Bayer School of Natural & Environmental Sciences

Spectrum

FALL 2007

From Molecules to Galaxies

Inside

From Molecules to Galaxies: About the cover

The cover of this issue of Spectrum merges two diverse images that represent the scope of research taking place in the Bayer School of Natural and Environmental Sciences. The active galaxy M82, depicted here in a composite of multi-wavelength images, points to the cosmology research of Dr. Simonetta Frittelli, chair of physics, featured on page 3 (courtesy of NASA). The molecular image, described in more detail on page 9, represents the biochemical research of Dr. Philip Auron, chair of biological sciences (courtesy of Dr. Aneel K. Aggarwal, Mount Sinai School of Medicine).

Spectrum
is published for the alumni and friends of the Bayer School of Natural and Environmental Sciences

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Dean's Message

Dear Alumni and Friends,

Welcome to the fall 2007 edition of Spectrum. Within the following pages, you will discover some of the many ways in which faculty, staff and students in the Bayer School of Natural and Environmental Sciences are advancing the legacy of excellence in science education and research at Duquesne University.

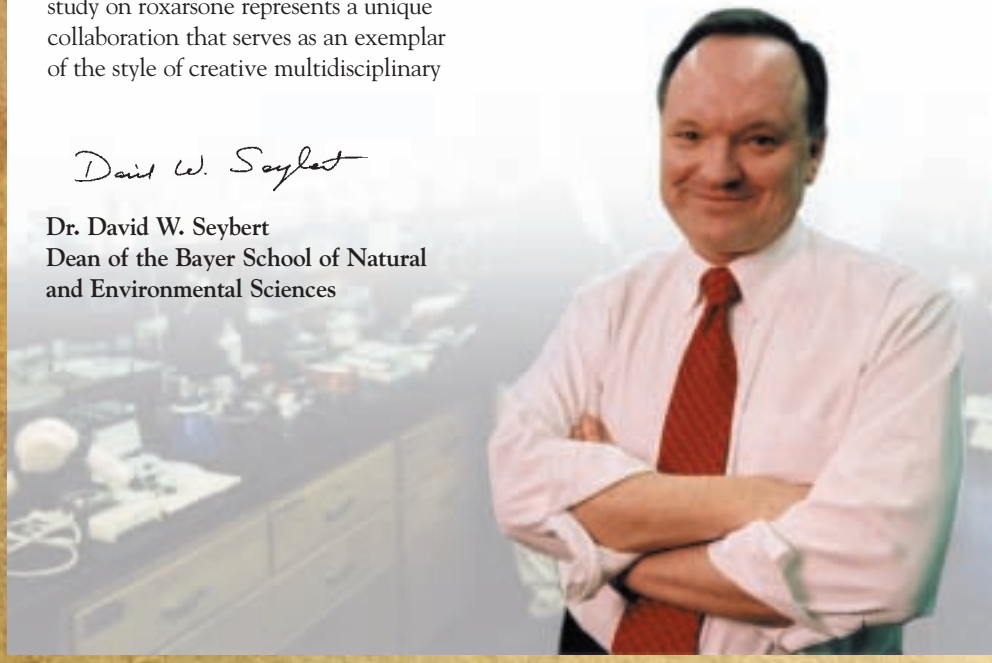
We welcome Dr. Philip Auron and Dr. Simonetta Frittelli as Chairs of Biological Sciences and Physics, respectively, and we look forward to their leadership in moving these programs to even higher levels of prominence. Our faculty continue their remarkable success in securing research and educational grants that continue to build and enhance the educational and research infrastructure of the University. The new NMR spectrometers enhance the infrastructure to support research ranging from structural studies of synthetic polymers to studies which explore the molecular basis of one of the most common inherited forms of mental retardation. The feral cat project, conducted by Drs. Trun, Morrow, and Ludvico, exemplifies the intersection and union of research, education, and outreach that embodies our mission in the Bayer School. The study on roxarsone represents a unique collaboration that serves as an exemplar of the style of creative multidisciplinary research that is becoming increasingly frequent in the Bayer School, where productive overlap of creative minds leads to significant new discoveries.

We note with sadness the loss of our long-time friend and colleague, Dr. Theodore (Ted) Weismann, and we will miss his remarkable dedication to students. At the same time, we celebrate the "official" retirement from the University of Dr. Heinz Machatzke, founding Dean of the Bayer School and recent Vice President for Research. I emphasize "official" since Dr. Machatzke continues to be actively engaged with many of our ongoing initiatives, particularly our collaboration with the University of Cologne.

The generosity and vision of Mr. Crable's bequest highlights the lasting impact that such a gift can exert on current and future generations of students. As we eagerly anticipate the coming years of what promises to be a bright future for the sciences at Duquesne, we look to you for your support. I want to thank each of you for your uncommon generosity, for your past and your future support, and I encourage you to explore the many ways in which you can help to sustain and enhance the supportive environment that enables us to realize our vision of preparing tomorrow's scientific leaders.

David W. Seybert

Dr. David W. Seybert
Dean of the Bayer School of Natural and Environmental Sciences



Conditions are right for growth in physics

By Lisa Mikolajek Barton

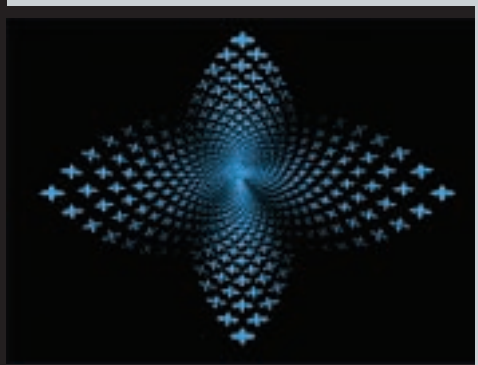
When Dr. Thomas R. Davies, professor of physics, teaches his upper-level course in chaos, he stresses the importance of "sensitivity to initial conditions." For example, two almost identical weather patterns, with very slight differences at the outset, could lead to drastically different conditions one week later.

Professor Davies, chair of the physics department since 1993, has passed the leadership of the department to Dr. Simonetta Frittelli, an associate professor who has taught at Duquesne University since 1995. She is the first female to chair a department in the natural and environmental sciences at Duquesne.

According to Frittelli, she assumed her new role at a time when conditions are ideal for growth in the department, and she gives the credit to Davies.

"Dr. Davies has made the department what it is today," she said in summer 2007, when her appointment became official. "Not only are our programs excellent, but we have excellent faculty teaching them. We are now in the perfect position to take the department to the next level."

Frittelli appreciates the mentoring she has received from Davies during the transition. While no longer chair, Davies will continue advising students and teaching courses. The course in chaos is one he introduced, along with a course in elementary particle physics that he teaches.



Fractals (left) are forms of beauty derived from mathematical equations used in chaos theory.

A third course, "Big Bang and Beyond," was created by Frittelli at his charge. This popular course, designed for non-majors, has earned its place in the new University Core Curriculum.

Besides new courses, there is virtually no part of the physics curriculum that does not bear the mark of Davies' careful construction. "What I've accomplished in my time that I am most proud of are the changes we've made to the curriculum," he reflected. "The program for our physics majors is comparable to programs found at larger institutions."

The capacity for research in the department also increased significantly during Dr. Davies' tenure as chair. "I really admire this department for doing research at the same level that big departments do," Frittelli stated.

Frittelli's current research is revving up with the opening of LIGO—the Laser Interferometer Gravitational-Wave Observatory. These $300 million facilities built by the National Science Foundation are capable of detecting the gravitational waves in space that were first predicted by Albert Einstein in 1918.

The waves, which theoretically originate in the collision of black holes, would be very dim by the time they reach our solar system. The powerful LIGO will be able to detect them—with the help of theorists like Frittelli, who are developing complicated mathematical equations to predict the shape of the waves.

Davies hopes to conduct more research himself now that he has shed many of his administrative responsibilities, but his primary reason for staying on the job is his love of teaching. That is what originally brought him to Duquesne. Before he was recruited as chair, he worked for 30 years in Oak Ridge National Laboratory, performing basic research in the areas of low- and intermediate-energy nuclear physics.

Dr. Simonetta Frittelli (right) was elected the new chair of the physics department after Dr. Thomas R. Davies (left) stepped down in summer 2007.

"I had always wanted to get back into teaching since my days in graduate school," he said. He has no regrets about the dramatic change of direction in his career. "Teaching has been the best part of being here," he said.

Frittelli's vision for the future of physics at Duquesne includes a continued commitment to teaching and research—a firm foundation from which she plans to build. By raising awareness about the program's unique strengths, she hopes to make it available to more students than ever before.

"Our curriculum and our faculty are outstanding, but our programs are not very well known," she said. "I want potential students to know that they are not shortchanged when they come to Duquesne for physics; on the contrary, they have all the benefits of a small department without any of the disadvantages."

Dr. Heinz Machatzke retires*

*Again

By Lisa Mikolajek Barton

After a successful career as an industrial researcher and corporate executive, Dr. Heinz Machatzke found "a nice, part-time retirement job" at Duquesne University. Dr. Richard White, one of his colleagues from the Bayer Corporation and then university board chair, asked Machatzke to serve as Industry Science Advisor, applying his expertise to strengthen the school's science programs.

Machatzke retired again on June 30, 2007, after more than 17 years of visionary leadership that eventually made him the founding dean of the Bayer School of Natural and Environmental Sciences and the first Associate Academic Vice President for Research at Duquesne University. When he began working at Duquesne, he did not imagine that his innovative recommendations would eventually undo his original retirement plans.

"I thought, 'This is a nice retirement job, as long as it doesn't take that much time and I can do something that is fun,'" the German-born chemist recalled with a chuckle. Although Machatzke invested more time than he expected, his years at Duquesne delivered on the fun. "It was a superb experience," he said. "In hindsight, I didn't want to miss that."

After serving as an advisor, dean and associate academic vice president of research, Dr. Heinz Machatzke has successfully retired.

The sciences needed focused leadership

Machatzke began his work in 1989 by meeting with the faculty to assess their needs. "The sciences at Duquesne were in very bad shape," he stated; faculty had neither the funding nor the instrumentation to do any significant research.

At that time, biology, chemistry and physics were three small departments in the former College of Arts and Sciences. The disadvantage of this arrangement was evident to Machatzke. "There was no guidance," he explained. "The dean of the college was taking care of some 14 other departments. There was no way to set goals or priorities." Machatzke's business experience informed him that the sciences would never flourish on the sidelines.

"I proposed that in order to make progress, first of all the sciences needed focused leadership," he continued. The surest means to do so would involve building a separate science unit, an idea he recommended the first day on the job. The college faculty, however, could not conceive of such a split in the traditional union of the humanities. Machatzke's best idea was swiftly rejected and soon forgotten—or so he thought.

Undeterred by the slow-moving wheels of an academic institution, Machatzke used his business savvy to succeed against the odds. "Organization is not the crucial point," he explained. "You can manage things in any kind of organization, as long as you have a real goal and the people are willing."

In four short months, Machatzke and a small group of faculty drafted a five-year plan. A mere 13 pages, the goals outlined in this spare document became the foundation of success for the sciences at Duquesne. Over the next five years, the sciences were struck by a perfect storm of opportunities, including $2 million in funding and an influx of students. The previous dean of the college departed, and Machatzke's radical idea suddenly seemed quite reasonable.

Unbeknownst to Machatzke, the late former provost, Dr. Michael Weber, talked to the faculty about making him the first dean of the new Bayer School of Natural and Environmental Sciences in 1994. When former president, Dr. John E. Murray, Jr., sprang the idea on Machatzke, he told him the faculty had responded with "overwhelming support."

How could he refuse? "This was my idea in the first place," Machatzke said, "and these were great people to work with. So I accepted it, and I've been here ever since."

Researchers should concentrate on research

History seemed to repeat itself again in 2000, when the current dean, Dr. David W. Seybert, was appointed. Retirement was the plan, but once again Machatzke was faced with the timely success of another good idea.

He had observed that research at Duquesne was tied up in red tape. "When someone wanted to apply for a grant, they needed more than 10 signatures!" he exclaimed. In the 1990s, academic researchers also came under greater scrutiny to follow government regulations related to animal care and human health and safety. Furthermore, researchers were discovering

(Continued on page 14)

By Kasey Clawson

Researchers uncover the dangers of arsenic in chicken feed

Roxarsone, an organic arsenic compound, has been added to chicken feed since the 1960s to increase growth rate and produce meatier chickens. But researchers at the Bayer School of Natural and Environmental Sciences have found that these bigger chickens may carry a hidden threat to public health.

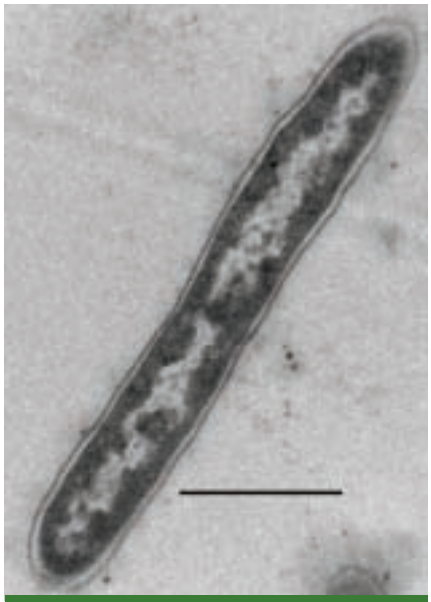
Organic arsenic passes through the chickens virtually unchanged, ending up in their litter, which is often used as fertilizer in farm fields. The organoarsenic compound present in the chicken litter eventually converts into more mobile, inorganic arsenic.

Dr. Partha Basu, associate professor of chemistry and biochemistry, and Dr. John F. Stolz, professor of biological sciences, have discovered that this chemical transformation could transpire much more rapidly than formerly thought, even in as little as three days. This means that roxarsone could be transforming into inorganic arsenic during its use as fertilizer, posing environmental and health concerns that roxarsone and its metabolites could contaminate surface water run-off and permeate groundwater drinking reserves.

"People have the perception that while inorganic arsenic is toxic, organic arsenic is somehow okay," commented Stolz. However, their findings show that bacteria in chicken litter, *Clostridium*, can make organic arsenic toxic under anaerobic conditions.

Stolz and Basu's findings lead to feature articles in several publications, spanning from the first reporting in the publication *Environmental Science & Technology* in early 2007 to *Chemical & Engineering News*, *The Baltimore Sun*, the *Pittsburgh Post-Gazette* and even an interview on local news station KDKA.

According to U.S. Department of Agriculture inventory charts, a staggering 8.8 billion broiler chickens are produced annually, with 70 percent being fed organic arsenic.



Organic arsenic fed to chickens is converted to the toxic variety by *Clostridium* in the fowls' intestines. Pictured here, a transmission electron micrograph of *Clostridium oremlandii* strain OhILAs, courtesy of Jonathan Franks.

Chronic exposure to inorganic arsenic can cause cancer, diabetes, tumors, and heart disease. But the difficulty in proving roxarsone's association with these health problems is that there is "no direct connection yet between arsenic in chicken feed and arsenic in drinking water," Stolz explained.

This is the same contention that the Food and Drug Administration holds for dismissing research on this subject. There is "no real data to suggest that there have been any adverse health effects in humans" from roxarsone in chicken feed, argued FDA spokesman Mike Herndon.

Stolz noted the publicity created by their study and other reports about toxic amounts of arsenic in drinking water make the timing ripe for this investigation to be reconsidered by the FDA. "Contamination from run-off has been going on for 30 to 40 years in Bangladesh, and the problem came to the forefront only recently," he said.

Over the past ten years, millions of people have become sick from Bangladesh's drinking water, which may also be the cause of as many as 3,000 deaths annually. In 2002, scientists at Massachusetts Institute of Technology assessed that groundwater in Bangladesh has been chemically altered through the transformation of organic carbon by bacteria. They speculated that arsenic is being drawn into the aquifers of family wells due to rice crop irrigation that began several decades ago.

Basu and Stolz continue their research, which began over three years ago. Basu's next step leads to a pairing with Duquesne University's Mylan School of Pharmacy faculty to uncover the mechanism by which arsenic and roxarsone interact in cells. Stolz is examining how microbes present in gut flora of mice deal with arsenic.

"We hope to find the direct association between inorganic arsenic in chicken feed and water contamination," Stolz explained. The professors believe that this finding could finally force the FDA to take notice of a potential peril. ■

Feral cat study

incorporates service learning

By Katie Jones

Faculty and students in the sciences have "adopted" a special population of cats—not as animal companions, but as subjects of research and rescue.

Although they can be described as common house cats *(Felis catis)*, most of these felines have never experienced the comforts of home. Known as feral cats, they have reverted back to a wild state because of various factors, including abandonment and human neglect. While skittish of human contact, they are a sadly familiar sight near farms, in suburbia, and throughout city areas.

In August 2004, Dr. Lisa Ludvico, assistant professor of forensic and biological sciences, Dr. Becky Morrow, assistant professor of biological sciences and veterinarian, and Dr. Nancy Trun, associate professor and microbiologist, partnered with the Homeless Cat Management Team (HCMT). This Pittsburgh-based, non-profit organization sterilizes feral cats, in an attempt to limit population numbers.

The process, commonly called TNR (Trap, Neuter, and Return), is a highly structured and detailed routine. After volunteers bring the animals to a participating clinic, the feline is anesthetized while still in the humane trap, so that there is no handling of the wild cat. Morrow, along with other veterinarians, administer a general physical and complete the spay/neuter surgery. The cats are also "ear tipped," in which a small section of the ear is removed, thereby designating the cat as a participant in the program, and preventing recapture and unnecessary anesthesia.

Post-surgical steps include providing doses of flea medicine, antibiotics, rabies vaccinations, or any other ancillary medications to the unconscious animal. After recovering from surgery, the cats are monitored closely every fifteen minutes, and finally released back to their natural habitat—this step is critical to preventing overpopulation so that no other cats migrate into a vacated area.

The scientific gains from this project are fascinating. Duquesne University professors and students are able to utilize clinical samples across a variety of classroom discussions and laboratories. Ludvico has been processing DNA from the ear tips of these animals with the hope of obtaining a complete genetic profile. "Studying this information will help us to find out the colony compositions, discover colony kin relationships, and study the social dynamics of these animals through genotyping," she explained.

Students uniquely benefit from this project at the service learning level. Morrow says, "We have about ten student volunteers who check the cats in, assist with the sample collection and ear tipping, and monitor the recovery areas." Students enrolled in Morrow's Mammalian Physiology course who do not actively participate at the clinic are asked to design a brochure on overpopulation or research the cost of owning a pet. Biology majors may also choose to take a semester-long Superlab course taught by Trun that focuses on the microbes carried by feral cats and compares them to the microbes found on client-owned cats.

As service learning becomes increasingly required at the University-wide level, this project provides a great opportunity for students to actively help the cat population and educate the community. The National Science Foundation recently awarded a grant of $205,969 to Ludvico, Morrow, and Trun in support of the project, entitled "A Model for Incorporating Application-Based Service Learning in the Undergraduate Science Curriculum." The funding will allow all involved in the feral cat project to continue their research in laboratories, classrooms and veterinary clinics. ■

Students can observe the procedure as it is performed by Dr. Becky Morrow, a doctor of veterinary medicine.

Dr. Lisa Ludvico helps prepare a feral cat for spay/neuter surgery.

NMR upgrades accelerate research

By Lisa Mikolajek Barton

Duquesne University researchers who explore the structure of molecules are able to see their samples in ways not possible before. The new capabilities are due to significant upgrades in the nuclear magnetic resonance facility, including a new 400 MHz Bruker NMR and a new Bruker console for the existing 500 MHz Varian NMR spectrometer, with a total estimated value of half a million dollars.

Installed in spring 2007, the new and improved equipment was made possible by a $383,756 award from the National Science Foundation. Dr. Fraser. F. Fleming, professor of chemistry and biochemistry, was the principal investigator on the grant. He was joined by three other chemistry department colleagues as co-PIs: Dr. Partha Basu, associate professor; Dr. Rita Mihailescu, assistant professor; and Dr. Tomislav Pintauer, assistant professor.

When a sample is characterized by nuclear magnetic resonance spectroscopy, the nuclear spin, which can be thought of as a small magnetic field, is aligned with the powerful field of the NMR magnet, yet at the same it is influenced slightly by neighboring nuclei. The result is a spectrum with peaks and valleys that contain information about the molecules in the sample.

Pintauer described how the upgrade has enabled him to structurally characterize metal complexes that serve as catalysts in the synthesis of new compounds. "In our research, we heavily rely on the NMR machines, because we need to characterize the products very carefully," he said. "Often when you have a low-field NMR machine, the peaks overlap, so you can't see all of them exactly the way they are supposed to look. When you increase the magnetic field, the peaks spread out, and you have a much better idea of exactly what is there."

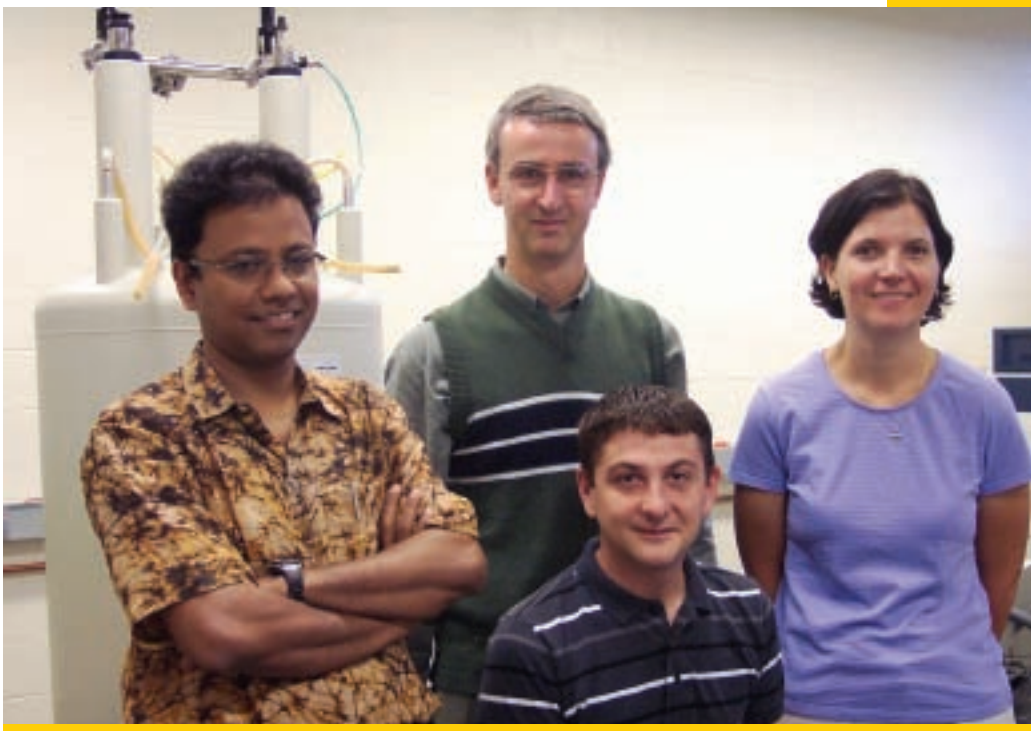
Mihailescu uses two-dimensional NMR, one of the enhanced capabilities made possible by the upgrade, to observe her molecules in even greater detail. "In 2-D NMR, you not only look at the peaks, you also look at cross peaks for any two interacting protons," she explained.

Multi-dimensional NMR is critical in Mihailescu's work with the Fragile X mental retardation protein, the absence of which leads to Fragile X Syndrome, the most common form of inherited mental retardation. By learning more about the structure of this protein and the location where it binds to RNA, it might be possible to mimic its function, leading to a potential therapeutic. "We use a whole array of biophysical techniques," she noted, "but the one that gives you the high resolution information about the structure of the protein is NMR spectroscopy."

In addition to enhancing the power of the equipment, the upgrade has also accelerated its speed. Pintauer said, "In the older machines, typical procedures would take between five and six hours just to do one sample. With the new machine, it's fantastic, because in 20 minutes you can do the full NMR characterization for any compound that you have."

While the new 400 MHz NMR features more power and speed than the 300 MHz model it replaces, the new console for the 500 MHz NMR should increase reliability and eliminate the frequent downtime that occurred when the obsolete operating system required repairs. In addition to the principal investigators, Duquesne University's NMR facility is used by two faculty in the Mylan School of Pharmacy and up to 30 graduate students. Undergraduate chemistry majors also use it on a regular basis.

Despite the increasing demand for magnet time, the many users of the Duquesne University NMR facility are fortunate to have two of these elite instruments at their disposal. As Fleming noted, "We now have a really excellent facility compared to other schools of our size." ■



The National Science Foundation grant for upgraded NMR facilities was awarded to chemistry faculty (from the left), Dr. Partha Basu, associate professor; Dr. Fraser Fleming, professor; Dr. Rita Mihailescu, assistant professor; and Dr. Tomislav Pintauer, assistant professor (seated). The group gathers by the 400 MHz Bruker NMR, which replaces a 300 MHz model.

Auron's laboratory is equipped with a new confocal microscope that can be used to observe the molecular events that take place within living cells.

Biomedical researcher tackles the challenges of chair

By Lisa Mikolajek Barton

Dr. Philip E. Auron

Sometimes it is good to be sick. While a mother anxiously monitors her feverish child, a flurry of exchanges are taking place among the cells in the child's body as chemical signals set off a chain of physiological events. While the child's rising temperature may cause alarm, fever is a sign that the body is waging war against unwelcome invaders.

The biochemical pathway of fever and inflammation is traveled by cytokines, molecules sent out as messengers from one cell to another. This particular pathway and its messengers are the chief interest of Dr. Philip E. Auron, professor and chair of biological sciences.

Auron arrived at Duquesne University in August 2006, bringing nearly 30 years of experience in ground-breaking biomedical research. His stellar career began as a post-doctoral fellow at the Massachusetts Institute of Technology, where in 1983 he was part of the group that was awarded the original contract to establish a government database of DNA sequences. Somewhere in his closet, Auron jokes, he still has the giant tape that represents the humble beginnings of the now-famous GenBank.

Auron, a native of Wilkes-Barre, Pennsylvania, remained in the Boston area for the next two decades, going on to work at Tufts University, where his research group identified a molecule that is central to the inflammatory response—and Auron discovered the focus of his life's work.

A mysterious messenger

"Fever is usually a response to a bacterial infection," Auron explained. "Bacteria have molecules on their cell membranes that are recognized by receptors in your macrophages. When a bacterial cell comes into your body, it triggers these receptors, called Toll-like receptors. The macrophages respond immediately and turn on a collection of genes, which code for cytokines that are released and trigger other cells. It's analogous to waving a red flag and crying, 'We're being invaded! We're being invaded!'"

Acting as first responders, these cytokines activate the T-cells and antibody-producing B-cells of the immune system, and also send signals to the hypothalamus in the brain, which in turn responds by causing fever in the body.

When Auron began to study the inflammatory response, scientists knew what was happening, but they did not know the chemical messenger that was responsible. "Originally, it was just an activity," Auron explained. "We knew there was a fever protein, and there were all this protein's activities, but it was never seen as a molecule. What I set out to do, as a biochemist, was to find out what the molecule was."

Before anyone had seen it, it was named *Interleukin 1*. "Medical doctors and physiologists had been working on it, but I approached it as a biochemist,

and that is how I found it," Auron said. "I tackled it with everyday techniques in biochemistry and quickly realized that it was a specific molecule."

A 'Pillar of Immunology'

Fever and inflammation are excellent weapons against the bacterial invaders. "Fever is bad for the bacteria, because they don't want too high of a temperature, and it's good for the immune system, because it boosts T-cell and B-cell division and increases antibody production," Auron explained. "It's all positive—as long as it is acute and only lasts a short time."

In some cases, however, the normal inflammatory response is out of control, resulting in chronic inflammatory diseases such as rheumatoid arthritis. Instead of attacking foreign invaders, the body eventually attacks itself, as the chronic inflammation breaks down tissues. Over time, the effects are debilitating.

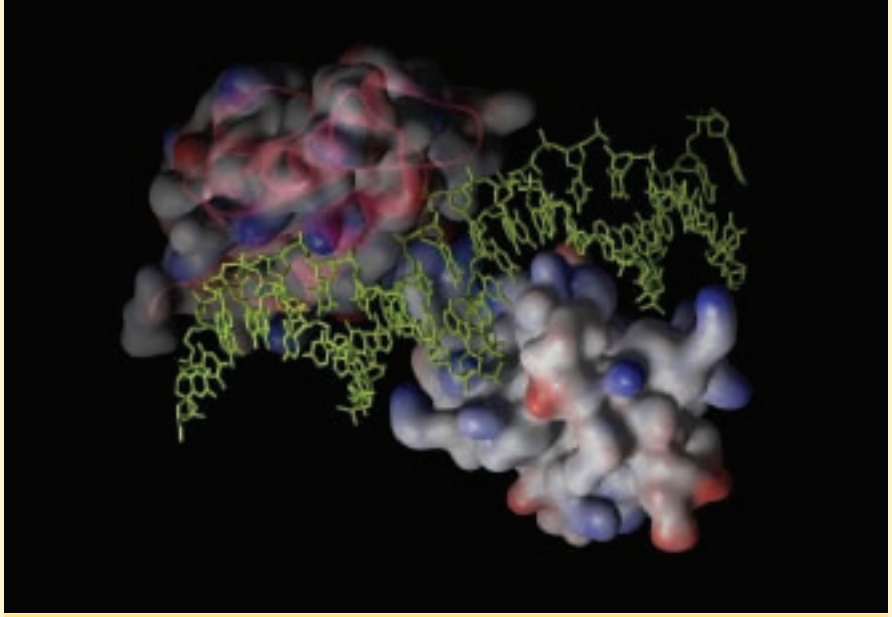
When Auron's group isolated human interleukin 1 (IL-1) and reported their findings in 1984, they heralded a revolution in the understanding of the inflammatory response—and new possibilities for the treatment of inflammatory disease. The Journal of Immunology recently honored Auron's original publication as a "Pillar of Immunology," in a series that revisits seminal papers that have profoundly impacted the field.

"The cloning of IL-1 has stimulated over 20 years of research and unique discoveries, with more than 40,000 reports published on IL-1 during this period. Of the multiple and diverse biological activities of IL-1, some have had a major impact on disease pathogenesis," the journal reported.

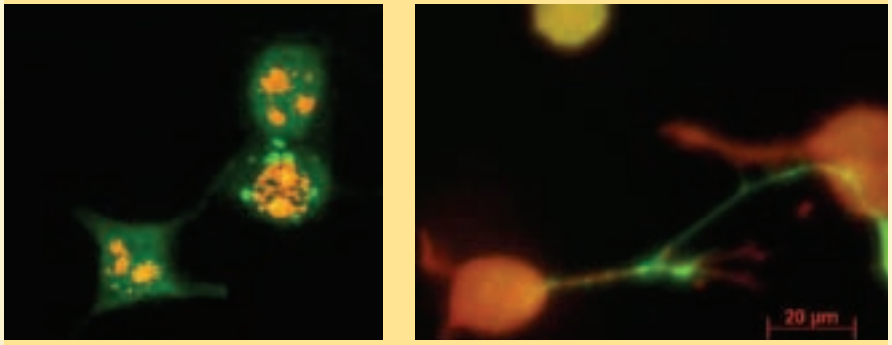
A strong desire to teach

Auron continued his research for 13 years at the Harvard School of Medicine. He and his family relocated to Pittsburgh in 2002 when his wife, a junior researcher in a related field, was hired as an assistant professor at the University of Pittsburgh. Auron also served there as a professor of molecular genetics and biochemistry, until Duquesne University caught his attention with a national search for a biology chair.

Like many of his colleagues in the Bayer School of Natural and Environmental Sciences, Auron was drawn to Duquesne by a strong desire to teach. In the medical school environment, he noted, teaching is peripheral because the focus is on research funding. The balanced commitment to teaching and research in the Bayer School has been a welcome change.



Molecular model of a complex formed between Spi-1/Pu.1 (upper left translucent surface) and IRF (lower right opaque surface) transcription factor proteins bound to DNA (yellow sticks). The formation of this sort of structure was recently reported by Dr. Auron's laboratory to be a likely component for expression of the interleukin 1beta (IL-1β) gene in response to bacterial infection (S. Unlu, et al., Molec. Immunol. 44:3364-79,2007). The molecular model was generated with a program from Accelrys Software, Inc. and X-ray diffraction coordinates kindly provided by Dr. Aneel K. Aggarwal of the Mount Sinai School of Mecine, New York, NY.



Left Panel: TRAF6, an intracellular molecule that mediates the activities of IL-1, is localized to structures within the cytoplasm of cells (green dots), and not to the nucleus (red structures) following transfer into kidney cells. **Right Panel:** Dr. Auron's laboratory has reported that overexpression of TRAF6 in kidney cells can result in the growth and interaction of axon-like structures (green), similar to those found in neurons (K.Z.Q. Wang, et al., J. Cell Sci. **119**:1579-91, 2006). This may be an important observation for tissue engeineering and nerve injury repair.

The spirit of camaraderie in the department of biological sciences was another strong draw. "They are fabulous," Auron said of the faculty. "They are a family, and students benefit from that. Students experience the personal interaction, and they feel they are becoming a part of that family."

The caliber of students at Duquesne also impressed Auron, another factor in his decision to try something distinctly different from what he had done before.

'We've accomplished a lot'

The position of chair comes with its share of administrative challenges. Since his arrival, Auron helped to complete the department's transition to an all-Ph.D. program, a strategic move that is designed to increase the output of scholarly research. "When graduate students are with us for four or five years, there is more consistency, and hopefully they can get to a higher level of productivity and competency in that period," Auron explained.

Although he never had the honor of meeting them, Auron experienced the impact of losing two highly responsible faculty members—Dr. Ed Weisberg, former graduate coordinator, and Dr. John Doctor, former undergraduate coordinator and interim chair, both died unexpectedly in 2005. Fortunately, others have stepped

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forward to assume new roles. "Dr. Joe McCormick has been absolutely instrumental in helping me get through this first year," Auron said. McCormick, who was interim chair when Auron was hired, is the new graduate coordinator; Dr. Lisa Ludvico serves a similar role for undergraduate matters.

In August 2007, the department filled one of the vacancies left by the deceased faculty. Dr. W. Bruce Sneddon, assistant professor of biological sciences, is an expert in kidney physiology and molecular biology. Together with Auron, he brings a stronger biomedical focus to Duquesne.

Looking back over his first year as chair, Auron was able to admit, "We've accomplished a lot."

'Just the beginning'

Due to the complexity of IL-1 and its pathways, Auron's research has branched off in many fascinating directions over the years. One such direction involves the intracellular signaling protein TRAF6, which mediates Toll-like and IL-1 receptor activities by activating gene expression via transcription factors like Spi-1. Auron observed that in a field of vast potential, the greatest challenge may be one of focusing his research.

"Over the many years since 1982, we've been very interested in all the aspects of the inflammatory response, because we were there through all the seminal discoveries, whether on the periphery or finding them ourselves," Auron said of his research group. "We're committed to trying to understand the details of this mechanism, because the more we know about it, the more of a handle we have on designing inhibitors." The ultimate goal is the development of therapeutics that cut off the damaging action of chronic inflammation, with fewer side effects than currently available medications.

After surveying the many paths of research that emerged from the isolation of IL-1, Auron recounted an interesting exchange he had with a colleague shortly following his initial discovery in 1984. "He was thinking of quitting the field, and he said, 'Now that you've done this, what are you going to do with the rest of your life? It's all over.'"

Auron responded, "I think this is just the beginning." ■

Save the Date!

Darwin Day 2008

Evolution and the Law

February 8, 2008

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Honorable John Jones III
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Darwin Day described

"Making of the Fittest"

In the past, biologists have primarily relied on the fossil record to study evolution. Today's investigators can access a rich store of information that is contained in every living thing—DNA.

In *The Making of the Fittest: DNA and the Ultimate Forensic Record of Evolution*, Dr. Sean B. Carroll addresses how animals continue to evolve by making accidental genetic mutations a permanent part of a species' DNA if a trait helps ensure survival. Carroll, professor of molecular biology genetics and medical genetics at the University of Wisconsin-Madison, was the featured speaker at the annual Darwin Day lecture on February 9, 2007.

Sponsored by the Bayer School of Natural and Environmental Sciences and the Department of Biological Sciences, the event brings in distinguished guest speakers to promote a better understanding of evolution, and is scheduled each year around the February 12 birthday of Charles Darwin.

Carroll has analyzed DNA to determine how new animal species develop and evolve. In fact, he has found evidence that most of the world's animals evolved from a common ancestor—a primitive, worm-like animal—whose DNA had the potential to grow appendages, such as legs, arms, claws and fins.

Carroll is also an expert in the emerging science of "evo devo"—the evolution of development—which explores possible connections between a creature's development from an embryo to its final adult form and the process of evolution. His most recent book is *Endless Forms Most Beautiful: The New Science of Evo Devo and the Making of the Animal Kingdom.* ■

Bayer School faculty lead habitat restoration project

By Kasey Clawson and Lisa Mikolajek Barton

Murphy's Bottom, located along the Allegheny River in Armstrong County, has become the site of biological study for a number of faculty and students at the Bayer School of Natural and Environmental Sciences. The 100+ acres of open fields, woods, wetlands and pond have the potential to become an outdoor classroom for the school.

Once the site of surface mining, Murphy's Bottom has been proposed as a habitat restoration project by the Pennsylvania Department of Environmental Protection (DEP). According to Bob Volkmar, interim director of the Center for Environmental Research and Education (CERE), companies that receive permits to perform dredging are required to perform habitat restoration elsewhere. "Creation of relatively scarce river backwater habitat at Murphy's Bottom provides a unique opportunity to both enhance the habitat through physical changes and monitor the subsequent biological effects of those changes," Volkmar said.

In 2006, the DEP approached representatives of the Bayer School about assisting in the proposed Murphy's Bottom Ecological Project. Central to the restoration is studying the habitat's long-term ecological transformations. As recently retired DEP biologist Tom Proch said, "It is imperative that a project of this scope include provisions for studying the changes in fish, amphibians, reptiles, invertebrates, birds and vegetation that occur over time."

Dr. Brady Porter, assistant professor of biological sciences and adjunct professor for CERE, has coordinated a series of baseline biological inventories, in which samples of plants and animals are collected and catalogued, to define the species and biological communities at the site. These inventories must be completed prior to implementing habitat modifications.

In November 2006 and May and August 2007, Porter enlisted other Duquesne faculty and student volunteers, as well as partners from the Carnegie Museum of Natural History, the Western Pennsylvania Conservancy, the National Aviary and other organizations, to perform the initial fieldwork.

On a larger scale, such an inventory is popularly known as a "BioBlitz." Many

(Continued on page 16)

Bayer School students sample fish and aquatic wildlife during a biological inventory at Murphy's Bottom.

Generous gift funds Crable Fellowship

By Lisa Mikolajek Barton

Lauren Marbella, one of the first recipients of the Crable Fellowship, presented her research at a poster session during Duquesne University's Undergraduate Research Program in Summer 2007.

The late John V. Crable received his B.S. in chemistry from Duquesne University in 1949. Although he had no children to whom he could bequeath his estate when he passed away in 2001, many young people will benefit from his generosity. His gift of half a million dollars has been used to create an endowment that funds The John V. Crable Fellowship for Undergraduate Scholars.

Established in 2006, the fellowship is awarded annually to four junior and senior honors students pursuing a degree in chemistry or biochemistry. Crable Fellows receive $3,000 in tuition assistance, $500 for travel to national conferences, and $500 for spending on thesis preparation, books, and other class or research materials, per year. Juniors, who also receive a $3,000 stipend for summer undergraduate research following their junior year, are eligible for a second year of support if they meet the criteria for continuance.

As honors students, Crable Fellows must maintain a minimum overall average of QPA of 3.2, with a minimum QPA of 3.5 in their major studies. Honors chemistry students must complete at least two semesters of undergraduate research, and perform additional research necessary to write a thesis, which they defend in the senior seminar. They must also present their research in a poster at a professional meeting. The Crable Fellowship was created to support the students who pursue this challenging path.

"This award has meant a great deal to me," said Lauren Marbella, who is pursuing her bachelor's in biochemistry and master's in forensic science and law. Marbella was among the first four students to receive the award in 2006. "The award has guaranteed me an undergraduate career in research, and provides funds so that I will be able to write a successful thesis by my senior year." Marbella plans to use her travel stipend to attend the national meeting of the American Chemical Society at New Orleans in April 2008.

Lauren Matosziuk, another one of the first Crable Fellows, used her travel stipend to attend the ACS national meeting at Chicago in March 2007, where she presented her research on copper catalyzed cyclopropanation. "The scholarship money has let me put more focus on doing research instead of worrying about a part-time job to pay for school," said Matosziuk, who plans to receive her B.S. in Chemistry in 2008.

During his lifetime, Crable was involved in research for the National Institute for Occupational Safety and Health, including an analysis of pollutants in the lungs of coal miners, as well as the quantitative determination of quartz in airborne coal dust by infrared spectroscopy. He was also editor of *Methods for Biological Monitoring: A Manual for Assessing Human Exposure to Hazardous Substances*, a volume published by the American Health Association in 1988. ■

In Memoriam: Theodore "Ted" Weismann

The Bayer School of Natural and Environmental Sciences lost a dear friend on June 6, 2007, when Theodore "Ted" Weismann died at age 77. Weismann, who received both his bachelor's degree and Ph.D. in chemistry from Duquesne University, had served as an adjunct professor in the department since 1982.

Weismann was an avid mentor of young chemists, which was evident during his 25 years as coordinator of Student Affiliate activities for the Pittsburgh Section of the American Chemical Society (ACS). Under his leadership, the Duquesne Student Affiliates won 18 ACS Outstanding Chapter Awards.

"Dr. Weismann had the unique ability of recognizing special talents in young people and encouraging them to pursue a career in chemistry," said Dr. Paul Johnson, assistant professor of chemistry and biochemistry. According to Johnson, Weismann directed the research of more than 60 undergraduate students, keeping in touch with many of them as they moved on to successful careers. Some of them returned to speak on his behalf when he won the prestigious ACS Pittsburgh Award in 1999.

Weismann entered teaching in 1982 after he retired from an outstanding career at Gulf Research and Development Company, where he had been the manager of the Geochemistry and Minerals Department. He had only been at Duquesne for a short time when he suffered his first stroke, but its debilitating effects did not slow him down; Weismann remained active throughout the next 25 years.

"His colleagues simply called him 'Ted,'" Johnson recalled of Weissman. "When you mentioned the name at an ACS function, everyone knew who you were talking about. No last name was necessary."

Although his presence will be missed, Weismann's legacy survives in the achievements of the many chemists whose careers he influenced. The chemistry department recently established a fund in memory of Weismann to benefit students. Gifts may be sent to the Bayer School of Natural and Environmental Sciences, 100 Mellon Hall, Duquesne University, 600 Forbes Avenue, Pittsburgh, PA 15282. Please make checks payable to Duquesne University. ■

Memory of John Doctor gives life to new initiatives:

Donations support memorial prize, equip conference room

By Lisa Mikolajek Barton and Rose Ravasio

More than two years after the unexpected death of John S. Doctor in October 2005, generous gifts made in his memory are giving life to new initiatives in the Bayer School of Natural and Environmental Sciences.

Duquesne University and the Bayer School of Natural and Environmental Sciences have partnered with The Pittsburgh Tissue Engineering Initiative in establishing the Dr. John S. Doctor Memorial Prize for Scientific Leadership to perpetuate the legacy of the beloved associate professor of biological sciences. PTEI has committed a $50,000 gift which, combined with donations to the Dr. John S. Doctor Memorial Fund, will create an endowment to support the prize.

The annual award will be presented to an individual of national and/or international renown whose contributions have lead to notable advances in tissue engineering and/or regenerative medicine, which were Doctor's areas of expertise. Recipients will be invited to Duquesne University to participate in an awards ceremony, deliver a plenary lecture and meet with students, faculty and staff.

Dr. David Seybert, dean of the Bayer School, met with PTEI executive director Alan Russell to discuss how the organization might recognize the many contributions of Doctor, who had represented Duquesne University on the PTEI board of directors. They developed the award in consultation with Dr. Mary Alleman, Doctor's widow and associate professor of biological sciences.

"This is certainly more than a fitting tribute," Seybert remarked when the award was announced in November 2006. "John's spirit will live on through this award."

Doctor's commitment to excellence in teaching and research also lives on in the department where he mentored and taught hundreds of students. On Nov. 17, 2006 the department dedicated the John S. Doctor Memorial Conference Room in Mellon Hall 202. His former students initiated the project to equip the recently renovated conference room with bookcases that contain items donated by students, colleagues and friends. Their efforts were organized by the Tri-Beta Biological Honor Society, with assistance from the Physical Therapy Student Association and the Pharmacy Student Association.

Dr. Charles J. Dougherty, president (left) and Dr. David W. Seybert, dean (right) joined Dr. Mary Alleman, associate professor of biological sciences, at the dedication of the John S. Doctor Memorial Conference Room.

Former students of John Doctor initiated the project to equip the John S. Doctor Memorial Conference Room.

Gifts in memory of Dr. John S. Doctor can be sent to:

The Dr. John S. Doctor Memorial Fund
Advancement Services
305E Administration Building
Duquesne University
600 Forbes Avenue
Pittsburgh, PA 15282

Please make checks payable to Duquesne University.

Dr. Heinz Machatzke retires*

*Again (Continued from page 4)

the possibilities in writing patents, but lacked legal guidance.

"I always felt very strongly that researchers should concentrate on their research, and administrators should do the paper work," Machatzke said. He envisioned an office that could provide "one-stop-shopping" for faculty to address all the administrative aspects of research, including matters of funding, regulatory compliance and intellectual property.

When Murray told him that the Office of Institutional Research was becoming a reality, Machatzke was delighted; he hoped to begin the search for a director immediately.

But the perfect candidate had already been identified.

Machatzke's 'third retirement'

In June 2007, Dr. Alan W. Seadler was named the new Associate Academic Vice President for Research. Seadler has worked closely with Machatzke since he became the Edward V. Fritzky Chair in Biotechnology Leadership and director of the University's Center for Biotechnology in 2005. Noting Seadler's unique combination of business and research expertise with academic experience, Machatzke expressed relief at leaving his former work in capable hands. "I have realized I have an investment of 18 years of my life in this university, so I have a keen interest in it!" he declared.

He does not mention any big plans for the months ahead, other than traveling with his wife across the country to visit their children and grandchildren. "I didn't know before that I should be very careful of whatever I say, because it could come back to me," he said with a smile.

Machatzke's "third retirement" may prove to be the most relaxing of all. ■

First Frontiers in Medicine

Seminar Explored 'Molecular Galaxies'

The first Frontiers in Medicine seminar was co-sponsored by the Bayer School of Natural and Environmental Sciences and the Pre-Health Professions and Post-Baccalaureate Pre-Medical Programs on April 10, 2007. The event will bring renowned medical researchers to campus to present advances in medical diagnosis and treatment. In the inaugural seminar, Dr. Martin C. Mihm, Jr. discussed "Malignant Melanoma—Entering the Molecular Galaxies."

Mihm, who received his bachelor's degree from Duquesne University in 1955, is one of the founders of the field of dermatopathology—the microscopic diagnosis and treatment of skin lesions. He is the senior dermatopathologist at Massachusetts General Hospital, where he also serves as co-director of its Pigmented Lesion Clinic, and clinical professor of pathology at Harvard Medical School.

In addition to his teaching and research career, Mihm has dedicated himself to extensive humanitarian efforts. As a member of the World Health Organization, he has volunteered to set up clinics around the globe; he serves the WHO as co-chair its Melanoma Pathology Program and co-director of its Rare Tumor Institute. He has received Duquesne University's Gold Medal for Excellence and has been named to the Century Club of Distinguished Alumni. ■

Faculty Highlights

The following grants, publications and other achievements cover the period of August 2006 through June 2007. Faculty highlights are voluntarily submitted by faculty and departments and do not necessarily represent the full scope of scholarly activities in the Bayer School of Natural and Environmental Sciences.

GRANTS

Scott Cohen, physics, received a research opportunity award from the National Science Foundation for "Quantum Foundations and Quantum Information," with R. B. Griffiths of Carnegie-Mellon University.

Jeffrey D. Evanseck, chemistry and biochemistry, received a grant from the National Science Foundation, Major Research Instrumentation (MRI), entitled "MRI: Acquisition of Large Shared-Memory Computing for the Center for Computational Sciences."

Evanseck received a grant from the National Science Foundation, Research Experiences for Undergraduates (REU), for "Integrated Computational and Experimental REU Site at Duquesne University."

Evanseck received a grant from the National Science Foundation, Supplement for REU, entitled "Integrated Computational and Experimental REU Site at Duquesne University: Request for American Sign Language Interpreter."

Evanseck received a grant from the American Heart Association, Florida and Puerto Rico Affiliate, entitled "Computational Investigation of Stereoelectronic Effects in Phosphorylation Reactions."

Fraser F. Fleming (PI), **Partha Basu**, **Rita Mihailescu**, and **Tomislav Pintauer**, chemistry and biochemistry, received a grant from the National Science Foundation, for "Acquisition of an Upgrade for a 500 MHz NMR Spectrometer," an award of $383,765.

Simonetta Frittelli, physics, received a grant from the National Science Foundation for "Theoretical questions of analysis and astrophysics in the Einstein equations," an award of $84,830.

The Pittsburgh Supercomputing Center awarded Frittelli (Co-PI) 10,000 XT3 service units for "Code Development for Large Scale Characteristic Simulations."

H. M. "Skip" Kingston, chemistry and biochemistry, received a grant from Milestone s.r.l. from Italy for Microwave Enhanced Chemistry Research CRDA in Italy.

Kingston received a grant for a project entitled "Cr(VI) Environmental Remediation Science Program" from the Department of Energy.

Kingston received a grant from MountainTop Technologies, Applied Isotope Technologies and the Air Force for Homeland Defense Project and the mass spectrometric method development for toxins.

Kingston received a grant from the National Science Foundation for instrumentation for an Agilent Chip Cube MALDI, ES, TOF MS.

Kingston received a grant from Pittsburgh Life Science Greenhouse for Applied Isotope Technologies' "Method Development of Life Science Measurement Methods in Blood, Serum, Urine and Tissue for Speciated Analysis of Toxins."

Kingston received a grant from the Department of Energy/National Energy and Technology Laboratory for ammonia process speciation for the modeling, measurement and validation of the model for the sequestering of carbon dioxide from coal fired power plants.

John A. Pollock, biological sciences, received a grant renewal from the National Center for Research Resources, a component of the National Institutes of Health, entitled "Regenerative Medicine Partnership in Education," an award of $263,665.

Brady Porter, biological sciences, was a co-PI on a grant from the U.S. Fish and Wildlife Service entitled "Genetic Structure and Gene Flow Between Isolated Habitats of the Federally Endangered Amber Darter (*Percina antesella*)."

Michael Seaman, biological sciences, (co-PI) received funding from the National Institutes of Health, National Institute of General Medical Sciences, for the project "Nuclear Integrations of Mitochondrial DNA in Great Apes."

Omar W. Steward, chemistry and biochemistry, received a Senior Scientist Mentor Program grant from The Camille and Henry Dreyfus Foundation, Inc. for "Crystal Engineering of Coordination Polymers: a Study of the Structures of Homonuclear and Heteronuclear Polymers and the Metal Arrangements in Bimetallic Polymers," an award of $20,000.

John F. Stolz, biological sciences (PI), and **Partha Basu**, chemistry and biochemistry, received a grant from the Department of Energy for "Nitrate Enhanced Microbial Cr (VI) Reduction," an award of $449,972.

Stolz received a grant from NASA for "Investigating alternative biogeochemical redox cycles in volcanic, hypersaline, environments," an award of $84,000.

Nancy Trun, **Becky Morrow** and **Lisa Ludvic**o, biological sciences, received a grant from the National Science Foundation for "A Model for Incorporating Application-Based Service Learning in the Undergraduate Science Curriculum," an award of $205,969.

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RECOGNITION AND ACHIEVEMENT

A landmark paper originally published in 1984 by Professor and Chair of Biological Sciences **Philip E. Auron,** "Nucleotide sequence of human monocyte interleukin-1 precursor cDNA, received honorary re-publication in May 2007 (J.Immunol. 178:5410-5417), along with an overview by T.T. Pizarro & F. Cominelli, as one of a series titled "Pillars of Immunology" by The American Association of Immunologists, Inc. The original article has received more than 1,020 citations.

Partha Basu, chemistry and biochemistry, received the 2006 Presidential Award for Excellence in Scholarship at Duquesne University. **Basu** was also appointed an adjunct associate professor in the School of Public Health at the University of Pittsburgh.

Jeffrey D. Evanseck, chemistry and biochemistry, gave three invited talks at the National ACS Meeting in March 2007: "Catalytic organizing elements of boron Lewis acid adducts of a,b-enal compounds," "The nature of high energy phosphoryl bonds," and "Undergraduate research with LSAMP and PUI faculty."

Kevin Garber and **Jack Ubinger**, environmental science and management, were both re-listed in *The Best Lawyers in America* for 2007.

W. Peter Geissler, environmental science and management, published his latest book, *WordSuccess: Why and How to Express Yourself to the Good Life*, through Quality Press in January 2007.

Stanley J. Kabala, published "Environmental Management Systems to Address Non-Point Source Pollution: Mediating the Boundaries Among Science, Politics, and Policy," through theTechnical University of Cluj-Napoca, Romania in 2007. The paper was originally presented at the international symposium, "Ten Years of Eco-Management at the Technical University of Cluj-Napoca," in September 2006.

John A. Pollock, biological sciences, is one of the creators of a simulation video game based on the immune system and an immersive planetarium movie produced by the *Regenerative Medicine Partnership in Education*. The work was presented at *Science + Society: Closing the Gap*, a national conference in Boston, Mass., January 2007. **Pollock** has also been named a Visiting Professor at the Entertainment Technology Center, jointly managed by Carnegie Mellon University College of Fine Arts and School of Computer Science.

Bob O'Gara and **Bob Oltmanns**, environmental science and management, were both elected to the Public Relations Society College of Fellows in recognition of decades of service to the profession. In January 2007, **O'Gara** was honored with the re-naming of the PRSA Renaissance Scholarship to the Bob O'Gara Scholarship.

Brady Porter, biological sciences, was reappointed to the American Fisheries Society's Endangered Species Committee to assist with updating the official list of imperiled freshwater fishes of North America.

Kyle Selcer, biological sciences, was appointed as Chair of the Annual Meeting Industrial Relation Committee for the Society for the Study of Reproduction, 2007-2008.

John F. Stolz, biological sciences, gave an invited talk, "Methods for detection of arsenic metabolizing bacteria," at the 2006 Geological Society of America Annual Meeting and Exhibition in Philadelphia, Pa., October 2006.

Sarah Woodley, biological sciences, received the Young Investigator Award at the International Symposium of Amphibian and Reptile Endocrinology and Neurobiology in Berkeley, Calif., March 2007. As part of this award, she gave an invited talk entitled "Chemosensory communication is sexually dimorphic and hormonally modulated in a plethodontid salamander."

STUDENT ACHIEVEMENT

Stacey L. Benner, B.S. Biological Sciences, co-authored a cover article with her undergraduate research mentor, Dr. Sarah Woodley, "The reproductive pattern of male *Desmognathine salamanders* (Family Plethodontidae) is neither associated nor dissociated," *Hormones and Behavior*, 51: 542-547 (2007).

DUQUESNE UNIVERSITY
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habitat restoration project

(Continued from page 11)

students have taken advantage of the hands-on learning opportunity, including Dr. Kyle Selcer's Terrestrial Field Biology class, which attended the May 2007 biological inventory to study invasive plant species. Selcer is a professor of biological sciences and adjunct professor for CERE.

Beyond ubiquitous local species, such as white-tailed deer, volunteers have also sighted bald eagles, osprey, and signs of black bear. Perhaps the most notable observation was a spider demonstrating an unusual feeding behavior. Rather than weaving a web, the specimen had spun long strands that can be compared to fishing lines, catching its prey on the ends with sticky globs of silk. According to Porter, this behavior, common to the bolas spider, may not have been previously reported in western Pennsylvania. A colleague from the Western Pennsylvania Conservancy, who observed the spider, is researching the phenomenon.

CERE is now developing a master plan for studying the long term biological enhancement of Murphy's Bottom. The ongoing studies of the site could entail anywhere from the original plan of five years to ten or even fifteen years, said Porter, who noted that the site might serve as a location for a Duquesne University field research station in the future. Access to Murphy's Bottom would facilitate classroom instruction and research, attract more students to the sciences, enhance university recruitment and increase Duquesne's competition for research grants.

While Murphy's Bottom Ecological Project remains in preliminary stages, the Bayer School's involvement with the site has already opened up a rich educational resource to students and faculty, who in turn have begun to shed light on the biodiversity of this former mining site. ■

Dr. Beth Dakin (right), postdoctoral research fellow, and Jennifer Gabel, biology Ph.D. candidate, sample for fish and salamanders at Murphy's Bottom. Dakin wears a backpack electrofisher, used to stun aquatic animals so they can be catalogued and released.