Dean’s Message

I have spent most of my adult life either attending or working at land-grant institutions. Now, as dean, I am truly proud to come to work every day here, where I see the critical role that land-grant schools play in helping to solve critical problems and in bringing important technologies to our state and nation.

Our researchers, students, and alumni are not sitting in ivory towers. The impacts around the state and nation from our work are pervasive. You can see our college’s work in Washington’s dams and floating bridges, in improvements in building energy usage, in wood-composite materials used on your decks, and in air pollution controls that provide cleaner air.

In the past few years, we have made a concerted effort to focus our research, teaching, and outreach on four key areas that we believe are fundamental and critical to the state and nation’s future. These four areas have become the cornerstone of our portion of The Campaign for Washington State University: Because the World Needs Big Ideas. We believe the research in this college in these areas will impact every Washington state citizen in the years to come.

Energy: We are building on existing strengths and making tremendous advances in advanced materials for energy, in sustainable design, and in electric power engineering. Sustainability is key to our efforts to solving our 21st century energy challenges. We are becoming national leaders in efforts to develop better catalysts that can lead to innovations in fuel cells and biofuels, improve chemical processes, and increase energy efficiency in manufacturing. Led by a group of WSU alumni, Miller|Hull is in the process of building one of the world’s most efficient office buildings in Seattle (page 11). Our power engineering program is taking off with the hiring of three new faculty members and the establishment of a smart grid engineering laboratory (page 7). We’re educating more students than ever to be the leaders in what will become the smart grid.

Environment: Our environmental research has a long history here in the college, and, again, we are making strides that will contribute directly to a better way of life for future generations of Washingtonians. Two of our CEA researchers, Brian Lamb and Claudio Stöckle, are participating in a multi-institutional project to better understand and mitigate the impact of climate change on cereal crops (page 13). While such a project may directly affect the economy of our Palouse-area farmers, it also promises to have bigger impacts for farmers and food consumers around the world.

Health: Our CEA engineering research plays an important role in maintaining and improving the health of our citizens. In one project, our computer science researchers have retrofitted apartments in a Seattle retirement community with smart sensors, allowing us to better understand and measure issues like cognitive decline (page 17).

The aim is to find ways to help keep people in their homes longer.

Of course, some of you may wonder how a focused effort in these research areas benefits our undergraduate students. I want to reassure you that having a strong research program in our small engineering college helps all of our students to thrive. Active, vigorous graduate programs bring in external resources that benefit undergraduates. Hiring and retaining talented research faculty members adds to the intellectual vitality of our college. If you look at the most highly-ranked land-grant universities in the United States, they also have thriving, rigorous, and highly-ranked undergraduate programs.

Innovative Leaders: The fourth cornerstone of our campaign is, of course, our students and our efforts to help them become innovators and future leaders. I hope you will enjoy reading about our continuing efforts in undergraduate education (page 21), where we strive to provide students with experiential learning outside the classroom. The opportunities for students include active student clubs, our successful entrepreneurship program, undergraduate research, and senior capstone experiences involving real, company sponsored projects. The result? Our graduates are known as being ‘work ready, day one’ when they enter the workforce. In fact, last year the Wall Street Journal named us one of the top 25 schools in the country for recruiting new hires, and the Daily Beast listed us among the top schools for educating technology industry leaders.

So, how do we take care of the whole house? The key for me is that we need to identify, cultivate, resource, and reward our excellent teachers as well as our excellent researchers. Private support can really make the difference in developing thriving undergraduate programs by providing not only scholarships, but also support for faculty excellence.

I hope you’ll join me in our efforts to build the strength of our college in these four important areas. Your support is more important than ever to our continuing success. Please feel free to contact us and let us know how you want to make a difference. Or you can just share your news with us. I always look forward to hearing from you.

Sincerely,

Candis Claiborn
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Reaching Our Campaign Goal
Inside back cover

Cover photos of power line workers and windmill courtesy of Avista and Puget Sound Energy.
The generation and efficient use of energy are at the center of a wide variety of engineering and societal challenges that will continue throughout this century.

**Advanced Materials.** WSU engineering faculty are developing bio-based materials for immediate energy supply needs, nanomaterials for renewable energy sources in the near-term, and positron production and storage for the future.

**Power and Energy Systems.** With the electric power system poised to undergo major changes in the industry over the next decade, researchers in the College of Engineering and Architecture are working to develop and incorporate new technologies aimed at improving the efficiency and reliability of electric power and energy systems.

**Sustainable Design.** Researchers in the College of Engineering and Architecture are working to develop novel solutions for building materials, design, and constructability and providing innovative approaches to benefit the public by pioneering changes for the design and construction of the built environment.

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**ADVANCED MATERIALS**

**Turning Organic Waste into Biofuels**

By Melissa O'Neil Perdue, WSU Tri-Cities

An innovative idea for making advanced biofuels such as jet fuel, diesel, and gasoline from regional resources is moving forward with a grant from the U.S. Department of Energy.

“This process will demonstrate the use of local biomass from our community and our farmers and it will answer questions across the state,” said Diahann Howard, Port of Benton economic development director. “It will also give more options locally to use waste for energy and not stockpile ag waste, which can create hazardous or unappealing situations.”

The team of WSU Tri-Cities, the Port of Benton, Clean-Vantage LLC, and the Pacific Northwest National Laboratory will conduct the $1.5 million BioChemCat pilot project in the Bioproducts, Sciences, and Engineering Laboratory at Washington State University Tri-Cities under the leadership of Birgitte K. Ahring, Battelle Distinguished Professor and director of the WSU Center for Bioproducts and Bioenergy.

BioChemCat refers to the biorefinery process, which makes use of both biochemical and thermochemical processes for making biofuels and biochemicals.

“The concept is feedstock agnostic, it doesn’t really care what kind of biomass you use,” Ahring explained. “It can use all kind of feedstocks—municipal waste, vineyard waste, feedlot manure, woody material, ag waste like corn stalks, straw, or corn cobs after the kernels have been removed. It could be implemented all over the world.”

The project is funded with a DOE grant to the Port of Benton of $951,000 plus $549,000 in matching funds. The project includes other new twists on biofuels production, including:

- The waste can be wet—many biofuels processes first require that the waste be dried, which can be expensive and time consuming.
- The process can be operated in a spoke-and-hub manner, where the initial part of the process (the creation of distillates) is done in small-scale local facilities, while the final upgrading into advanced fuels is done in a few specialized hubs.

Continued on next page
Both parts of the process combine new break-through knowledge that allows for reducing the cost of the final fuel.

This process is expected to be high-yield—for example, potentially making more than 70 gallons of jet fuel per ton of dry materials. This is much higher than other known processes.

The process can be operated to produce either gasoline, diesel, or jet fuel depending on the needs. Therefore, it represents an example of producing “drop-in replacement fuel” for oil-based products.

“It’s really exciting because it’s a true Tri-City project,” Ahring said, noting the partnership includes a local company providing the overall concept, a university campus, the port, a national laboratory setting up and operating the pilot facility, and the regional biomass materials that will be used. “We think we will be capable of demonstrating within two years that the BioChemCat process has major value.”

3M invests in GoNano

3M’s New Ventures is investing in GoNano Technologies Inc. The terms of the agreement were not disclosed. “GoNano Technologies’ unique technology platform offers significant performance improvements for chemical flow reactions that benefit from large surface areas,” Stefan Gabriel, president of 3M New Ventures, said in a press release. “The combination of this potentially game-changing nanomaterial with our technology platforms further stimulates disruptive innovation and creates new business opportunities in the catalytic conversion space for 3M.”

GoNano, based in Moscow, Idaho, came out of research conducted by Grant Norton, associate dean of research and graduate programs in the College of Engineering and Architecture at WSU, and David McIlroy, a physics professor at the University of Idaho. The researchers were trying to build nanowires several years ago and instead accidentally created a Nanospring™. The researchers soon determined that the tiny and unique Nanosprings have valuable properties, the most important of which is that they create an extremely high surface area. The researchers received a W.M. Keck Foundation grant in 2004 to study the properties of the tiny structures. They began getting patents for their technologies and established GoNano in fall of 2007.
Nearby is the smooth-sided and seemingly perfect fluorescent Yttrium Aluminum Garnet (YAG). Add a little bit of cerium and the garnet can be used in radiation detectors; it glows when hit with radiation. It can also be used in medical diagnostics.

A light purple crystal stands delicately by. When used as a laser, it can cut all the metal in your car, says Lynn.

A good crystal using infrared radiation allows you to see clearly. You might be able to see molecules in smoke coming from a factory that is miles below. You might detect radiation at a border crossing, or see the tiny beginnings of a cancer.

**A Delicate Business**

Lynn and his colleagues in the Center for Materials Research are helping industry around the world with the challenge of growing better crystals.

Although lasers were invented almost 50 years ago and are used in everything from missile guidance to eye surgery, growing the crystals that are used in solid state lasers has never been an exact science. Because of the prohibitive cost of growing them, little research has been conducted on the basic science of the methods that are used.

When Lynn arrived at WSU about 15 years ago from Brookhaven National Laboratory, he saw a need. Washington grows more crystal materials than any other state in the United States. The industry is made possible by the continuous and inexpensive hydropower along the Columbia River, says Lynn. If you’re a crystal grower and you lose power, you lose your crystal and probably your profit for an entire year. By being located along the Columbia River, the industry guarantees a reliable source of power and doesn’t need expensive back-up generators. So, for example, REC Silicon Inc., based in Moses Lake, is one of the largest producers of silicon materials in the world for the solar industry.

CMR researchers work with industry leaders to grow and characterize crystals that are used for civil and military laser applications. The researchers are working to improve...
crystal growth of Yttrium Aluminum Garnet (YAG), which they hope leads to more efficient, high-powered, smaller-sized, and lighter-weight lasers. They also are working to improve Cadmium Zinc Telluride (CdZnTe) crystals for use as radiation detectors in medical imaging and handheld instruments.

As with lasers, growing crystals that are used in the production of silicon chips is also expensive. The process calls for a large amount of electricity to heat the crystal to high temperatures for a period of months. The silicon crystal is then carefully sliced into thin wafers that are used for microchip processors. The CMR researchers are working to better understand and improve the silicon crystal growth process, assessing damage or defects that occur in the industrial process and mitigating it.

The researchers buy powder for their crystals and then heat them in specially built furnaces. Temperatures might range from 1,450 to over 2,000 degrees centigrade. Growing some of the world’s best crystals can take a few days or several weeks.

“We figure out the right environment, the right dopants (additives), and the right growth rate,” says Lynn.

An Interdisciplinary View

Originally from South Dakota, Lynn had an early interest in math and science. Math, he says, “is elegant.” In new science, he said, “nobody knows the answers.”

“It’s the ultimate adventure. It’s a real exciting drive to solve something that no one else has solved.”

When he entered college, he studied a variety of math and science topics, including materials science, physics, chemical engineering, chemistry, engineering, and math. At one time, he considered getting a degree in philosophy. He finally settled on degrees in math and materials science and engineering.

He came away from his education with the feeling that the distinct fields “were all related, although they were taught differently.”

After getting his doctorate, Lynn worked at Brookhaven National Laboratory as a physicist and materials scientist. There he conducted pioneering research in the design of positron beams and constructed the first prototype. A fellow of the American Association for the Advancement of Science (AAAS) as well as the American Physical Society, his work has been extensively cited around the world.

Lynn was drawn to WSU partly because of the reputation of Professor John Hirth and because of the materials science program, which he says, was uniquely integrated in the graduate program. The program included physicists, engineers, and chemists. In addition to his work in crystals, Lynn is conducting pioneering positron research, working to develop a trap for tricky antimatter particles, which want to annihilate the instant they run up against matter.

And Lynn continues to build materials research capability at WSU into a truly interdisciplinary effort. The university’s material science and engineering graduate program is growing, the number of students is increasing, and the program’s reputation is on the upswing. Lynn hopes to develop a research center focused particularly on using new materials as sensors, including radiation detectors, which would include high-level materials science research in crystal growth and systems, as well as in electronics, packaging, and forensics.

“I do science because I really love it. When I use my creative energy to do better science, I do just fine, and everyone else, hopefully, benefits too.”

—Kelvin Lynn

The Imperfect Part

The work is sometimes difficult. Lynn is embarrassed that it took him and his colleagues so long to figure out positron traps—which, he says, “are so simple.” Then, it took another few years to get support for his ideas with plenty of rejection. Sometimes, scientific discussions around a research point can become “scientific shouting,” he says, wryly.

The work that this integrated team is doing has the ability to change the world, though, says Lynn.

“I do science because I really love it. When I use my creative energy to do better science, I do just fine, and everyone else, hopefully, benefits too.”
YOUR IMPACT
Fuel Cell Gift Could Help to Answer the Call in an Emergency

Every year on the fourth Saturday of June, amateur radio operators from across the United States participate in a large-scale, emergency communications exercise.

Their aim: Set up communicating field stations that don’t use any existing infrastructure.

Trying to operate without commercial power or even a standard gasoline-based generator simulates what might really happen in an emergency. Operators might use car batteries, solar panels, bicycle generators, or, on occasion, hydrogen fuel cells.

The WSU student chapter of the Amateur Radio Club this year used a 1,000 watt hydrogen fuel cell, made possible through a recent donation from ReliOn Inc.

The 16-year-old company, originally a subsidiary of Avista, is based in Spokane and specializes in the production of Proton Exchange Membrane (PEM) fuel cells. PEM fuel cells are most often used for purposes that require reliable, back-up communications.

With support from the school’s power engineering faculty and College of Engineering and Architecture shop staff, students from the WSU Amateur Radio Club assembled a portable fuel cell demonstration unit.

“The goal of this project was to help students learn about hydrogen fuel cells while they produced a portable power source with instrumentation that could produce enough power to support emergency communications needs,” said Jim Kusznir, who advises the club.

The group then participated in the field day, held at Latah County Fairgrounds, where the unit provided power for three transmitters and supported equipment for the 24-hour event. “And they still had a fair bit of hydrogen left over,” said Kusznir.

ReliOn’s fuel cell can produce up to 1,000 watts of power at 48 volts, which is the power typically used at communications facilities. With support from the WSU shops, the WSU student group built a rack on wheels with a series-parallel array of batteries to provide the 48 volt bus, a 48-volt to 12-volt converter, and necessary fusing and DC isolation and distribution. In addition, the group installed a flow meter, so that students can see how much hydrogen is being consumed to make the electricity.

ReliOn provided two such fuel cells to the college for educational purposes. The second will be used in the School of Electrical Engineering and Computer Science’s renewable energy class.

“We want to train students, so that they can contribute to industry and have hands-on training in these technologies,” said Mark Grimes, vice president of engineering for ReliOn. “Having the fuel cell in their classrooms means the students can see the product as it is used in the field.”

“It’s a long way between understanding a concept (of hydrogen fuel cells) and using a commercial product,” he added. “From our perspective, this provides a more well-rounded education in renewables.”

Are you interested in supporting the College of Engineering and Architecture with a donation? Please go to www.cea.wsu.edu/givingopportunities or contact the CEA Development Office at 509-335-3342 or robinb@wsu.edu.
To understand the power grid of the future, think about the difference between your old cell phone and a smart phone. Aiming to train students in understanding the electric power grid concepts that they will encounter in their careers, Anurag Srivastava, assistant professor in the School of Electrical Engineering and Computer Science, is developing a smart grid demonstration and research investigation laboratory (SGDRIL).

Having a good understanding of the smart electric power grid is imperative, says Srivastava. Similar to a new smart phone, the renovation of the power grid is going to be more functional and flexible and provide more interactive control for the consumer. The aim is for a system that will help energy security and provide energy savings. “The problems and the challenges are going to be a bit different than in the past,” he says.

The idea with the new lab is to bring the small devices to the students and let them try out new algorithms and technologies. “Most schools don’t have enough smart grid devices and equipment with real time simulation capability for student training,” says Srivastava. Instead, they mostly teach theory. The research focus of the lab, says Srivastava, is to develop, test, and validate smart grid algorithms as well as to test new devices that might be used in a smarter electric power grid. These new and smarter devices and algorithms will be in the areas of power generation, transmission, and distribution, as well as at the home network level. At the same time, the lab will be used as a teaching lab, where students will be able to use smaller smart grid devices and learn about their operation.

“The electric power system is moving toward smart grid development,” he says, “but the implementation of such a system requires the development, enhanced testing, and validation of smart grid technologies.” For instance, students will have access to phasor measurement units, which are able to make measurements of power system states and can synchronize with global positioning satellites.

A real-time digital simulator will also be able to simulate the power system and provide access to real signals to

Liu Brings Smart Grid Research Leadership to WSU

Chen-Ching Liu, an internationally leading researcher in the smart electric power grid, is joining the WSU faculty as Boeing Distinguished Professor. The position comes with support from the state Economic Development Commission and the Higher Education Coordinating Board STARS Researcher funding program. The program promotes economic development and technology transfer from research institutions to the private sector through strategic hires in critical research areas.

Liu’s hiring will bolster WSU’s internationally recognized power engineering program and provide a nexus of regional expertise that will drive the next generation of power grid research and innovation. Continued on next page
OUR IMPACT IN POWER ENGINEERING

- WSU did the physical modeling for designing Northwest dams.
- When Washington’s aluminum industry pioneered the use of aluminum conductors for transmission lines after World War II, the expertise came from WSU.
- WSU organizes the largest conference and the largest short course on power grid protection in the United States.
- Middleware developed by Professors Bakken and Hauser is influencing next-generation communication for the power grid.
- Oscillation detection technology invented by Professor Venkatasubramanian is used to prevent instabilities in the Eastern and Western interconnection.
- Robert Olsen is one of the authors of the Electric Power Research Institute’s Red Book, which is considered the authoritative text for design of high-voltage transmission lines.
- Schweitzer Engineering Laboratories was founded by alumnus Ed Schweitzer. Started in 1982, SEL, which produces digital protective relays, employs approximately 2,500 people with offices in 16 countries. Every utility in North America uses SEL products.

LIU Continued from page 7

“The STARS Researcher program is a vital tool to help attract outstanding scientists to Washington,” said WSU President Elson S. Floyd. “At Washington State University, we are proud of the leadership role that we have taken in clean technology and developing a smarter grid. Bringing Chen-Ching Liu to our university will further enhance our state’s effort to develop the clean tech jobs and the secure and efficient grid that will power our future.”

“Efficient management of the electrical power system is critical to our emerging green energy economy,” said Howard Grimes, vice president for research and dean of the graduate school. “Indeed, a major emphasis of this new position is to rapidly transfer new technologies from WSU to the private sector.

“By hiring Liu and further strengthening WSU’s research program in power engineering and the smart grid, we are contributing directly to a strong future economy for the state,” he said. “Building fundamental research around the next-generation smart grid will create high tech jobs in Washington and throughout our region.”

Liu is a fellow of the Institute of Electrical and Electronics Engineers. He is internationally recognized for pioneering contributions to the development of decision support systems for power system restoration following major outages.

Most recently, he has been a professor in the School of Electrical, Electronic, and Mechanical Engineering at University College Dublin, Ireland, where he also served as deputy principal of the College of Engineering, Mathematical, and Physical Sciences.

His research interests include cyber-power system vulnerability assessment, wide area control and protection technologies for the power grid, and engineering and economic issues related to the integration of renewable energy. He has conducted research extensively for industry and governments, including the power industry in the United States, Europe, and Asia, the National Science Foundation, Electric Power Research Institute, Science Foundation Ireland, and European Commission programs.

He has published more than 100 articles in major power engineering journals and 20 book chapters. Liu also held faculty positions at Iowa State University and the University of Washington where he served as associate dean of engineering from 2000 to 2005. As a former board member of the Washington Technology Center, he will bring his experience in facilitating economic development through technology transfer.

Liu was recognized for his outstanding contributions in the field of electrical engineering with an IEEE Third Millennium Medal in 2000. He received several teaching awards, including the IEEE Power and Energy Society (PES) Outstanding Power Engineering Educator Award. He also played a leadership role in IEEE PES future power engineering workforce activities.

Liu received his doctorate from the University of California, Berkeley, in electrical engineering.

“Research to develop smart grid technologies and to address the daunting and exciting energy challenges of the 21st century is a top priority for the College of Engineering and Architecture,” said Candis Claiborn, dean of the college. “Both Chen-Ching Liu and WSU’s power engineering program are recognized leaders in this important research area and will help the state solve the critical challenges that lie ahead.”

SMART GRID LAB Continued from page 7

devices, giving students a hands-on opportunity to simulate the power grid. The lab will also contain physical control devices.

The lab is more important than ever for training, says Srivastava. There is a significant shortage in the power engineering workforce with a large number of retirements expected in the next few years.

At the same time, the field of power engineering offers new opportunities that are starting to attract students, he says. The students are becoming increasingly interested in areas such as renewable energy and the smart grid and in the interdisciplinary research that the field provides.
Your Impact
Public/Private Partnership Builds a Power Engineering Program

It was something that no cash-strapped entities could do by themselves. But put our efforts together, and the result is the hiring of three new faculty members and the strengthening of a critical program in power engineering.

“By bringing everyone to the table to make a contribution, we are able to hire new faculty, but, more importantly, we’re able to move forward in helping to meet the need in power engineering in the Northwest,” said Dean Candis Claiborn.

In recent years, the power industry has faced the challenge of an aging workforce. As much as one third of its workforce is due to retire in the next ten years. Meanwhile, power engineering programs have been on the decline and only five programs have more than four full-time faculty members in the United States. At the same time, there are ever-increasing demands for a smarter, more secure, and more efficient electric power grid.

To meet the demand for power engineers due to workforce retirements, the College of Engineering and Architecture has worked to increase the scale and scope of WSU’s power engineering program.

The university administration recently funded three new faculty positions in power engineering, strengthening and expanding the power program with the additions of Anurag Srivastava, Chen-Ching Liu, and Ali Mehrizi-Sani, who will join the EECS faculty in spring 2012.

At the same time, through critical industry support, the region’s public and private utilities are coming together to help fund annual operating costs for the Power Systems Engineering Program and to establish a new endowed faculty chair over the next five years.

The result: More educational opportunities for students in power engineering and more research efforts in developing a better power grid for the future.

“This successful partnership brings a consortium of funders together to accomplish what they individually could not achieve for the mutual benefit of their utilities and customers and our students and faculty,” said Claiborn.

For more information on how you can support WSU’s power engineering program, contact Jody Opheim, CEA Development Office, at 509-335-6456 or opheim@wsu.edu.

Sustainable Design
Creating New, Sustainable Methods for Storm Water Management at Ferry Terminals

By Melisa Virnig, CEA Intern

Trying to prevent rainwater from moving pollution from oil-covered city streets into nearby Puget Sound is tricky.

But when the polluted water is falling almost directly over the water, the designers have quite a challenge on their hands.

Michael Wolcott, professor in civil and environmental engineering, Liv Haselbach, associate professor in civil and environmental engineering, and Cara Poor, clinical assistant professor in civil and environmental engineering, are helping Washington State Ferries (WSF) design more sustainable ferry terminals with storm water management as a major component of the effort.

“Washington State Ferries is working to design guidelines that are more holistic,” Haselbach said. “They are considering how everything interacts. They want to address environmental and operational problems at the same time.”

Continued on next page
Ferry Terminals Continued from page 9

The ferry terminals are unique because the majority of the infrastructure is directly over water. Normally, researchers and designers of pollution controls need to consider both the quantity and quality of storm water that reaches a receiving body. But since ferry terminals are located over the receiving body, quantity is not a major issue, says Wolcott.

“If it rains, the water goes into the Sound anyway,” says Haselbach.

The volume of water entering the Sound is not the main issue, unless it comes from landside facilities. The challenge with ferry terminals is finding unique ways to deal with the storm water or prevent contaminants in the first place because there is frequently little land to work with for subsequent treatment, she said.

“We can’t always put the water back on the land to treat it,” she said.

In coming up with design guidelines for the ferry system, the researchers are focusing particularly on the use of durable materials. The idea is to use materials that will last in a harsh marine environment that often includes waves and spray while not further contributing to pollution problems. Meeting this challenge is difficult because material treatments that increase durability are often harmful to the environment. One example is the zinc coatings used to galvanize steel.

The researchers are also looking at ways to best manage and minimize pollution from the uncontrolled activities that constantly occur near the water.

“Whenever the water touches the trestles, or docks, it picks up contaminants,” Haselbach said. “Contaminants can come from a number of uncontrolled variables like cars, birds, and the material trestles are made of.”

Haselbach said the number one challenge they are facing is that water doesn’t flow uphill. “It frequently all meets at one point,” she said. “The terrain leading to the terminal can be very steep. We’re basically looking for ways to be proactive considering all the effects of operation at the site.”

Haselbach said WSF has already done a tremendous job with maintenance and prevention.

“There’s really not much pollution in the first place because they have such good procedures already,” she said. “They are being proactive. They want to make sure it is as sustainable as possible for the future. Some ferries are by sensitive areas so they want to be extra careful.”

Haselbach said they are realizing how challenging this task is. The professors will be compiling recommendations and ideas that they will pass on to WSF to include in their design guides.

“We are going to look at what technologies can be developed or what ones have already worked somewhere else that could be modified,” she said.

“Washington State Ferries is working to design guidelines that are more holistic. They are considering how everything interacts. They want to address environmental problems at the same time.”

—Liv Haselbach
The World’s Most Energy Efficient Office Building

By Eric Sorensen. Reprinted from Washington State Magazine’s Discovery blog at wsm.wsu.edu/discovery.

Try as you might to save energy at home—wear sweaters, hit the lights on the way out of the room—you can still see vast amounts of energy going to waste at work. Empty rooms have lights on. Large, nearly empty spaces have the heat cranking. It turns out that buildings take up the bulk of our energy use.

The environmental sustainability goals of the Leadership in Energy and Environmental Design, or LEED, rating system have been taking a crack at this problem in recent years. WSU’s own Compton Union Building was refurbished with the guidelines in mind, earning a silver rating by saving energy and water and recycling construction waste, among other things. WSU Vancouver’s undergraduate classroom building went one better, earning a gold certification from the U.S. Green Building Council.

But such efforts pale in comparison to the Cascadia Center for Sustainable Design and Construction, a six-story office building slated for East Madison Street on Seattle’s Capitol Hill. All of the building’s energy demands will be handled on the site. All of the building’s water will come from rainfall. Where other green buildings compete over certifications of silver, gold, and platinum, this will simply be the most energy-efficient office building in the world.

Participants in the project—the Bullitt Foundation, PAE Consulting Engineers, and the Miller|Hull Partnership—spoke about the effort earlier this year in a seminar put on by WSU’s Center for Environmental Research, Education, and Outreach (CEREO). A look at just some of the steps in the effort shows it is indeed possible to make such a dramatically sustainable building. It also shows how hard it can be.

A typical building uses more than 70,000 British thermal units of energy per square foot per year. This translates to an “energy use intensity” of about 70. A LEED platinum building cuts that by more than half, to 32. The Cascadia Center cuts that in half again, to 16. Craig Curtis (’83 Architecture, ’84 Construction Management), a Miller|Hull partner and lead designer for the architecture team, said this is probably the lowest of any office building in the state.

All the building’s electrical needs will come from solar panels. To get the most surface area, and therefore the most energy from Seattle’s intermittent sunshine, the architects extended the roof outside the property line and ran panels down much of the building facade.

The roof’s rainwater will be filtered and disinfected for drinking and showers. Water from the low-flush toilets, as well as the solid waste, will be composted and used to fertilize and water plants.

Laptops, which use less energy, will replace desktop computers. In some cases, computing will be done through common servers.

Tenants will include the building’s owner, the Bullitt Foundation, which focuses on environmental issues in the Northwest. The foundation, said Amy Solomon, a program officer, decided to develop the building to create a “replicable prototype” and inspire more environmental policies, including building codes.

Other tenants will need to agree to limit their energy use, although heavier energy users may be able to take advantage of an inter-office “cap and trade” system. Workers will need to expand their comfort zones, tolerating a few degrees warmer in summer—there will be no air conditioning—and a few degrees cooler in winter. The only on-site parking will be for a shared electric car. And with an elevator using as much as 4 percent of the building’s energy, tenants will be encouraged to use a glassed-in stairway with views of downtown Seattle and Puget Sound.
Environment

The most compelling societal issues worldwide stem from the challenge of sustaining our lifestyles and economies in the face of finite resources and a fragile environment. A large part of the sustainability equation means addressing challenges to our environment—maintaining the health of our finite water, air, and soil resources, especially in light of the impacts of global change. In WSU’s College of Engineering and Architecture, our research strengths include the Laboratory for Atmospheric Research (LAR), one of the earliest and most prestigious air pollution research groups in the United States.
Helping one of the largest wheat producing regions in the world mitigate and successfully adapt to climate change is the focus of research that scientists from the University of Idaho, Washington State University, and Oregon State University will conduct with a five-year, $20 million grant from the USDA National Institute for Food and Agriculture.

The grant is one of three awarded nationwide. Led by the University of Idaho, WSU’s portion of the grant is $8 million.

Although they emphasize that there are more than 60 different agri-ecological zones within the region, project scientists say, in general, temperatures in the Pacific Northwest’s prime grain growing regions are expected to increase by 3.6 degrees by 2050. Winter precipitation is expected to increase by approximately 5 percent in that same time frame; summer precipitation, however, is expected to decrease. They also say a 5 percent increase is relatively small compared to the large variations in precipitation throughout the region from year to year.

“The challenges that we are facing in agriculture are enormous,” said Howard Grimes, vice president for research at WSU. “Everybody who has looked for even a moment at the population increase that is facing our planet, coupled with the arable land issues, coupled with the water use issue, coupled with the regional climate change issues, understands immediately how grand this challenge is.”

Scientists from a variety of disciplines at the universities will tackle different aspects of the climate change challenge—cropping practices, weed and disease management and prevention, economics, computer modeling and mapping, soil science, rural sociology, carbon sequestration and greenhouse gas emissions, and education and Extension. The team will include 22 principal investigators, 14 graduate students, three postgraduate researchers, and several technical and administrative staff. They will create a region-wide research, outreach, and education network to address climate change issues.

College of Engineering and Architecture researchers who have a role in the project include:

- Brian Lamb, Regents’ Professor in the Department of Civil and Environmental Engineering, and his colleagues will be measuring the uptake of carbon dioxide and the release of nitrous oxide from farm fields for the project. The researchers will be installing instrumentation at several sites in a variety of Northwest climate zones over the next five years. In particular, the sites in Othello, Lind, Pullman, Genesee, and Pendleton each have unique temperature and precipitation conditions. The researchers will be studying changes in carbon storage and greenhouse gas emissions as a variety of cropping techniques and growing practices are tested at these sites.

- Claudio Stöckle, chair of the Department of Biological Systems Engineering, and his colleagues will be providing simulation models for various cropping scenarios in the project to assess their impact on greenhouse gas emissions. Stöckle is a leading authority on cropping systems modeling. They will also be participating in direct field monitoring of greenhouse gas emissions and will be studying how crops and yields may change as future climate change occurs.

More information about the scientists involved and their roles in the project is available at www.uidaho.edu/reachpna.
Integrated Earth Systems Model to Show Realistic Effects for Environmental Decision Making

By Melisa Virnig, CEA Intern

The problem with the earth is it’s a little tricky.

Add a little extra nitrogen to your crops here, and it changes the biology of a distant lake there.

Spew a little carbon dioxide from your car, and it warms up the ocean, which causes a little more evaporation and a few more clouds—and then it snows a little bit more in Baltimore.

All the biological and physical processes that occur on the planet are interrelated and react to each other.

A team of researchers from six institutions, led by Dr. Jennifer Adam in the Department of Civil and Environmental Engineering, is working to address the integrated nature of physical processes through the development of a regional-scale Earth Systems Model for the Pacific Northwest. The researchers are developing the model to help them better understand the effects and consequences of human activity on global and regional changes.

The Earth Systems Model, called BioEarth, integrates standalone models that capture real processes of the environment. The atmospheric, terrestrial, aquatic, and socioeconomic models will show how changes in one component affect the other.
Adam said a model like this has an advantage over conducting an experiment. “With experiments you can only observe what has already happened,” she said. “The nice thing about modeling is you can test changes that haven’t occurred yet. If we evoke a change, we think the model can tell us what that change would cause.”

The stand-alone, computer-based systems that are being integrated already exist and are continuously undergoing development.

“By coupling them, we’re making the stand-alone models talk to each other,” she said.

The integration of the individual models can show feedback effects, which can be very beneficial to understanding realistic situations and how one change can affect the entire system. Warming in the atmosphere, for example, causes some response on the terrestrial land surface, which then additionally affects the atmosphere, she said.

Forest management is one of the main environmental aspects that the model will consider and test.

“The borders of a stream are sensitive to logging,” Adam said. “Logging along this area can damage the stream. This Earth Systems Model is meant to be useful for land management.”

The model could also help farmers in agricultural resource management as they make decisions about irrigation, fertilization, and land use. One of the models included in the project is a crop systems model.

The five-year BioEarth project will include efforts to gather input from stakeholders, including farmers, forest managers, and local tribes.

“We’re building a conceptual understanding of earth processes, we’re also learning a lot from these groups of people,” she said.

The integrated model will focus on the flow of nitrogen and carbon as it applies to climate change, which can help future decision makers and stakeholders understand the balance between productivity and negative effects.

“Nitrogen is a nutrient that a lot of plants need to grow,” Adam said. “Most plants can’t utilize the nitrogen already in the environment. You have to add nutrients by adding fertilizer, which can have negative environmental consequences.

Too much environmental nitrogen can affect air and water quality. It can cause problems in the air, she said. “It increases greenhouse gases that contribute to climate change.”

Adam said fertilizer is one of the most expensive things a farmer buys, so it is important to understand the nitrogen cycle.

“We’re trying to use the Earth Systems Model to understand the nitrogen cycle and how it relates to other cycles,” she said.

The overall goal of the BioEarth project is to work toward informed decision making regarding global change at the local and regional levels, said Adam.

“What we’re trying to do is tie it in with human activities and decision making,” she said.

For more information on BioEarth, visit www.cereo.wsu.edu/bioearth.

Julian Reyes, WSU 2010 alumnus and current WSU doctoral student in the Department of Civil and Environmental Engineering, received a Fulbright grant to study abroad in Germany for the 2011 academic year.

The Fulbright Program is sponsored by the U.S. Department of State and is the largest international exchange program for students, faculty, and other scholars in our country. The program was established in the late 1940s to increase mutual understanding between other nations and the United States and to foster cultural exchange and intellectual engagement. The U.S. Student Fulbright Grant provides support for individual study and research projects in another country or an English language teaching assistantship.

Reyes’s research, advised by Dr. Jennifer Adam, focuses on how atmospheric deposition of nitrogen affects the terrestrial biosphere using an eco-hydrologic model and a sophisticated chemical transport model. His work is part of a larger project at WSU called BioEarth, an Earth Systems Model framework that seeks to integrate the atmosphere, terrestrial biosphere, and aquatic systems. He is interested in how carbon and nitrogen processes will affect the biosphere and atmosphere in a changing climate. At the University of Bonn, Reyes is working with Dr. Stefan Siebert in the Institute of Crop Science and Resource Conservation to learn more about nutrient cycling within crop systems and grassland processes. Reyes says, “These areas are important to the overall Earth Systems Model framework as we seek to incorporate nutrient cycling of different landscapes.”

Reyes’s Fulbright grant started in September. By conducting research at the University of Bonn, he has access to a vast network of professionals familiar with Earth systems, hydrology, and crop science research. This will allow him to incorporate American and German methodological and analytical perspectives into his research project, resulting in a prototype model for international collaboration in the field of climate change. Reyes is hopeful that his eleven-month stay in Germany will yield more insights into terrestrial biosphere processes so that he can incorporate these into his research. He is also hopeful that this opportunity will assist him in building a network of collaborators for future research.
A group of research, industry, and government leaders gathered this spring for the state’s first-ever Green Chemistry conference to come up with a less piecemeal, more holistic roadmap for the use of chemicals in the state.

“We are very good at our chemistry, but we are not always good at understanding the effects of our chemistry,” says Dave Sjoding, renewable energy specialist for the WSU Extension Energy Program.

The conference, held at the Boeing Longacres facility in Renton, was sponsored by the Washington State Green Chemistry Roundtable, a partnership of Washington State University, the Department of Ecology, the Department of Commerce, Boeing, the Northwest Pollution Prevention Resource Center, and the Bullitt Foundation.

The idea of green chemistry came about in the early 1990s with the aim of developing chemicals that are less toxic for people and the environment while also being economical. Some of the principles of green chemistry include using catalysts to increase yields of the most desired product while using minimal energy, preventing the development of harmful byproducts, designing safer chemicals and solvents, designing for energy efficiency, and using feedstocks from renewable resources whenever possible.

“There is growing recognition that you can do things in ways that have a small environmental impact and that advance the economy simultaneously. Doing so, however, takes careful thought,” says Jim Petersen, director of the WSU Gene and Linda Volland School of Chemical Engineering and Bioengineering.

In Washington, 66 chemicals are considered toxic and are carefully and extensively regulated, says Sjoding. But removing nasty chemicals from our environment has generally been done on a piecemeal basis.

From taking lead out of gasoline to cleaning up mercury and writing new regulations to deal with a fire-protective chemical in children’s pajamas, the trajectory has been similar: Chemists come up with new chemicals that help society only to later discover health or environmental effects. Scientists do some studies. People get upset and worried, and then regulators argue for awhile before making new regulations.

“We have to address these issues more than one at a time,” says Sjoding. “We need to re-think how we do chemistry.”

At the conference, researchers discussed ways to improve education and where research efforts should be focused. Petersen aims to have chemical engineering students taught to proactively think of green chemistry and engineering principles. Many courses implicitly cover green chemistry concepts, but the researchers would like to encourage a more careful thought process.

“If you do ‘green chemistry’ right, it’s less expensive and creates jobs, while reducing environmental impacts—all of which are good,” says Petersen.

The conference also included discussions about how some industries are developing safer products and materials and how to provide incentives. A number of companies have taken initiatives in green chemistry on their own, but the efforts have been isolated, says Sjoding.

“This is the first time that a group of people interested in green chemistry have sat down together in Washington,” says Sjoding.

As part of the effort, the group also developed a draft plan for green chemistry in the state, which can eventually be used by industry, government, and education leaders in their decision-making.

“This is a very important first step,” he said.
Engineering for Health

Engineering technology plays an increasingly important role in maintaining and improving health. Today, many medical advances in the treatment of cancer, heart disease, arthritis, and diabetes have occurred because of innovations in bioengineering. Research in the College of Engineering and Architecture is increasing fundamental understanding about biomaterials, molecular and cellular biological processes, and biomechanics that will lead to improvements in health and the quality of life for millions of Americans. College researchers are working to better understand the spread of disease and the behavior of pathogenic bacteria, to improve daily living as we age through the development of health-assistive smart environments, and to make our lives as pain-free as possible.

» OUR IMPACT

Seattle Research Project Will Look to Computers to Help Solve the Human Challenges of Aging

An increasing number of families know the stress of trying to deal with an elderly parent or spouse who is losing his or her ability to live independently.

How can we maintain dignity for those who are having trouble completing daily tasks? How do we keep our parents or elders safe, and who takes care of them?

“It’s a tragedy when a crisis comes up that families didn’t plan for or anticipate,” says Lee Burnside, medical director of Horizon House, a Seattle-based continuing care retirement community. “It’s very difficult for everyone, and our hope is that the stress can somehow be eased a bit. This kind of situation touches everyone.”

A WSU research team, led by Diane Cook, Huie-Rogers Chair Professor in the School of Electrical Engineering and
Computer Science, and Maureen Schmitter-Edgecombe, professor in the Department of Psychology, will be studying approximately 10-20 residents in Horizon House for three years as part of a research pilot project to develop better aging-in-place technologies.

Supported by the Washington State Life Sciences Discovery Fund as well as the National Institutes of Health and the National Science Foundation, the project is one of the largest studies ever done on the use of such technologies.

As the U.S. population becomes older, using technology to address the challenges of aging is of increasing interest to everyone from elderly residents themselves to care providers and government leaders. Allowing the elderly to stay in their homes not only keeps them happier, but it also saves money. Just keeping someone in their home for an additional few months can save tremendously on assisted living costs that average $70,000 per year, says Schmitter-Edgecombe.

“It’s a tremendous challenge that is coming,” says Aaron Crandall, a postdoctoral research associate in the School of Electrical Engineering and Computer Science who is working on the project.

Residents are eager to participate in research that will support their desire to age in place, said Lauri Warfield-Larson, health services officer at Horizon House.

“As care providers, we need to understand what technology can offer as we serve future consumers who will expect to remain in their homes even with decline,” she said.

Currently, there are a few technologies that can help with the challenges of aging, such as wearable buttons that people can activate if they fall.

Regarding clinical treatments for people with mild cognitive problems, “there are no gold standards of care out there,” says Schmitter-Edgecombe.

As part of the study, researchers will install between 30 and 40 sensors in each apartment, including motion, door, power metering, and temperature sensors. Motion detectors will make up the majority of the sensors, and will monitor residents’ activities as they move from room to room in their apartments. Data will be collected continuously. Half of the study participants have mild cognitive problems and the other half are healthy.

Unlike some home monitoring systems, the research project does not include any cameras or microphones.

“Respecting privacy is a primary tenet of the project,” says Crandall. “We want to monitor, not watch, residents.”

The researchers are hoping to find patterns in the data that will help them discern and quantify changes in residents’ health or possible decline. The sensors will be collecting vast amounts of data throughout the day on each resident, collecting information that will show their daily activities, such as brushing their teeth or cooking dinner. By having good information on these important activities that make it possible for people to live independently, the researchers hope that they can help caregivers better quantify and discern any changes that might indicate that people are losing their ability to function on their own. They will be comparing the information collected from the sensors with the typical medical assessments that are done to assess declines. The researchers also hope to develop computerized prompts for residents, reminding them of important activities that could help them to live in their homes longer.

“We hope to automatically detect signs of decline via the computer so that care providers will better be able to know the capabilities of their patients,” said Crandall.

The researchers are hoping that the initial pilot project at Horizon House leads to a larger, more comprehensive study that would follow a larger number of elderly residents for a longer period of time.

Using Computers to Solve the Largest Biology Challenges

Ananth Kalyanaraman, assistant professor in the School of Electrical Engineering and Computer Science, has received a prestigious Department of Energy Early Career Award for work to use sophisticated computer programming to solve challenging, big picture problems for biologists. The $750,000, five-year award supports the research goals of promising faculty members who are starting out their careers. A total of 65 researchers received the award nationwide out of approximately 1,150 applicants from universities and national laboratories.

The field of computational biology is still in its nascent stage, says Kalyanaraman. With ever-increasingly faster and better computers, biologists are able to gather vast amounts of data in fields such as genomics.

In environmental microbiology, for instance, identifying protein families has important implications in fields ranging from alternative energy to medicine. Scoop up one small handful of dirt, however, and you can get millions of microbes—trying to find the one that is doing something that you’re interested in can be impossible.
Current knowledge about the microbial world is limited to only about one percent of microbes, he says, and researchers face challenges when trying to find relationships that interconnect vast collections of uncharacterized protein sequences collected from environmental samples.

Kalyanaraman will be using speedy computers, which range from ten thousand to a million times faster than the average desktop computer, to help solve some of these challenging, big picture problems for biologists. The computers will help make the large-scale effort possible.

"A better use (than increasing speed) is to increase our capacity and our capability," he said. "I want to help solve much bigger problems and to improve the quality of the results."

With the grant, Kalyanaraman will be working to identify clusters within very large data graphs that are built from massive amounts of biological data. In the graph-based data, there can be billions of nodes. Researchers want to know where the nodes concentrate as groups, which could provide valuable information about something like the function of proteins in a community of microbes.

"The idea is to organize the data that they have and get information out of it," says Kalyanaraman.

A team of researchers led by Juming Tang, WSU professor of biological systems engineering, is working to develop new microwave technologies for food processing that could keep foods safer from bacterial and viral pathogens.

The researchers have received a five-year, $5 million grant from the USDA's National Institute of Food and Agriculture (NIFA) program for the project. The group includes researchers from the University of Tennessee, North Carolina State University, USDA's Agricultural Research Station (ARS) Eastern Regional Center, and the U.S. Army Natick Soldier Center.

Food poisoning is a common problem in the United States, says P. Michael Davidson, professor and head of the Department of Food Science and Technology at the University of Tennessee. According to the Centers for Disease Control, there are 9.4 million cases of food-borne illness, an average of 56,000 hospitalizations, and 1,350 deaths per year in the United States from 31 known pathogens. When people get food poisoning, they usually suffer a mild illness, although people with compromised immune systems face the possibility of more serious illness. The biggest economic effect is loss of productivity, he says.

The traditional methods of safeguarding foods have been canning and pasteurization, says Tang. The technologies, which are hundreds of years old, heat foods and kill off a significant amount of the bacteria, viruses, and spores. Problems occur, however, when food is re-contaminated at some point during or after food processing. Because it is heated for long periods, canned food also doesn’t taste as good as fresh.

“As engineers, we’re always looking for a new way for industry to do a better job,” says Tang.

Tang and a group of WSU researchers worked with representatives of the food industry during the past ten years to develop a microwave system to sterilize foods. Not only do the microwave-sterilized foods taste better, but they can potentially be more energy efficient than canning. In 2009, the FDA accepted WSU’s filing for a sterilization process based on the patented technology developed in Tang’s lab for the production of a shelf-stable, homogeneous food—mashed potatoes. In 2010 FDA accepted WSU’s second filing for a non-homogeneous food (salmon fillets). They were the first-ever FDA acceptance of a microwave technology for food sterilization purposes.

These two successful filings have paved the way for commercial applications of WSU technology, says Tang. The technology uses microwave frequencies of 915 MHz in single-mode, pressurized systems to provide efficient heating in pre-packaged foods. The technology reduces heating time for packaged foods by as much as 80 percent. In June 2010, WSU licensed the right to Food Chain Safety (located in

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YOUR IMPACT

Ivory Named Inaugural Hohenschuh Distinguished Professor

Professor Cornelius (Neil) Ivory has been named the inaugural Paul Hohenschuh Distinguished Professor in the Gene and Linda Voiland School of Chemical Engineering and Bioengineering.

The professorship, which was recently created by Paul Hohenschuh and Marjorie Winkler, was announced at the Voiland School’s spring advisory board meeting. The professorship is to be used to recruit and/or retain a world-class, internationally-recognized faculty member, providing annual funding support for materials, equipment, staff, graduate student salaries, or other support that furthers his or her research program.

A faculty member at WSU since 1989, Ivory is a well-known researcher in the area of bioseparations, where his work is focused on the development of novel systems to enable molecular-level protein separations and purification. The work has important implications in a variety of areas ranging from separations of radionuclides for national defense to purification of proteins that are used in pharmaceuticals and other health-related applications.

Ivory worked with his students to develop a separation technique called dynamic field-gradient focusing, which enables the isolation and purification of specific desired and undesired molecules by trapping them in an electric field gradient. Using this and other separation techniques, he is working with his collaborators to develop a blood test that may be used in a physician’s office to quickly and simply identify protein biomarkers that indicate if a patient is at risk of suffering a heart attack. He also has worked with pharmaceutical companies to develop ways to better detect impurities in commercial pharmaceuticals, and is applying his technologies to enable the purification and detection of specific radioactive isotopes that have implications for national defense.

Ivory holds five patents, with several others pending, and has more than 80 refereed publications. He holds a master’s degree and a doctorate from Princeton University in chemical engineering and received his bachelor’s degree from the University of Notre Dame.

The Hohenschuh professorship employs a unique gift mechanism that allows the donor to commit a specific gift amount for a set period of years to support a faculty position or a scholarship. While most chairs and professorships have typically come from an endowment established in a donor’s estate plan, this new annual gift mechanism allows a donor to fund faculty and students immediately, says Don Shearer, associate director of development for the Voiland School. In so doing, the donor is able to immediately see the gift’s impact.

Hohenschuh (’64 BS, ’70 MS) grew up in Washougal in rural southwestern Washington. When he came to WSU with support of a scholarship, he was overwhelmed by the rigorous program in chemical engineering as well as by continual financial stress. Two professors, George Austin, who was department chair, and Harry Stern, were particularly instrumental in helping him at critical times in continuing his education. He went on to become vice president of manufacturing of Genentech, a leading biotechnology/pharmaceutical company. He is now retired. With this gift, he recognizes the importance of world-class professors to the lives of students who will become society’s leaders.

“We are grateful to Paul and Marjorie for their investment in the faculty of this school,” said Jim Petersen, director of the Voiland School. “With this support, they are helping to enhance the school’s performance, helping grow its reputation while ensuring that we have the best faculty teaching, engaging, challenging, and educating our students. In so doing they’re showing how much they care about and support the school’s mission. They will truly make a difference in the lives of both chemical engineering and bioengineering students.”

If you would like to establish or learn more about an annualized term professorship, please contact the CEA development office at 509-335-3342 or robinb@wsu.edu.

Food Processing Continued from page 19

Maple Valley, Washington) for developing industrial systems for commercialization.

The successful development of the novel sterilization technology brought WSU the prestigious 2010 R&D Award from the Institute of Food Technologists, a professional organization with 20,000 members worldwide.

The new grant expands on the WSU microwave technology research to focus on pathogen control at low temperatures, says Tang. The idea is to include microwave heating as a step in the production chain for frozen and refrigerated meals sold in retail markets and as a possible last defense against food contamination, particularly after packaging, he said. The researchers are focused on common, high-risk bacteria and viruses that make people ill each year, including salmonella, listeria, and E. coli.

“We want to help the food industry produce safe foods while providing the best quality,” says Tang.

The researchers aim to determine how such food pathogens respond to microwave heating regimes with the goal of maintaining both food quality and safety.

“There are so many advantages associated with microwave technology,” says Davidson. “This work could really open up the possibility for its extensive use in the food industry.”
Solutions to today’s formidable challenges in energy, the environment, and human health will be determined by our students who become engineers, computer scientists, and architects. Engineers of the 21st century will need new skills to compete in a globally competitive workplace and to solve the grand challenges that lie ahead. Fundamental research discoveries may have little impact without a labor force that is prepared to apply technology, business skills, and cultural understanding in a global market.

As a destination university, we are proud to give our students an experience-enhanced education that will prepare them to graduate work-ready from day one. Part of WSU’s success in educating engineering and architecture graduates is our emphasis on student clubs and hands-on activities that promote student-centered learning aimed at enhancing the classroom experience. The Harold Frank Engineering Entrepreneurship Institute, a recipient of the prestigious Kauffman Award for Excellence in Engineering Entrepreneurship Education, is one example. The institute’s engineering and business students interested in technological entrepreneurship are given tools and experiences needed to pursue their innovative objectives.
A busy city engineering office doesn't always have the time to investigate the latest innovations in concrete or wetlands restoration. City engineers are often just busy with getting streets paved, building permits issued, and sewer lines fixed.

So a WSU student project to develop sustainable solutions is making a real difference in Auburn, Washington. “The students had really good ideas,” said Rich Wagner ('61 Mechanical Engineering), an Auburn City Councilman who is also a retired Weyerhaeuser engineer and serves on the college Executive Leadership Board. “It’s a step beyond what we’ve been doing.”

A multidisciplinary group of students from architecture, civil engineering, and organic agriculture developed projects for the city of Auburn to create a plan for sustainable development and green businesses in the city. As part of the project, 21 senior architecture students worked with approximately 20 civil engineering and organic agriculture students through the WSU Institute for Sustainable Design’s (ISD) collaborative Integrated Design Experience (iDeX) to develop a plan for 600 acres of land in the city of Auburn. The city of Auburn provided the ISD with $95,000 for the project.

These days, sustainability is the hottest topic in the building and construction industry. Everyone wants to have a sustainable lifestyle, and more than 90 percent of engineering and architecture firms expect to be building green in the next five years.

In 2010, a group of WSU researchers received a National Science Foundation grant to develop a model for learning about sustainability that aims to better prepare students for the change in building design practices and goals they will encounter as they graduate. Led by Mike Wolcott, director of the Institute for Sustainable Design and professor in the Department of Civil and Environmental Engineering, the project aims to establish a model that faculty from other universities can use in the future to understand and teach best practices in sustainable design and to engage students in sustainable engineering.

The researchers designed a yearlong Integrated Design Experience (iDeX) that brings together industry professionals in sustainability with faculty mentors who guide groups of students as they tackle design projects focused on sustainability. Students come from a variety of disciplines, including civil engineering, architecture, and construction management.

Because WSU uniquely contains engineering, architecture, and construction management programs within one college, the college is able to provide a multidisciplinary approach to the sustainable design projects, says Wolcott.

The group’s first project was the Smart Farm, in which students developed sustainable solutions for an expansion of the WSU organic farm.

For the Auburn project, the purpose of the multidisciplinary project was to provide students with hands-on experience, increase the value of the current properties, and substantially grow high-value green jobs. The master plan for the district also aimed to improve the energy and water performance of existing buildings and add a transit-oriented downtown.

“The project has served as an economic development tool for the city,” said Wagner. “We want to attract green businesses for jobs that pay $150,000 rather than $15 an hour.”

Michael Wolcott, professor in the Department of Civil and Environmental Engineering, and Deborah Ascher-Barnstone, associate professor in the School of Architecture and Construction Management, worked with the students to build an engineering, architectural, stormwater management, and biological plan for the space. Todd Beyreuther, Karl Olsen, and Cara Poor, clinical assistant professors in architecture and civil engineering, also worked with the students.

Adding to the richness of the iDeX learning experience, the students considered the economic and business aspects of their ideas using protocols for a “sustainable economy” developed by Professor Paul Smith of Penn State University.

“The Auburn project is important because of the integrated design component,” said Ascher-Barnstone. “More and more, firms discover that they need to begin projects with all the professionals at the table at the beginning.”

Bringing architect and engineering students together on the project along with some agriculture students was “very stimulating,” and allowed for both innovation and practicality to come together into something that might just work, said Wagner.

The zoned region of Auburn consists of two wetland areas, two commercial and light

Continued on next page
Support Means Studio Summers for Architecture Students

With support from regional architectural firms, architectural students had the chance to spend their summers in a real architectural studio. This summer’s host to 17 third-year architectural students was Olson Kundig Architects, based in Seattle. While taking their required third-year studio coursework with Professor Ayad Rahmani, students had the opportunity to work at Olson Kundig. The summer studio allows students to interact with architecture professionals from the firm. The architects participate in student crits, and the students are given exposure to the day-to-day operations of the firm. This was the sixth year of the summer studio program.

IDeX Continued from previous page

industrial areas, and one neighborhood zone. In particular, the students worked to create a sense of unity within these areas.

“One of my ideas was to utilize the large amount of parking lots by building a parking garage and using the unneeded parking lots for green spaces,” said Jessalin DeFord, an architecture student who worked on the project.

The students also hoped to develop a plan that transforms the suburban districts into a more transit-oriented development by mixing residential and commercial areas.

“The residential area is a completely dead space because it is surrounded by industrial buildings,” said Hung Ngo, an architecture student. “We want to make the neighborhood more alive by increasing outdoor activity such as bike paths.”

All of the projects aimed to reduce waste, reuse energy, and manage stormwater.

The IDeX project was so valuable for students because it allowed them to have real interaction with professionals in the field, said Wagner. “I really consider IDeX to be equivalent to about one year of real work experience,” he said.

At the same time, Auburn engineers got some good, well-researched ideas from the students—things that they might not have time to pursue themselves. “Our engineers began to see the calculations and the specifications that the students dug out,” he said.

Students made presentations about their projects in April, and the projects were on display at City Hall for several months after that. This summer, city engineers began an effort to use pervious concrete and other state-of-the-art storm water management in the city.

For more information on students’ ideas for the IDeX project, please visit www.idexstudio.org/.

CollinsWoerman Gift Expands Integrated Symposium

With support from CollinsWoerman, a Seattle-based architecture, planning, and interior design firm, the School of Architecture and Construction Management will be expanding its Integrated Education Symposium.

The event, which will be broadened from one to two days this year, will be held October 20 and 21 and will feature presentations by Arlan Collins and Mark Woerman, principals and co-founders of CollinsWoerman. In addition, professionals from throughout the region will be presenting best practices and case studies on models of integration and collaboration. There will also be two hands-on, collaborative student activities for both days.

The company’s support is a logical extension of the work that they have been doing since the early 1980s to integrate the industry, say Collins and Woerman. With approximately 85 employees, CollinsWoerman began as an architectural firm that from the start worked collaboratively with contractors and others involved in a building project. They do a broad variety of building projects with a basic philosophy that comes down to having designers and builders working together throughout a project.

Collins and Woerman decided to support the school symposium because its goals align perfectly with the way the company runs its business. The symposium, which has occurred for the past four years, brings students together from architecture and construction management for lectures and a collaborative project. It offers a valuable opportunity for students to learn how to communicate with each other and to learn what each discipline has to offer, says Gregory Kessler, AIA, director of the School of Architecture and Construction Management. While the symposium now only includes students from architecture and construction management, Kessler would someday like to include students from engineering as well.

“We’re grateful to CollinsWoerman for providing this valuable gift to the school,” he says. “The symposium is the reality of the work environment that these students are all going to work in. They have to collaborate.”

“We believe it is our responsibility to advance this type of education,” says Woerman. “This is not just a cash contribution. Rather, we’re providing a meaningful opportunity for students to learn about the power of an integrated approach.”

The company is providing three years of support to the symposium with the idea of expanding and broadening it. Their company has been on the leading edge of bringing integration into the industry, and can take a leading role in imparting that knowledge to students.

“We want to see if we can help advance the thinking. It’s very authentic to support this because it’s really what we think,” says Collins. “We’ve been working at this throughout our entire careers. It’s all about integration at the end of the day.”
team, part of the WSU student chapter of the American Society of Civil Engineers (ASCE), took first place out of nine teams from universities around the Pacific Northwest at the regional competition held at the University of Portland this spring. The team qualified for and attended the national competition, held in June in Evansville, Indiana. At last year’s Associated Schools of Construction (ASC) regional student competition in Sparks, Nevada, a WSU construction management and architecture student team for the first time took first place in the design-build division. There is no national competition. The WSU ChemE Car team is heading to nationals after taking second place at regionals this spring at Oregon State University. They will be one of 32 teams to compete in the national competition in October at the American Institute of Chemical Engineers (AIChE) annual meeting.

A Summer Filled with National Security-related Science Mix a senior chemical engineering student with some solid undergraduate research experience, good grades, and a passion for what she does, and you may not get a chemical reaction, but you will get a great candidate for a competitive internship program. Kelly Fitzgerald was selected as one of approximately 30 students in the United States to participate in the Pacific Northwest National Laboratory (PNNL) National Security Internship Program this summer. PNNL, located in Richland, Washington, is one of the Department of Energy’s ten national laboratories. The internship program provides the opportunity for students to participate in national security-related science. Fitzgerald spent the summer working in the radiochemistry department, where she was planning to work in computer modeling and electro-chemistry.

WSU Doctoral Student Places in Boeing ‘Engineering Student of the Year’ Competition Bin Li, a doctoral student in mechanical engineering, received a second place award in the Flightglobal Achievement Award: Boeing Engineering Student of the Year competition. Boeing holds its global competition annually to honor students from around the world whose work has or will have a significant impact on the engineering field, especially in the area of aerospace engineering. Li was nominated for the award by his advisor, Dr. Weihong (Katie) Zhong, an MME professor, for his work in multi-functional nanocomposites. He is conducting research in metamaterials, materials that do not exist under natural conditions, and his groundbreaking paper in 2009 on the topic is considered to be highly significant.

Bahr Named Director of School of Mechanical and Materials Engineering David Bahr has been named director of the School of Mechanical and Materials Engineering. A member of the Washington State University faculty since 1997, Bahr has most recently served as WSU’s undergraduate research director and has been a leader in efforts to encourage undergraduate participation in research. He established WSU’s long-standing National Science Foundation-supported Research Experience for Undergraduate (REU) program in materials engineering. Through the undergraduate research office, he also helped to establish several other REU programs throughout the university as well as an introductory week-long program for freshmen in laboratory research. Bahr has also advised WSU’s very successful student chapter of Material Advantage, which has received numerous awards. His research interests include mechanical properties of thin films, micromechanics of fracture, adhesion, and corrosion and environmentally-assisted cracking.

Understanding the Knowns and Unknowns in the Engineering Field Shane Brown, assistant professor in the Department of Civil and Environmental Engineering, has received a $400,000 National Science Foundation CAREER Award for a four-year project to better understand how practicing civil engineers gain understanding of engineering concepts. He plans to develop a model of engineering thinking about these concepts and research-based curricular materials. As part of the project, Brown will be surveying approximately 1,000 practicing civil engineers with several years of work experience. The engineers will take a ‘concept inventory,’ a test that examines their understanding of specific concepts. The project builds on work that Brown and his colleagues have done looking at the way engineering students learn or misunderstand concepts that are taught in the classroom.

Research Experience for Undergraduates: Students Climb Steep Hillsides for Science to Improve Fire Weather Forecasts A group of undergraduate student researchers is helping to answer critical questions and is hoping to improve fire behavior models in complex terrains. The students, part of WSU’s Research Experience for Undergraduates program, traveled to Riggins, Idaho, this summer, where they climbed steep hillsides overlooking the Salmon River to install wind measurement instruments. Led by Brian Lamb, Regents Professor in the Department of Civil and Environmental Engineering, the researchers are collecting detailed wind data in three types of terrain. The researchers will use the data to evaluate and improve the computerized simulations for fire weather forecasting.
WSU’s College of Engineering and Architecture is committed to providing a high-quality engineering and architecture education for the people of our state today, while enabling groundbreaking research to help us anticipate and address critical issues facing society tomorrow.

With ongoing success in clean technologies, such as smart environments, power grid, advanced materials, and sustainable design, WSU was ranked by the CleanTech Group as among the Top 10 Clean Technology Universities in the country. Now the CEA will build on these advances to meet sustainable energy and human health challenges while continuing advanced environmental research. By focusing our efforts in these directions, we help change lives for the better.

At the same time, boosting self-sufficiency is paramount as state support for higher education decreases. Along with universities around the nation, WSU must transform the way it operates to accommodate changes in the way research and education are funded.

Public/private partnerships will enable us to attract and keep the highest quality faculty members who produce the vibrant research and excellent undergraduate and graduate education that has been our tradition. And, as the cost of education rises, public/private partnerships will be the key to providing the scholarships, graduate assistantships, and student services so critical to attracting the brightest and most capable students to our programs.

Engineers and architects are at the forefront of creating and implementing the big ideas that shape our future. That’s why the WSU College of Engineering and Architecture has established a $125 million goal to advance solutions for sustainable design, energy, environment, and health through The Campaign for Washington State University: Because the World Needs Big Ideas. Our aspirations are high but achievable with the generous support of alumni and friends. We seek your participation as we apply our knowledge and innovation to improve the well-being of our state, nation, and world—ensuring a sustainable world for our children and grandchildren.

### Reaching Our Goal

With Your Help

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<tr>
<th>FACULTY EXCELLENCE</th>
<th>$52 Million</th>
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<td>Educating Tomorrow’s Leaders and Innovators</td>
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<td>World-Class Faculty</td>
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TOTAL | $125 Million
Do you remember how the time you spent at WSU changed your life? Please contact us at thilding@wsu.edu and tell us your story, so we can share it with your classmates and friends, or go to www.cea.wsu.edu/alumupdates to catch up with your classmates.

Do you want to help change somebody’s life? You can help to support the kind of educational experience that you once received. Please contact the CEA development office at 509-335-3342 or visit our website at www.cea.wsu.edu/givingopportunities.

Thank you for your support of the College of Engineering and Architecture at Washington State University.