

INSIDE INQUIRY

Research activities improve lives, help the economy

The University of Oregon's record-setting year in sponsored research provided funds to help communities avoid disasters, ease the public school budget crunch, study the link between cancer and bacteria, and more—Pages 2–3

Sea Slug provides environmental diagnosis

Resurrecting a 600-million-year-old gene can tell us about today's environmental health—Page 4.



New Records in UO Research

Long considered a premier, public, liberal arts institution, the University of Oregon has in recent times become increasingly successful in attracting competitively awarded grants as a reflection of the quality and scope of its scholarly work. Last year, research grants and contracts to the university grew to nearly \$78 million, setting a new record.



Richard Linton

While the sheer size of the research funding and the pace of its growth are eye-catching—we've grown by some \$20 million over the past two years alone—even more impressive is its impact. Within every college and school, faculty researchers are contributing significantly to the global body of knowledge, meeting key needs of local communities, the state, and the nation. The active engagement of the UO faculty in scholarly pursuits greatly enhances the education that our students receive in preparation for their future roles in the knowledge economy.

This edition of *Inquiry* describes how the university's emphasis on interdisciplinary research is one of the many reasons for our success. We also take a closer look at some specific projects funded by grants and awards.

Inquiry has been reformatted with this edition, providing more stories and news about research at University of Oregon. Readers are invited to learn more about faculty researchers and their projects by going to websites listed after a story. Stay up-to-date with UO research by visiting *Inquiry* online, <http://comm.uoregon.edu/inquiry/>.

Richard Linton is the vice president for research and graduate studies, and dean of the Graduate School at the University of Oregon

Connecting the Disciplines Advances Knowledge and Oregon's Economy

More than forty-four years ago, the University of Oregon began connecting disciplines in a formal way that has proven so successful that today it is replicated by many of the nation's research universities. This creative model, which encourages faculty members, students, and researchers to “think outside the box,” is responsible for making the university a national leader on nanotechnology and brain function.

Today, the university is about to make the next evolutionary step in collaborative research that promises to reap benefits far beyond the university's borders.

Historically, academic departments have largely functioned independently of one another, providing little opportunity for faculty interaction. Recognizing that scientific discovery often takes place at the boundaries of traditionally defined disciplines, UO faculty members sought long ago to facilitate and increase collaboration.

In 1959, the university created the Institute of Molecular Biology, bringing together biologists, chemists, and physicists. The campus' compact size, along with science buildings that integrate office and lab space used by different fields of study further encouraged collaboration.

“The university's interdisciplinary approach attracts nationally renowned faculty members,” said Tom Stevens, institute director. “They can intermingle seamlessly, taking advantage of the expertise around them to extend the limits of their knowledge. The method also encourages students to cross departmental boundaries to follow their curiosities and amplify their learning.”



BBMI's fMRI machine

This cross-pollinating of ideas has produced more than thirty research institutes and centers, including two major initiatives that have put UO research on the map.

The Brain, Biology, and Machine Initiative combines research in cognitive neuroscience, molecular biology, genetics, and computational science. Researchers' examination the cognitive and anatomical functions of the brain could have far reaching applications in medicine and education.

The heart of the initiative is the functional magnetic resonance imaging (fMRI) machine installed in 2002. It has generated more than twenty studies in areas as varied as stroke rehabilitation and improved learning and opened the door to other disciplines.

The Materials Science Institute is home to a new initiative, Multiscale Materials and Devices, which connects UO physics and chemistry researchers with engineering faculty members at Oregon State University and researchers at Portland State University.

Collaboration is helping UO researchers build momentum in nanotechnology, the development and use of technology on a molecular scale. They have discovered thermoelectric materials that could provide energy efficient, refrigerant-free cooling solutions, and biomolecular lithography,

a candidate for use in the miniaturization of electronic circuits and computers.

The next step of collaboration is integrating academic and industrial researchers.

“The opportunity for discovery will be greater than the sum of the parts, as scientists from different disciplines and experiences visit campus and share knowledge,” said James Hutchison, director of the Materials Science Institute.

The future for collaborative research is so promising that the 2003 Oregon Legislature allocated \$9.5 million in bond funds for Multiscale Materials and Devices as a component of the UO's Integrative Science Complex. State, university, and industry leaders hope such broad-based collaboration can ignite innovation and creation that will help light the way to a brighter economic future for Oregon.

Read more:

<http://www.molbio.uoregon.edu/lifesci/>
<http://materialsscience.uoregon.edu/>

Technology Transfer on the Rise

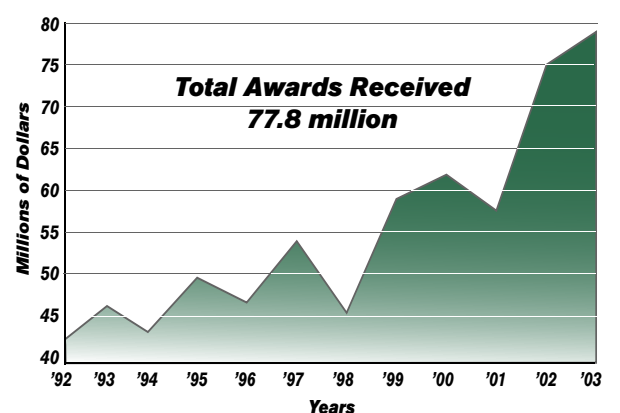
Technology transfer is climbing to new heights as UO researchers set records for the number of new inventions disclosed during the last fiscal year. New license and option agreements and the amount of licensing income increased for the eighth consecutive year.

These records reflect the university's growing success in moving research innovations to commercialization and, ultimately, in harnessing its expanding research programs as a source of diversification for the state's economy.

Researchers publicly unveiled a record thirty-six new inventions in the fiscal year that ended June 30. That's more than five times the number of inventions reported just four years ago. The university completed twenty-five licensing agreements, more than double the number in 2002.

Technology licensing revenue last year totaled more than \$1.77 million, a whopping 230 percent increase from the previous fiscal year's totals. This year's growth came from expanded UO innovation and licensing as well as inclusion for the first time of the long-established licensing of career information systems created by the highly ranked College of Education.

Significantly, the university reinvested and distributed most the licensing revenue to the university's inventors, departments, and laboratories to help support on-going research and patent yet more UO innovations, which will prime the pump for future technology transfers.



UO Research Record: Nearly \$78

University of Oregon faculty members earned \$77.8 million in competitive grants and awards for the 2003 fiscal year, making this UO's second consecutive record-setting year. The awards benefit the faculty and students as well as Oregon communities and society.

Of the \$77.8 million in grants and contracts received by the university, more than 70 percent is for research, 21 percent for community service, and 8 percent for instruction.

Projects include researching causes of cancer, preventing adolescent substance abuse, teaching science in elementary schools, and developing the science of nanotechnology. Grants also underwrite postdoctoral research, pay for specialized equipment, and recruit world-class faculty members. Many awards help communities pay for planning or special projects. (See details about specific project stories in this newsletter.)

Awards and contracts earned by UO faculty members help Oregon's economy by bringing new revenue into the state. For every \$1 million in sponsored research, forty jobs are supported, according to the U.S. Department of Commerce.

This year's 3.6 percent increase reflects an upward trend in grants and awards experienced by the university over the past decade. Since 1992, the amount of sponsored research has increased 67 percent. Total awards for that time exceed half a billion dollars.

Higher education officials often point to research contracts and grants as a key benchmark of university success. The University of Oregon ranks among the nation's leading universities in research funding generated per faculty member.

"For our faculty to perform so well on the heels of a 30-percent growth year and at a time when other financial support has decreased is a testament to the collective strength of our researchers," said Richard Linton, vice president for research and graduate studies. "Not only does their work contribute significantly to the global body of scientific knowledge, their studies enhance UO's position as a leading public research university."

Sponsored research funding is particularly significant to the university in the context of falling state contributions. The university received \$69.6 million in general fund money from the state of Oregon in FY 2003, \$8 million less than it received in sponsored research funds.



Helping Communities Avoid Natural Disasters

Oregon communities are subject to a variety of natural hazards ranging from earthquakes and floods to wildfires. Beyond managing a crisis when natural disasters happen, a contract awarded to University of Oregon's Community Service Center aims to help communities avoid disaster losses altogether. The \$180,000 contract with Oregon Emergency Management is helping to fund applied research and development and implementation of disaster action plans to reduce risk in Oregon communities.

The Disaster Mitigation Act of 2000 requires communities to take steps to reduce the risk of natural disasters. Led by Research Associate Andre LeDuc, a team of UO researchers and students assists communities throughout the state in identifying potential hazards, such as floods or wildfires, investigate past natural disasters, and develop an action plan the

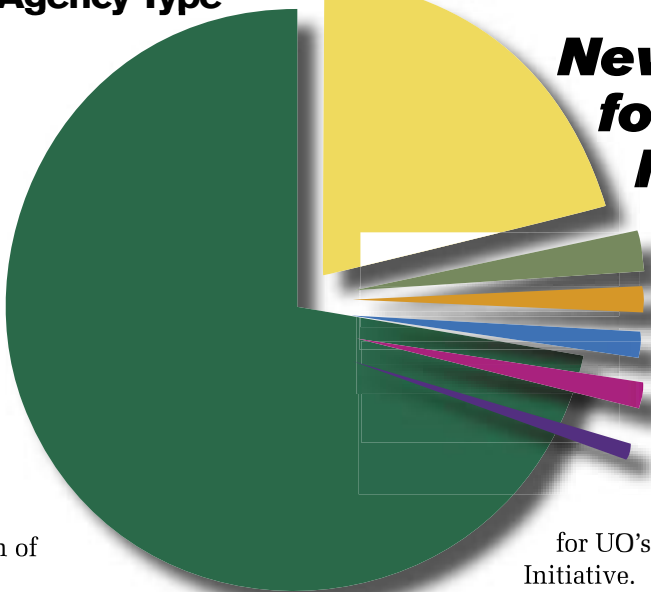
communities can implement to avoid future disasters.

The UO team provides technical resources, coordinates training, and assists with the development of plans to increase the community's capacity to implement the mitigation plan and meet the new federal requirements.

This is the second year for the Predisaster Mitigation program. This year the teams will work with Deschutes and Columbia Counties and the city of Medford. Last year assistance was provided to Douglas, Clackamas, Grant, Baker, Union, Wallowa, and Tillamook Counties and cities of Beaverton and Hillsboro.

Read more: <http://www.uoregon.edu/~csco>

Total Awards by Agency Type



- 71% Federal**
- 19% Federal Pass-through**
- 3% Foundations**
- 2% Associations**
- 2% States**
- 2% Other**
- 1% Corporations**

New Funds for Key UO Initiatives

The 2003 Oregon Legislature allocated \$9.5 million in bonds to build the Multiscale Materials and Devices Signature Research Center, and Congress approved \$3 million in the fiscal year 2004 Department of Defense Appropriations bill for UO's Brain, Biology, and Machine Initiative.

The university is a world leader in green nanotechnology, part of Multiscale Materials and Devices (MMD) research that promises to revolutionize products and processes in areas from electronics to medicine. UO's Brain, Biology, and Machine Initiative addresses the most fundamental questions about the human mind.

MMD funding includes \$4.75 million in bonds supported by the Oregon lottery, which is reserved for economic development initiatives. Its use for this higher education project indicates the project's importance to Oregon's economy.

Read more: <http://oga.uoregon.edu/OGAUpdate.html>

Nanomaterials, Human Products

A National Science Foundation grant awarded to Mark Lonergan, associate professor of chemistry, will help answer a major question confronting nanotechnology scientists, the development and use of technology at the molecular scale.

Nanotechnology has widespread applications in medicine, transportation, electronics, and space exploration. Using the unique properties of materials at the nanoscale, UO researchers are developing products that could help industry rethink manufacturing processes and make changes that minimize the use of hazardous materials, increasing safety for humans and the environment.

How people will be able to use such small products is a major question facing nanotechnology researchers. Lonergan's \$180,000 grant seeks to answer very fundamental questions about connecting nanoscale materials to human-scale products. Since many materials behave differently at the nanoscale, the research seeks to identify those differences and to help scientists take the next step toward application of nanotechnology.



Mark Lonergan

Read more: <http://www.uoregon.edu/~chem/lonergan.html>

Million in Funding



Key Support for Project SUPPORT

Preventing one youth from reentering a correctional facility saves the state tens of thousands of dollars annually, says UO College of Education professor Mike Bullis. Bullis' research found that youth eligible for special education services were reincarcerated at statistically significantly higher rates than nondisabled youth.

In 1999, the Oregon Youth Authority, Department of Education, Vocational Rehabilitation Services, and University of Oregon teamed up to address the transition from correctional facilities to the community.

Project SUPPORT has already helped over 300 incarcerated Oregon youth with disabilities find stability in their communities. Now, the U.S. Department of Education has awarded Project SUPPORT \$250,000 each year for three years to expand to Multnomah and Lane Counties.

Evaluation results demonstrate SUPPORT participants are employed or enrolled 68 percent of the time in a six-month period says UO research associate Deanne Unruh. The collective savings to society make transition services a wise investment: The U.S. Department of Justice suggests that cutting convicted juvenile "return" rates by just 4 percent over five years would save \$65 million and reduce violent crimes.



Mark Bullis and Deanne Unruh

Read more:
<http://education.uoregon.edu/faculty/bullis.htm>

Preventing Adolescent Drug Abuse

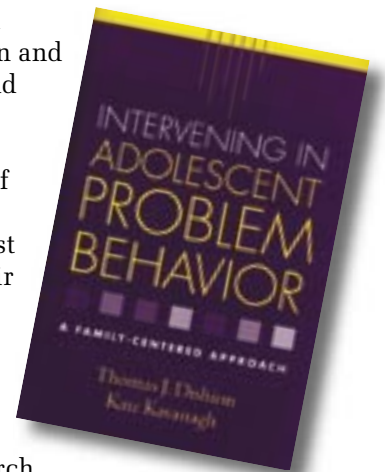
Adolescence is a time when many parents feel they can "let go" of their children, but that is precisely the wrong approach, according to Thomas J. Dishion and Kate Kavanagh in their new book, *Intervening in Adolescent Problem Behavior: A Family-Centered Approach*.

The Adolescent Transitions Program pioneered by Dishion and Kavanagh in Portland public schools, is a national model. The National Institutes of Health awarded the team \$1.6 million last year to continue their research on early, family-centered prevention of drug use with 1,000 Portland families.

Dishion is research director at the UO Child and Family Center, and Kavanagh is intervention director for the Project Alliance office in Portland.

"The natural inclination is for parents to let the reins go as their kids get older," explained Kavanagh. "But adolescence is the time to hold on with 'long arms.' If they get into trouble they need parents as a resource."

The book also points out that kids in group treatment often teach each other new ways to be bad. "Those situations offer a very real potential for making kids worse," emphasized Dishion.



Read more:
<http://cfc.uoregon.edu>

Bacteria Research Looks at Cancer Link

A bacterium known as *H. pylori* colonizes the stomachs of over half the world's population. In most infected individuals, *H. pylori* is a benign gastric resident. In certain cases, however, it becomes a serious pathogen and even carcinogen, causing gastritis, peptic ulcers, gastric adenocarcinoma, or mucosal-associated lymphoid tissue lymphoma.

Through her research, Karen Guillemin, assistant professor of biology, is trying to determine why the bacteria makes some people so sick while it has no effect on others. She received a \$600,000 grant last year from the American Cancer Society to further that investigation.

Her research focuses on a correlation between certain genes and cell formation. Genetic factors of both the human and the bacteria play a part in causing disease, as each genome responds to and is regulated by the other. Guillemin is examining whether these genes cause damage in the host cells and, if so, how that occurs. Her research aims to identify the molecular nature of the bacteria-host dialogue that determines disease outcome.



Karen Guillemin



UO graduate student Melanie Hauser conducts an experiment

Nurturing an Interest in Science

A grant awarded to two UO chemistry professors will ease budget pressures on local schools while encouraging interest in science. The \$560,000 National Science Foundation (NSF) grant will pay for UO graduate students to teach science in elementary schools and help their teachers learn how to use science experiment kits.

Professors David Johnson and David Tyler are coordinating the program. As part of the program, elementary students conduct experiments to help them better understand that science doesn't just come out of books, but is about observation and discovery. Teachers get a practical demonstration in use of the science kits, provided by NSF, and a graduate student in the classroom to answer questions.

Six Lane County elementary schools are in the program this year. The grant may be extended for an additional five years, which would bring the program to every elementary school in Lane County.

Read more:
<http://materialscience.uoregon.edu/GK12/Overview.html>

Learn more:
<http://www.molbio.uoregon.edu/facres/guillemin.html>

Biologist Resurrects 600-Million-Year-Old Gene

By successfully resurrecting a gene that existed 600 million years ago, evolutionary biologist Joe Thornton has brought a bit of Jurassic Park to the University of Oregon. Thornton's research demonstrates that estrogen was the first steroid hormone to evolve, dating back to the early eons of animal evolution, far earlier than previously thought.

Thornton's findings, published in the September 19 issue of *Science*, has important implications for evolutionary theory and environmental health. The strategy of resurrecting ancient genes promises major advances for evolutionary biology, because it allows the function of long-extinct molecules to be studied experimentally.



Joe Thornton

The paper's coauthors are UO research assistant Elle Need and David Crews, a collaborator at the University of Texas. It was funded in part by the National Institutes of Health.

First, the team isolated the gene for a steroid hormone receptor from a modern mollusk, the sea slug *Aplysia californica*. Steroid hormones control reproduction, behavior, and many other processes in humans and other vertebrates. Each hormone interacts with a specific protein called a receptor in the cells of hormonally responsive tissues.

Thornton's finding that steroid hormone receptors exist in distantly related invertebrates indicates that the majority of animal species inherited these molecules from their ancient common ancestor, broadening the scope of damage that hormone-disrupting chemicals in the environment may cause. Most chemical testing and regulatory programs are focused on vertebrates and take little account of impacts on other kinds of animals.

Thornton turned to the ancestral gene from which all of today's steroid receptors evolved. Applying innovative statistical techniques to a large number of modern-day receptors, Thornton's group inferred the DNA sequence of the ancestral gene. They used biochemical methods to synthesize the gene and transferred it into cells they cultured in the lab, which were made to produce large quantities of the ancient receptor protein. A series of experiments on the ancestral receptor showed that it responds only to estrogens and that other hormones evolved more recently.

Thornton's evolutionary research program is a natural outgrowth of his passion to protect the environment and reduce the effect of chemicals on human health. His book on global chemical pollution, *Pandora's Poison: Chlorine, Health, and a New Environmental Strategy* (MIT Press), was called "a masterpiece" and "a landmark book" by the scientific journal *Nature*.



Sea slug, *Aplysia californica*

Thornton joined the UO Department of Biology as an assistant professor in fall 2002 from Columbia University's Earth Institute. Graduate and postgraduate biology students are working with Thornton to trace the specific changes in the gene that allowed it to evolve affinity for new hormones and to reconstruct other ancient members of this gene family to determine the exact sequence of events by which our modern hormones and receptors evolved.

Read more:
<http://www.uoregon.edu/~joet>

POINTS OF PRIDE

Here's a look at some of the ways University of Oregon enriches lives and communities.

Conserving energy. Faculty members and students at UO's BetterBricks Lab in Portland help residential and commercial building owners reduce electrical energy costs by up to 60 percent through use of daylighting. Read more:
<http://www.betterbricks.com>

Preserving cultures. The new Many Nations Longhouse, scheduled to open in 2004, is a partnership between the university and Oregon's nine federally recognized tribes. It will be a valuable state resource in sustaining and celebrating regional Native American cultures. Read more:
<http://longhouse.uoregon.edu>



Changing an industry. The University of Oregon is a world leader in green chemistry, devising methods to cut or eliminate waste from manufacturing processes and foster use of better materials. Read more: <http://www.uoregon.edu/~hutchlab/greenchem/>

Sensible and sensitive. Architecture students from the University of Oregon created an urban design for the cities of Troutdale, Gresham, Fairview and Wood Village that provides an economic framework for new industrial development while preserving nearby sensitive environmental areas. Read more: <http://arch-guest.uoregon.edu/programs/portland-program/portland.html>

Guidance for community goals. Graduate students from the UO's Community Service Center helped officials from Jackson County, Oregon, develop a master park plan that included a vision for the system over time and a business plan for increasing revenue and long-term operation. Read more: <http://www.uoregon.edu/~csco>

Inquiry

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Wyden: Champion of Science

The University of Oregon and the Science Coalition honored U.S. Senator Ron Wyden (D-OR) in August as a Champion of Science for his support for basic scientific research that leads to new discoveries and applications that benefit society. President Dave Frohnmayer presented the award to Wyden.

Senator Wyden has strongly supported university programs that train scientists and engineers as a means of stimulating industry in Oregon and nationwide. He was instrumental in the 2002 National Science Foundation reauthorization that laid out a plan to double the NSF budget within five years. Wyden, who authored the Twenty-first Century Nanotechnology Research and Development Act, is strongly committed to ensuring that women are represented in the field of science. Wyden is also a 1976 graduate of the UO School of Law.

The Science Coalition is an alliance of more than 400 organizations that encourage a strong partnership between the federal government and research universities to advance science.



U.S. Senator Ron Wyden accepts award from UO President Dave Frohnmayer

Read more:
<http://wyden.senate.gov/media/photos/science.html>