

With Green Chemistry, Green Tea Makes a Potent Brew

*Kumar and Braunhut Develop New Compounds with Anti-Cancer Properties
Service Learning Projects Bring Learning to Life*

Green tea gets a mixed reputation in scientific circles. While green tea has reportedly been effective in the treatment/prevention of several cancers, including breast cancer, the findings have been inconsistent and controversial due to lack of quality control and consistency in the commercially available preparations.

Now an interdisciplinary team is making rapid progress in modifying an active component of green tea—a catechin—using benign green chemistry techniques, which make it remarkably effective against breast cancer cells while it doesn't harm normal cells. The key breakthrough is the use of naturally occurring enzymes to "stitch together" green tea catechins—yielding polycatechins that are effective selectively against breast cancer.

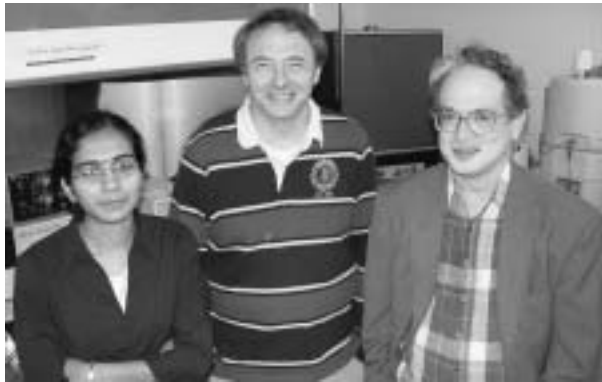
Prof. Susan Braunhut of biological sciences, whose lab has been a source of research related to breast cancer for more than a decade, is

excited about the collaboration with Physics Prof. Jayant Kumar, director of the Center for Advanced Materials (CAM).

"We've made rapid progress by working together," says Braunhut. "Jayant takes the small molecules, the active component of green tea, and links them together in long strings. This binds them in a

much more stable form than is found naturally. The compound is much more potent against cancer cells when compared to the naturally occurring catechins, besides being more stable."

The "long strings" are polymers or oligomers, explains Kumar, "'poly' for many and 'oligo' for a few, depending on the length of the string. We did the synthesis in a one-pot reaction using water, alcohol and the



▲ Subhalakshmi (Subha) Nagarajan, left, with Dr. Ferninando Bruno and Prof. Jayant Kumar

enzyme horseradish peroxidase as a catalyst. There is no component that is toxic, so there are no toxic by-products that have to be removed before being used with living cells." CAM has extensive experience with enzyme-based catalysis. A patent from CAM on enzyme-catalyzed synthesis, in collaboration with Dr. Ashok Cholli, has also been licensed to Polnox for polymeric anti-oxidants.

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Nagarajan Wins EPA Student Grant for Green Tea Research

Interdisciplinary collaboration mentored by Kumar and Braunhut

Rarely does a student member of a research team acquire the very first external funding for a major project. But that's just what Subhalakshmi (known as Subha) Nagarajan accomplished.

The Environmental Protection Agency (EPA) sponsors an annual national student design competition—the P3 Award for Sustainability Focusing on People, Prosperity and the Planet. Nagarajan won the competition and a \$10,000 grant that will enable her to develop preliminary research results and make a presentation to the EPA next May, in competition for a \$75,000 full development and implementation grant.

"The purpose of the EPA grant is to encourage environmentally friendly methods to

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Nanotechnology Penetrates the Cosmetics Industry

Watterson's Research Highlighted at ACS

Cosmetics are big business. In fact, one of the fastest growing sectors in the chemical industry worldwide is personal care products. Now nanotechnology is transforming cosmetics with new formulations and techniques.

Vitamin E, an antioxidant, is known for its ability to protect skin and hair from damage. But Vitamin E is not easily absorbed through the skin's layers.

Arthur Watterson, director of the Institute for Nano Science and Engineering Technology (INSET), has led a team of researchers to a potential solution: encapsulation.

"We have chemically attached and encapsulated Vitamin E in our nanospheres for both long- and short-term release to create dual polymeric nano carriers," says Watterson. "The polymeric antioxidants are more effective than the antioxidants themselves. Essentially, we're turning Vitamin E, a lipid or oil, into a water-soluble substance that can penetrate deep into the skin." Applications would include sunscreens and sunburn treatments, as well as encapsulations of cosmeceuticals such as retinol. Drugs may also be incorporated in this dual carrier method.

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Division of Continuing Studies Online Program Receives Three National Awards

Institution-Wide Programming, Faculty Development and Teaching Recognized

The Division of Continuing Studies was notified this past month that it has received three national awards for excellence in its online education programs from the Sloan Consortium—an association of more than 1,000 institutions and organizations of higher education engaged in online learning.

"This recognition is one of the highest honors we could receive," says Jacqueline Moloney, dean of Continuing Studies and Corporate Education, who launched UMass Lowell's online program 10 years

ago. "It's tremendously rewarding to have our faculty, staff and administration be nationally recognized as leaders in this field."

The Sloan Consortium (Sloan-C) has recognized the Division for: "Excellence in Institution-Wide Online Teaching and Learning Programming," "Excellence in Faculty Development for Online Teaching," and "Excellence in Online Teaching," which was awarded to Assoc. Prof. Joan Cannon of Psychology.

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The green chemistry choice is in striking contrast to some of the best-known anti-cancer drugs such as Taxol(r), which are synthesized in a multi-step process that uses or generates large amounts of carcinogenic chemicals and solvents.

The new polycatechins, tested in vitro in Braunhut's lab, are potent in inhibiting several types of human breast cancer cells. Even more interesting, they are more effective at much lower dosages than naturally occurring catechins. Best of all, the polycatechins do not harm the growth of normal mammary cells when tested in parallel, unlike the other catechins.

"Another great aspect of our compound is that it is ingestible," says Braunhut. "In animal model testing, the mice will be treated with polycatechins in their drinking water. We have several goals. Does the compound work in routine use as a cancer preventive? Does it slow the growth of pre-existing tumors, or cause established large tumors to regress? Can it fully eliminate a tumor?"

As so often happens, the research breakthrough was a tangent from another project—a collaborative research program between the Center for Advanced Materials and the U.S. Army Natick Soldier Center (NSC). New compounds were under investigation for use as electrolytes in solar cells, involving Dr. Ferdinando Bruno and Dr. Lynne Samuelson of NSC, with Kumar and Dr. Ramaswamy Nagarajan of CAM. Interested in the potential for medical use, the researchers changed their focus to developing bioavailable versions of the compounds, and turned to Braunhut and her team for their expertise.

The project was funded initially by a Chancellor's seed grant. With preliminary data in hand, the principal investigators were able to submit and win a concept award grant from the U.S. Army Breast Cancer Initiative, Department of Defense, and a

student researcher, Subhalakshmi Nagarajan, won a competitive grant from the Environmental Protection Agency (see related story). Also, a patent application has been filed.

"The next question is the bioavailability of the compound in vivo," says Kumar. "The early studies were funded by the Army with a grant of \$114,000. The team has also submitted a proposal to the US Army Medical Research and Materiel Command. The competition is enormous; the proposal goes to a board of reviewers that includes breast cancer survivors,



▲ Prof. Susan Braunhut, left, with Donna McIntosh, senior scientist, and students Rachel Mendes, Soumya Vemuri, Doanh Mai, front left, and Matt Belmonte

so the abstract must be written in accessible form."

Breast cancer is diagnosed in more than 212,000 people in the U.S. each year. The lifetime probability of a woman getting the disease is over 12 percent and, while early detection has helped, there is no cure for breast cancer that has metastasized to bone, brain or liver. Existing chemotherapies are harmful to some of the healthy and normal cells in the body, besides putting a strain on the environment in their manufacture.

Braunhut says, "We believe these new compounds may prove to be a new family of anticancer drugs from green chemistry that will cause a paradigm shift in the development of drugs for breast cancer treatment."

Research note: General information is available at the Center for Advanced Materials and Prof. Susan Braunhut's lab.

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"The Institution-Wide award speaks to the high quality of the online programs at UMass Lowell," says Chancellor William T. Hogan. "We're very proud of the accomplishments of all of the administrators and faculty involved."

UMass Lowell's programs are offered through the UMassOnline system initiative headed by CEO David Gray who says, "UMassOnline proudly acknowledges the contributions of UMass Lowell to the greater whole and its work in developing its own programs and those of the whole system."

The purpose of the Sloan-C is to help learning organizations continually improve quality, scale, and breadth of their offerings

according to their own distinctive missions, so that education will become a part of everyday life. Created with funding from the Alfred P. Sloan Foundation, the Sloan-C encourages the sharing of knowledge and of effective practices.

"Quality online education continues to show vigor and strength," says Frank Mayadas, President of Sloan-C. "The individuals and institutions honored this year are, as before, exceptional, and we honor them for demonstrating exceptional leadership in advancing online education along these dimensions."

For more details on the Sloan Awards, go to: www.sloanc.org/aboutus/awards.asp.



▲ Continuing Studies and Corporate Education Dean Jacqueline Moloney, front left, is joined by the faculty and staff who helped UMass Lowell receive a Sloan-C institution-wide award for excellence. Catherine Kendrick, CSCE director of Corporate and Distance Marketing, is to Moloney's left. Continuing by row from left are: Sciences Dean Robert Tamarin, Education Dean Donald Pierson, former continuing studies staffer and new faculty member Steven Tello, Math Prof. Ann Marie Hurley, continuing studies staff members Johanna Bohan-Riley and Amy Yacus, and St. Anselm College's Paul Damour of Chemistry. In the top row, from left, are: Math Prof. Alan Doerr, Psychology Prof. Richard Siegel, CSCE manager Patrick Driscoll, Engineering Technology Coordinator Nihar Mohanty, CSCE Director Pauline Carroll, and Engineering Technology Prof. Robert Tuholski.

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Watterson presented the research at a special symposium of the annual meeting of the American Chemical Society (ACS) and contributed a chapter to a book based on the symposium. The ACS promoted the research worldwide in a small selection of symposium highlights, resulting in science spot reports on major networks and an article in the Deutschland Financial Times.



Research note: Researchers included Rajesh Kumar, Virinder Parmar, Jayant Kumar and Rahul Tyagi. Tyagi, a doctoral student, was supported by funds from the Committee of Federated Centers

and Institutes (CFCI). INSET, the Center for Advanced Materials and the Departments of Physics and Chemistry were represented. Contact: Arthur_watterson@uml.edu.

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Nagarajan Wins EPA Student Grant for Green Tea Research

make materials of commercial and human benefit," says Nagarajan. "Most drugs used to treat cancer are made using toxic chemicals that generate harmful by-products. Meanwhile, naturally occurring compounds like green tea catechins, which are promising in anti-cancer studies, are not very stable or soluble."

Nagarajan, a doctoral candidate supervised by Prof. Jayant Kumar, director of the Center for Advanced Materials (CAM), began working on ways to polymerize the catechins using enzymes as catalysts. The Center has considerable expertise in the area of enzyme catalysis, with more than 50 published papers and five patents filed.

"My challenge was to modify the catechins, using a green chemistry protocol, to get polymers with increased stability and good water solubility," says Nagarajan. "I characterize them spectroscopically and optimize the conditions under which they are synthesized to obtain good anti-cancer activity."

Nagarajan thanks Drs. Ferdinando Bruno and Lynne Samuelson (U.S. Army Natick Soldier Center) for



▲ Subhalakshmi (Subha) Nagarajan

their support and guidance of her research. She says, "It's been a pleasure to work for CAM and an honor to work for Prof. Kumar. I am also very excited about working with Prof. Susan Brauhut and her research group and learning new things in the area of treatment of breast cancer." She also credits her brother, Dr. Ramaswamy (Ram) Nagarajan, with encouraging both her research and the application to EPA. Ram Nagarajan, while working in CAM, was a major contributor to the patent and grant applications.

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Kashner Recollects Kerouac School Days

Kerouac Conference keynote speaker Sam Kashner told tales full of humor and pathos, recounting his life as a young man among aging beat poets in the 1970s to an audience of close to 100 at O'Leary Library.

At age 19, Kashner became the first student to enroll in the Jack Kerouac School of Disembodied Poetics at Naropa University, armed with lengthy self-penned poems, a much-coveted watch from his parents, and a Diner's Club Card. Kashner moved the audience with anecdotes involving those three possessions, Beat poets William Burroughs, Gregory Corso, Kerouac School founder Allen Ginsberg, and himself. The tales were read from Kashner's most recent book, *When I Was Cool: My Life at the Jack Kerouac School*.

"I am honored to be here in the presence of Cassadys and Sampas's and their noble bloodlines," Kashner said as he came to the podium, nodding to those in the audience with close connections to Kerouac. John Sampas of Lowell, Kerouac's brother-in-law, executor of his estate and Kerouac Conference benefactor, was in attendance. In addition to Sampas, the conference was sponsored by the Jack and Stella Kerouac Center for American Studies and the UMass Lowell English Department.

Conference director Prof. Hilary Holladay said she was pleased with attendance at the conference, which had expanded to two full days this year. "We have a nice mix of students, community people—and we had some all the way from Australia," she said. Session attendance ranged from 40 to 90.

Kashner is a regular contributor to *Vanity Fair* and *GQ* magazines, and has written other books, including *Sinatrland*.



▲ Conference Director Hilary Holladay, left, and English Department Chair Melissa Pennell join author and Kerouac Conference keynote speaker Sam Kashner.

Redesign Gives UMass Lowell Websites New, Fresh Appearance

Departments, Offices Will Maintain Own Sites with New Software Application

Exciting changes are occurring on the UMass Lowell website, including a new universal look for all colleges and departments, easier navigation, and an eNews site that updates the University community on the latest campus happenings.

These changes are being implemented by the Web Office, which is now under Information Technology, and the Communications Office. The Web Office will continue to create, manage and develop websites and web applications. Communications will continue to handle web requests and content issues.

Altogether the University has more than 150 sites totaling nearly 250,000 pages.

Jeff Thompson, vice chancellor for Information Technology, says, "The UML web has grown immensely since its inception. It has become a strategic communications tool for the faculty, staff, students and alumni. Our goal over the next two years will be to use this strategic tool to bring the University even greater public visibility and help make this the campus of choice for prospective students."

All websites henceforth will be created using a new content management system (CMS) called *Serena Collage*, which separates content from design, and enables departments to maintain their websites without using programs such as *Dreamweaver* and *MS FrontPage*. The new software will make it possible for the entire site to be updated more efficiently.

As part of this implementation, all websites are undergoing a redesign, including the addition of a universal navigation bar on every page. This bar will "brand" the University and offer users a way to return to the main site, search, and choose other linking options.

Ten groups or families of design have been identified on campus: Main/Top Level Pages, Intranet, Administrative Offices, Student Affairs, Undergraduate Admissions/Graduate School, Academics (colleges and departments), Research (including Centers/Institutes, councils and independent labs), Advancement/Alumni, Community/Outreach and Athletics.

Each of the 10 is defined by its own color scheme, unique logo and creative area. All 150-plus sites fall under these 10.

Every college, department and office will be required to designate a

web maintainer, who will be trained by IT.

Web content writers from the Communications Office will meet with departments to establish site navigation, update content and gather artwork.

With certain exceptions, the Web Office will not be creating new sites during the transition to CMS but existing sites will continue to be updated as needed. Changes may be sent online to the Web office.

A campus-wide Web Steering Committee, chaired by Vice Chancellor Thompson and Provost John Wooding, is overseeing the implementation of the project, taking into consideration the concerns and requirements of all segments of the University community.

To help the Web and Communications offices deal with the task of importing all sites into CMS and a new template design, the steering committee has established and will prioritize a list of sites.

Web Office Director Gerry Nelson says this list should make it easier for website maintainers to plan changes to their sites or to create new ones.

"This new software will make the University's website more functional and more attractive for visitors. This is a huge project and we appreciate everyone's cooperation and patience during the transition," Nelson says.

The Web and Communication offices serve the more than 150 sites with a combined staff of seven.

More information about the web changes can be found at <http://intranet.uml.edu/it/weboffice>

The eNews page, launched this fall simultaneously with CMS, carries news of all campus events, including activities of faculty, staff, students and researchers. It also will contain all University news releases, stories about the University that have appeared in the media, and the calendar of events.

This eNews site is available at www.uml.edu/enews — or by clicking on "News" at the top of the main UML page.

With the introduction of eNews, the printed version of the *Shuttle* has been reduced to four pages, with the content consisting mainly of feature articles and photos. It will continue to be distributed to faculty and staff, as well as to a significant off-campus distribution list. As in the past, it will be published every three weeks during the academic year.

University Energy Costs Increased by a Half Million Dollars This Year

UML Community Asked to Take Part in Conservation Efforts

From the standpoint of energy conservation, what good could it possibly do if you simply turned off your lights and computer when you left your office at the end of the day?

"You'd be surprised how much it would help," says Diana Prideaux-Brune, vice chancellor of Facilities. "The smallest things add up."

Hypothetical case: If all the lights in the buildings on UML North and South were left on for one night, the electricity used would cost the University \$3,000.

The University is not immune from the soaring prices of heating oil, natural gas, gasoline and electricity that residents throughout the state are facing. It's estimated that energy expenses for the University this year will be half a million dollars more than last year — \$4.5 million as opposed to \$4 million.

Energy and Utilities Manager Mark Lukitsch says the cost of fuel oil, the main energy source during the winter, has increased by 50 percent and natural gas costs have nearly doubled.

Electricity represents the greatest portion of the energy bill but, fortunately, David Kiser, director of Physical Plant, negotiated an electricity contract two years ago that is saving the University \$1.5 million this year alone.

Prideaux-Brune says, "We reduced power usage last year and we hope to reduce it again this year to offset the price increases to some degree. We anticipated these increases and have provided for

them to some extent in the facilities budget."

As part of the strategy to control costs, she says, some maintenance projects that aren't absolutely necessary, such as the re-paving of parking lots, may be delayed. In addition, other projects may be reshuffled, giving priority to the implementation of energy-saving initiatives, such as computer-controlled ventilation systems or window replacement.

"Major projects, such as the new dining area in Southwick Hall and the parking garage on UML East will go ahead as planned," she says.

Lukitsch says, "We've been working on energy conservation for several years and we'll continue to do that, but to have any effect on the budget this year we'll have to look to even greater economies in the operation."

The goal is to reduce energy usage by 20 percent by 2009, based on the fiscal 2004 consumption. One strategy being considered is to consolidate classes during the summer session when buildings need air conditioning.

"By doing that, we might be able to close down one or more buildings," he says. "We have the software tools in place that would enable us to do that."

Regardless of the strategies incorporated, the cooperation of faculty and staff is essential.

"We're asking the University community to take ownership of this energy conservation initiative," Prideaux-Brune says.

Hostetler and Thomson Join Staff of CWW

Concentrating on Work, Family and The Lowell Collaborative

The Center for Women and Work (CWW) has announced the appointment of a new faculty associate, Asst. Prof. Andrew Hostetler of the Psychology Department, and a visiting scholar, Susan Thomson.

Hostetler will concentrate on two papers already in progress on work and family, the completion of a third study, and the initiation of an integrative paper or project tying together his research in the area of gender, work and family.

Thomson will work on a research project regarding women and civic engagement in conjunction with The Lowell Collaborative at Middlesex Community College. Initially, she will supervise

students conducting interviews with key players in Lowell's annual Women's Week, an effort that will culminate in a Women's Week exhibit, "Public Festivals and Civic Engagement."

Hostetler and Thomson join CWW's four senior associates, Profs. Meg Bond, Laura Punnett, Jean Pyle and Paula Rayman; two other faculty associates: Assoc. Prof. Sarah Kuhn and Asst. Prof. Cheryl Najarian; and visiting scholars Pia Markkannen and Susan Moir.

The Center is dedicated to improving the conditions of work and enhancing economic opportunities for women through research, education and social action.



▲ Susan Thomson

Where's the Train When You Need One?

Dukakis Speaks at Seminar on Regional Economies



"We have an extraordinary resource in this nation: a rail network that is underutilized and underfunded," said Michael Dukakis at a recent seminar. "We should invest in a first-class national passenger rail system and it would require only modest investment, about seven percent of the amount spent on highways and airports. The Northeast is a strong user of rail transport, but the second most successful passenger train in America is in California. Dukakis is a professor of political science at Northeastern University and visiting professor at the School of Public Policy at UCLA, is well known for his advocacy of public transportation. His presentation was part of the fall seminar series organized by Assoc. Prof. William Mass of the Department of Regional Economic and Social Development and director of the Center for Industrial Competitiveness.

Donors Sought for Costello Gym Renovation

The Athletics Department is half way toward its goal of raising \$750,000 to renovate the interior of the Costello Gym. The fundraising initiative, called "Homecourt Advantage," will help fund the installation of a new floor, bleachers, scoreboard and sound system for the gym, which was built in the 1960s.

"With all the new construction of athletics facilities in the last seven years, the Costello Gym has missed out on its proper upkeep," says Athletic Director Dana Skinner. "It's time."

The renovation will start in March when the floor will be replaced, with the rest of the work progressing as funds are available. Skinner says he hopes the entire project will be finished by September 2006.

A fundraising brochure and appeal will be sent out soon to the university community asking for donations. The campaign will include

a brick sale, where donors can give \$100 or \$200 for a brick, with an inscription chosen by the donor, that will be installed in the lobby of the gym. A similar campaign successfully raised funds for the Campus Recreation Center.

The Costello Athletic Center is home to the basketball and volleyball teams, and serves as an indoor practice site for virtually all other athletic teams. The facility is also used for youth tournaments, summer camps

and clinics, and many other non-athletic events.

For more information, or to send a donation, contact Peter Casey, 978-934-2337.



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