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Science

Spring 2005

College and University Research, Work in Progress, and Expert Opinion Regarding Issues of Science, Environment, and Technology

Indoor Air Becomes Captive To Energy Efficiency, Soiled By Air "Fresheners"

Take a cleansing breath before you look at Dr. Richard Corsi's indoor air quality research. Ranging from the benefits/detriments of vacuuming to toxic air contamination of foodstuffs, Corsi has documented the pollutants that unassuming homeowners and office workers create when they "freshen and clean" their space.

With the success of energy-efficient building techniques, indoor air remains trapped and more easily maintained at a constant temperature to limit costs of air cooling and heating. Unfortunately, as Dr. Corsi has found, the chemicals from cleaning products, candles and moth balls, among other things, remain trapped indoors as well, making the indoor environment sometimes more hazardous than outdoors.

A brief summary of his work can be seen at:

<http://www.ce.utexas.edu/prof/corsi/IAQslides/index.htm>.

For more information, contact Becky Rische, public affairs, The University of Texas at Austin, College of Engineering, 512/471-7272, brische@mail.utexas.edu.

Hoot Couture

Corey Freeman-Gallant, associate professor of biology at Skidmore College in Saratoga Springs, NY, prowls woodland thickets in spring rains and summer heat on an intriguing mission: to document how fashion affects gender relations.

He is studying common yellowthroats, dapper little songbirds whose males sport bright-yellow bibs and jet-black facial masks. Freeman-Gallant spent a recent summer researching yellowthroats in Skidmore's North Woods and concluded that females

preferentially mate with larger-bibbed males. That project piqued the interest of a Milwaukee yellowthroat researcher who'd found that large masks, not bibs, made the difference. A shared \$270,000 grant from the National Science Foundation allows Freeman-Gallant to study bibs, masks, and mating success in Saratoga yellowthroats, while two University of Wisconsin ornithologists conduct the same studies in their region.

For more information, contact Andrea Wise, director of media relations, Skidmore College, 518/580-5736, awise@skidmore.edu.

An Eye For An Eye: Research May Mean Fewer Cataract Procedures

Researchers at the University of Dayton have discovered that a mouse is capable of regenerating the lens in its eye. This discovery means mammals might possess much stronger potential for lens repair than originally thought, which could warrant studies in humans.

Panagiotis Tsonis, a professor of biology at UD, says this discovery will be indispensable for cataract research, surgery and therapy, considering more than 350,000 cataract operations are performed in the United States every year.

"In traditional cataract surgery, doctors take out the old lens and replace it with a synthetic lens," Tsonis said. "Because some cells remain, they can make the lens opaque over time, creating the need for a second cataract surgery. This would be alleviated if humans could regenerate their lenses." The results were published in *Experimental Eye Research* (Feb. '04) medical journal.

For more information, contact Panagiotis Tsonis, professor of biology, University of Dayton, 937/229-2579, panagiotis.tsonis@notes.udayton.edu.

Herbal Benefits Vs. Herbal Dangers

The National Center for Complementary and Alternative Medicine and the National Center for Health Statistics estimated in 2004 that 62 percent of adult Americans use some form of complementary or alternative medicine to treat or prevent disease. A large number of people have turned to using herbs, often without medical supervision. Many of these products claim to "boost the immune system." Some students at Hampshire College in Amherst, Massachusetts, have become interested in knowing if and how these products affect immunity. Collaborating with Christopher Jarvis, associate professor of cell biology, they are examining such effects.

"Some of these phytochemicals clearly have an effect on immune function," Jarvis said. "These effects may be beneficial to some patients while detrimental to others. A patient with an aberrant immune response, such as an individual with allergies or an autoimmune condition such as diabetes or rheumatoid arthritis, may find such treatments make their conditions much worse." The students hope their work will illuminate which products will be useful for specific conditions and which ones should be avoided.

Contact Elaine Thomas, director of communications, Hampshire College, 413/559-5482,

ethomas@hampshire.edu.

For more information, contact Christopher D. Jarvis, associate professor of cell biology, Hampshire College, 413/559-5580, cjarvis@hampshire.edu.

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Enzyme Releases Sudden Burst Of Energy

A sudden burst of energy. For world-class athletes, it can be the difference between gold and silver. For smaller, less-heralded organisms, it can mean the difference between life and death.

At the heart of it all is an enzyme involved in the muscle function of most, if not all, organisms, which helps maintain a reserve of energy for use when these sudden bursts are required. Three scientists at The College of Wooster are working collaboratively to learn more about it, including Mark Snider, assistant professor of chemistry.

The trio hopes to get at several fundamental questions about an important enzyme family (including creatine kinase) that uses phosphagens to provide short, sudden bursts of energy, including how the biochemical differences between these enzymes result in different physiological functions across organisms.

For more information, contact Mark Snider, assistant professor of chemistry, The College of Wooster, 330/263-2391, msnider@wooster.edu.

Science Fiction Becomes Reality

Laura Kay, Associate Professor of Physics at Barnard College, recently received the Mellon New Directions Fellowship Award for designing her astronomy course "Introduction to Astronomy – Life in the Universe." The course serves as an introduction to astronomy intended primarily for non-science majors, focusing on such topics as the discovery of extrasolar planets, the Search for Extraterrestrial Life (SETI), gravitation and planetary orbits, the physics of the Earth and its atmosphere, and the exploration of the solar system.

An avid science fiction fan, Kay has been interested in the question of whether extraterrestrial life exists for a long time. "Some parts of science fiction are becoming science reality," said Kay. "Astrobiology is a pretty new topic. Two factors that have pushed this study forward are the discovery of planets outside our solar system and the existence of extremophiles – living things that exist in extreme conditions."

Professor Kay also teaches a first-year seminar on the search for extraterrestrial life. Her main research interest is on active galaxies with big black holes in the center.

More information about the course can be found on the course website at www.phys.barnard.edu/~kay/ast1753.

For more information, contact Petra Tuomi, senior associate director of public affairs, Barnard College, 212/854-7907, ptuomi@barnard.edu.

Sleight Of Hand: Interpreting The Language Of Gesture

Not all hand gestures are created equal, according to Spencer Kelly, assistant professor of psychology at Colgate University.

They can be spontaneous, creative, and unconscious. Ask someone how to tie a shoe, and that person will invariably use several gestures during the explanation.

They can also be rehearsed, conventional, and deliberate, said Kelly. Sign languages used by deaf communities are examples of codified gesture systems.

Kelly is working to identify a neurological link between language and gesture that may one day shed light on how children and adults learn, or even predict the ability to learn.

"Gesture and other forms of visual communication are tightly integrated with language," he said. "Long before humans developed speech, they most likely communicated with non-verbal signals, such as gesture."

For more information, contact Spencer Kelly, assistant professor of psychology, Colgate University, 315/228-7350, skelly@mail.colgate.edu.

U.S. Songbirds Show High Pesticide Levels

Although the United States has banned the use of organochlorine pesticides such as DDT for more than three decades, an Illinois Wesleyan University biologist has discovered that North American songbirds show higher frequencies of contamination than do songbirds from South or Central America, where some of the pesticides continue to be used.

Given Harper, chair of Illinois Wesleyan's biology department, said that differences in contamination levels were unexpected and suggests that North America is the source of the contamination. Most previous studies of have focused on raptorial birds such as hawks, falcons, and eagles. In his ongoing study of North American birds from three different latitudinal gradients, Harper anticipates that birds that spend more time at northern latitudes will have higher pesticide levels.

For more information, contact Given Harper, professor and chair of biology, Illinois Wesleyan University, 309/556-3056, gharper@iwu.edu.

Novel Chemistry At Work To Provide Parrot's Vibrant Red Colors

Parrots, long a favorite pet, are attractive to owners because of their vibrant colors. But those colors may mean more to parrots than what meets the eye. An Arizona State University researcher has uncovered the chemistry behind the colors of parrots, describing on a molecular level what is responsible for their bright red feathers.

The work defies previous assumptions and explanations for color variations in parrots, said Kevin McGraw, an assistant professor in ASU's School of Life Sciences. "We've uncovered a system where all red parrots use the same set of molecules to color themselves," McGraw said. "It is a unique pigment found nowhere else in the world." McGraw's research was published in the Feb. 16 issue of *Biology Letters*.

Parrot images can be accessed at: <http://www.asu.edu/news/newsroom/PhotoGallery-Parrots.htm>.

For more information, contact Kevin McGraw, assistant professor, Arizona State University School of Life Sciences, 480/965-5518 or Kevin.mcgraw@asu.edu.

A Small Solution To A Big Environmental Problem

Ferritin, an iron storage protein found in humans and animals, is being used to create nanoparticles that might have applications in environmental remediation. Daniel Strongin, professor of chemistry at Temple University, has been loading horse spleen ferritin with iron to create nanoparticles and has been investigating their use in transforming toxic metals often found in lakes, rivers, or groundwater for easier cleanup.

"We've been looking at the reduction of toxic Chromium (VI), or hexavalent chromium, which is the basis of the movie '*Erin Brockovich*' and one that the EPA has on their toxic metal list for groundwater," says Strongin. With the aid of visible light or solar radiation to activate the nanoparticles, Chromium (VI) was reduced from hexavalent to trivalent. "Trivalent chromium is much easier to clean because it can be more easily filtered."

For more information, contact Daniel Strongin, professor of chemistry, Temple University, 215/204-7119, dstrongi@temple.edu.

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Groundbreaking Science And Technology Facility Under Construction

Construction on Seton Hall University's new, \$35 million science and technology building begins in May, and when it is complete Seton Hall will have one of the nation's most innovative and energy-efficient facilities to combine teaching and research functions, all in one "green" building.

"This is not merely a renovation," explains John Sowa, associate dean of the college of arts and sciences. "Every office, every classroom, and every public space has been designed to encourage discovery through collaborative teaching and research."

For more information, contact John Sowa, associate dean of the college of arts and sciences, Seton Hall University, 973/761-9034, sowajohn@shu.edu.

For photos, contact Catherine Memory, director of media relations, 973/378-2650, memoryca@shu.edu.

Two Hearts Better Than One: Calf Muscles Give Heart A Leg Up

Most people don't know that humans have "two hearts" a primary heart and the one in your leg - your calf muscles!

Kenneth McLeod, professor and chair of Binghamton University's Bioengineering Department, says that calf muscles are essential in maintaining good health.

McLeod is in the midst of getting final approval from the FDA to market a device, which enhances calf muscle activity and therefore increases blood flow in the lower limbs. This serves to prevent hypotension and reduce the risk of deep vein thrombosis and pulmonary emboli, which are quite common in sedentary individuals, or those who have undergone surgery. In addition, says McLeod, if you don't use your "second heart", your primary heart has to carry the full load, leading to early heart failure.

For more information, contact Kenneth J. McLeod, professor and chair, Binghamton University, 607/777-5779; kmcleod@binghamton.edu; website: bioeng.binghamton.edu.

A Virtual Cane For The Blind

Tim Oates hopes to give the white cane used by the blind a high-tech update: a "virtual cane" glove that lets users "feel" 3-D space. Oates, an assistant professor of computer science at the University of Maryland, Baltimore County, and his team are now in the second round of a national R&D contest held by the sensor maker Canesta, Inc.

"High-tech for the blind has typically focused on communication, reading machines, Braille printers, and so on," said Oates. "Combining the virtual cane with a traditional cane will give the blind a quantum leap in navigational power." Through vibrations and pressures, the glove's wearer "feels" the layout of rooms and obstacles in real-time and at distances much farther than the reach of the old-fashioned cane.

For more information, contact Tim Oates, assistant professor of computer science, University of Maryland, Baltimore County, 410/455-3082 or oates@umbc.edu.

From Slippery When Wet To Super Glue

Andy Smith is interested in animal secretions. The associate professor of biology at Ithaca College studies how some mollusks can secrete gels that make them so slippery one minute and demonstrate remarkable stick-to-itiveness the next.

"Limpets, for example, temporarily glue themselves firmly onto rocks at high tide to keep from being washed away, yet when the tide recedes they are able to continue foraging," says Smith. "It is particularly impressive that they produce the gel underwater, attaching to wet, slippery surfaces that confound artificial adhesives. These secretions themselves are often 97% water, when most glues harden only after expelling any water they contain."

Understanding how these gels work could lead to the development of new glues, which would be especially promising as potential medical adhesives.

For more information, contact Andy Smith, associate professor of biology, Ithaca College, 607/274-3975, asmith@ithaca.edu.

Eleven Degrees Of Separation

Smith College researchers identified a biochemical mechanism that provides insight into the death of large expanses of coral during the most recent El Niño event. The study, published in the latest issue of *Marine Ecology Progress Series*, found that differing levels of heat shock proteins—proteins that function as the first line of defense against environmental stress in organisms from bacteria to humans—play a role in making corals either resilient or vulnerable to temperature change. Temperature anomalies of just eleven degrees Fahrenheit proved the death knell to coral with low levels of heat shock proteins.

For more information, contact Paulette Peckol, Louise C. Harrington Professor of Biological Sciences, Smith College, 413/585-3844, ppeckol@email.smith.edu.

Oberlin Sciences Get Super Support With New Computer

A 64-bit supercomputer, coveted for its gigantic memory and incredibly fast processing speeds, arrived in Oberlin College's Science Center in late January. Oberlin is one of the first four-year, liberal arts colleges in the country to gain a supercomputer of this magnitude, says chemistry Professor Manish Mehta. The National Science Foundation (NSF) presented a \$300,000 check to Oberlin to cover the costs of the supercomputer, software, installation, and maintenance.

"The supercomputer will strengthen science education at Oberlin," says Mehta. "It will enhance research at Oberlin and will immediately be incorporated into advanced quantum mechanics-based physical chemistry courses, astrophysics research, bioinformatics, computational biology, computational mathematics and computer science.

"Computation is becoming an ever more important facet of work in the natural sciences," says Oberlin Provost Clayton Koppes. "The supercomputer will also foster interdisciplinary work in the natural sciences and mathematics division; this is particularly important since interdisciplinary approaches are becoming ever more critical in the sciences."

For more information, contact Manish Mehta, assistant professor of chemistry, Oberlin College, 440/775-8359, Manish.Mehta@oberlin.edu.

Exploring Radical Bonds

Mark Marshall and Helen Leung, professors of chemistry at Amherst College, study the detailed structure and dynamics of small molecules and chemical complexes. Their research, first reported online in *Chemical Physical Letters* last December and appearing in print in January 2005, examined the manner in which the extremely reactive hydroxyl radical (OH) interacts with potential reaction partners such as water (H₂O).

The hydroxyl radical, a powerful oxidant, is maligned for the damage it can cause in biological systems such as the human body, but is also capable of reactions that remove pollutants such as volatile organic compounds (VOCs) from the atmosphere. Since water is ubiquitous in living things and in the atmosphere, chemists have speculated on the

importance of the chemistry of an H₂O-HO radical complex, in atmospheric science, genetics and other fields. "The hydroxyl radical is like nature's detergent," Marshall says.

For more information, contact Paul Statt, director of media relations, Amherst College, 413/542-8417, psstatt@amherst.edu.

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