A new department will address fundamental chemical and physical issues that arise when engineers work at the nanoscale.
Training Tomorrow’s NanoEngineering Leaders

Apple may have defined cool in the minds of many consumers with the iPod, but the nano version, isn’t nano. It’s just a pint-sized iPod.

Nanoengineering is more than a trendy-sounding name of the sixth department in the Jacobs School. The curriculum of the Department of NanoEngineering, home of our chemical engineering program, will address fundamental chemical and physical issues that arise when engineers work at the nanoscale. The country needs engineers rigorously trained in this area to address the challenges of assembling all kinds of new high performance inorganic, organic, and composite materials into higher order materials and devices.

Our industry partners have strongly supported this new department and the U.S. Bureau of Labor Statistics predicts that the bulk of employment growth for chemical engineers will be in specialty areas such as nanotechnology.

While a dozen or so U.S. universities offer baccalaureate or graduate programs and courses in nanoscale science and engineering, ours is the first department that will address research and undergraduate and graduate education in a comprehensive way. As a result, the graduates from our Department of NanoEngineering will become leaders in the evolving nanotechnology industry and benefit new and existing enterprises in the region and the nation.

The five faculty members on the NanoEngineering Department leadership team and other faculty members who will join them have been exploring the properties and behaviors of a wide range of nanoscale engineering problems. (See “No Small Thing,” page 6.) From biomedical nanotechnology to nanotechnologies for energy conversion and from computational nanotechnology to novel nanomaterials, the NanoEngineering faculty will foster the kind of stimulating multidisciplinary environment where cutting-edge discoveries are made.

This innovative approach goes to the heart of the Jacobs School’s style of research and education. The newest department, like the other five, fulfills the Jacobs School’s mission to educate tomorrow’s technology leaders and to conduct leading edge research that benefits society. We’re confident that our graduates will solve many problems that we can not even foresee today.

Jeanne Ferrante
Acting Dean
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Thousands of gently aged computers gather dust or get prematurely recycled while nearly one-third of San Diego families are left on the wrong side of the digital divide with little or no access to basic computer technology. In fall 2006, the UCSD branch of IEEE joined forces with Computers 2 San Diego Kids (computers2sdkids.org) in an outreach effort to solicit donated computers, refurbish those systems and get them into the hands of as many young people as possible. So far, they have distributed more than 1,000 computers to low-income families and organizations such as community centers and schools that provide more centralized access to the communities they serve throughout San Diego. For example, third grade teacher Aida Hernandez arranged for her entire class from Ibarra Elementary School to go on a field trip to the refurbishment center where each student received a computer and a brief lesson on how to use it.

“Students cover the wide array of tasks necessary for this program—anywhere from technical support and computer refurbishing, to seeking and managing donations,” says Philip Huang, IEEE branch external vice president. They’ve obtained significant equipment donations from the Jacobs School, Sharp Hospital, Booz Allen Hamilton and the Preuss School at UCSD as well as many smaller organizations and individual contributors.

To maximize the efficiency of the operation, IEEE branch president David Jackson developed a Web-based tracking system.

“As our list of services continues to grow, our range of support will increase as well. It’s clear that computers provide the richest resource for supporting our educational outreach vision, and equipping children with the tools needed to learn and exercise the computing skills necessary for today’s society is exactly what we continue to provide,” Huang added.

“Volunteers, like those from the UCSD branch of IEEE, are invaluable to the success of C2SDK,” says Cheri Pierre, C2SDK’s executive director. “Through their generous donation of time and talent, we can fulfill our mission of ensuring that all of San Diego’s children have access to technology.”

**How to Donate Computers**
Contact Philip Huang (p1huang@ucsd.edu) or Cheri Pierre (info@computers2sdkids.org).
More than two-thirds of graduating seniors responding to the annual Jacobs School Career Outlook Survey reported annual starting salary offers of $56,000 or higher, up from 61 percent last year. Once again, computer science majors received the highest pay with nearly 80 percent reporting offers above $56,000. “The solid increases in starting salaries indicate that demand for advanced computer science skills is stronger than ever,” says Keith Marzullo, chair of the Computer Science and Engineering Department.

The June 2007 survey revealed that 59 percent of the new graduates planned to work full-time after graduation, while 26 percent plan to pursue further education full-time, with 12 percent planning to combine work and continuing education. Of those planning to seek employment, nearly 70 percent hoped to stay in Southern California. The class of 2007 included 1,015 students receiving baccalaureate degrees, nearly half of whom responded to the survey.

Starting Salaries Climb for UCSD Engineering Graduates

Starting Salaries $56,000 or Higher

2007 Starting Salaries Greater Than $56,000

A+ Grade for C++ Butterfly

To capture the reflections of a butterfly inside water drops, you need a high speed camera and luck. In the field of computer graphics, to get a similar image, you need thousands of lines of C++ code and a high speed processor. Using this second set of tools, Iman Sadeghi, a computer science Ph.D. candidate at the Jacobs School (http://graphics.ucsd.edu/~iman ), won the spring 2007 image rendering competition for CSE 168, Rendering Algorithms. The judges were impressed by Sadeghi’s use of caustics, which can occur when light passes through a curved surface and then concentrates on other surfaces. The rings of light on the pebbles and bamboo beneath the water’s surface are caustics that formed when light passed through the curved, rippled surface of the water. To calculate caustics, Sadeghi used the photon mapping algorithm invented by Henrik Wann Jensen, the computer science professor with the new model for rendering the appearance of milk (see page 9 in this issue) and Sadeghi’s CSE 168 professor.

The three streaks of light in the bottom left corner of the image are caustics that form when light passes through the rippled surface of the water.
Jacobs School faculty members and their collaborators have for years been experimenting with tubes, wires and particles built of various materials on a Lilliputian scale of engineering, the nanoscale. At the size of 1 to 100 nanometers, many materials can have extraordinary chemical and physical properties that far surpass their tiny sizes, which partly explains why nano is big at the Jacobs School.

Seeking to capitalize on the potential of a new generation of multi-functional nanoscale devices and special materials at this tiny scale, the school has established a new Department of NanoEngineering. The department was officially established as of July 1, but NanoEngineering classes will be offered for the first time next year. Undergraduates and graduate students will learn from an interdisciplinary team of professors who are leaders in various fields of engineering, physics and chemistry and a variety of new sub-disciplines where those fields overlap.

“Many of the most exciting, cutting-edge discoveries are being made at the interfaces of scientific and engineering disciplines,” said UCSD chancellor Marye Anne Fox. “This new Department of NanoEngineering, one of the first such departments in the nation, continues UC San Diego’s leadership role in the paradigm shift to interdisciplinary research and education in revolutionary new fields that will benefit both society and the planet.”

The new department will cover a broad range of topics, but focus particularly on biomedical nanotechnology, nanotechnologies for energy conversion, computational nanotechnology, and molecular and nanomaterials.

“Nanotechnology promises to produce revolutionary advances in medical diagnostics and treatments, energy systems, electronics and materials,” said Frieder Seible, dean of the Jacobs School. “Yet we are only just beginning to understand how to assemble and fabricate nanocomponents into higher order materials. Our industry partners tell us they need a new breed of engineers trained in this field to help them fulfill their future workforce needs, not just on the biotechnology side, but in many other areas.”

The Department of NanoEngineering’s educational program will develop in phases, with plans to reach a steady state of approximately 20 faculty members and an enrollment of 400 undergraduate students and 120 graduate students. The department will also serve as the administrative home of the existing undergraduate and graduate programs in chemical engineering.

The Department of NanoEngineering is supported by faculty in the five other departments at the Jacobs School, and the new department is seeking collaborations with faculty throughout UCSD. The leadership team that was the driving force for creating the new department is made up of engineering professors Sadik Esener (Department of Electrical and Computer Engineering), Michael Heller (Department of Bioengineering), Sungho Jin (Department of Mechanical and Aerospace Engineering), Jan Talbot (Chemical Engineering program within the Department of Mechanical and Aerospace Engineering), and Kenneth Vecchio (Department of Mechanical and Aerospace Engineering).

In the past five years alone, the five members of the leadership team filed 51
patent applications and licensed six inventions to private companies. Those professors and their fellow faculty members will continue to work closely with the Jacobs School’s William J. von Liebig Center for Entrepreneurism and Technology Advancement and UCSD’s Technology Transfer and Intellectual Property Services office to accelerate the commercialization of discoveries and prepare engineering students to contribute to the local, national, and global entrepreneurial workplace.

The new department will capitalize on a growing trend throughout public and private research-funding organizations to focus on nanoscale science and engineering approaches that have the potential to make valuable contributions to biology and medicine. For example, in recent solicitations for research proposals, the National Institutes of Health said, “A revolution has begun in science, engineering, and technology based on the ability to work on a nanoscale.”

In a manifestation of that revolution, in September 2005 the National Cancer Institute implemented a $144 million initiative by forming eight Centers for Cancer Nanotechnology Excellence (CCNE) in the U.S., including one at UCSD and its Moores Cancer Center. Esener, a Jacobs School professor and founder of several startup companies, is the principal investigator of the CCNE based at UCSD. That center, which includes scientists at the Burnham Institute for Medical Research and University of California campuses at Irvine, Riverside, and Santa Barbara, brings together the best and brightest from engineering, chemistry, physics, mathematics, biology and health sciences to use nanotechnology to help fight cancer. Esener’s CCNE will work closely with the new Department of NanoEngineering.

The new department will occupy nearly half of a new 110,000-square-foot building, currently in the final stages of design that will be built by 2010. The building will house core instructional and laboratory areas and complement the existing Nano3 facility at the UCSD division of the California Institute of Telecommunications and Information Technology (Calit2).

The growing commitment to nano-engineering at the Jacobs School and UCSD is part of a pioneering visionary approach to embrace promising new areas of study. For example, the Jacobs School established the first Department of Structural Engineering and one of the first Bioengineering departments in the nation.
Jacobs School computer scientists have found striking differences between the infrastructure used to distribute spam and the infrastructure used to host the online scams advertised in these unwanted email messages. This work is expected to aid in the fight to reduce spam volume and shut down illegal online businesses and malware sites.

Based on an analysis of over one million spam emails, 94 percent of the scams advertised via embedded links are hosted on individual Web servers, according to research from the Jacobs School presented at the USENIX Security 2007 conference held August 9 in Boston.

Using an Internet monitoring approach developed at UCSD called “spamscatter,” computer science professors Geoff Voelker and Stefan Savage and two graduate students—David Anderson and Chris Fleizach—studied a spam feed over the course of a week. They analyzed Web servers hosting online scams that were advertised in spam and either offered merchandise and services or used malicious means like phishing and spyware to defraud users. The researchers followed the URLs embedded in spam back to the hosting servers, probed the servers and analyzed the Web pages advertised in the spam.

“Spamscatter provides a mechanism for studying global Internet behavior from a single vantage point. Our findings suggest that the current scam infrastructure is particularly vulnerable to common blocking techniques such as blacklisting,” Voelker says.

The computer scientists recorded the server locations and captured screenshots of the spam URL destination Web pages. From these screen shots, the researchers grouped the scams using a technique called “image shingling.” This approach matches visually similar Web pages based upon images rendered in a Web browser rather than on HTML source, URL text, or spam email contents. Image shingling enables spamscatter to foil common scammer techniques for avoiding detection in which, for example, the scammers compose their Web sites entirely with images.

Through the Collaborative Center for Internet Epidemiology and Defenses (CCIED), the UCSD researchers will continue their efforts to measure and understand the infrastructure used to support the active underground market for illegal online goods and services as a basis for developing controls and defenses against them.
With Milk Model, Computer Graphics Spills into Medicine

A new Jacobs School computer graphics model from computer science professor Henrik Wann Jensen is capable of generating realistic milk images based on fat and protein content. The model, which extends use of the Lorenz-Mie theory, will likely push the field of computer graphics into the realms of diagnostic medicine, food safety and atmospheric science, according to a new study published at SIGGRAPH 2007.

How to Get Students to Blog during Class

Computer scientists at UCSD are working on ways to get students to blog, read blogs, instant message and send text and photo messages from cell phones during class. It’s not about goofing off; it’s about using technology to engage students in active learning exercises in the classroom.

“We are exploring approaches that shift the classroom environment from a unidirectional flow of information to an environment in which students can control their own experience,” says Beth Simon, a lecturer in the Department of Computer Science and Engineering at the Jacobs School.

Simon, computer science professor William Griswold, and graduate and undergraduate students from UCSD, have recently published papers on in-class blogging and on the use of cell phone text and photo messaging for submitting answers to classroom exercises.

This work revolves around Ubiquitous Presenter—a Web-based technology developed at UCSD that allows lecturers to add notes to their electronic lecture slides during class via a tablet PC. These annotated slides are immediately posted to the Web and are accessible by students who bring laptops to class.

Blogging, chatting and cell phone messaging technologies are new add-ons to Ubiquitous Presenter that are allowing the UCSD researchers to explore different avenues for in-class communication. Student bloggers can use tablet PCs to write notes on top of the instructor’s electronic slides during class in real time. During class, non-blogging students can simultaneously monitor student blogs and the teacher’s notes—all superimposed on the lecture slides—from their own laptops. In addition, students can instant message bloggers and teaching assistants during class.

“We are striving to provide a more student-centered approach to the university lecture,” Griswold says.

The researchers are also hoping to use the notes taken by student bloggers, and other information captured by ubiquitous presenter, to study how lecture materials and basic concepts are learned in large lectures.

Ubiquitous Presenter is a streamlined and Web-enabled extension of “Classroom Presenter,” an educational application developed at the University of Washington. Educators can use Ubiquitous Presenter in their classrooms free of charge.

Top: Jacobs School computer scientists Bill Griswold (left) and Beth Simon (right) discuss a blogging application with students.
Bottom: Beth Simon holds a tablet PC that teaching assistants and students use to blog during class—on top of the instructor’s slides.
Jacobs School Gears Up Stem Cell Research

The Jacobs School has initiated an ambitious new research program designed to enhance the scope of the Department of Bioengineering’s biomedical and biotechnology research by adding a 3,000-square-foot shared core facility for human stem cell engineering and technology development. Shu Chien, director of the UCSD Whitaker Institute of Biomedical Engineering and a university professor of bioengineering and medicine, will lead the new laboratory, which will operate as a satellite facility of the UCSD School of Medicine’s Human Stem Cell Core facility.

The new lab was made possible in part with the help of a $2.8 million grant from the California Institute for Regenerative Medicine. CIRM was created after California voters in 2004 approved a ballot measure that called for $3 billion in state funding for stem cell research at universities and research institutions in the state. The CIRM grant will be used to upgrade UCSD’s stem cell core and establish the new shared satellite facility in the Jacobs School, which will include labs for biomaterial synthesis and characterization, high-throughput screening, bioreactor design, and tissue engineering.

“The cell engineering core won’t be trying to produce new stem cell lines, but rather carefully working to define and understand the culture conditions and growth requirements that can be used to control stem cell differentiation and fate,” says Andrew McCulloch, chair of the Department of Bioengineering. “For example, we’ve seen that in the case of heart-muscle cells, we already know that their differentiation is influenced by electrical excitation, mechanical stiffness of the substrate, and other physical conditions found in a beating heart. We will seek to replicate those conditions in novel bioreactors in which stem cells will be grown.”

The Jacobs School has earmarked $1 million in discretionary research funds as a match to the CIRM funding to remodel the shared core facility. The new lab will be used by six faculty members from the Department of Bioengineering as well as faculty from other departments across campus.

The matching funds also will be used to purchase specialized laboratory equipment that will be used by Jacobs School faculty to help understand how stem cells differentiate into heart muscle cells (McCulloch and professor Karen Christman), cells of vascular tissue (Chien and professor Shyni Varghese), chondrocyte cells in cartilage (professor Robert Sah and Varghese), neural cells (professor Gabriel Silva), and many other cell types. For example, the lab will have a LEAP™ (laser-enabled analysis and processing) machine, technology developed by San Diego, CA-based Cyntellect Inc., to enable high-throughput imaging and manipulation of live cells.

UCSD researchers are currently investigating how stem cells might be used to treat cancer, Alzheimer’s and Huntington’s diseases, spinal cord injury, and other conditions that today are considered incurable by traditional means. In a hopeful sign that these cells may fulfill their promise, Dr. Martin Marsala, an associate professor in UCSD’s department of anesthesiology, reported in the October 2004 issue of the European Journal of Neurosciences that rats paralyzed due to loss of blood flow to the spine returned to near normal ambulatory function six weeks after receiving grafts of human spinal stem cells.

McCulloch says lessons learned from using bioengineering approaches to control stem cells in the laboratory could be the basis for inducing a diseased or damaged tissue itself to undergo...
repair processes. “In no way do we imagine that the only possible outcome of stem cell research is to inject stem cells to the body to treat a medical condition,” says McCulloch. “That’s just one of many possibilities.”

The new stem cell engineering core in the Jacobs School will be the research home for three new bioengineering faculty members; Karen Christman, Shyny Varghese, and Kun Zhang, who come to UCSD from postdoctoral fellowships at UCLA, Johns Hopkins University, and Harvard Medical School, respectively. They will bring a wide variety of novel approaches to stem cell engineering. For example, Christman and Varghese will use nanotechnology-based techniques to synthesize biomaterials designed that send differentiation signals when they come into contact with stem cells. Zhang will develop genomic technologies for understanding the signaling pathways regulating stem cells. These new faculty members will try to understand better how to manipulate such signals for therapeutic applications.

In February 2007 Chien received a $638,140 grant from CIRM to develop a high-throughput system to rapidly determine the optimum physical and chemical conditions required for stem cell differentiation into specific cell types. The ability of the bioengineering team to coax human embryonic stem cells to differentiate is considered a milestone in a larger field of study called regenerative medicine, which seeks to accelerate natural healing processes or to prompt damaged tissues to regrow.

“We will apply an array of the most promising technologies for controlling stem cell differentiation, delivering stem-cell based therapies, scaling up cell production, and engineering replacement tissues,” says McCulloch. “We consider the solution of each of these technical hurdles as steps toward our goal of establishing regenerative medicine as a new paradigm of medical treatment in this century.”

Primate Sperm Competition: Speed Matters

In a paper published in the Journal of the Royal Society Interface, a team led by Michael Berns, an adjunct professor of bioengineering at UCSD and a professor of biomedical engineering at the Beckman Laser Institute at UC Irvine, and UCSD Ph.D. candidate Jaclyn Nascimento reported that sperm cells from polygamous chimpanzee and rhesus macaque swim much faster and with much greater force that those of humans and gorillas, species where individual females mate primarily with only one male during a reproductive cycle.

“Rapidly swimming sperm cells would be evolutionarily favored in polygamous species and that is consistent with our measurements of chimp and rhesus macaque sperm,” says Nascimento.

Nascimento found significantly lower swimming forces and slower swimming speeds with human sperm. Gorilla sperm was the slowest.

“Dominant silverbacks are known to effectively discourage other males from mating with the females in their harems, so faster sperm wouldn’t seem to be an advantage to them,” Nascimento says. However, she and Berns were surprised that the speed and force of human sperm fell in between the gorillas and the chimps. “Maybe humans haven’t always been as monogamous as we had thought,” Berns says.

Scientists will work to define, understand and control stem cell differentiation.
Biofuels from Cornstalks, Not Kernels

California researchers led by a Jacobs School professor plan to make biofuels in a novel way that doesn’t involve food crops or microbial fermentation. Three University of California campuses (San Diego, Davis, and Berkeley) and West Biofuels LLC, will develop a prototype research reactor that will use steam, sand and catalysts to efficiently convert forest, urban, and agricultural “cellulosic” wastes that would otherwise go to landfills into alcohol that can be used as a gasoline additive.

“We have a very feasible design to combine individual components of technology that have been proven separately into a successful biomass processing prototype,” says Robert Cattolica, principal investigator of the research program and a professor of mechanical and aerospace engineering at the Jacobs School.

Since carbon dioxide is naturally recycled from the atmosphere into cellulose in plants and back into the atmosphere as carbon dioxide when plants decompose, burning biomass-derived fuel such as alcohol in internal combustion engines has a zero net effect on the amount of carbon dioxide in the atmosphere. On the other hand, burning fossil fuels continually adds carbon dioxide, a greenhouse gas, to the atmosphere.

The new biofuels research project was inspired by California’s Global Warming Solutions Act, which was signed into law by Governor Arnold Schwarzenegger in September 2006. The act requires a 25 percent reduction in greenhouse gas emissions in California by 2025. Substituting biomass fuel for petroleum would help California achieve its goal. The two-year UC project is funded with a $1.85 million grant from West Biofuels LLC, a San Rafael, CA, company that is developing the biomass-to-alcohol technology, and a $1.15 million state-funded UC Discovery Grant.

“My company is excited about partnering with the University of California on a very promising technology that could eventually have a significant beneficial impact on our environment while also reducing California’s reliance on oil imports,” says Peter Paul, chief executive officer of West Biofuels.

The alcohol currently added to gasoline sold in California is derived from corn, sugar cane, beets, or other farm crops. About 95 percent of the alcohol additive comes from outside of California, as far away as China. Rather than fermenting food crops into ethanol, Cattolica’s project will use a thermo-chemical process to break down shredded cellulosic wastes into a mixed alcohol, predominately ethanol. “The technology we’re developing will tap a huge, energy-rich resource that now is literally going to waste,” says Cattolica.
**Professor’s Pet Project: Agile Hopping Robot**

Professor Thomas Bewley and his fellow inventors in the Coordinated Robotics Lab are teaching iHop, a hopping, sheltie-sized three-wheeled rover, to perform increasingly amazing tricks. iHop maneuvers on wheels like other robots, but it can also balance on a toe, jump, and twist in mid-air like a canine agility course champion. Unique combinations of motions and situational awareness are made possible by a patented spring-loaded hopping mechanism, gyroscopic wheels and sophisticated software.

“Most people are captivated by iHop’s playful demeanor,” says Bewley. “However, its mechanical simplicity, efficiency, and maneuverability make iHop an appealing candidate for search-and-rescue, defense, and homeland security applications.”

Bewley used funding from the UCSD-Los Alamos National Laboratory Engineering Institute to initially develop iHop. That funding was followed in May 2007 by a commercialization grant awarded by the Jacobs School’s William J. von Liebig Center for Entrepreneurism and Technology Advancement.

iHop’s MEMS gyroscopes and accelerometers feed sophisticated on-board altitude estimation and stabilization algorithms in iHop’s carefully designed brain. The new grant will be used to develop the mechanical components and control algorithms that will enable iHop to efficiently perform even more pet-like tricks, such as hopping up and down stairs.

No word yet on whether the robot will bark.

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**Digital Dandelions**

What looks like the fluffy head of a dandelion is actually a digital map of the Internet. But it is no ordinary Internet map—it is a reproduction of a corner of the Internet done at a larger scale that retains important inter-connectivity characteristic of the original.

The ability to produce detailed Internet maps at different scales is useful for research focused on better ways to defend against denial of service attacks and large-scale worm outbreaks—and for a variety of other network research projects, says Priya Mahadevan, the first author on a SIGCOMM 2007 paper describing this work. Mahadevan recently finished her computer science Ph.D. at UCSD and joined Hewlett Packard Laboratories.

“The techniques we have developed are generally applicable to a broad range of disciplines that consider networks, including physics, biology, chemistry, neuroscience and sociology,” says computer science professor Amin Vahdat, the paper’s senior author and the director of UCSD’s Center for Networked Systems.
Getting Light Right:  
Shaya Fainman Awarded Cymer Chair

Information technology, health care, lighting, sensing and national security applications are all benefiting from the field of nanophotonics, which involves the fabrication of devices that can generate, manipulate and control light at the nanoscale. For his contributions to this field, Yeshaiahu (Shaya) Fainman, an electrical engineering professor at the Jacobs School, was named the first holder of the Cymer Inc. Endowed Chair in Advanced Optical Technologies.

In the early 1990s, Fainman began working with light on the sub-wavelength scale and helped to develop what is now called the field of nanophotonics. “At any scale, optics can be an enabling technology. We are looking to integrate optical, electrical, fluidic, magnetic, mechanical, acoustic, chemical, and biological signals and processes on a single chip,” says Fainman.

“At Cymer we’re committed to pushing the limits of DUV lithography in order to advance the production of chips that power the electronic devices we rely on everyday,” says Bob Akins, Cymer Chairman and CEO. “The work of Shaya and others at UCSD on lithography applications for commercially viable nano-optics is of great interest to us, as these advances will help drive the industry forward.”

Fainman, for example, has been working on the CMOS-compatible integration of optical interconnects onto processors. He is also director of the DARPA-funded Center for Optofluidic Integration, which includes world-class researchers from Caltech, Stanford, UCSD and Harvard.

In a project that could be useful for large scale protein analysis and single molecule DNA detection, Fainman and colleagues are using massively parallel surface plasmon resonance sensors to monitor biochemical binding reactions.

In addition, Fainman is involved in the development of nanolasers that could be used to further miniaturize optical sources for integrated nanophotonic circuits and systems of the future. He is also using surface plasmonics to build new microscopy tools.

“With his pursuit of deep knowledge in several cutting-edge research areas that touch important aspects of society, Shaya is a quintessential Jacobs School engineering professor. He has shown great leadership in forming interdisciplinary teams across departments, universities, and industry,” says Jacobs School dean Frieder Seible.

This is the second Cymer endowed chair donated to the Jacobs School. Cymer co-founders Akins and Rick Sandstrom, chief technical advisor, met as UCSD students more than 30 years ago and their 20-year-old company now employs nearly 1,000 people worldwide.

Silicon-slab Lens and Output Waveguide

In a paper in the July 2007 issue of Physical Review Letters, Fainman and coauthors from the Jacobs School and Sun Microsystems describe progress toward what they call a “free space optics on a chip” configuration. Such a configuration would allow light to propagate freely in the slab of silicon, while interacting with discrete optical components that are located along the propagation direction.

“We believe that this new concept may become essential for applications such as optical interconnections, information processing, spectroscopy and sensing on a chip,” Fainman and colleagues write.
Linden Elected to Royal Society

Paul Linden, director of UCSD’s Environment and Sustainability Initiative and chair of the Jacobs School’s Department of Mechanical and Aerospace Engineering, was one of 44 scientists elected in 2007 as fellows to the United Kingdom’s National Academy of Science. Linden was recognized for his worldwide influence in the field of experimental fluid dynamics.

Linden’s laboratory experiments and theoretical analyses of fluid flows are relevant to oceanography, meteorology, and environmental and industrial problems. He has played a crucial role in stimulating the development of innovative imaging and measuring techniques which have had an important influence on experimental fluid dynamics. The Royal Society’s approximately 1,400 fellows and foreign members include more than 60 Nobel laureates, and have included such scientific pioneers such as Isaac Newton, Charles Darwin, Ernest Rutherford, and Albert Einstein.

New Faculty

**Eric Lauga, Assistant Professor**  
Mechanical and Aerospace Engineering

Continuum mechanics applied to biological problems: swimming mechanics, the motion of gastropods, and propulsion by flagella; fluid mechanics, biophysical fluid dynamics and control of fluid flows.  
PH.D. HARVARD UNIVERSITY, 2005  
Most recently: Asst. Professor, MIT

**Kun Zhang, Assistant Professor**  
Bioengineering

Human genetics, synthetic biology, neuroscience, polymerase cloning (ploning), genomics with emphasis on high-throughput genomic analysis of single DNA molecules and applied issues in microbial and stem cell biology.  
PH.D. UNIVERSITY OF TEXAS, 2003  
Most recently: Postdoc, Harvard Medical School  
Department of Genetics

**Alison Marsden, Assistant Professor**  
Mechanical and Aerospace Engineering

Computational fluid mechanics, cardiovascular mechanics, bio-fluid mechanics and biomedical devices technology emphasizing optimization methods relating to vascular surgery; exploring the interface between biology and the quantitative, physical, and theoretical disciplines.  
PH.D. STANFORD UNIVERSITY, 2005  
Most recently: Postdoc, Stanford University  
Cardiovascular Biomechanics Research Lab

**Jorge Cortés, Assistant Professor**  
Mechanical and Aerospace Engineering

Systems and control, distributed coordination algorithms, cooperative control, geometric mechanics, nonlinear mechanical systems, robotics, cooperative motion control of unmanned vehicles and geometric control theory.  
PH.D. UNIVERSIDAD CARLOS III DE MADRID, 2001  
Most recently: Asst. Professor, UC Santa Cruz

**Juan Carlos del Alamo, Assistant Professor**  
Mechanical and Aerospace Engineering

Bioengineering, fluid dynamics, flow turbulence, numerical methods for physics simulations and parallel computer simulations.  
PH.D. POLYTECHNIC UNIVERSITY OF MADRID, 2005  
Most recently: Fulbright Postdoctoral Fellow, UCSD

**Karen Christman, Assistant Professor**  
Bioengineering

Regenerative medicine, systems biology, tissue engineering, polymer chemistry and bio-nanotechnology, multi-scale bioengineering and biomaterial design.  
PH.D. UC SAN FRANCISCO & UC BERKELEY, 2003  
Most recently: Postdoc UCLA Polymers/ Bio-nanotechnology

**Ryan Kastner, Associate Professor**  
Computer Science and Engineering

Reconfigurable computing, VLSI computer-aided design, sensor networks, radiolocation, computer architecture, security, embedded systems and optimization algorithms.  
PH.D. UCLA, 1999  
Most recently: Assoc. Professor, UC Santa Barbara

**Hovav Shacham, Assistant Professor**  
Computer Science and Engineering

Applied cryptography using pairings—computable bilinear maps over certain elliptic curves—to construct cryptographic systems, systems security, and tech policy.  
PH.D. STANFORD UNIVERSITY, 2005  
Most recently: Postdoc, Weizmann Institute of Science

**Shyini Varghese, Assistant Professor**  
Bioengineering

Biomaterials, tissue engineering, fabrication and analysis of polymeric materials, interface of biomaterials engineering and regenerative medicine, stem cell differentiation methods.  
PH.D. NATIONAL CHEMICAL LABORATORY, INDIA, 2002  
Most recently: Postdoc, Johns Hopkins University

**Gaurav Arya, Assistant Professor**  
Mechanical and Aerospace Engineering

Chemical engineering with a focus on molecular dynamics applied to nanomembranes, polymers and biomaterials.  
PH.D. UNIVERSITY OF NOTRE DAME, 2003  
Most recently: Research scientist, New York University and the Courant Institute of Mathematical Sciences
Thinking ‘Inside’ the Blackbox
Papadopolous Brothers Shake Up Computing

About 10 a.m. on May 31 three loud warning beeps echoed off the sheet metal walls of the Jacobs School’s cavernous seismic testing lab. Seconds later, UCSD engineers jolted a shake table that supported Sun Microsystems computer servers, storage, and networking equipment inside a 20-foot-long metal shipping container. Eight racks of computer hardware rocked and swayed for about a minute to the crazy rhythm of the 1994 Northridge earthquake. Nothing broke. A system of springs and rubberized supports dissipated most of the seismic energy.

The container looked like millions being transported worldwide every day by truck, rail and cargo ship. Sun wants to use those modes of transportation to deliver what it calls project Blackbox, the world’s first virtualized datacenter. The datacenters are rapidly deployable shipping containers packed with state-of-the-art technology optimized for low energy consumption and high data processing performance.

That concept of a completely lights-out, self-contained data center, says Jacobs School alumnus and Sun Chief Technology Officer Greg Papadopolous, could lead to the industrial revolution of information technology, not to mention an exponential growth in the Internet.

“We’re challenging all of the assumptions. Why do we have machine rooms? It’s an outdated concept left over from the era when computers were operated manually,” says Papadopolous, who himself toiled as a nightshift computer operator mounting tapes and booting machines as a student at UCSD in the late ’70s.

The result could be a chief information officer’s dream—a prefabricated data center delivered to the corporate doorstep ready to be deployed on a rooftop, parking lot, or garage. Loading, shipping and dropping the Blackbox on site means rough handling of computer systems, and so Sun turned to Jacobs School structural engineers to test the box on the nation’s largest six-degrees-of-freedom shake table. The Jacobs School routinely uses the $15 million test facility to create realistic seismic shakes on building and bridge components for the California Department of Transportation and other clients.

Enter brother and fellow Jacobs School alumnus, Phil Papadopolous. A research scientist at UCSD’s San Diego Supercomputer Center, Phil is a world expert on fully automated grid computing. Jokes Greg: “Phil is usually pulling the plug on Sun supercomputers, this time we’re both excited about the same project.”

For his part, Phil enabled researchers worldwide to use tools and resources running on the Sun servers throughout the earthquake test. “The outcome was much better than any of us expected,” says Phil. “If an earthquake rocked your house this hard, you’d most likely have plumbing leaks, but not even the cooling-water pipes in the Blackbox leaked. It couldn’t have performed any better.”

In a follow-up to last year’s successful mixer, Yahoo! treated northern California alumni from the Jacobs School to an evening of technology, conversation, food and camaraderie at a cocktail reception on June 6. More than 60 alumni were drawn to Yahoo!’s Sunnyvale campus to hear Jacobs School dean Frieder Seible discuss the “State of the School” and hear a talk titled “The Exciting Future of Ubiquitous Computing” by William Griswold, a professor of computer science. Next year, Northern California will get another chance to connect with old friends and make new ones at another mixer. Keep up with alumni news at www.jacobschool.ucsd.edu/alumni/.
MentorNet Connects Students with Alumni—Virtually

If you think that one person can’t make a difference or that volunteer work takes too much time, think again. Through a partnership with MentorNet, the Jacobs School is leading a campus-wide effort to pair students majoring in engineering and the sciences with “e-mentors.” These virtual advisors participate in a one-on-one email relationship facilitated by MentorNet to provide information, advice, and encouragement that can have a big influence on a protégé’s future success. Designed to be quick and accessible, MentorNet’s model matches mentor-protégé pairs based on mutual interests and involves as few as 20 minutes of email contact per week.

Bioengineering PhD. candidate Anna Raskin is one of more than 150 UCSD participants since the university joined MentorNet in 2006. “I had spent months trying to optimize an experiment that would never end up working,” says Raskin. “My experiences left me questioning my abilities and commitment to obtaining a Ph.D.” Shortly after registering with MentorNet, she was paired with an e-mentor. “I found she too had had many of the same feelings and similar experiences while working towards her Ph.D. She has not only been a major source of support throughout the months we worked together, she also provided thoughtful and solid advice,” says Raskin.

MentorNet is free for UCSD students, postdoctoral fellows and junior faculty in engineering, mathematics, and science (excluding medicine or pre-med).

How to Get Involved
To mentor a UCSD student, visit www.mentornet.net and specify UCSD as a requirement if you prefer to work with one of our students in your area of expertise.

From Rockets to Submarines, Student Projects Have New Lab

When Taner Halicioglu (B.S. ’96), senior systems engineer at Facebook, heard that the Triton Engineering Student Council (TESC) hoped to upgrade its rudimentary work area to an industrial-quality lab space where student organizations could develop design projects, he offered assistance. “I just wanted to give back to my school—to the current and future students who would be making use of the lab,” Halicioglu explains.

Thanks to his generous contribution, the new facility will go into service this fall and likely benefit AIAA’s Design, Build, Fly team, the AUVSI team (autonomous aircraft), the Hybrid Rocket Project team, the Human-Powered Submarine Team, and the Society of Automotive Engineers’ Formula 1 teams. TESC president Jeffrey Mounzer says participating students will have access to a variety of power tools, welding equipment and a hydraulic lift.

Taner Halicioglu

Anna Raskin
At traffic lights, red means stop. For Quanlight, a Jacobs School startup developing new light emitting diodes (LEDs) for traffic lights and many other applications, red means go.

The new yellow–amber–red (YAR) LEDs from Quanlight may also be used in LCD backlighting, architectural displays, theatrical lighting and signs.

Quanlight’s chief technical officer is Vladimir Odnoblyudov, an electrical engineer who earned his Ph.D. from UCSD in 2006. His journey from graduate student to Quanlight CTO provides an inside look at the Jacobs School experience.

When Odnoblyudov came to UCSD, he started working on an emerging class of compound semiconductors called dilute nitrides. He had studied similar materials back in Russia and saw great promise in work done in the labs of Charles Tu, an associate dean and electrical engineering professor at the Jacobs School.

In 2004, Odnoblyudov and Tu won pre-commercialization funding from the Jacobs School’s von William J. von Liebig Center for Entrepreneurism and Technology Advancement. This funding supported their efforts to further define and study the fundamental properties of the indium-gallium-nitride-phosphide (InGaNP) compound semiconductor system that make it an attractive material for building better YAR LEDs.

For this work, Odnoblyudov won the 2005 and 2006 ECE Outstanding Student Poster at Research Expo—the Jacobs School’s annual graduate-research showcase and competition.

At the 2006 Research Expo, Odnoblyudov approached Neil Senturia, principal of Blackbird Ventures and a serial entrepreneur who Odnoblyudov recognized from a talk at the von Liebig Center.

After their first conversation, Odnoblyudov returned with a business plan that he had developed for a von Liebig entrepreneurship class.

“Quanlight will be a classic story of how a Jacobs School engineering student takes a Jacobs School entrepreneur class through the von Liebig Center, talks to a venture capitalist at Jacobs School’s Research Expo, and forms a business partnership licensing a Jacobs School’s technology,” says Charles Tu.

“I was impressed by the quick response and by the business plan,” says Senturia. “I did due diligence, and felt the technology and financials were interesting. But I was really betting on Vladimir, a man who demonstrated to me both the desire and the ability to walk through walls.”

While Odnoblyudov has not yet been seen walking through an actual wall, he is hard at work on Quanlight’s LEDs. They have a novel structure and will shine brighter while using the same amount of power, cost less to manufacture and provide better overall color stability than today’s YAR LEDs.

“In addition, our YAR LEDs maintain their efficiency as heat increases much better than the competition,” Odnoblyudov says during a phone interview from Quanlight’s crystal growing facilities near Manchester, NH.

In December 2007, Quanlight expects to have a product ready for potential customers. In the meantime, it has hired two more recent Jacobs School Ph.D.s—David Keogh and Kevin Tetz.
Class Notes

1981  John S. Kirkpatrick
M.S., BIOENGINEERING
Dr. Kirkpatrick is professor and chairman of the Department of Orthopaedic Surgery and Rehabilitation at the University of Florida, Jacksonville. He also serves as chair of the Biomedical Engineering Committee of the American Academy of Orthopaedic Surgeons and recently completed a term as chair of the FDA’s Orthopaedic and Rehabilitation Devices Panel.

1985  Daniel Jacobson
B.S., APPLIED SCIENCE, MECHANICAL AND AEROSPACE ENGINEERING
Principal investigator for San Diego Composites, a small aerospace company with expertise in design, analysis, testing, systems integration, and manufacturing of aerospace composite structures; Jacobson lives in Scripps Ranch with wife Teri and sons Joshua, 7, and Merrick, 19 months.

1988  David C. Reiter
B.S., COMPUTER ENGINEERING
Reiter has been working for Napster for 5 years in charge of the serving infrastructure (downloads and streams) that serves millions of requests a month. His son turns 5 this year.

1993  Sunil Dalal
B.S., BIOENGINEERING
Dalal is a principal IS analyst at Amgen. He and wife Sonal Pandya-Dalal are happy to announce the birth of their son, Milan, born March 5, 2007. Milan joins big sister Naia.

1994  Richard “Cub” Schlatter
M.S., AEROSPACE ENGINEERING
Schlatter is currently the chief of aircraft operations for NASA. After obtaining his M.S. at UCSD, he led Aeronautical Engineering programs in the US Coast Guard before retiring as Commander at Air Station Atlantic City, NJ. Previously, he served as director of programs for helicopter manufacturer Eurocopter, subsidiary of the European Aeronautic Defence and Space Company (EADS).

1995  Roy Axford
PH.D., ECE
On May 2, 2007, Axford received the 2006 Department of the Navy Top Scientists and Engineers of the Year Award. He was recognized for leading a team of engineers that, through interoperability testing, uncovered a flaw in new DoD communications satellite payload prior to launch. Had it not been detected and corrected, the flaw would have reduced the satellite’s capability to support bandwidth efficient modulations. This was the inaugural year for this Department of the Navy award.

1997  Eric Takeuchi
1993 B.S., 1997 M.S., ELECTRICAL AND COMPUTER ENGINEERING
Takeuchi recently joined Daylight Solutions as business development manager, focused on molecular detection and imaging. Daylight is commercializing technology intended to provide non-invasive glucose monitoring solutions for diabetics as well as diagnosis of disease through breath analysis. He and wife Kathryn (UCSD 1996) have a daughter, Megan, 4 and son, Kevin, 2.

1998  Robert Hackett
B.S., COMPUTER SCIENCE AND ENGINEERING
After receiving an MBA in 2005 Hackett is now working for Panasonic Avionics as a Senior Product Manager for in-flight games.

Win Contest by Telling the Boss ‘Enough’

Inspired by the story of a friend who was berated for returning three minutes late from his 30-minute lunch, Jacobs School alumnus Forrest Kolb has offered 10 percent ownership of his company to the producer of an original video judged best at telling the boss enough is enough.

The most creative and motivational video submitted by the Nov. 1, 2007 deadline wins a 10 percent stake in BizzFlip (San Francisco), Kolb’s Web-based company that lists small businesses for sale, and related investment resources.

“The challenge is part promotion, part social experiment,” says Kolb, 25. “We’re interested to see different views of the workplace, from both young and old. I think my generation has a whole new attitude about work — do what makes you happy.”

To learn more, visit www.BizzFlip.com.

What’s New with You?
Jacobs School alumni, we want to hear from you! Send us updates on your professional activities and personal achievements. Your information will be included in the next Pulse magazine and posted on our alumni website. While supplies last, we’ll send you a Jacobs School tote bag when you submit a class note.

soecom@soe.ucsd.edu
www.jacobsschool.ucsd.edu/alumni/

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1999 Doug Chang
Ph.D., Bioengineering
When not working at UCSD in the Department of Orthopaedic Surgery, Doug Chang spends time at home with his new son Eli Simon Chang. Fellow alum Dave Carta (1997, Ph.D. Bioengineering) served as best man at his wedding and also had a son recently.

1999 David Lubitz
B.S., Mechanical Engineering
Lubitz married UCSD alumna Rebecca Gordon in 2002 and they now have two boys, Danny, 2, and Joshua, 4 months. He completed a Ph.D at UC Davis in 2005 and is now serving as an assistant professor of environmental engineering at the University of Guelph (Ontario, Canada) focusing on wind energy-related research.

2000 Michael Rosett
B.S., Computer Science
Rosett recently completed an M.S. in Software Engineering from Carnegie Mellon University. He moved to Los Angeles to work for Yahoo! Search Marketing starting as a senior software engineer on “Project Panama” (aimed at regaining market share from Google) and has since been promoted to software engineering manager. Previously Rosett worked for IBM as a software engineer. After graduating from UCSD, he married UCSD alumna, Mya Rosett and they have a son, Nadav, 2.

2001 Judy Alvarez-Gallardo
1998 B.S., 2001 M. Eng., Electrical Engineering
Alvarez-Gallardo has worked at ST Microelectronics, Inc for the past 10 years, currently as senior design engineer in the Data Storage Division. She and husband, Victor Gallardo (UCSD B.S., Computer Science 1999) are the proud parents of future UCSD Alumnus, Victor Milan born March 13, 2007.

2001 Michael Houston and Tina Wang
B.S., Computer Science
Classmates Michael and Tina celebrated their first wedding anniversary in August. Houston is currently completing a Ph.D. at Stanford University in computer science while Wang graduated from law school in the spring and was studying for the bar exam at last report.

2004 William L. Hui
B.S., Mechanical Engineering
Hui has been working as a design engineer on the Joint Strike Fighter (F-35) program at Northrop Grumman Corp. in El Segundo, CA, converting fuel and electrical schematics into 3-D models. He is also studying for a master’s degree in Product Development Systems at USC.

2005 Cailyn Le (Mai)
2004 B.S., 2005 M.S., Structural Engineering
Since graduation, Le has worked with the Office of Structure Construction in the Bridge Department at Caltrans. Although different than working for a design company, Le enjoys the “best-of-both-worlds... of the design aspect in the office and seeing your bridge being constructed out in the field.”

2006 June-Carlo Magpantay
B.S., Computer Science
After an internship doing manual software testing at Mitchell International in San Diego, Magpantay was recently hired full time as a software quality engineer to write automated scripts for test plans.