



Research *Review*

Spring 2003

GREETING FROM THE DEAN

The UW-Madison College of Engineering not only is a leader when it comes to cutting-edge research, but also in transferring knowledge and results to businesses and industry. Through this inaugural issue of Research Review, and subsequent quarterly editions, we hope to keep you abreast of the outstanding research our faculty, staff and students are conducting.

This is a one-time mailing; if you would like to continue receiving Research Review, click [here](#) to sign up. And please recommend this bulletin to others you feel might be interested in learning more about the college's work. We do not sell or share E-mail addresses and use them exclusively for Research Review.

In this issue, as in future issues, we highlight current research, technologies that have been or will be patented, newly funded projects, and a few of the media outlets in which members of the college have appeared. I hope you find Research Review informative and useful.

Sincerely,

Dean Paul S. Percy

Research News



HYDROGEN: CLEAN AND GREEN

UW-Madison chemical engineers have developed a way to make hydrogen fuel—a potential source of unlimited, clean power—from plants.

[Read more.](#)

NURSING-HOME CARE MEASURES UP

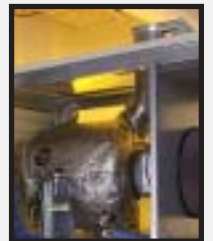
Residents in some 17,000 nursing homes worldwide benefit from quality indicators that help assess their care.

[Read more.](#)

POWER IN SMALL PACKAGES

With new “plug-and-play” power-electronic systems, someday buying and installing a business-sized power plant could be as easy as ordering a custom computer.

[Read more.](#)



SOBERING SYSTEMS

A \$9.5 million initiative aims to identify and improve organizational systems that negatively affect patients' access to and success in substance-abuse treatment programs.

[Read more.](#)

THE SPEED OF LIGHT—FASTER



In the future, optical fibers and light will replace wires and electrons, making processors thousands of times faster than they are today. And two UW-Madison electrical and computer engineers have developed a computer algorithm that may speed such advances in optical communication, signal processing and computing.

[Read more.](#)


Research News (continued from front page)

OFF THE GRID

Mechanical Engineering Associate Professor Vadim Shapiro is perfecting an alternative to the tedious, time-consuming “meshing” necessary for analyzing materials or objects with traditional CAD software.

[Read more.](#)

TO EVERYTHING: TURN, TURN, TURN

 Drivers often are confused when confronted simultaneously with a red signal indicating “stop” and a left-turn arrow that permits a driver to move through an intersection, according to research by Civil and Environmental Engineering

Assistant Professor David Noyce.

[Read more.](#)

MANAGING MEDICAL MISTAKES

Although medical errors don’t always result in physical harm, they’re events physicians and other clinicians hope to avoid. During a recent UW-Madison study, they voiced opinions about a system that could help them learn from their mistakes.

[Read more.](#)



DECONTAMINATING H₂O

To ensure safer drinking water worldwide, UW-Madison engineering researchers have developed an adsorbent that can remove arsenic from water at faster rates and lower costs than current methods.

[Read more.](#)



CAPPED LAGOONS NOW CAPITAL SPRINGS

What once was contaminated sludge is now a section of Wisconsin’s newest state park, thanks to the help of a team of civil and environmental engineering faculty and students.

[Read more.](#)

College of Engineering in the News

UW-Madison engineers are featured in many media outlets. Here are a few.

- Chemical Engineering research scientist Randy Cortright, graduate student Rupali Davda, and Professor James Dumesic’s process for converting oxygenated hydrocarbons to hydrogen received international coverage, including Reuters news service, NewsDay, CNN.com, the Wisconsin State Journal, Der Standard and [The Why Files.](#)

- An Oct. 17 New York Times story about new California Institute of Technology microfluidics-based microchips quoted Biomedical Engineering Associate Professor David Beebe, who said the new chips might be used in drug discovery to perform thousands of assays simultaneously in minute volumes. [Read the story](#) with an online subscription.

- Engineering Physics Adjunct Professor Harrison Schmitt and Professor Gerald Kulcinski were quoted in stories Dec. 8 and 9 in the Houston (Texas) Chronicle and Halifax (Nova Scotia) Herald Limited, respectively. The stories discussed helium-3, its possibilities as a radiation-free source of fusion-generated energy, and its abundance on the moon.

Patent Pending, Patent Granted

Faculty and staff in the College of Engineering are among the leaders in creating new intellectual property at UW-Madison. Following are examples of some of the ground-breaking research resulting in recently disclosed or granted patents. For licensing or other information, contact the [Wisconsin Alumni Research Foundation.](#)

SEPARATING SIGNALS

Assistant Electrical and Computer Engineering Professor Akbar Sayeed and graduate student Ke Liu have developed novel iterative algorithms that significantly simplify signal processing and improve performance of antenna arrays used in wireless communications systems.

[Read more.](#)



Patents (continued from page 2)



MINIATURE LABS MADE EASY

Using a method developed by UW-Madison biomedical engineers, biologists could fabricate elaborate palm-sized “laboratories” more easily and for about a quarter of the cost of current techniques.

[Read more.](#)

QUICK CHIPS

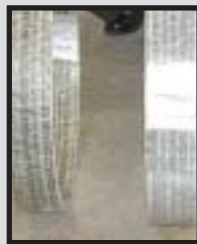
New high-resolution lithographic techniques could allow chipmakers to write semiconductor features with dimensions as small as 20 nanometers.

[Read more.](#)

OLD BRIDGES GET LONGER LIFE

Aging concrete bridges are ideal candidates for composite “bandages” that attach to a bridge’s underside and extend its life.

[Read more.](#)



MANIPULATING MATERIALS

By adding small quantities of elements such as lead to certain materials, UW-Madison researchers can make a more versatile aluminum alloy that’s stronger by weight than steel.

[Read more.](#)

ENGINE PERFORMANCE: IT’S ALL IN THE TIMING

A new invention, the “variable valve timing actuator,” allows engine valves to open and close independently of each other—without a camshaft—making an engine run more efficiently.

[Read more.](#)

New Funding

EXTREME MATERIALS

Wisconsin Distinguished Professor Rod Lakes, Professor Walt Drugan and Assistant Professor Rob Carpick, engineering physics, and Materials Science and Engineering Professor Reid Cooper have begun a four-year, \$800,000 National Science Foundation project to study novel extreme composite materials due to constituents with negative stiffness. The group hopes its research will help develop new classes of materials with extreme properties.

ENGINE RESEARCH

General Motors Corp. has funded a \$5 million collaborative research laboratory in the college over five years to help develop cleaner, more efficient diesel and gasoline engines. UW-Madison’s Engine Research Center (ERC) will use part of the funding to model diesel exhaust after-treatment systems and diesel particulate emission traps. Researchers also will conduct experiments

and three-dimensional simulations of advanced combustion processes for both diesel and gasoline engines.

SIMPLER, SPEEDIER MR EXAMS

Assistant Professor Walter Block (biomedical engineering, medical physics), Professor Charles Mistretta (medical physics, radiology, biomedical engineering), Professor Thomas Grist (radiology, medical physics, biomedical engineering) and Assistant Professor Andrew Alexander (medical physics, psychiatry) have received \$1.44 million for four years from the National Heart, Lung, and Blood Institute to study 4-D magnetic resonance angiography.

POLYMERS AT THE NANOSCALE

Chemical Engineering Professors Paul Nealey and Juan de Pablo, Electrical and Computer Engineering McFarland-Bascom Professor Franco Cerrina and Chemistry Professor Mark Ediger have re-

ceived a four-year, \$1.25 million grant from the National Science Foundation to study the thermo-physical properties, including transport and mechanical behavior, of polymeric materials in nanoscopic structures. The group also plans to develop an educational and outreach program to bring nanotechnology to pre-college students, teachers and the public.

STUDYING CELL BEHAVIOR

Chemical Engineering Professor Juan de Pablo, Assistant Professor Sean Palecek, and researchers in the School of Pharmacy and the Medical School have received a \$1.3 million, three-year contract from the Navy. The grant funds efforts to combine molecular modeling with experiments to elucidate fundamental mechanisms of cell stabilization during cryopreservation and lyophilization of platelets and embryonic stem cells.