technology in the future." White was active in politics and at one point in his career he declined a presidential appointment as Secretary of Defense. Moseley believes her father felt his greatest contributions could be made in the business world and he spent a good portion of his career representing management's position in negotiating with unions and their representatives.

The morning-long symposium on "New Systems for a New Era" explored future implications of the interconnections of nanotechnology, bioengineering, and information technology. Symposium keynote speaker, 1978 Nobel Laureate Arno Penzias, called for the need for cross fertilization of ideas in tackling systems problems. Penzias and Bell Laboratories colleague Robert Wilson received the Nobel Prize for their discovery of cosmic microwave background radiation, which gave unprecedented support to the "Big Bang" theory of the universe's creation.

"It is so important and fitting that this symposium and the building we are celebrating are all focused on integrating technologies— one with another," shared Penzias. "While society depends upon technology, the application of organized knowledge, it really depends on the systems created by that technology," he added. "How these systems interact with each other and their interaction with society is all part of systems thinking."

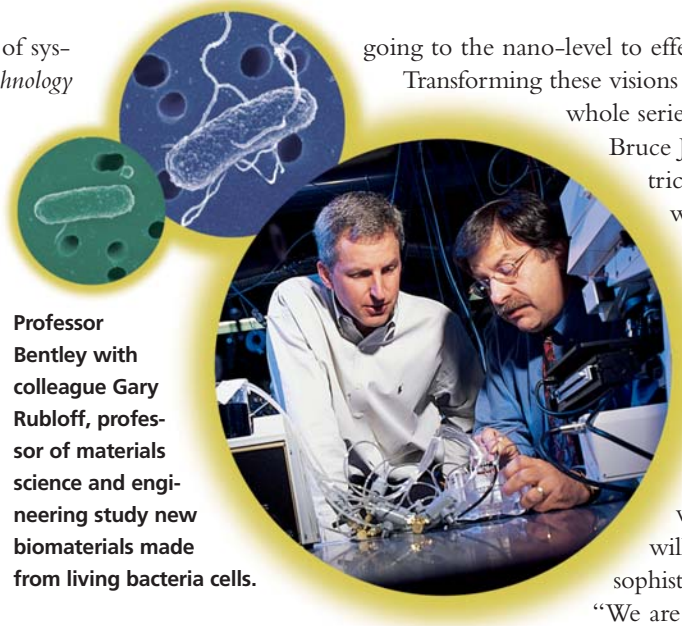
Several Clark School faculty gave presentations in their respective fields, followed by a lively panel discussion moderated by William Destler, senior vice president for academic affairs and provost, and former engineering school dean.

Christopher C. Davis, electrical and computer engineering professor, shared a key message regarding the confluence of bioengineering and nanotechnology. "Biologic entities have had billions of years to evolve and to become incredibly efficient at what they do, and they do it all at the nanoscale because they work at the molecular level," offered Davis. "We can learn a lot from biology and engineers are beginning to realize

Continued on next page

wrote in a recent paper on the future of systems biology to be published in *Biotechnology and Bioengineering* later this year, "Collecting, managing and analyzing comparable data from various cellular profiles requires expertise from several fields that transcends traditional discipline boundaries."

From vaccine development to disease prevention, biological innovations rely on information technology expertise to guide data collection and analyses, as well as to model the behavior of biological systems.



Professor Bentley with colleague Gary Rubloff, professor of materials science and engineering study new biomaterials made from living bacteria cells.

Information Technology Guides the Process

The work of Bentley and Klapa presents precisely the kind of communications challenge Baras and others are eager to tackle as the flurry of scientific inquiry in nanotechnology and bioengineering converge with information technology. "Biologists have asked for help writing equations about how things behave," Baras says. "The information gets so complex that you need technology—information technology tools—to analyze these systems."

Baras cautions that "no single brain can understand" all the issues raised by this confluence of research—team approaches will become increasingly important.

Even within the information technology field itself, there is a tremendous focus on the creation of tiny computers that rely on atomic-scale components that could, in theory, handle the most complex parallel computing chores.

"We have found that some materials have fantastic properties," Baras says. "There's a very big dream in engineering—going to the nano-level to effect change."

Transforming these visions into realities will require a whole series of scientific breakthroughs.

Bruce Jacob, associate professor of electrical and computer engineering, is working with Baras and other colleagues to design embedded computer systems that integrate both digital and analog components. For now, the computing chip Jacob imagines will function at the micro level and as nanoscale research unfolds, new tools and devices will be constantly evolving that will permit engineers to build more sophisticated nanostructures.

"We are decades away from that point of realizing nano-machines," Jacob says. "Nanoscale devices will be built with the concept of computing embedded within them. Our work today will make those advancements possible at smaller physical scales and larger scales of integration."

From Prototype to Product

The process for creating products from nanotechnology discoveries will require new engineering technologies and methods.

How, for example, do you actually build a bio-machine capable of assembling drugs or chemicals or position 100,000 individual molecules into a substance to create a material with unique magnetic or electrical properties in a cost-effective manner?

A faculty working group in the mechanical engineering department is immersed in determining what is required to turn new scientific findings into a whole new generation of products that are cleaner, stronger, lighter and less expensive than their predecessors.

From left, Cynthia and Jeong H. Kim, benefactors of the new Jeong H. Kim Engineering Building, and Jean Moseley, daughter of Charles and Helen White with her husband Tom, enjoy the day's events.

that we can mimic biologic organisms and can build engineering structures that incorporate biological features, and use biological systems to do engineering work for us," he said.

Ramamoorthy Ramesh, Distinguished University Professor (materials science and engineering, and physics) described the emergence of the nanotechnology field. "We have no option but to look at nanoscale dimensions due to our technology needs for more highly developed materials and due to our basic need as humans to find new phenomena."

Linking all of the physical sciences is information technology, claimed John S. Baras, Lockheed Martin Chair in Systems Engineering and director of the Center for Hybrid Satellite Communications. He suggests that the challenge for engineers, as we go to smaller dimensions for building information systems, is to capture design specifications and to create models to describe the methods used. Physical theories from different scientific domains are being incorporated in the process and engineers are working closely with biologists and mathematicians to create the information tools of the future, he adds.

While the morning event focused on exploring the future implications of the inter-

"If we're going to go from the nanofiction to nanoproducts, engineers must look at these challenges and get involved," says Professor Avram Bar-Cohen, chair of the mechanical engineering department.

In laboratories around the world, remarkable nanostructure discoveries are taking place everyday, including the recent creation of spun carbon nanotubes—super strong, micron-length structures, with walls only an atom or two thick—into fiber the diameter of a human hair and many feet long. Eventually, collections of nanotubes could reinforce composite materials or coat the surfaces of cars and airplances, increasing the strength and durability of the surface.

This innovation is a good example, says Bar-Cohen, of the kind of developments that are necessary to commercialize nanoproducts. While new manufacturing processes and equipment may make it physically possible to create these thin cylinders of carbon atoms, they are still far from economically feasibile. In fact, the current estimated price of $15,000 an ounce makes its use impractical at best, adds Bar-Cohen.

He cites additional challenges inherent in the formation of nanoparticle-based composites. For example, while researchers can identify unique structural and thermal properties in these composites, controlling the distribution of the particles to promote uniform properties or tailoring particle distributions to create functionally-graded materials that could be soft to the touch but internally rigid will depend on establishing suitable fabrication processes.

Bar-Cohen is an expert in thermal packaging, which involves managing heat generated by electronic devices. "Today, we face a problem of heat removal and power delivery," he offers, referring to the ever-shrinking features on computer chips created by the semiconductor industry. "Developing totally new ways of cooling hundreds of watts from centimeter-sized chips is of great interest."

His department is working with the National Institute of Standards and Technology on nanomanufacturing and the two groups have hired a leading researcher — Michael R. Zachariah — in nanoparticle fabrication and characterizations to serve as the coordinator of an extensive collaboration in nanometrology and nanomanufacturing. Zachariah is the former director of an Army-funded, multi-university Center for NanoEnergetics Research and Reacting Flows based at the University of Minnesota, where he also served as director of the Nanoparticle Laboratory.

"With the addition of Michael to our faculty, we are poised to move the Clark School to the forefront of nanoscience and technology," says Bar-Cohen.

The Next Industrial Revolution

The full potential of nanotechnology has not yet hit the public's radar screen, but nanoproducts are slowly entering the consumer market. "Dozens of companies are using nanoscale ingredients to make powders for different applications," notes Penzias. One suntan lotion product on the market for several years uses nanoscale zinc components to improve coverage on the body.

Penzias warns not to expect a "ta-da" moment in this ongoing scientific exploration. "People sort of think nanotechnology is something that's in the future, that it requires exotic research," Penzias says. "The question isn't when you'll see nanotechnology, it will just happen as part of the natural progression of technology."

For the Clark School, a wide range of research across many disciplines is laying the groundwork for this next progression of technology— from new drugs to new genetic sensing devices to new types of computers. And this research is placing the Clark School close to the center of what many scientists predict will be this country's and the world's next technological revolution.

Tom Waldron, a freelance writer, was a reporter for The Baltimore Sun *for 17 years. His work has appeared in* The Washington Post, Los Angeles Times, People *and* Newsday.

A multimedia presentation marked the virtual groundbreaking of the Kim Engineering Building.

section of nanotechnology, bioengineering, and information technology, the afternoon's activities centered on the addition of a new building to the Clark School that will foster multidisciplinary engineering research and house some of the most sophisticated educational laboratories in the nation.

A novel approach to a traditional event, the virtual groundbreaking ceremony was a multimedia presentation that reflected the innovative approach to engineering education that will be made possible through the Kim Engineering Building. Attendees glimpsed the new building and virtually walked its halls as part of the event.

Jeong H. Kim, engineering professor of the practice and chief executive officer of Jurie Holdings, and his family were honored at the event for their generosity to the Clark School. The ceremony also featured video presentations complemented by theatrical presentations, including the university's gymnastics troupe, Gymkana.

Construction is progressing on the 160,000-square-foot building, which is on the site of former parking lot G3, near the A. V. Williams Building. The foundation of the building is complete, concrete is in place, structural steel beams have been erected and masonry work has begun. The building is set for completion in 2005. To watch our progress, visit the Clark School web site at www.eng.umd.edu/Kim/intro.html.

TECHNOLOGY TRANSFER

BUILDS COMPANIES AND BOOSTS THE REGIONAL ECONOMY

It began with beakers and two-quart containers filled with algae. Now Columbia-based Martek Biosciences Corporation grows its algae in 260,000-liter tanks as tall as seven-story buildings, and the fatty acids produced there have revolutionized the infant formula industry. Martek now boasts licensing agreements with manufacturers representing more than 80 percent of the world market for infant formula and this year's sales are expected to exceed $100 million.

Martek made the leap from a small business to an emerging biotech powerhouse with assistance from the A. James Clark School of Engineering. Indeed, when Martek began working with the Clark School in the 1980s, its Chairman and Chief Executive Officer Henry "Pete" Linsert says the company lacked the equipment and expertise to progress toward large-scale fermentation.

Martek joined forces with the Clark School's Technology Advancement Program (TAP), which provides incubator facilities, business and technical support to technology-based early stage companies. Martek also contracted with the school's Bioprocess Scale-up Facility, a state-of-the-art laboratory for developing and accelerating biotechnology products and processes. In addition, the Maryland Industrial Partnerships (MIPS) program provided matching university resources for collaborative research for three Martek projects.

Linsert says help from the university programs came at a crucial time. "The TAP, the MIPS and the Bioprocess Scale-up Facility were there for us at the right time and the right place," he says. "Without them, I don't know if Martek could have made it through some of the lean years."

Martek's story exemplifies the evolving world of technology transfer—in this case, collaboration with the university and, in particular, the Clark School of Engineering's Maryland Technology Enterprise Institute (MTECH)—and its role in fostering company growth along with regional economic development.

As private research and development budgets continue to shrink and the reliance on federal funding grows, the university is expected to play an increasingly bigger role in tech transfer, just as its research counterparts have fueled economic growth in technology hotbeds such as the Silicon Valley, Boston and Seattle. Can Maryland become such a magnet for research that translates into business and job growth? Top state economic development officials and university leaders offer a resounding affirmative answer, especially when discussing the collaboration between the public and private sectors.

Aris Melissaratos, secretary of the Maryland Department of Business and Economic Development, views tech transfer as vital to economic growth. "Maryland has a very diverse economy," says Melissaratos. "In order for that economy to continue to diversify, we need to keep building the number of companies in the state and technology transfer allows us to do that."

"The University of Maryland and the Clark School are well positioned to lead the region's technology transfer efforts with a strong sense of collaboration and cooperation already in place between academia and industry," he adds. "The university offers a strong research base across a full spectrum of disciplines."

MTECH continues to yield impressive results. Over the last two decades, the institute and its predecessor, the Engineering Research Center, have created more

STORY BY GARY GATELY

than 800 jobs, spurred more than $300 million in product sales and pumped nearly $115 million into research and development for university and commercial technology initiatives. The Institute comprises several programs promoting the transfer of technology to Maryland's economy through collaborative research between the university and businesses, including a university-based incubator for tech companies, a matching grants program, on-site consultation for manufacturers, a state-of-the-art laboratory for biotech products, and a program to enhance productivity in biotech manufacturing. A new initiative to stimulate new business ventures among faculty, staff and students will soon be launched through MTECH, which also provides an entrepreneurship program for undergraduates and a technology club for graduate students.

The university's attractiveness to tech businesses stems not only from its track record, but also its location in a state that has earned a reputation as a good place to do business. Maryland sits first among all states in the percentage of professional and technical workers, first in the percentage of the population age 25 and over that has completed at least a bachelor's degree and second in the percentage of the population 25 and older with a graduate or professional degree as well as in the concentration of doctoral scientists and engineers, according to the Maryland Department of Business and Economic Development (DBED).

Maryland is not only blessed with a well-educated workforce, but also plenty of federal research dollars and a steady supply of capital for business. The state places fifth nationwide in total venture capital investment and in per capita federal government expenditures. DBED also reports Maryland is second in federal obligations for research.

The state ranked first in per capita spending for academic research and development in 1999, according to the National Science Foundation, ahead of California and Massachusetts and their respective high-technology corridors. The university's College Park campus received more than $350 million in research dollars, including funds from federal and private sources in fiscal 2002, University President C.D. Mote Jr. told the Maryland General Assembly earlier this year. Those funds are directly channeled into faculty, graduate and undergraduate research projects, training programs and other scholarly activities.

Brian Darmody, the university's assistant vice president for research and economic development, says the university is poised to capitalize on the region's tech transfer opportunities. "I like to say we are the most research-intensive state," he says. "We have everything it takes here at College Park to agressively promote technology transfer—we have a large research and development base, a nationally-ranked state university and a highly skilled faculty."

Continued economic growth in Maryland, experts agree, will depend heavily on technology transfer. Amid a national economic downturn, many industries have cut back on research, says Christopher Foster, state technology coordinator. "With the current national economy, it becomes even more important that we leverage that investment in the educational system," Foster says. "University research and development is probably more important than ever before."

The Clark School has plenty of experience in that regard. Through TAP, some 45 companies have moved from the incubation stage to commercial success. Take, for example, DataStream Conversion Services, which is headquartered in the TAP incubator and has received two MIPS joint research and development awards. The company, which converts electronic and paper data into computer formats, has been named 2003

Mark Anstey, president of DataStream Conversion Services LLC—a TAP company—which converts data digitally to meet customers' needs. *Photograph by Amy Davis, Sun Staff.*

Incubator Company of the Year in Maryland and is on a pace to hit $3 million a year in revenue. AnthroTronix, another TAP company, has created a computer-controlled robot to be used in interactive therapy for children with disabilities. Gaithersburg-based Digene Corporation has developed a gene-based diagnostic test for a virus that is the primary cause of cervical cancer, and the company's revenue soared 43 percent to $48.8 million in fiscal 2002.

With help from the MIPS program, Gaithersburg-based MedImmune Inc. produced the 10th-best-selling biotech drug in the world, Synagis, which prevents a respiratory disease in infants. Sales of the drug reached $668 million in 2002. MIPS also conducted joint research with Hughes Network Systems in Germantown, Maryland, which produces the only satellite-based Internet product for consumers; Applied Data Systems in Columbia, Maryland, which created a handheld device used by soldiers in Afghanistan to translate English into four languages almost instantly; and Quantum Sail Design Group based in Annapolis, which is the world's number two sailmaker.

Other MTECH success stories include College Park-based Alertus Technologies, which is developing a wireless communications system to disseminate information quickly in emergencies, and Maryland-based American Dehydrated Foods, which extracts proteins for animal feeds from hatchery wastes.

For its part, the state of Maryland has shown strong support for the university's role in fostering tech transfer. In June, a $5 million state investment in the development of the University of Maryland Enterprise Campus was approved. The Enterprise Campus, on 130 acres near the College Park Metro stop, will focus on the advancement of technology, computer science, mathematics, engineering, physical and life sciences and biotechnology.

The state also approved a $775,000 grant for equipment for MTECH's cutting-edge Bioprocess Scale-Up Facility and the Maryland Technology Development Corporation (TEDCO) has awarded $100,000 to University of Maryland researchers developing research projects with commercial potential. Satyandra Gupta, assistant professor of mechanical engineering, received funding for his company, Terplicators, which is working on developing software to reduce the development time, design time and costs for producing different type of molds. (See related story, p. 18)

"There's greater recognition of the importance of technology as the underlying driver of our economy and all the things that spring forth from a dynamic economy," says Herbert Rabin, director of MTECH. "We contribute to creating jobs in the state, to adding to the tax base and to enhancing company competitiveness. Our programs certainly accelerate technology assimilation – that is, technology from the university into the private sector."

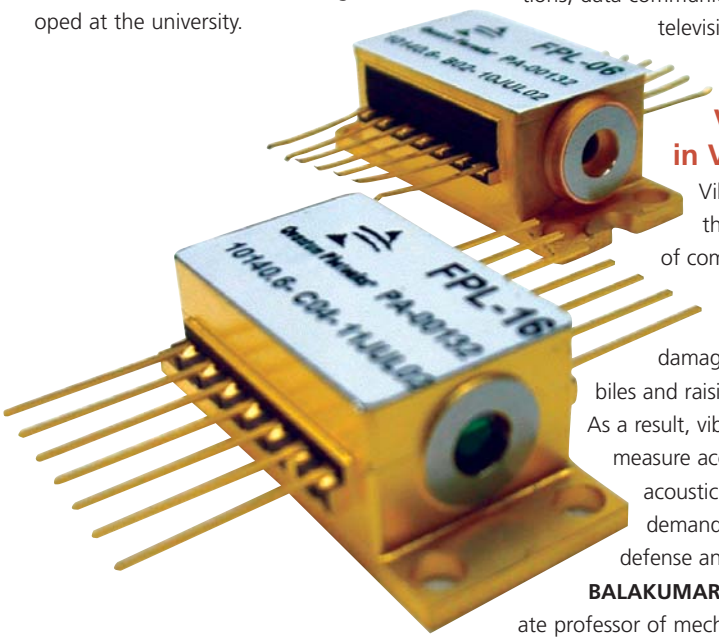
As Martek's Linsert puts it, "The university is rich in scientific talent, technology and know-how. Anytime these benefits can be transferred for commercial purposes, everyone gains – students and faculty, the university, private enterprise, potential employees and the consumer."

Gary Gately is a Maryland-based freelance writer who was a reporter for The Baltimore Sun *for 11 years. He has written extensively for publications that include* The New York Times, Newsweek, Business Week, *and* The Chicago Tribune.

Faculty Garner Invention, Entrepreneurship Awards

Clark School faculty members were among the winners of the recent 2002 Invention of the Year competition, sponsored by the university's Office of Technology Commercialization (OTC). Each year, an independent panel selects winning innovations, one each from the areas of information, life and physical science, based on creativity, novelty and potential benefit to society. A new Award for Entrepreneurship also honored Clark School researchers.

OTC was established in 1986 to facilitate the transfer of information, life and physical science inventions developed at the university to business and industry. The office has recorded more than 1,000 technologies, secured more than 180 patents and licensed more than 600 technologies, generating more than $20.8 million in technology transfer income. More than 45 high-tech, start-up companies have been formed based on technologies developed at the university.



The highly sophisticated optoelectronic components produced by Quantum Photonics won the firm this year's OTC Award for Entrepeneurship.

Managing the Flow of Data

MARIO DAGENAIS, professor in electrical and computer engineering, and Peter Helm, a former research associate in that department, won the inaugural **OTC Award for Entrepreneurship** for Quantum Photonics, a Jessup, Maryland-based company started in 1998.

The base technologies for Quantum Photonics were invented in Dagenais' and Helm's university lab and transferred to the company by OTC through an exclusive technology licensing agreement. The company develops lower-cost, high-performance optoelectronic components to facilitate the flow of data through fiber optic networks.

Quantum Photonics merged with Codeon Corp. this March. The new company, Covega Corporation will provide optical components, modules and subsystems to the telecommunications, data communications, military and cable television industries.

Measuring Variations in Vibration

Vibration can adversely affect the performance of all kinds of complex structural and mechanical systems, including causing fatigue damage in aircraft and automobiles and raising noise levels in theaters. As a result, vibration sensors that can measure accelerations, velocities and acoustic pressure are in great demand for many industrial, defense and commercial applications.

BALAKUMAR BALACHANRAN, associate professor of mechanical engineering, and graduate student researchers Miao Yu and Moustafa Al-Bassyiouni were honored with the **Physical Science Invention of the Year** for the development a new fiber optic sensor system for acoustic, pressure and acceleration measurements of vibration. Advantages of this new system include its high sensitivity level; its ability to be miniaturized to the fiber optic diameter-level for micro-electromechanical systems (MEMS) applications; and its remote sensing capabilities.

The inventors received a Maryland Technology Development Corporation grant for $50,000 to further research and develop enhancements to the technology for commercialization. OTC is in the process of licensing this platform technology to a new University of Maryland start-up company.

Reducing Life Cycle Mismatches

The life cycles of many electronic parts are often significantly shorter than the life cycles of the products in which they are used. If a system or product has a long life but is not a driving force in the market for its electronic parts, then there is a high likelihood of a lifecycle mismatch between the system or product and those electronic parts. These life cycle mismatches can result in high maintenance costs for long-life systems.

PETER SANDBORN, associate professor in the department of mechanical engineering and Pameet Singh, a graduate student researcher, received the **Information Science Invention of the Year Award** for a new methodology for determining the optimum design refresh (redesign) schedule and strategy for life-long electronic systems based on future production projections, maintenance requirements and parts obsolescence forecasts. The methodology, Mitigation of Obsolescence Cost Analysis (MOCA), is the first of its type for parts-obsolescence-driven refresh scheduling and optimization.

Based on a detailed cost analysis model, MOCA determines the optimum design refresh plan, which consists of the number of design refresh activities and their respective calendar dates and content to minimize the life cycle sustainment costs of the product.

The methodology has been demonstrated on Honeywell International's Full Authority Digital Electronic Controller, which is a long-life, low-volume, safety-critical component used in engines for regional jets.

Terplicators Wins Annual Business Plan Competition

This year's university-wide Annual Business Plan Competition highlighted both the creative and entrepreneurial abilities of Clark School faculty, students and alumni. The Business Plan Competition, established in 2000 and managed by the Hinman CEOs program, fosters entrepreneurship at the university. The winning companies, comprised of students, faculty and alumni from across the university, focus on new or next-generation technologies in areas such as homeland security, high-tech manufacturing, and recreational vehicles.

This year's first-place winner, Terplicators, was led by **SATYANDRA GUPTA**, professor of mechanical engineering, and graduate students Rohit Kumar and Alok Priyadarshi. The company designs software modules to enable manufacturers in industries such as prosthetics, plastic surgery, jewelry and toys to produce accurate mold designs within minutes from Computer Aided Design (CAD) or scanned data. More than a third of the 30 potential customers contacted by Terplicators have already expressed interest in the company's product.

"Winning this competition will help us realize our entrepreneurial dream," says Priyadarshi, whose company was awarded $20,000. "Being recognized by such a distinguished panel of judges validates our business plan and gives us the confidence and credibility to move forward as we seek additional funding."

Second-place winner Alertus Technologies LLC, which received a $15,000 award, is developing a secure wireless communications system for emergency warning information. The system is designed for closed communities such as universities, large corporations or government campuses. It can disseminate detailed information—such as the nature of an emergency and what actions to take as a result—to large populations within seconds.

"Our recognition through this competition gets our name out in critical places," states Sandeep Mehta, EE '02, a member of the Alertus team along with Robert H. Smith School of Business student Jason Volk. "It will also make our pitch stronger as we approach future customers because we now have greater credentials."

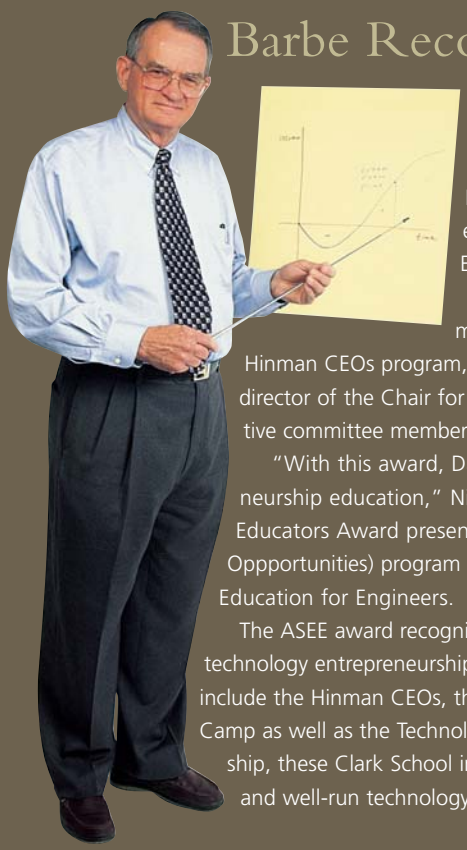
Software designed by Terplicators may help manufacturers across industries produce more accurate molds more quickly.

Third-place finisher Castle Duncan Inc. won $7,500 for its prototype of an ultra-safe all-terrain vehicle (ATV), which is designed to reduce ATV-related injuries and deaths with a custom roll-cage and four-point safety harness. The Castle Duncan team includes mechanical engineering undergraduate student Adam Herbert and alumnae Richard Duncan, '94.

Each of the remaining winning teams,which included Clark School representatives, Cermet Solutions, Creative Photonics Inc. and Rogue Amoeba Software LLC, were awarded $2,500.

An elite panel of five judges from the venture capital and legal communities selected this year's winners. Past winners of the competition include Chesapeake PERL Inc, which has raised $2 million in financing and $1.5 million in grants since winning in 2001 and AnthroTronix Inc, which acquired seven Small Business Innovation Research Awards last year.

The Business Plan Competition is sponsored by the Hinman CEOs program, a joint initiative of the Clark School and the Smith School of Business that brings undergraduate students together in a dynamic, living-learning experience that spurs the formation of new ideas and substantial creative ventures.



Barbe Recognized as Leader in Entrepreneurship Education

David Barbe, executive director of the Maryland Technology Enterprise Institute (MTECH) and professor of electrical and computer engineering, has received the first American Society of Engineering Education (ASEE) Outstanding Entrepreneurship Educator Award.

"Dave's selection was based on the unique contributions he has made to entrepreneurship education in the field, particularly the Hinman CEOs program," says Steven J. Nichols, associate vice president for research and director of the Chair for Free Enterprise at the University of Texas, Austin and ASEE executive committee member.

"With this award, Dave has captured the 'double crown' of engineering entrepreneurship education," Nichols added, referring to the Price Foundation Innovative Educators Award presented to the Hinman CEOs (Campus Entrepreneurship Oppportunities) program late last year at the prestigious Roundtable on Entrepreneurship Education for Engineers.

The ASEE award recognizes Barbe's leadership and innovation in engineering and high-technology entrepreneurship education and the breadth and impact of those programs, which include the Hinman CEOs, the Business Plan Competition and the Technology Start-up Boot Camp as well as the Technology Ventures Club for graduate students. Under Barbe's leadership, these Clark School initiatives are recognized as among the most dynamic, innovative and well-run technology entrepreneurship programs in the nation.

Students Capture Top Prize in NASA RASC-AL Competition

A team of 27 aerospace engineering students was awarded first place in this year's NASA Lunar and Planetary Revolutionary Aerospace Systems Concepts–Academic Linkage (RASC-AL) competition for the design of a Space Construction and Orbital Utility Transport (SCOUT). The team was led by Aerospace Engineering Associate Professor David Akin and Visiting Professor Mary Bowden.

The SCOUT model was developed in response to an announcement by the NASA Decadal Planning Team that the next major goal in space should be a "gateway" station between the Earth and the Moon. The gateway station will become the focal point for future large telescope assembly and further space exploration, all of which will require extensive dexterous operations traditionally performed by extravehicular assembly.

Since current pressure suits are not ideal for operations in deep space, the SCOUT Project involved a detailed design and assessment of a closed-cabin atmospheric system for extravehicular operations. This concept has been referred to as a bottle suit, closed-cabin cherry picker or manned autonomous work system. No such system has ever been tested, simulated or designed beyond a conceptual image in an artist's concept.

"I have been participating in this type of NASA-sponsored competition for 15 years and I have to say that this year's team was extraordinary," relates Akin. "They truly approached the project as if they were running a real business to build the SCOUT."

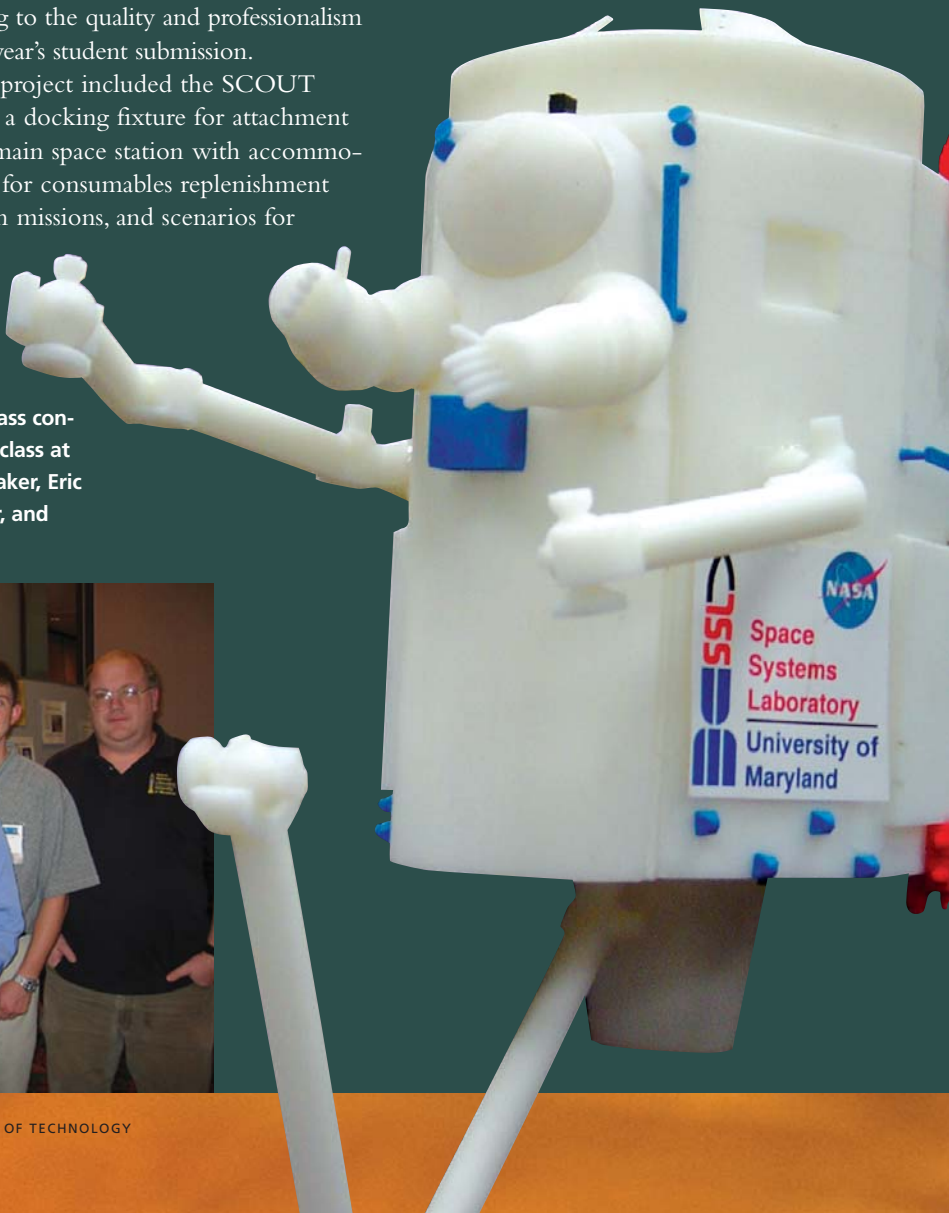
"I would put this team's results up against the preliminary proposal designs of any major aerospace company," adds Akin, speaking to the quality and professionalism of this year's student submission.

The project included the SCOUT vehicle, a docking fixture for attachment to the main space station with accommodations for consumables replenishment between missions, and scenarios for operational applications of this new category of vehicle.

Judges called the Clark School's presentation "totally professional" and "unbelievably thorough." NASA has requested the team's computer-aided design models and documentation as they believe the SCOUT concept both identifies and fills a "gaping hole" in their advanced space operations architecture.

The team bested second place Princeton, third place Georgia Tech and seven other universities, including Penn State, University of Washington and University of Texas.

Twenty-seven seniors in the Aerospace Engineering 484 class contributed to the SCOUT project. Selected to represent their class at the RASC-AL competition in Florida this spring: Meghan Baker, Eric Rodriguez, Andrew Long, Wendy Frank and William Miller, and Aerospace Engineering Professor David Akin.



Pati and Hinman Honored by Alumni

Two Clark School graduates were honored this spring for their outstanding achievements and successes at the Fourth Annual Alumni Association Awards Gala.

Y.C. Buno Pati

Y.C. BUNO PATI received the Clark School of Engineering 2003 Distinguished Alumnus Award for his contributions to the field of engineering and the advancement of technology. Pati is one of the world's leading innovators in semiconductor manufacturing processing technology. In 1995, he founded Numerical Technologies and served as its president and CEO until August 2002. He led Numerical from the initial development phases through its initial public offering in April 2000 and completed three successful acquisitions. Pati led product development, marketing and sales for software and technology products that span the design-to-silicon spectrum and cover the semiconductor manufacturing, photomask and IC design markets.

Previously, Pati was an assistant professor of electrical engineering and computer science at Harvard University. Prior to Harvard, he led a research group at Stanford University that developed the original technology for Numerical.

Pati, who received all three of his degrees in electrical engineering from Maryland, serves on the board of directors of Brion Technologies and the Clark School Board of Visitors. ■

Brian Hinman

BRIAN HINMAN received the Ralph J. Tyser Medallion for providing unique and significant service to the university. Hinman holds 11 U. S. patents and has been honored as one of the nation's most successful entrepreneurs. At the age of 22, this engineering alumnus co-founded PictureTel Corporation and served as director and vice president of engineering from 1988 through 1990. Today, as president and CEO of 2Wire, which he founded in 1998, he leads the nation's largest provider of DSL home networking equipment.

Hinman also was the co-founder and former CEO of Polycom, Inc., an internationally recognized teleconferencing equipment company. In 1999, Hinman's $2.5 million gift to the University of Maryland established the Hinman Campus Entrepreneurship Opportunities (CEOs) Program. This program offers a residential setting for upperclassmen where they can grow their ideas for starting a business in an experiential learning environment.

Hinman, who graduated with a degree in electrical engineering from Maryland in 1982, is a member of the Clark School Board of Visitors and the University of Maryland College Park Foundation Board of Trustees. ■

Alumni News

DINO CAPOROSSI, EE '88, is vice president of marketing for Hier Design Inc., an electronic design automation (EDA) supplier delivering software for high-end field programmable gate array designs.

S. JOE QIN, CE Ph.D '92, was promoted to professor of chemical engineering at the University of Texas at Austin, where he holds the Quantum Chemical Corporation Endowed Faculty Fellowship in Engineering.

RANDALL N. ROBINSON, CE Ph.D. '01, received the Robert E. Wilson Award at the AIChE 2003 meeting in New Orleans. This annual award recognizes outstanding chemical engineering contributions in the nuclear industry.

TIM SEELEY, EE '86, has been named vice president of engineering at Protiveris, Inc., a bio-nanotechnology company commercializing technologies to facilitate protein research and the discovery of new pharmaceuticals.

HAROLD C. SMITH, EE '80, is senior vice president, Science Applications International Corporation (SAIC), the largest employee-owned research and engineering company in the country.

THOMAS YOUNG, ME '88, is vice president of sales and business development for PlatformLogic, and was previously vice president of sales and service for Unwired Express, a provider of context-based mobil applications.

Robeson Inducted Into Innovation Hall of Fame

Lloyd M. Robeson, a principal research associate for Air Products and Chemicals, Inc. and an accomplished engineer in the field of polymer and polymer blends, was inducted into the Clark School Innovation Hall of Fame in May. He conducts projects on long-range polymer science research for his firm's Corporate Science and Technology Center in Allentown, Pennsylvania.

Robeson received his Ph. D. in chemical engineering from the University of Maryland in 1967. His inventions include polymer composites for the shoe industry, housing for Polaroid cameras, orthotic products, a number of commercial polymer blends, and polymers for electronic applications. Robeson holds 91 patents for his work with polymers.

He has authored or co-authored more than 90 publications, including *Polymer-Polymer Miscibility*, which after 20 years is still the primary reference on the subject. Robeson was elected to the National Academy of Engineering in 2001, the same year he received the Clark School of Engineering Distinguished Alumnus Award for his contributions to the field of engineering and service to the university.

Honor Roll of Donors Biannual Report 2002 and 2003

THE A. JAMES CLARK SCHOOL OF ENGINEERING

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All Gifts, Pledges and Matching Gifts received July 1, 2001 to June 30, 2003

ON BEHALF OF OUR STUDENTS, I would like to thank all of our alumni and friends who have given to the School of Engineering over the past two years. Your significant support makes a decided difference in the quality of our academic programs; in the breadth of our innovative and exciting research activities; and in our strong commitment of outreach to the state of Maryland and the surrounding region.

While gifts to the Clark School may vary in shape and form—including contributions of cash, appreciated securities, equipment and property—the intent of this philanthropy has one unified goal: an uncompromising standard of excellence in all aspects of our operation. Your support builds the cornerstone of quality that ensures the Clark School remains one of the nation's top engineering programs.

Thank you again for sharing in our vision. We fully recognize that our continued success is a reflection of our generous friends.

Sincerely,

Nariman Farvardin

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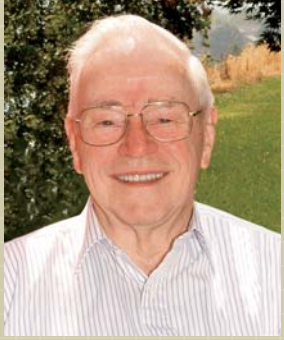

PHOTO BY LUISA DIPIETRO

Edwin Inglis

Inglis Creates Charitable Trust

Edwin Inglis, class of 1943, is the first in his family to receive a college degree, an achievement he credits to an innovative program called the "A" course at Baltimore Polytechnic Institute. Completing this high school program certified his enrollment at Maryland as a sophomore.

In those days, the university was small with only four engineering disciplines offered. "I was afraid of chemical engineering, so I chose mechanical engineering, thinking that it was the most commercially oriented discipline available at the time," Ed recalls. "I never regretted that decision."

Due to World War II, Ed's college education was accelerated. "I completed six semesters in two years and then the Navy sent me to Cal Tech for training in aviation engineering," Ed shares. "I was one of the youngest guys there, and many of the older guys had been practicing the profession for a few years. I was able to hold my own," he adds proudly. "It seems to me that my professors at Maryland had prepared me well with a good education."

Ed had a long and successful 36-year career with what was then Standard Oil and today is Exxon-Mobil. His work, primarily in lubricants and petroleum products, took him to three continents and to various positions within the company, so Ed never lacked for a challenge.

In gratitude to the engineering school, Ed recently established a charitable remainder trust for $500,000 that is earmarked for the new Kim Engineering Building. "It feels good to pay back the university for giving me such a good education," says Ed. "Funding a new building where students will learn and do research is a wonderful idea."

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G. Steven Miller
Howard S. Moy
H. Hudson Myers III
Paul F. O'Donnell
Allie C. Peek Jr.
Robert Lance Peskin
Donald Scott Ruhl Jr.
James A. Ryan
Charles K. Salter
Frank A. Saus
Michael J. Shama
Jonathan J. Sheperd
Williams C. Sherbin
Georg A. Shultz
Robert R. Sidi
John M. Talbott Sr.
Hugh V. Tamassia
Daniel P. Vance
Raymond E. Weber
Howard O. Wilson
Steven E. Zalesch

1974

Allan Victor Abelow
Dwain W. Alexander
Walter William Arbogast Jr.
Dale C. Barrick
Jerry L. Barron
Wayne Berman
Bert F. Black
Robert K. Brooke Jr.
Wallace L. Brown Jr.
Drew D. Cummings
Rebecca M. Eubank
Michael H. Ficco
Arthur P. Gile
Frederick O. Graddy
Frederick H. Halvorsen
Charles A. Irish Jr.
David V. Kalbaugh
Donald T. Knauss
Paul W. Knopfle
John Raymond Lawrence
Jeffrey W. Lindsey
Gordon Lee Lushbaugh Jr.
Kevin Robert Madigan
Thomas L. Martin
Roger G. Petzold
Thomas E. Schmitt
Allan Schneider
David T. Speargas
David L. Tate
Mahmod M. Tehrani
John S. Tracey
George W. Usher Jr.
Michael J. Veraa

1975

Marianne Evans Abercrombie
Mansoor Ahmed
Mark F. Arnold
Michael J. Baum
Philip Gilbert Berman
Charles Matthew Ciany
Randall Eberly
Andree N. Filipov
Wesley S. Foley
Michael L. French
James C. Glascock
Lawrence B. Goodwin
Michael J. Goss
Carlton K. Gutschick
Richard P. Healy
Richard Ho
David Jay Icove
Andre Kebreau
Don S. Kondoleon
William R. Kowalyshyn
Ronald Y. Leung
Keith W. Lindler
Jeffrey H. Marcus
Richard Joseph Marinshaw
Wayne H. Montag
Richard E. Pelc
Clinton B. Ramsey
Gary A. Staley
John P. Stroczkowski
Timothy L. Theis
Eric S. Walbeck
John C. Wallace
Donald E. Zehner

1976

Curtis J. Behun
Daniel S. Cobb
Gerald Patrick Dougherty
Rizwan Elahi
Kenneth L. Fowler
Thomas P. Gaske
Arthur Dubrutz Jacques
Kenneth C. Kiddy
David Perry Klein
Robert M. Kube
Donald Gregory McMican
James Albert Milke
John A. Moeller
Richard P. Reckert
William M. Roberts
Rick R. Schartel
Mark S. Spotz
Thomas H. Stengle
Martin F. Sterba
George Frank Stimak
Philip B. Tarbell III
Robert E. Toense
Jiin P. Wei
David L. Welsh
Bryan L. Yri

1977

Dennis P. Abremski
Frederick R. Adamchak
John M. Albert
Gregory Anderson
Henri D. Bartholomot
Horace E. Cascio
Timothy Coughlin
Frank D. K. Der
James H. Dietz
Ramachandra Diwakar
Kim L. Doyle
Richard E. Duncan
James M. Earlbeck
John W. Gird
Alan S. Goldfarb
John G. Hemphill
Byrd C. Hennessee
Ronald T. Jerdonek
Patricia M. Lacey
Jeffery W. Lee
James E. Malcolm
William R. Mosher
Dennis E. Nowstrup
Ira J. Perlow
George J. Quinn
Harry J. Rebbert
Timothy J. Regan
Guy W. Riffle
Jeffrey L. Schwab
Bruce P. Semple
Karen Gainer Thomas
Mark R. Tilyou
Steven A. Varga
Stephen M. Watkins
Charles L. Weaver
George J. Wrobel
Agnes T. Wu

1978

Balakrishn S. Babu
Charles E. Ball III
Gary L. Biggs
Louis J. Breitenother
Frank J. Burgess
Curtis C. L. Chapman Jr.
Michael C. Cheok
Shaocheng Chiu
Robert J. Deutsch
Keith A. Duerling
Thomas D. Duff
Keith H. Eggert
John D. Foster
Ian M. Friedland
Karl E. Gangstad
Pedro S. Hurtado Durand
John G. Irwin Jr.
Edward E. Kadala Jr.
Kurt R. Keydel Jr.
Thomas J. Kirk
William H. Kuiper
Mary E. Lacey
Richard E. Levine
David B. Libby
John D. McClure
Eric J. Meyer
Richard B. Morrison
Errol C. Noel
Robert P. Olszewski
Michael W. Pfarr
Kenneth M. Romney
Bernard C. Rudell
Michael A. Russo
Leonard R. Sellman
Holger O. Serrano
John D. Sigler
Ronald R. Smoker
John J. Snyder
Judith H. Stein
Leland T. Warnick
Charles J. Weber
Ulysses S. Yee

1979

Donald W. Ausherman
Dale L. Belschner
Lucien E. Biron
Timothy Arthur Bond
Brian J. Brown
Gary M. Callahan
Jon P. Casamento
Joanne M. Cheok
William G. Cleveland Jr.
Ronald F. Cox
John W. Craig
Protagoras N. Cutchis
Brian Delgrosso
Sanford H. Duryee
Robert H. Estes
Mitchell A. Fishbein
Thomas P. Fusco
George D. Hill
David E. Hormby
Raymond E. James
Thomas A. Jochum
Kent Edward Kaufman
Rhys N. Kuklewicz
Stephen O. Leslie
Philip E. Liebrecht
Robert G. Martino
Gerald R. McHenry
Michael A. Metzger
Christopher E. Miller
Dennis J. Moler
Ray A. Price
Robert J. Reuter
Douglas K. Roberts
Renato Sarti
Robert L. Schoeneman Jr.
Evan E. Stauffer Jr.
James A. Stokes
Stuart B. Taub
Hong Tran
David M. Walencewicz
Martin D. Walther
Norman D. Welch
Jeffrey E. Wieselthier
Raymond Lee Wilcher Jr.
Robert D. Wilson

1980

Mourad E. Amer
John C. Bernot
Ronald E. Boenau
Michael H. Burgoyne
Michael C. Butler
Loris Jones Butterfield
John M. Carroll
Glenn C. Culbertson
Mary Y. Dan
Kevin H. Dixon
David F. Dorros
Joshua W. Elvove
Larry R. Ernst
David Farrow
Mark A. Flamand
Gene M. Garner II
Christopher Gratton
Sung Young Han
Thomas J. Hannan Jr.
Albin L. Hawkins
Christopher Edward Hayden
Timothy D. Hirrel
Richard H. Hollis
Gerard F. Iacangelo
Steven W. Ide
Barres J. Jackson
Marc W. Joslow
Michael C. Kammer
Cynthia S. King
Richard S. Konapelsky
Benson Kwong
Barry L. Leslie
David J. Ludwig
David C. Mackes
Michael J. Mannion
Gregory E. Moores
Timothy J. Morris
Catherine M. Naabe
Edward R. Neal
Stewart G. Nutis
Eric R. Olson
Jeffrey S. Ray
Julio A. Reategui
Richard C. Reilly
Guy R. Richardson
Eric Schwartz
Julien A. Scott
Douglas E. Sharp
Carl L. Siefring
Steven C. Sprinkle
Linda Trageser-Kale
Timothy Lee Upton
David M. Van Wie
Daniel K. Yu
Daniel F. Zivi

1981

Barry M. Abzug
Davendra P. Bakshi
Rafik Bazikian
Ronald J. Beegle
Leita S. Bennett
David G. Bivans
Gary Nelson Bonadies
Gordon M. Brown
Rhea Morgan Burrow Jr.
Ronald A. Cohen
Gordon D. Cook
Russell A. Deubler
Eugene Thomas Furey
Casey C. Grant
Douglas S. Grant
Joel M. Graybeal
Jiyon Hahn
Paul S. Henig
Donald J. Hirsch
Jerry W. Howell

Morris A. Hymes Jr.
John D. Hynes
Peter A. Johnson
Steven D. Jones
John F. Keagle
Stephen E. Keefe
David B. Lee
Terence S. Lee
Jackson K. Liu
Dorothy B. McGarrah
Anthony C. McMurtray
Daniel N. Miller
Theodore G. Mordfin
Julio Cesar Morinigo
Ram Mukunda
Kevin J. O'Neill
John B. Ostaffe
Paul E. Panneton
Robert G. Rahikka
David L. Reese
Albert V. Romano
James T. Rosenwald
Randolph Kevin Seasely
Charles S. Slingland
Kevin Lovett Smith
Robert A. Smith
Carl M. Stahle
Michael D. Vanous
Frank C. Vogel III
Norine M. Walker
Dale William Walter
Cherng Y. Wang
Gary L. Wang
Douglas L. Watson
Stanley Bruce Wernek
Jan S. Wolpert
Barry E. Wood

1982

Juan P. Amenabar
James S. Barney
Kijong H. Basel
Timothy J. Bennett
Jeffrey G. Bernstein
Thomas P. Billheimer
Thomas M. Brandt
Daniel J. Brenner
George E. Burall
Theresa Ann Butler
Mark J. Carney
Candace F. Cederman
David W. Cooper
Scott D. Dehaven
Mark A. Deluca
Alfredo Diaz
Donald H. Dripps
Earl E. Eaton
Mark E. Eney
William H. Engel IV
Michael F. Ernst
Sharon D. Faulkner
Timothy M. Fertig
Ray I. Fields
Paul C. Friedlander
Kathryn W. Garber
Naveed M. Gill
David A. Goldberg
Saul Goldfarm
Stephen R. Gray
Alan L. Hartman
Lorraine M. Herger
David Herzberg
William Henry Hettchen
Brian L. Hinman
Larry J. Hooks
Shang L. Hsiung
David S. Illar
James W. Kelly
Douglas S. Kim
Steven F. Kimmett
Mark S. King
Joseph D. Klunder Jr.
David Carl Kraus
Barry M. Lewis
David S. Lipka
Robert T. Lubaszewski
Lawrence Scott May
James R. McConnell
Kenneth M. McNabb
Jonathan L. Miner
Jennifer Louise Nelson
Les A. Newcastle
Charles S. Nolan
Michael J. Nusca
Layne C. Party
Tulsidas C. Patel
Robert R. Payne
William D. Reckley
Orlando Reyes
Jaye Richardson
Alan Rosenbaum
Gregory J. Rusbarsky
Jay C. Schaefer Sr.
James M. Schissler
Steven E. Schulz
Paul T. Shultz
Monica S. Sluyter
Robert A. Storke Jr.
John Robert Tighe
Yogesh Tiwary
John Stephen Vantucci
William F. Wahl
Jay D. Warshowsky
Robert M. Willbanks
Andrew F. Wright

1983

Aderemi A. Adeyeye
William E. Armour
Stephen R. Benson
James J. Bezila
Cynthia A. Bohse
James Borzatti
W. Scott Boyer
Daniel L. Brandel
Daniel R. Brouns
Ronald G. Busch
Lydia Anne Butterworth
Ken Shu Chen
Robert M. Connerton
Michael E. Cooley
Ken R. Crouse
Stephen E. Crum
Steven W. Diggins
Steven E. Gagnon
Michael W. Gallagher
James M. Garner
Ronald E. Gist
Scott Alan Gordon
Jeffrey F. Griffin
Daniel D. Helfrich
William D. Homick
Bonnye A. Hur
Carol L. Ingram
Patrick R. Jackson
Robert Ray Kifer II
Richard C. Klein
Terrence M. Klosky
Mark T. Lewis
Richard E. Link
Dennis C. Loh
Lorice E. Mason
Richard J. Murphy Jr.
Jonathan E. Nesbitt
Brian M. Nixon
Mark William Nixon
Daniel J. Radack
Ellen F. Rhude
Catherine P. Rice
Lee A. Rodberg
Ming-Yun Shih
Edward M. Silversmith
Jeanne M. Stahle Nolan
Dean J. Tills
Stephen J. Treado
Mary Vogelsang
Norine M. Walker
Peter Scott Weinberger
Gregory M. Wilkins
David Scott T. Yon

1984

Victor J. Arca
Brock R. Arnone
Michael S. Baracco
Donald F. Belz
Dale P. Bentz
Edward J. Burke
James L. Cantor
Michael A. Caselli
Cecil Bradford Collins III
Anthony M. DePaul Jr.
Raymond A. DiBerardo
Wade H. Donnelly
William M. Eister
Patricia C. Fennell Restivo
Vonderlear A. Fields
Richard Paul Fischer
Elliott R. Gross
Thomas L. Hartman Jr.
Venugopal G. Iyengar
Roch Joseph Kallmyer
Mark J. Kane Jr.
David Martin Kehne
Shirin Keshavarz
George I. Legarreta
David B. Legg
Allen G. Lim
Claudia Oswald Marlow
Donald H. Marlow
Nancy P. Marx
Kevin L. McIntyre
Reid Matthews McKeown
Alfred T. Mecum
Michael W. Miller
Craig W. Moon
Esther S. Ng
Thomas V. Ng
David W. Orndorff
Shailesh J. Patel
Suzanne Edna Prickett
Nancy P. Reilman
Herbert E. Reinhold III
John G. Roby
Vincent K. Ruminski
Stephen P. Schrantz
Krishnan Sridhar
Scott Alan Stephenson
Theodore E. Tedijanto
Yvonne Thelwell
Christine A. Tierney
Craig D. Walrath
Jeffrey S. Watt
John F. Weiland Jr.
Jenifer C. Weinbach
Edward C. Wenzinger
Peggy M. White
Victor F. Williams
Jeffrey A. Wong

1985

Philip M. Anderson
David C. Bardach
David L. Bartolomei
Sharon L. Bauer
Samuel C. Bell
Michael E. Bohse
Stephen K. Bozman
Frank George Buell Jr.
Keith D. Burns
Kimberly M. Buschman
Mark T. Butkiewicz
Lawrence Carin
John E. Carney
Michael J. Colgan
Jacqueline A. Desrosiers
Martin B. Dinsmore
Jeffrey A. Gavenas
Kenneth L. Gillespie
Brian J. Goldsmith
Jeffrey L. Harris
Brian D. Hoover
Mark P. Huston
Steven J. Johnson
Peter R. Karasik
Kenneth R. Katz
Richard E. Kavanagh IV
Jeffrey B. Kempic
Robert Edward Klug
Mohanjeet S. Kohli
Francis J. Kub
Byron James Lambert
Michael J. Laurine
Gerald A. Lavallee
Lawrence O. Liberman
Richard Eugene Maltagliati
John D. McCord
Karen A. McDonald
Thomas G. McElhinney
Thomas P. McGrath Jr.
David W. Murphy
Sang Y. Nahm
Kevin W. Noonan
Angela M. Orentas
Scott R. Pettygrove
William B. Pino
Alexander R. Psaros
Barbara B. Riggs
Laura A. Rossell
Jason A. Roussos
George Sazaklis
Brian Royce Schwiesow
Gifford D. Scott
Randall James Shearman
David A. Shindle
Brian P. Sievers
Joel M. Simpson
Bernard A. Sokolis
Sharon A. Steele
Scott C. Stocklin
Nicholas M. Teti
Mark A. Thoreson
David Tom
Trinh Q. Truong
Steven T. Uehling
Diane R. Vernooy Gallagher
Donald C. Wellmann
Morris John Zwick

1986

Richard J. Adams Jr.
Alain L. Bashore
John E. Bate
Roger L. Bazzarre
Sarah E. Brewer
Byron T. Brezina
Thomas M. Buchanan
Arnold P. Burr
Joel Vincent Caudill
Elaine L. Clark
Michael Patrick Connor
Michael A. Cox
John P. Crupi
Shailesh M. Dave
John S. Donegan
Andrew L. Dull
Robert E. Edgin
Michel P. Ellert-Beck
Walter R. Eppler
Warren Keith Foster
Rufus M. Gant III
Clifford George
Linda Lee Gilpin
Brett T. Gleadall
James T. Gottwald
Herbert S. Graham
Stephanie S. Green
Kerry E. Griffin
Thomas A. Hahn
Shirley H. Harmon
Samuel E. Hawkins III
James C. Hovater
Vanessa D. Howard
Ivan J. Humberson
Douglas H. Kanter
Jacqueline T. Kelly
James N. Kiladis
Carl R. Klee
Keith R. Koch
Eric J. Kominski
Joan G. Law
Changta T. Lee
Mary B. Leidig
Mark David Levin
Ernset Sze-Chung Mak
Benedict M. McDonald
David T. McElhaney
John F. Meier
Louis N. Molino
James H. Morehart
Sherrill W. Mosee
Robert Lawrence Munach
Jeffrey R. Nickel
Ward L. Oberholtzer
Angel S. Paredes
Y. C. (Buno) Pati
Robert G. Peranich
David P. Plant
Michael Popp
Frederick M. Proctor
Robert N. Renner
Douglas S. Rowand
Katherine M. Ruben
Michael P. Scardera
Michael Brian Schneider
Gregory A. Schultz
Nikhil Madhu Shirodkar
Judith Lynn Sikora
Scott A. Spangenberg
Alan Douglas Stemple
David J. Sulerzyski
Catherine T. Tiernan
Geralyn S. Trombly
Mark A. Uehling
J. Timothy Van Sant
Gregory J. White
Thomas E. Wilson
Kerry W. Wisnosky
Shih Don Yen
Nancy D. Zeigler

1987

Ronald J. Allen
Edward G. Amatucci
Joseph M. Askins
Joann I. Barney
Edgard F. Bertaut Jr.
Timothy E. Beville
Kenneth J. Bocam
Joe E. Brewer
Celeste Thompson Butler
Jimmy C. Cachola
Robert Capparelli
Gregory N. de Kramer
Kevin Lewis Dill
Arthur E. Dunn
Steven C. Eberly
Harry P. Freed
Hugh N. French
Victor B. Gehr
Richard L. Gezelle Jr.
Richard B. Glass
Daniel R. Goldstein
Barry L. Hammond
Christoph D. Hardin
Joyce N. Hardy
Debra A. Henretty
Richard M. Hillis
Moses J. Holmes
Tereza Jacoby
Wein-Shen Jiang
Jeffrey J. Johnson
Kimberlie H. Kerfoot
Michael Stephen Klassen
Richard J. Link
Troy J. Logan
John K. McGuckin
Michael B. Mill
Chun Y. Moon
David G. Morgan
Thomas E. Murray
Michael A. Neal
Cherryl Gillette O'Donnell
Stephen M. Poltorak
Harry S. Ransom Jr.
Dennis K. Rathbun
Jeffrey A. Reddish
James C. Roberts Jr.
Mark H. Salley
Fredric M. Scali
Mark J. Schoppet
Naiming Shen
Mary Angela Shields
John W. Simons
Steven Stow
Deanna W. Temkin
Philip H. Temkin
Steven A. Walsh
Daniel Joseph Weidman
Deidre Ann Willard
Susannah M. Williams
Norman B. Willner
H. Steve Winters Jr.
Steven P. Wrightson
Jen-Dong Yuh
Jing Zheng

1988

James S. Abell
Steven D. Acenbrak
Lewis I. Askew
John Anthony Bielec
Pamela Gasper Boland
Diane B. Brabston
John F. Cavanaugh
Shing-Chong Chang
Kun-Min Chen
Minze Vincent Chien
Dawn M. Clayton
Edward A. Connell
Richard H. Danz
Giordano J. DeCandia
Andreas Doulaveris
Thomas James Drach
Alexander C. Drohat
Mostafa Kamal A. Elnahal
Mostafa A. Fahmy
William F. Fields
A. Dirk Fitzpatrick
Jeffrey W. Gluck
Michael W. Gust
Steven B. Hall
Dawn M. Hawkins-Nixon
Susan M. Hill
Patrick K. Holub
Roberto J. Kaliman
Jeffrey D. Karceski
Edward A. King
Douglas A. Kukucka
Bonita F. Lewis-Bell
John Brian McKirgan
Timothy J. Mermagen
Carolyn J. Merry
Marshall G. Millett
Bibhu R. Mohanty
Brian L. Moore
Mary D. Moore
James D. Moreland Jr.
Michael G. Nishizaki
Richard J. Piluk
Catherine A. Ruseau
Richard J. Sansone
Michael J. Schmidt
Michael S. Shemer
Brent Sherwood
Timothy J. Smidt
Michele Stern MacCollum
Matthew T. Storck
Cha-Hsian Tan
Kevin M. Thomas
Tung-Duong Tran-Luu
Matthew F. Ukleja
Karl E. Walinskas
Douglas Dean Wasson
Rex G. Wescott
John S. Wilcher
Randy L. Willard
Winnie S. Yip
Jen-Lun Yuan
Ann Zaks
Mark P. Zalubas

1989

Anthony Foronda Albano
Bryan P. Anderson
Daniel M. Barbieri
Daniel P. Beatty
Lawrence D. Boehm
Gary Paul Daelemans
Edward Orr Devlin
Anthony John Diventi Jr.
William Lawrence Freeman

J. Kevin Frick
David M. Goblirsch
Kimberly Jane Green
Jeffrey E. Harper
Wendy L. Harris
Dang Hai Hoang
Reginald Harry Holt
Daniel I. Hott
Victor Kenny Hwang
Wojciech Kajetan Kasprzak
Kerry R. King
James Scott Koehler
John W. Kosher
Steven G. Krone
Dar-Ning Kung
Rita B. Leahy
Callie L. Lee Tourigny
Brian Edward LeGette
John Paul Marple
Linda Lucero Matteson
Edward L. May
Kevin Marc Merriman
Robin A. Morey
David Royal Mumford
Hamid R. Nassiri
Hatsumi T. C. Nielsen
Larry A. O'Ferrall
John Allen Oliver Jr.
Zezhong Peng
William Bela Penzes Jr.
James M. Silbermann
Brian Sircus
Walter N. Strojny
Amy L. Tarleton
John E. Tourigny
Robert C. Toy
Anita Lynne Tracy
Stanley C. Underwood
Harald Willem Van Aller
Michael Ray Weaver
Martin W. Whitelocke
Shun-Tak Wu
James Christopher Zeller
Qin Zou

1990

Julie Anne Banner
Russell E. Beall
Rowland Hobr Bedell Jr.
Roger F. Bonham Jr.
Thanh-Chau Mireille Buu
Craig Care Carter
Seth Cottrell Churchill
Daniel Andrew Cronin
Michael Andrew Deeds
Samuel Anthony Denny
Daniel Edward Diehl
Changli Duan
Robert Michael Gagnon
John V. Garnett
Peter James Griffin
Anirma Rakshpal Gupta
Stephanie A. Harrington
Dean Guy Jarrett
Ian C. Jung
Joseph Edward Liberatore
Susan Che-Cha Lin
Steven Ellsworth Lohr
Joseph Ronald Mashinski
Joseph Michael Mate
Bruce Joseph McCanna
Matthew Alexander Miltenberger
Robert Francis-Dante Piacesi
Carl George Reitenbach Jr.
Edward Norman Schinner Jr.
James Francis Skarbek III
Cynthia Folz Slaughter
David Stanton Sutherland
Aleksy Lukjan Szachnowicz
John S. Tsantes
Andrew Paul Valente
Venugopal K. Varma
Charlotte W. Wagner
Hang Zhou

1991

Warren B. Albert
Karim Amrane
Thomas William Bennett
Dhiraj Bhatt
Lioun Wee Chen
Tien-Seng Chiu
Rodney Aric Diehl
Thomas Eric Dissinger
Bruce Allen Douglas
Michael Folkart
Robert Scott Grossnickle
Ranjana Khan
Tom Wadie Khoury
Jeong H. Kim
Michael J. Klemenz
Jon Eric Morris
Peter F. Nash
Tai-Loi Ng
William Clinton Raynor
Susan King Roden
Jonathan Christoph Rolf
Darren Philip Ryan
Mamadou Sevede
Ermis Sfakiyanudis
Donna Carrier Smith
Andrea T. Stenberg
Douglas Dwayne Stump
Mark Alan Uebel
Michael Charles Weiss Jr.

1992

Arshia Arvandi
Jonathan Daniel Baker
Lauren Kucner Crews
Anthony Joseph Davenport
Charles Arthur Greene
Feng Huang
Joseph Edward Huesmann
Shobhan M. Jha
Martha Dene Keely
Robert Anthony Lim
Philip Ray Prather
Samir Puri
Shawn Xiaonong Ran
Lothar John Schroeder
Timothy D. Sheckler
Kristofer L. Singleton
Richard Albert Smedley
Matthew Eric Theurer
Mark Alan Thomson
Cinnamon Nancy Tinsley
Stephen Lloyd Vail
Robert Jude Wagner
Elizabeth Wilcher
John Scott Williams
Jacqueline Crystal Young

1993

Ronald Stephen Barbaro
Heather Marie Borowski
Antonio Martinez Bouza
Daniel Thomas Casem
Emad H. Elshafei
Barbara Maureen Flaherty
Derrick Shawn Frost
Bradley Paul Gruss
Philip Seth Margolies
Mark Eugene Melton
Antonios Minas Nicolaidis
Linn L. Oaks
Jumoke O. Osias
Michelle Renee Patton
Rajesh Ratnakar
Jeffrey L. Robinson
Paul Christopher Robinson
Marc Kendall Sours
Lorenzo Taylor II
Carlos Jose Vargas
Richard B. Wank
Sen-Jung Wei
Thomas Lawrence Wynn
Wen-Bin Yang

1994

Archana Basi
Sandra Ingham Brown
Mark Francis Caggiano
Laura Aileen Denny
Kathleen J. Field
Earl Francis Gill III
Fred Allen Householder
Sean Brian Ledford
Michael Joseph Levendusky
Kenneth Tyler Lowe
Timothy Steven Mossman
Jeremy Brain Neilson
Nicole Young Pak
Andrew Jason Paradise
Paul Thomas Qualey
Stephen Judd Sickels
Abtar Singh
Sonja Patricia Soleng
Polly Solliday
David Alan Steury
Daniel Seth Weile
Yunfang Yu
Brenda Carpenter Ziemba

1995

Scott Randall Baker
John Michael Bird
Judy Bitman
Robert Andrew Cerbone
Martin Brokner Christiansen
Christina Tadle Contreras
Michael Cee Etheredge
John Michael Fines
Jonathan Arius Grant
Ruth G. Gresser
Stephen Patrick Hoffman
Ernesto Ramon Mercado
Ravi K. Nangunoori
James Henry Pickett Jr.
Barry Conley Smith
Brian Thomas Vigna
Karen Ann Voglezon
Jordan Thomas Wilkerson
Caryn Gae Williams
Jeffrey Joonnyong Yoon
Michael Steven Younkers
Qingsheng Zheng

1996

Alfred Lyle Adcock II
Brian W. Baldwin
Raymond Walter Blowitski
Jason Duane Calderwood
Shih-Ying Chang
Timothy Alan Conley
James Leonard Driessen
James Edward Gibbons III
Sean Patrick Illig
Payman Kaveh
Christopher J. Kloss
Yohan Mark Lin
Martha Grace Mansfield
Brian Allen Markey
Nelson Alexandre Nazario
Christopher Keiu Olsen
Paul Dirk Oosterhout
Dontrell Evette Pinder
Kartik Ramaswamy
Paul Andreas Tittel
Ayse S. Tokar
Jason C. Tseng
Damon Clark Webster

1997

Peter Panayiotis Campanides
Eric Trevor Carpenter
Timothy James Clark
Jeremy David Cooper
Michael Terrance Doster
Timothy Scott Hillier
Viet H. Huynh
Christopher T. Jones
Ted Kakavas
Mark Francis Klappenberger
Jun Lang
Ashish Aaditya Malik
Kristin Marie Mihalcik
Timothy Walker Osborne Jr.
Yogesh A. Patel
Supathorn Phongikaroon
Elizabeth Rosenfeld
Mathew V. Samuel
Heather Grau Svahn
Kenneth E. Yeatman

1998

Alan Barney
Aasha Ashvin Desai
David Glenn Erickson
Michael R. Gouel
Brian P. Gregory
Joseph E. Hayden
Rhett Jason Hesprich
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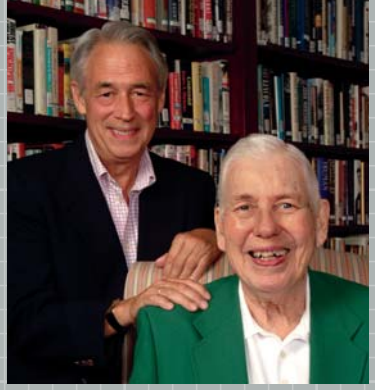

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William and Arnold Korab

Arnold A. Korab Endowed Scholarship Fund

The Arnold A. Korab Endowed Scholarship is a testament of family pride and dedication to the university and the School of Engineering. In 1998, William (Bill) Korab and his sister Anne Korab Faffley established this $100,000 endowed scholarship for electrical engineering students in honor of their father, Arnold, a 1938 mechanical engineering graduate.

"My father is a man with no pretense or desire for publicity," says Bill Korab, Clark School Board of Visitors member and 1964 alumnus of the chemical engineering department. "He goes through life trying to do the right things and to do them well."

For those reasons and for being an exceptional father, his children created a scholarship in his name, something he never would have considered for himself. "With the university's help, we have honored him in a most appropriate and meaningful manner," explains Bill.

An advocate for education, Arnold always hired Maryland engineering students to work for his fire alarm and safety systems company, Ellenco. "My dad always found extra money to help the engineering students, and would often help them pay tuition," recalls Anne, a 1969 graduate of hearing and speech sciences. "It is his philosophy of life—to help and bring the next generation along."

"Society is as good as the quality of people playing a role in it," adds Bill. "Your ability to add to that quality is largely a function of the education you received."

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Forward Thinking

In virtually every aspect of their lives, Jan Sengers and Johanna (Anneke) Levelt Sengers are pioneers. Internationally recognized for their groundbreaking work in thermophysics, the Sengers are role models as scientists, as immigrants, as a successful two-career couple, and as people devoted to supporting and advancing educational equality and diversity in engineering and physics.

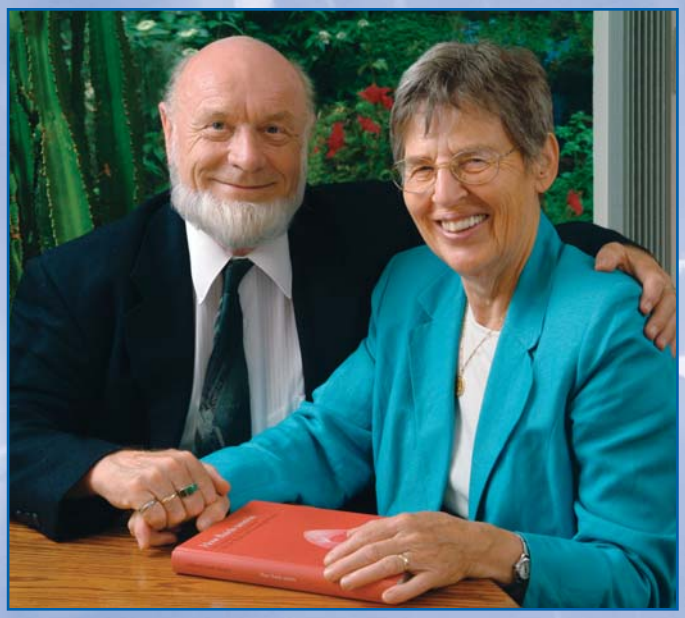

PHOTO BY LUISA DIPIETRO

Jan and Anneke met in graduate school at the University of Amsterdam. Jan was from a rural village north of Amsterdam, while Anneke was raised first in Amsterdam, then in a nearby suburb. Jan, the son of a local utility company employee, was the first in his family to enter a university, made possible by an interest-free loan from the Dutch government. Even then, Jan had to commute by train to the university until he was able to secure a teaching assistant job to pay for a tiny room in Amsterdam. Anneke's parents, on the other hand, held university degrees in the sciences. Nevertheless, being the oldest of a large family, she had to support herself with government loans and a high school teaching job.

In 1962, Jan earned his doctorate in physics. During his doctoral student career, he made a major discovery in the measurement and calculation of the thermal conductivity of fluids that set the standard still in use today. Anneke received her doctorate in physics in 1958, and during her prolific scientific career would make a landmark discovery in the critical behavior of fluids and fluid mixtures.

In December of 1963, the same year Jan and Anneke married, the National Institute for Standards (NIST—known then as the National Bureau of Standards) made a special exception and hired this young Dutch couple to work in the same division. Since then, the Sengers have shared joint projects, publications, awards and honors, as well as parenting four children: Rachel, Arjan, Maarten and Phoebe. While the Sengers agree there was no formula for their success as a couple or as parents, they remember the challenges of raising children in a culture different from their own.

In 1968, Jan made the move from NIST to the University of Maryland. He attributes his dedication to the university to his experience as a professor in science and engineering. Jan explains, "It is very gratifying for a professor to help a young person discover something new that no one else yet knows about."

As chair of the chemical engineering department from 1994-1999, Jan noticed that although the department had various endowed scholarships for undergraduates, it had none for graduate students; yet he believed that scholarships were the key to attracting good students. "Good graduate students build research capabilities and great universities have great research capabilities," he adds.

The Sengers decided to set a precedent in the hope that other faculty would follow. In 2000, the Jan and Anneke Sengers Fellowship Fund was established to support doctoral students in the Department of Chemical Engineering. The fund was created with an initial gift of $10,000, and a plan for additional annual gifts from the donors coupled with a matched gift of $50,000 from a state of Maryland private donor incentive program, to total $100,000. Another $100,000 will be funded through an IRA, which is an attractive asset for charitable contributions. The Sengers Fellowship Fund also remains open for donations.

"You don't have to be a millionaire to set up an endowed fund at an institution that has given so much," explains Jan. "We all know that the world certainly can not be sustained without technology. Our scholarship will help educate the engineers of the future," adds Anneke.

To learn more about charitable Remainder unitrusts or for confidential inquiries about other planned giving arrangements, please call or write:

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PHOTO BY JOHN T. CONSOLI

Kim Building Takes Shape

The Jeong H. Kim Engineering Building is rapidly taking shape. The building is changing the face of the North Campus, just as it will change of face of engineering education at the Clark School upon its completion.

Construction continues at a good pace on the 160,000 square-foot building, and the foundation is now in place. Structural steel beams are being erected and that process will be completed by mid-November. Brick installation has begun on the south wing and masonry work will continue throughout the fall and winter.

The building will house some of the most sophisticated engineering research and educational laboratories in the nation and its interior design will foster an atmosphere that encourages collaboration among all engineering disciplines. Progress on the site is striking and everyone in engineering eagerly anticipates the building's 2005 completion. Clark School alumni and friends can share in the excitement and watch future construction by visiting the school's web site at **www.eng.umd.edu/Kim/intro.html**.

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