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Welcome from Dean Seybert

It is a pleasure to welcome you to the inaugural edition of *Spectrum*, our newest publication designed to inform alumni and friends of the many exciting initiatives in the Bayer School of Natural and Environmental Sciences.

Since the formation of the Bayer School in 1994 as a separate school of science, we have witnessed remarkable growth and development in our dual missions of research and teaching. Just a sample of our recent program developments gives a testimony of our progress. In addition to our excellent longstanding bachelor’s programs in biological sciences, chemistry and biochemistry, and physics, we now offer a B.S. degree in Environmental Science. In 2001, Biological Sciences added a Ph.D. program to its nationally recognized M.S. program. The thoroughly revised Ph.D. program in Chemistry and Biochemistry continues to produce successful and sought after doctoral graduates. In collaboration with the School of Law and the Cyril Wecht Institute of Forensic Science and Law, our school now offers a unique five-year entry-level Master’s in Forensic Science and Law.

We have implemented a new core curriculum for undergraduate science majors, including mandatory courses in ethics, history of science, cultural anthropology and scientific presentation and writing. This new core reflects our continued commitment to a strong liberal arts background for our science students.

Our nationally and internationally renowned faculty receive $2 million in external funding each year from agencies such as the NIH, the NSF and the Department of Energy. They are also publishing their research in premier journals and are invited to present their findings at national and international conferences.

We have a thriving undergraduate research program, and many of our undergraduate researchers appear as co-authors on peer-reviewed publications. Ongoing renovations of Mellon Hall laboratories provide the highest quality research and teaching facilities. Our students are being taught the most up-to-date techniques using some of the most modern instrumentation available.

Duquesne University has witnessed remarkable achievements in recent years, and one of the premier success stories is the development of the sciences. Within this and future issues of *Spectrum*, we hope to provide you with an ongoing description of how we are educating tomorrow’s scientific leaders. We welcome your comments and reaction to our first issue of *Spectrum*, and I extend to each of you a personal invitation to visit us at Duquesne to tour our facilities and meet the faculty, students, and staff of whom we are so proud!

— Dr. David W. Seybert
Dean of the Bayer School of Natural and Environmental Sciences
DEVELOPING A VACCINE TO DEFEND THE DEFENSELESS

There are invisible bacteria all around us — in the air we breathe, the food we eat, and the water we drink — yet for most of us, the body’s defense mechanisms render them harmless. However, these bacteria can become potentially dangerous enemies when they come into contact with people whose immune systems are compromised.

Dr. Peter Castric

For the past thirty years, Dr. Peter Castric has been studying Pseudomonas aeruginosa, a naturally occurring soil microbe that can become pathogenic to people with compromised immune systems, such as those battling cystic fibrosis or HIV/AIDS. Castric, a professor of biological sciences who began teaching at Duquesne in September 1971, recently received a five-year award from the National Institutes of Health totaling more than $800,000.

Castric is focusing his research on this particular microbe because it is hearty and highly adaptable. “It will grow almost anywhere,” he confirmed, going on to explain that P. aeruginosa is found within the surface layer of many common vegetables. “Something like ten percent of humans carry the organism in their intestinal tracts,” he said. “But their immune systems are strong enough to fight it off. This shows how important our defense mechanisms really are.”

Castric wants to provide a defense against this invisible enemy for those who have none. Since 1995, he has been working on designing a vaccine against P. aeruginosa. Through his research, Castric strives to understand how the organism moves and attaches to host cells in weakened immune systems. He studies the pili — the external protein fibers used for motility and attachment — because he believes that the secret in designing the vaccination might lie here. “The pili allow the bacteria to recognize and bind to the host cell. If we can better understand how the pili help the organism move and attach itself, we might be able to prevent attachment.”

Castric currently has two patents pending on his vaccination designs. His work is also supported by a research grant from the National Institute of Allergy and Infectious Disease. •

— SB
SCHOLARSHIP LEAVES LEGACY OF LOVE

Women in science classrooms were uncommon in the 1950s, when Norb C. Maranowski received his dual degrees in chemistry and physics from Duquesne University. Rarer still was a woman who applied her education in the laboratory setting. Nancy Dorman Maranowski fit both profiles, which made her doubly unique.

“Not only did Nancy earn degrees in both chemistry and mathematics at the University of Pittsburgh, she was the only woman in her chemistry class. She was a high achiever – a medal winner, member of the prestigious Phi Beta Kappa honor society, and first in her class of 1954,” Norb Maranowski proudly explained. “I met her at the industrial research lab where we both worked. We both attended night school at Pitt, and eventually began sharing rides together.”

Nancy and Norb were married in 1963 and remained partners in all they did for the next 37 years. This included volunteer work, travel, and the upbringing of two sons, Steven and Kevin, both graduates of Carnegie Mellon University.

Although the Maranowskis had ties to three local universities, Duquesne always held a special place in both of their hearts. “I always found the support I needed at Duquesne. Nancy shared my appreciation and found the same wonderful family atmosphere at Duquesne during the many events we attended over the years. We took pride in actively supporting the campaigns to transform the University into the beautiful facility it is today,” Maranowski recalled.

The Maranowskis were developing a proposal for planned giving when Nancy became unexpectedly ill and died after a brief but courageous battle with cancer. Despite their sorrow, the Maranowski family chose to honor Nancy’s memory in a way that they thought most fitting: establishing an endowed scholarship to support students studying the natural sciences at Duquesne University.

“The boys and I wanted to remember Nancy in a very special way. We all valued our education in the sciences, and we could think of no better way to honor Nancy’s memory than to create a scholarship in her name,” Maranowski explained.

According to Lois Brozenick, director of Planned Giving, “The Maranowski Endowed Scholarship was established to assist undergraduates majoring in one of the natural sciences, including mathematics, who have demonstrated high academic excellence and financial need.”

The first Nancy and Norbert Maranowski Endowed Scholarship was awarded last fall to Susan Ondrejco, a senior physics student with a 3.7 grade point average in her major. Currently a physics tutor, Ondrejco is considering adding an education degree to enable her to teach high school physics.

Although the scholarship is not limited to women, it seemed fitting that the first recipient was a woman after Nancy’s own heart. Dr. David Seybert, dean of the Bayer School of Natural and Environmental Sciences, remarked, “We were delighted to find a young woman who not only met the standards but who exemplified the spirit of the award.”

When benefactor and beneficiary met shortly after the scholarship was bestowed, Maranowski told Ondrejco, “I felt Nancy had a guiding hand in your selection. I speak for both of us in wishing you the very best in your future career.”

— KS
Certain Duquesne University science students were recently asked to take a lie detector test in class. The retired FBI polygraph operator did not probe their study habits, but he did instruct them to answer simple questions falsely in order to demonstrate one of the many aspects of a career in criminal justice.

According to Dr. Fred Fochtman, it is true that this entry-level Master’s in Forensic Science and Law program is the only one of its kind in the nation. “When you look at what is offered across the nation, you see other graduate programs in forensic science, and a smattering of undergraduate programs in forensic science or criminal justice, but no other degree has our combination of rigorous science courses with the law component,” he said. Furthermore, no other graduate program in forensics allows students to enter in their freshman year of college.

Fochtman has served as the new director of the program since it was officially established under the auspices of the Bayer School of Natural and Environmental Sciences in summer 2002. Fochtman, currently the director of the Forensic Laboratory Division of the Allegheny County Coroner’s Office, also serves Duquesne’s Mylan School of Pharmacy as an associate professor of pharmacology-toxicology, and teaches environmental toxicology for the Environmental Science and Management program.

The forensics program grew out of the efforts of the Cyril H. Wecht Institute of Forensic Science and Law, which was established as a result of the Allegheny County coroner’s ongoing collaboration with the Duquesne University Law School.

The first class of approximately 30 students entered the program in fall 2001, and since then the number of applicants has skyrocketed. According to Fochtman, the University’s administration has offered exceptional support in this area, funding the renovation of two new forensic science laboratories in Mellon Hall and the addition of two new faculty members, Assistant Professor of Biology Lisa Ludvico and Assistant Professor of Chemistry Kerry McMahon.

Duquesne University will fill a specific need by releasing well-prepared graduates into the field of forensic science and law. “Being involved in the field for many years as I have been, teaching toxicology and working in investigation, I have seen the great need for educated individuals,” Fochtman said. “The new technologies have come a long way in assuring that the person who is being prosecuted is the right one. The science itself is non-biased.”

— LVM
The human body is an intricate universe of 100 trillion cells. These cells are organized into highly specialized tissues that work together in systems. Although the cells in bone, muscle, skin or other tissues have vastly different functions, each individual cell contains DNA — a master plan with instructions for building every other type of cell that exists in the body. This is the potential driving adult stem cell research.

Although the term “stem cell” may seem to be a new one in the popular lexicon, Dr. John Doctor, associate professor of biology in the Bayer School of Natural and Environmental Sciences, explains that human adult stem cells are as old as humanity itself. In 2001, they also became such a population that has been known by scientists for some time. “These cells divide, and some become specialized. At that point they have reached their potential, so to speak, and they don’t divide again. They live the rest of their lives as that specialized cell and perform a specific function.”

On the other hand, some cells exist with the sole purpose of dividing. When these stem cells split, one will develop into a specialized cell to do the job of skin, yet another will eventually divide again to perpetuate the stem cell population. This self-renewing property of skin helps heal our cuts and scrapes.

Dr. John Doctor

Microscopic analysis of human adult stem cell colonization on a biomaterial commonly used to repair bone injuries. Live (green) adult stem cells greatly outnumber dead (red) cells.
Many people do not know that Charles Darwin began his adult life as an orthodox Christian with a divinity degree. However, he was apparently unable to reconcile his famous scientific findings with his faith, and ended life as an agnostic.

Dr. Kenneth Miller, a distinguished professor of biology at Brown University and a believing Catholic, also faced an initial clash between faith and reason in his career. Throughout his highly acclaimed book, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution* (Harper Collins, 1999), Miller upholds the validity of Darwin's great discoveries and goes on to discover a personal resolution between science and religion that Darwin did not achieve.

Miller spoke at Duquesne University's first Darwin Day celebration on Monday, Feb. 17. His presentation, “Time to Abandon Darwin? The Challenge from Intelligent Design,” was followed by an open discussion and a reception in the Bayer Rotunda.

Miller's lecture reviewed the substantial evidence for evolution in order to critically evaluate the claims of Intelligent Design, a movement that is active in contemporary Christian circles of creationists, who oppose the theory of evolution on religious grounds. According to Dr. David Lampe, assistant professor of biology in the Bayer School of Natural and Environmental Sciences, it is an important issue to address because “Intelligent Design is currently used by creationists who address public school boards to promote a scientifically legitimate alternative to the theory of evolution.”

Lampe, who coordinated the event, remarked, “What we wanted to do with this event is teach people about Darwin, teach people about the scientific evidence supporting evolution, and try to dispel the notion that religion and science have to be in complete contradiction.”

Lampe proposed that supporters of Intelligent Design, who interchange the inspirational message of the Bible and the informative words of a science textbook, are fundamentally confused. “At some point, there are questions that science cannot answer,” he reflected. “Those are the kinds of questions where faith enters in.” •

— LVM
Water and sunlight are the most basic necessities of life. They can also be the basic ingredients to make fuel for the future – with the help of another common ingredient that is used in everyday products like sunscreen.

Titanium dioxide (TiO₂) keeps noses from burning because it absorbs light. For decades, scientists like Dr. Shahed Khan, associate professor of chemistry in the Bayer School of Natural and Environmental Sciences, have studied TiO₂ as a light-triggered catalyst that can be used to split water molecules to release hydrogen gas.

Although past trials have yielded an efficiency of only one percent, Khan and his research group recently discovered a chemically modified version of the catalyst with an efficiency of 8.5 percent. The findings were published in Science, the nation’s most prestigious research journal, in September 2002.

“There are other materials that can reach more than 10 percent efficiency as a catalyst, but they are expensive, they are not plentiful, and they are not stable,” Khan said. While TiO₂ has the ideal attributes the others do not, it only absorbs ultraviolet rays, a small fraction of the spectrum of sunlight that reaches Earth, making it inefficient.

According to Khan, the turning point occurred when his research group developed a different way to turn titanium into TiO₂. While the metal was heated in a flame of methane gas at 850 degrees F in order to oxidize it, the flame also added a small amount of carbon that made a big difference.

When the new carbon-containing catalyst was tested, it was found to absorb light waves in the violet, blue and green regions of the spectrum as well as UV rays, making it over eight times more efficient in splitting water molecules into hydrogen gas.

“We must heat the metal at a very controlled temperature of 850 degrees,” Khan reported. “If the temperature of the flame is just a little lower or a little higher, we do not have this high efficiency.”

The current efficiency level still falls below the 10 percent benchmark for a commercially viable catalyst mandated by the U.S. Department of Energy, but that has not prevented major corporations from contacting Khan to express interest in the findings, for which the patent is currently pending.

“Our goal is to make it 10 percent efficient, and this can be done,” Khan said. “The main thing is that we have identified that the carbon is what makes this level of efficiency possible. We have to do more work, but something really good is happening now.”

— LVM
Leslie (Huth) Williams explained how her career path was first chosen by frogs: “I was walking around Mellon Hall trying to figure out what I should do with my life. When I met Dr. Selcer’s frogs, I knew I wanted to conduct research in his lab.”

For the next four years, Leslie researched endocrine disruption with Dr. Kyle Selcer, associate professor of biology, while finishing her B.S. degree in biology and M.S. degree in environmental science and management (ESM). She advises all science students to take advantage of on-campus research. “Conducting undergraduate research made all the difference in where I am today. Laboratory work provides the chance to apply so much of what is learned in the classroom. There are also many things that can be learned that aren’t necessarily science-related, such as teamwork and presentation skills. Lab work promotes personal growth.”

During her last year of school, Williams accepted a position with Fisher Scientific, where she was able to apply her specialized background in biological sciences with the broader, management-based skills of the ESM program. She was recently promoted and considers herself fortunate to have so much responsibility this early in her career. As part of the regulatory affairs department, Williams works with support from the director of environmental safety and health to manage the environmental compliance for all of Fisher’s U.S. facilities.

Williams is part of the team charged with completing environmental audits of these facilities. “I have to know a lot of details about environmental regulatory requirements of the state and federal government and train facility managers to meet those requirements,” she said. Although the responsibilities of her position are challenging, Williams says it is also “an excellent growth opportunity.” Some of the audits she conducted were used as a gap analysis for the environmental management system Fisher began putting in place last year.

Williams is actively involved with the Bayer School of Natural and Environmental Sciences and is a member of the Center for Environmental Research and Education (CERE) Advisory Board. She feels honored to be able to provide feedback to the team that made her current job possible. “I am doing what the programs were designed to do,” she said. “I’ve used my focused background in biology and combined it with the management functions taught through ESM.”

While her career keeps her on the move, Leslie enjoys simply spending time at home with her husband. She also enjoys her pet frog, a reminder of her days in Dr. Selcer’s lab. •

— SB
Not content with limiting her learning experience to just the classroom, Rachel Klemens embarked on a remarkable journey throughout her four years at Duquesne University. Rachel, who graduated with her bachelor’s degree in biology this May, has pursued every opportunity available to expand her knowledge during her years at Duquesne. During her first two summers, Rachel joined the Summer Undergraduate Research Program at Duquesne and worked with Dr. Olushola Adeyeye, assisting with the protein analysis of cornea worm throughout her sophomore and junior year. “Dr. Adeyeye was my most influential role model at Duquesne,” Rachel remarked. “By working under his guidance, not only did I learn research techniques, but I was also able to enhance my writing and presentation skills. He really motivated me and helped me to start my career.”

Rachel interned at the Allegheny County Coroner’s Office in fall 2002, an incredible experience that helped her define her future career path. “I want to be a pathologist,” she stated. “The thing about forensics that I find most exciting is that I will get to see something new everyday. There are so many twists and turns to each case. Being able to piece evidence together to solve a crime seems like such a rewarding and interesting career.”

Research has not been Rachel’s only activity at Duquesne. Early in her freshman year, she joined the Alpha Gamma Delta sorority, eventually becoming the VP of recruitment. As one of the members, she is instrumental in raising funds for the Juvenile Diabetes charity, and she volunteers her time to Mercy Hospital. Rachel also managed to squeeze in time to participate in the Study Abroad Program, enjoying six weeks in Rome and learning some conversational Italian along the way.

Not surprisingly, Rachel would like to take a break from school following graduation. But her record suggests she will not be content to take it easy for long. “My classes and research experience at Duquesne have given me a better and more wholistic understanding of modern biological techniques and concepts,” she said. “I feel that I have adequate knowledge of the field and am prepared for my future endeavors.”

— CR

Recent Grants

Peter Castric received funding from the National Institutes of Health to complete research on Pseudomonas aeruginosa 1244 pilin glycosylation.

Jeffrey D. Evanseck and Jeffry Madura received funding from the National Institutes of Health to complete research in conjunction with Ivet Bahar at the University of Pittsburgh on a project entitled “Multiscale Dynamics of Cell Cycle Control and Apoptosis.”

Jeffrey D. Evanseck and Jeffry Madura will complete research in collaboration with Jonathan Mathews at Penn State on “Modeling of Coal and CO₂ Sequestration.” This project is funded through the Department of Energy, Phase 2, Advanced Coal Research at U.S. Universities and Colleges.

Jeffrey D. Evanseck and Steve Firestine received funding from the Commonwealth of Pennsylvania, Tobacco Money fund, to complete research on the Synthesis and Modeling of DNA Bending Agents.

Jeffrey D. Evanseck received a grant from the National Energy and Technology Laboratory to complete research entitled “Theoretical and Computational Treatments of STARBURST Dendrimers.”

Stanley J. Kabala received funding through the Growing Greener Grant Program, Pennsylvania Department of Environmental Protection, to complete work on a grant entitled “A Watershed Management System for Murrysville, Pa.: A Tool to Address Non-Point Source Pollution in the Turtle Creek and Pucketa-Chartiers Creek Watersheds.”

Stanley J. Kabala received funding from the Pennsylvania Environmental and Energy Challenge Grant Program, the Pennsylvania Consortium on Inter-Disciplinary Environmental Policy, and the Pennsylvania Department of Environmental Protection to research the Sustainability Indicators for Pennsylvania.
John A. Pollock received a grant from the National Science Foundation-Office of International Science and Engineering to direct U.S.-Australia Cooperative Research: Molecular Genetic Analysis of Normal and Mutant Visual System Development.

Monica Sorescu received a grant from the Department of Energy in support of the project entitled “Laser processing of advanced magnetic materials.”

John F. Stolz and Partha Basu received a grant from the U.S. Geological Survey-National Institute of Water Resources titled Enrichment, from the U.S. Geological Survey-National Institutes of Health. She is researching the Assessing Microbial Arsenic Reduction.

Nancy Trun received a grant from the National Institutes of Health. She is researching the molecular dissection of chromosome folding in E. coli.

**Publications**


Lampe, DJ, Witherspoon, DJ, Soto-Adames, FN and Robertson, HM (2003) Recent horizontal transfer of mellifera subfamily mariner transposons into insect lineages representing four different orders shows that selection acts only during horizontal transfer. *Molecular Biology and Evolution*, in press.


**Achievements and Recognition**

Partha Basu received tenure and was promoted to Associate Professor, effective fall 2003.

Bruce Beaver was awarded the 2003 Award for Excellence in Teaching by the Bayer School of Natural and Environmental Sciences.

Jeffrey D. Evanseck was awarded the 2003 Excellence in Scholarship by the Bayer School of Natural and Environmental Sciences.

Simonetta Frittelli received tenure and was promoted to Associate Professor, effective fall 2003.

David Lampe received tenure and was promoted to Associate Professor, effective fall 2003.

Robert O’Gara was appointed to serve on the Western Pennsylvania Conservancy Community Outreach Advisory Committee and elected to the Renaissance Hall of Fame, Pittsburgh Chapter, Public Relations Society of America.

Robert J. Oltmanns was inducted into the Public Relations Society of America’s College of Fellows.

John Pollock produced and directed the educational movie “Tissue Engineering for Life,” now playing at the Henry Buhl, Jr. Planetarium at the Carnegie Science Center.

Edward F. Schroth received the Outstanding Educator Award from Baldwin-Wallace College.

Kyle Selcer was selected to be Chair of the Education Committee for the Society for the Study of Reproduction and Program Officer for the Division of Comparative Endocrinology for the Society for Integrative and Comparative Biology.

Steve Thomas was awarded the 2003 Award for Excellence in Service by the Bayer School of Natural and Environmental Sciences.
Bone is another tissue with renewable power, and it is one that holds the most interest for Doctor at this time. “Bone is such a remarkably regenerative tissue that every ten years our entire skeleton is recycled,” he marveled, likening it to the manner in which highways are endlessly being torn up and refilled with new concrete. Our bones are constantly “under construction.”

The process may run smoothly in the life of an uneventful body, but as Doctor pointed out, “There are tens of thousands of broken bones every day.” Traditionally, surgeons have situated the broken ends, possibly with the aid of pins or even a bone graft, then allowed the body to do the rest. Through tissue engineering, Doctor and others are developing ways to give the body a helping hand.

“We have taken adult stem cells derived from bone marrow and developed them into bone making cells,” he reported. “We are looking at ways to deliver our adult stem cells into a wound site in order to regenerate bone.” Working with a team of graduate and undergraduate students, Doctor is evaluating various “biomaterials,” manufactured material that is compatible with the physiology of the human body, to develop an ideal delivery system for the cells.

“These little things are going to act like buses,” he said. “If we all want to go to Heinz Field to watch the game, the best plan would be to get on a bus here at Duquesne, get dropped off at the gate, and we would all get there together. That’s the idea. We want to put our stem cells onto the biomaterials and then plant them into the patient so they will get where they need to go.” * — LVM