The secrets of DNA repair

As every sun worshipper knows, ultraviolet light is harmful. It can damage fundamental molecules like DNA and adversely impact life itself. A Montclair State professor is looking at ways to repair that damage with research that could eventually lead to new methods to prevent skin cancer.

For the next four years, Chemistry and Biochemistry Professor Yvonne Gindt will study how the DNA photolyase enzyme repairs DNA damaged by UV light. Gindt, who shares a $1.1-million NASA grant with colleagues from Temple University and Duke University, will

The power of tea

Until now, there has been little hope of relief for the millions of people infected with incurable herpes viruses. Promising new research by Biology and Microbiology Professor Sandra Adams suggests that a topical application made from readily available tea extracts could change that.

“In the United States, Herpes Simplex I, which causes cold sores, persists in 40 to 60 percent of the population,” says Adams. And more than 16 percent of Americans suffer from Herpes Simplex II, responsible for genital herpes.

For the 15 to 40 percent of people infected with these viruses who experience symptomatic, recurrent infections, relief may be on the way, based on Adams’ research.

Adams has been investigating how natural products — like black and green tea extracts and curcumin or turmeric extract — can inhibit the infection of Herpes Simplex I and II (HSV-1 and HSV-2). “Our research to date indicates that these polyphenols affect the ability of HSV-1 and HSV-2 to bind to cells, thus reducing the ability of the viruses to infect,” she explains.

Her research is supported by Montclair State’s Science Honors Innovation Program (SHIP), and the Department of Biology and Microbiology. Selected SHIP students receive tuition funding for two years, says Adams, who works with both undergraduate and graduate students. A current SHIP student has successfully used curcumin to inhibit both herpes viruses in cultured cells.

“Students in my lab make a long-term commitment to the projects and are critical to the success of
Gender wage gap starts early

In studying America’s teen workforce, Sociology Professor Yasemin Besen-Cassino, a leading expert in gender pay equity, has found that the gender wage gap begins in the teen years and widens with age.

With support from the W.E. Upjohn Foundation, the 2012 Montclair State University Distinguished Scholar of the Year is also redefining assumptions about America’s teen workers – from why they work and who gets hired to what they are paid.

“Affluent teens dominate today’s youth labor force,” she says. “They work for social – not financial – reasons.” Teens who need to work for the income often miss out on these jobs because they don’t have the right look.

Yet while 12- and 13-year-old boys and girls begin work earning the same money at jobs like babysitting, yard work and snow shoveling, by age 14 and 15, the first gender wage gap emerges. Besen-Cassino has detailed the quantitative results of her study of the inequalities in the youth labor force in her book, Consuming Work: Youth Labor in America, which will be published by Temple University Press in January 2014. “It discusses how early work experiences not only create and sustain socio-economic inequalities, but also create lasting gender inequality in the workplace,” she says.

A gender equality advocate, Besen-Cassino spoke beside Lily Ledbetter to support the 2009 Lily Ledbetter Fair Pay Act and has testified as an expert witness before the New Jersey State Legislature. The American Association of University Women recently funded and published a study Besen-Cassino co-authored about New Jersey’s gender wage gap.

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take thermodynamic measurements on the project, which will show how biological systems work under unusual and extreme conditions.

“In evolutionary terms, photolyase is relatively ancient. It’s present across all kingdoms of life, with the exception of placental mammals — so humans don’t use this repair enzyme.”

The team is working with DNA that contains the UV-induced cyclobutyl pyrimidine dimers that cause skin cancer and has been damaged by exposure to UV light at temperatures as high as 140°F or 60°C. “The DNA base thymine is especially sensitive to UV damage,” Gindt explains. “It can crosslink with an adjacent thymine base to create the dimer, which is responsible for around 70 percent of skin cancers in humans.”

She notes that sunblocks could eventually contain a DNA repair molecule. “It’s a question of designing the appropriate molecule for the job,” Gindt says. “Our work is to fully understand what the actual job is.”

Photolyase uses a relatively simple process to repair UV damage.

“Since all organisms, regardless of environment temperature, experience DNA damage, by studying this system, we can understand how different environments affect how the enzyme works.”

Gindt and student researcher Ban Abdulrazzaq are measuring the amount of heat absorbed or released when DNA binds to photolyase.

“This project will give us a better understanding of how to design a biological molecule for use under higher or lower temperatures.”
A matter of taste

Montclair State Psychology Professor Debra Zellner’s research shows that the pairing of food and how it’s arranged on the plate helps determine how much the diners like it — findings that could help people eat healthier.

After conducting studies in the campus Chemical Senses and Hedonics Laboratory with simple dishes such as hummus with carrots and pita chips and chicken tenders with either chips or lima beans, Zellner partnered with the Culinary Institute of America to test gourmet meals.

“There’s only so much I can do with meals as a researcher. I’m not a chef,” she says. “Chefs create art on the plate — does that make the food taste better or just look better?”

To help answer that question, chefs at the Culinary Institute of America in Hyde Park, N.Y., prepared a gourmet meal of chicken, brown rice and green beans almondine on two separate nights — one night serving the dish artistically presented, spiraling the sliced chicken atop the brown rice with the green beans placed in a lattice pattern around the plate. The next night, the same dish was served in a more “traditional” style with the chicken in the middle and rice and beans next to it, Zellner says.

The results were fairly conclusive: Diners served the artistic and beautifully styled plates enjoyed the food more. They described the brown rice, in particular, as the best they’d ever tasted, but the diners with traditional plates did not react that way.

Zellner’s earlier research found that when one food is paired with foods a diner already likes, it tastes better than when paired with less appealing foods. Her research could be used to make healthy food more appealing simply by pairing it with something tasty and serving it artistically.

Zellner hopes to take a sabbatical next year to team up with the Vetri Foundation (founded by Philadelphia Chef Marc Vetri), which runs an elementary school lunch program. She will work to find ways to encourage children to be more open to new and healthy foods.

Seeking the perfect pitch

A Montclair State researcher is studying ways to reduce injuries in baseball pitchers without compromising pitch speed or performance on the mound.

Professor Steven Leigh, a biomechanist in the Exercise Science and Physical Education department, is evaluating new throwing motions for pitchers that could minimize the chance of elbow and shoulder injuries. The study is an extension of his past research with javelin throwers.

Leigh calculates the shoulder and elbow stress caused by throwing and, using computer simulations first and then pitchers, seeks to develop safer throwing motions that reduce this stress. The challenge is that the throwing motions used to achieve the best performance on the field cannot be altered much without consequences to the pitch. “Most of the throwing motion is associated with both injury and performance, so you can’t make big changes without affecting performance,” Leigh says.

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Aquatic mercury contamination

Biology and Molecular Biology Professor Melyn Wu and Environmental Management doctoral candidate Natalie Sherwood are measuring the levels of mercury contamination in New Jersey’s aquatic ecosystems with the help of funding from the U.S. Geological Society and Rutgers University. Wu, the director of the Passaic River Institute, says the work ties into several ongoing research projects evaluating state waterways and the impact of human-induced pollution on the region’s aquatic flora and fauna.

Snapping turtles, and the insects, fish, snails and algae they consume, are a key focus of the study that will identify mercury transport pathways and accumulation levels in regional biota on the aquatic food chain.

“The ultimate goal is to develop consumption advisory advice for those who eat the turtles,” explains Wu. “Turtle stew is considered a delicacy in parts of southern New Jersey.”

Mercury is present in aquatic habitats in its inorganic form, where it has been methylated by anaerobic bacteria to produce methylmercury. “Methylmercury is the form of mercury most easily absorbed and stored by organisms,” says Sherwood. People who eat contaminated seafood risk ingesting high levels of methylmercury.

“Our intestinal tract absorbs up to 100 percent of the mercury consumed through food,” Sherwood says. “When ingested in high enough concentrations, it can act as a neurotoxin, first attacking the brain and the nervous system. Ingestion of mercury is most dangerous for pregnant women and young children.”

Because of snapping turtles’ varied diet and longevity — 40-year lifespans are common — their meat has a potentially high concentration of mercury. “If consumed regularly, this could have significant human health implications,” Sherwood notes.
Evaluating NJ charter schools

A team of Montclair State researchers is studying whether New Jersey public charter schools are making the grade. New Jersey was one of three states to receive a 2012 U.S. Department of Education Charter School Program grant to foster awareness of public charter schools and increase its number of high-quality charter schools.

The New Jersey Department of Education (NJDOE) has contracted with Center for Research and Evaluation on Education and Human Services (CREEHS) Director Eden Kyse and Senior Research Associate Rebecca Swann-Johnson to evaluate the state’s Charter School Grant Program.

During the course of the two-year contract, which began in April, Kyse, Swann-Jackson and Research Associate Jessica Marini ’06 will visit five of the 13 New Jersey charter schools that have been awarded Charter School Program (CSP) planning and implementation grants through the NJDOE. “We’ll measure the grants’ impact and implementation through focus groups, interviews with key stakeholders and surveys, as well as existing school enrollment and achievement data,” explains Swann-Jackson.

Working with the Office of Charter Schools, the CREEHS team is assessing several aspects of the program, beginning with how schools receiving grants were selected. “We’ll compare how those funds were proposed to be used and how they have actually been used,” says Swann-Jackson.

Subliminal persuasion

Advertising on the web falls into two categories — ads you don’t notice and those that pop up and annoy you.

Montclair State Associate Professor of Marketing Patrali Chatterjee’s research explores how ads we think we’ve ignored actually get burned into our subconscious and shape our preferences. Her findings show that repeated exposures to the same type of ad over time while browsing the web — or even playing video games or watching TV — generates familiarity with the images or logo in the ad, even if the consumer does not recall having seen the ad.

“This perceptual familiarity generates positive affect, thereby making the consumer responsive and more likely to prefer it when it appears in other contexts or competitive situations,” Chatterjee explains.

Yet, because consumers are increasingly cynical of advertising messages, marketers often resort to intrusive forced-ad formats such as those that have to be closed, even though Chatterjee’s studies show those types of ads lead to negative associations with the brand. So when it comes to creating positive perceptions, advertisers do better with the repeated use of ads consumers don’t notice first, before introducing ads they have to notice.

“Subconscious advertising exposures function on an alternate route — they ‘prime’ or ‘prepare’ the consumer to prefer the brand and respond to its advertising when the need arises,” she says. “Multiple subconscious advertising exposures over time improve brand recognition and attitude but have never been shown to lead to brand recall.”

“Multiple subconscious advertising exposures over time improve brand recognition and attitude.”

— Patrali Chatterjee
**SPOTLIGHT: Grants**

**White House funding**

The White House Office of National Drug Control Policy awarded a $625,000 Drug-Free Communities grant to the Paterson Coalition Against Substance Abuse (P-CASA), a collaborative effort between Montclair State Family and Child Studies specialists and the community. The five-year grant will support efforts to prevent substance abuse among teens.

**Upward Bound ensures success**

The successful outcomes of Montclair State’s Upward Bound program — 95 percent of participants finish high school and 90 percent graduate from college within four to six years — have resulted in more than $3.5 million in federal funding for the program over the last 14 years. The U.S. Department of Education recently renewed its funding for another five years.

“Our goal is to generate the skills and motivation these students need to complete their post-secondary education,” says Health Careers Director Donna Lorenzo, who’s directed the University’s Upward Bound program since 1999. “My motto is ‘When you graduate, not if you graduate.’”

Upward Bound provides educational support to more than 50 students — most of whom are low-income and first-generation college-bound — enrolled in grades 9-12 from East Side High School and John F. Kennedy High School in Paterson, N.J.

University faculty and staff, instructors from local school districts and guest speakers offer supportive classroom tutoring, counseling, mentoring, SAT prep and personal development activities. “These kids are the best,” says Lorenzo. “I’m so pleased to help them succeed.”

**Engaging the community**

The University’s Environment, Education and Community Outreach (EECO) program is currently in its third year of a $600,000 grant by the New Jersey Commission on National and Community Service.

A collaboration between Montclair State’s New Jersey School of Conservation, the Service-Learning and Community Engagement Program and Center for Student Involvement, the program serves the community, in part, through its AmeriCorps volunteers. Student AmeriCorps members perform 1,700 hours of community service each year for public schools, non-profits and civic organizations while developing personal and professional skills.

“AmeriCorps students currently serve in Orange Public Schools, the Montclair YMCA and St. Vincent’s Nursing home,” says Bryan Murdock, director of Service-Learning and Community Engagement. They receive scholarships, as well as career development guidance and leadership training.
NSF funds science teacher grants

New Jersey has long faced a shortage of qualified Science, Technology, Engineering and Mathematics (STEM) teachers in its high-need school districts. Now, thanks to two National Science Foundation (NSF) awards, Montclair State will prepare science and math teachers to fill this gap.

Douglas Larkin of the Department of Secondary and Special Education and Sandra Adams, biology and molecular biology professor and science education coordinator for the College of Science and Mathematics have received a five-year, $1.4-million NSF Robert Noyce Teacher Scholarship program grant to recruit, prepare and support 30 new science teachers for New Jersey’s high-need K-12 districts.

“This program provides 10 scholarships that cover in-state tuition and fees for junior and senior biology, chemistry, earth science and physics majors in the Teacher Education Program,” says Adams. Noyce scholars must commit to teaching two years for each year of support they receive — or four years total.

Adams, Larkin and co-principal investigator John Berger of the County College of Morris are recruiting the 10 students who will receive scholarships next year. “We’ll accept all applicants, but are focusing on physics and chemistry, which are two of the most difficult-to-staff certifications in the state,” says Larkin. Mathematics professors Steven Greenstein and Erin Krupa in collaboration with Jennifer Robinson, director of the Center of Pedagogy, have also received NSF Noyce funding for a two-year project to develop a new enhanced degree program leading to a BA in mathematics with a concentration in K-6 teaching.

“The project responds to decades of appeals for the increased preparation of elementary mathematics teachers,” says Krupa. “It will be the first four-year STEM degree with elementary teaching certification at Montclair State.”

Current students interested in math and elementary education are being recruited for an innovative teacher education program featuring urban teaching experiences, inquiry-oriented coursework and research opportunities.

Recovery Fund supports NJ News Commons

The New Jersey Recovery Fund awarded Montclair State’s Center for Cooperative Media, a hub for hyper-local news websites and one of 27 grantees of the Recovery Fund, part of the Community Foundation of New Jersey. The grant is part of a larger effort aimed at averting the type of devastation caused by Sandy through formulating better policies, informing and engaging the public and fostering healing of impacted communities through the arts.
Listening to the universe

A new type of astronomical observatory lets scientists listen to the music of the cosmos produced by gravitational waves, and scientists

"The grant involves improving our understanding of GW signals so we can better analyze the data from the detectors," he explains. "These signals have properties similar to sound waves, so in a certain sense, we are attempting to listen to the universe."

Favata describes gravitational waves, which were predicted by Albert Einstein in 1916, as "ripples in the fabric of space and time produced by movements of dense, massive objects like binaries," says Favata. "Eventually, the stars will collide and release a final strong burst of GWs." LIGO operates detectors in Louisiana and Washington designed to provide precise measurements of such wave signals.

"Observing the final collision of neutron stars provides a new way of looking at the universe," explains Favata. "My project consists of several separate parts related to modeling GWs." These involve modeling detector data; calculating the errors expected if an incorrect model is used; and producing mathematical models of the "memory effect," a non-oscillatory signal that occurs when gravitational waves themselves produce more waves.

"These signals have properties similar to sound waves, so in a certain sense, we are attempting to listen to the universe."

—Marc Favata

neutron stars or black holes moving at close to the speed of light."

Neutron stars and black holes occur when stars larger than the sun reach the end of their life spans.

"Many stars in the universe are in

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