

# Spectrum

SPRING 2004

# WOMEN

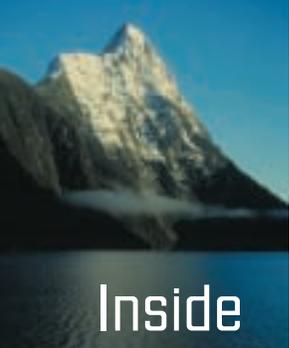
# IN



# SCIENCE



**More women  
are beginning  
to pursue  
advanced  
degrees in  
the sciences.**



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## Spectrum

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

Published by Dr. David W. Seybert, Ph.D.  
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Produced by Duquesne University  
Public Affairs

# From the Dean's Desk

**W**e are excited to be able to keep in touch with you through each new issue of Spectrum. This magazine aims to reflect the Bayer School's diversity, our achievements, and the collaboration for which we are renowned—collaborative approaches that extend across Duquesne University and into the community.

We are striving, as a school and across the university, to increase diversity on campus and in our endeavors. In the sciences, women are typically underrepresented, and this issue of Spectrum explores that topic from a several perspectives.

In fall 2003,\* 60 percent of our undergraduate science students and 59 percent of graduate science students were female. Currently, 21 percent of the Bayer School's faculty is female. One of our strategic goals is to increase the ranks of female faculty so that we provide adequate women role models for these budding female scientists. In fall 2003, our chemistry department welcomed two excellent new professors who are helping us reach that goal. Their story can be found on page 4.

In this issue you will also find profiles on Dr. Nancy Trun and Dr. Barbara Manner, two other remarkable "Women in Science" whom we are proud to call our own. Their stories are only a sample of what each of our female faculty members achieve in the classroom and the laboratory. The pages of this publication could never capture the full spectrum of what our faculty do!

A unique collaboration between the Departments of Studio Art and Biological Sciences showcases "where art meets science" and highlights interaction between what most would think are two very opposite disciplines.

Read more about this on page 9.

Dr. Stanley Kabala of the Center for Environmental Research & Education exemplifies the teamwork that brings us success. His last three grants resulted from partnerships with local municipalities to reduce the pollution of watersheds. Learn more about his pioneering work on page 11. You can also take a quick tour of the universe on page 12, where we report on our latest Distinguished Scientist Lecture,



presented by Dr. Robert P. Kirshner, and gauge the reaction of Duquesne's resident "star gazer," Dr. Simonetta Frittelli.

Alumnus Ted Weismann exemplifies the Duquesne spirit by giving back. His devotion to serving students brought him back to Duquesne after a successful career in industry, and even a debilitating stroke could not keep him away from

his alma mater. His inspiring story is on page 10. In this issue you can also read about alumna Mary El-Shammaa, page 13, who learned the importance of teamwork as a physics major at Duquesne and now utilizes her skills as a patent examiner with the U.S. Patent and Trademark Office.

Thank you for your continued interest in and support of the accomplishments of our faculty, staff, students and alumni. It is this group's collective commitments to collaboration and teamwork that make this publication so successful.

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

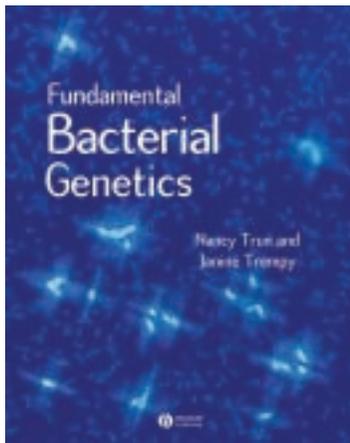
*\*Enrollment statistics at a university are pulled and reported based on the fall semester.*

# She Wrote the Book on Bacteria

**D**r. Nancy Trun used a new textbook to teach Biology 405 this spring. It has everything she's been looking for in a book — it even has her name on it.

Trun, assistant professor of biological sciences, is co-author of *Fundamental Bacterial Genetics*. Internationally released by Blackwell Publishing in fall 2003, the textbook began showing up in biology classrooms in January.

Trun's fascination with bacteria has been the driving force of her career. However, the decision to pursue this particular project rose out of a human friendship. Now in her fourth year of teaching at Duquesne, Trun completed her post-doctoral work at the National Institutes of



Health, where she met co-author Dr. Janine Trempy, now an assistant dean at Oregon State University.

"Janine decided that we needed to write this book," Trun said. "Because I focus primarily on the genetics of bacteria, and she focuses on physiology, she saw that both of us working together would make a good collaboration."

Trempy also knew she could depend on Trun to keep the project moving forward. "I tend to be a stickler for deadlines," Trun added.

Trun likes to keep things simple and craves quick results, which is why she finds bacteria such a worthy subject of study. "Bacteria have 'lean, mean genomes,'" she explained. "Whenever they get extra sequences that they don't use, they throw them away, whereas human cells tend to

save DNA. Estimates are that 90 to 92 percent of the human genome is extraneous DNA, whereas only 10 percent of many bacterial genomes are extraneous."

The efficiency of bacteria allows one to more easily observe the processes of life unfolding within the one-celled organisms.

With the ability to divide every 20 minutes, bacteria are fast in the lab. "You can do a lot of experiments at once, and you can do 'iffy' experiments with bacteria. 'What would happen if I did this? What if I did that?' It could take 20 minutes to do the experiment and a day to get the results," Trun said. A similar experiment with a tissue culture, for example, could take six months.

The speed and simplicity of bacteria offer Trun's students greater freedom as well. "I can say to my undergraduate researchers, 'Go try that,' without worrying," she said, noting that her laboratory uses only non-toxic bacteria.

Publishing a book on bacteria proved to be much more complicated. According to Trun, writing was only the beginning of the three-and-half-year project. In revising the text, one of the primary goals was to present the information in a manner appropriate to college sophomores and juniors. Each chapter was carefully reviewed by at least four other scientists.

The arduous task was not without its highlights, however. "Our editor at Blackwell was great," Trun said. "They hired a very talented artist to create the illustrations. She did a wonderful job with a modest budget."

Dr. Nancy Trun, co-author of *Fundamental Bacterial Genetics*, shows biology students that "bacteria are really cool."



## A Woman in Science

*In her own words...*

"Of all the sciences, biology is traditionally the most female-friendly. In terms of undergraduate students in the classroom and graduate students in the lab, the majority is female. The bad part is that when you get to the higher level positions in academia, the professor level or the director level, men still dominate. We are starting to see more women at the assistant professor level.

Recent studies of women in biology were done to demonstrate how to get women involved in science. What was expected was a model of fairness and equality, and then the results came back. When you get to the levels where the big decisions are made, the women aren't there. At NIH, it was found that women had a third fewer resources and, interestingly enough, published a third fewer papers than men. But the papers women did publish tended to be longer and were judged to be more thorough."

*continued on page 7*

## Women in Science: Degrees of Separation

*Doctoral scientists by broad field of doctorate*

### All Sciences\*

TOTAL .....	543,580
MALE .....	385,640
FEMALE .....	157,940

### Employed full time

TOTAL .....	433,220
MALE .....	314,520
FEMALE .....	118,690

\*Categories of survey include biological and agricultural sciences, computer and information sciences, health sciences, mathematical sciences, physical and related sciences, psychology and social sciences.

### Biological and agricultural sciences

TOTAL .....	161,220
MALE .....	114,780
FEMALE .....	46,440

### Employed full time

TOTAL .....	132,220
MALE .....	95,510
FEMALE .....	36,720

### Physical and related sciences

TOTAL .....	131,670
MALE .....	113,870
FEMALE .....	17,790

### Employed full time

TOTAL .....	104,520
MALE .....	90,710
FEMALE .....	13,810

### Mathematical sciences

TOTAL .....	29,550
MALE .....	25,140
FEMALE .....	4,410

### Employed full time

TOTAL .....	24,010
MALE .....	20,670
FEMALE .....	3,340

Notes: Numbers are rounded to nearest ten. Details may not add to total because of rounding.

SOURCE: National Science Foundation/Division of Science Resources Statistics, 2001 Survey of Doctorate Recipients

# Balancing the Equation

Jennifer Aitken and Ellen Gawalt are becoming the role models they never had.

In August 2003, the women were hired as assistant professors of chemistry and biochemistry in the Bayer School of Natural and Environmental Sciences. According to Dr. Jeffry Madura, professor and chair of chemistry and biochemistry, the new faculty members will begin to balance the equation in a department that previously had only men in tenure-track positions.

“Dr. Gawalt and Dr. Aitken are both exceptional scientists with excellent teaching skills,” Madura said. “We are particularly

excited about bringing them in, because it is difficult for schools to recruit female faculty in chemistry. Traditionally, the population of graduate students in chemistry has been mostly male, so there were not a lot of women coming out of the system. But now we are starting to see more women pursuing advanced degrees in chemistry.”

In September 2000, the Chemical and Engineering News, published by the American Chemical Society (ACS), reported that while 31 percent of Ph.D.s in chemistry were earned by women, only

*continued on page 5*





Dr. Jennifer Aitken



Dr. Ellen Gawalt

*continued from page 4*

about 10 percent of tenure-track chemistry positions in the nation's top 50 universities were held by women.

"Some people have called it 'the pipeline theory,'" remarked Gawalt, whose work focuses on biomaterials such as those used in joint replacements. "There are so many undergraduate majors in chemistry, and only some of them go on to graduate school, a few earn their Ph.D.s, and then even fewer become faculty. So somewhere along the way, women are 'leaking out' of the pipeline, and the question is, why?"

In August 2002, the ACS sponsored a symposium to address that question. A panel of five women faculty from various institutions of higher education discussed the factors that contribute to creating a successful environment for women in chemistry.

Several speakers pointed out that "numbers matter" and that it's important to achieve a "critical mass" of women faculty in a department. Carol T. Christ, president of Smith College in Northampton, Mass., estimated that the critical mass is somewhere between a quarter and a third of the faculty. "It's easy for women in smaller proportions to feel isolated, different or exceptional," she stated.

Members of Duquesne's new women in chemistry group performed laboratory demonstrations with girls in the Ellis School as their first outreach activity.

Those remarks resonated with Aitken's experience. "When I was an undergraduate and when I first entered graduate school, I never felt that I was different because I was a woman," she said. "But in graduate school I started to attend professional meetings, and that's when I began to notice that there were so many more men than women in the field."

Why is the number of women disproportionate? "For some, the problem is a lack of role models," Aitken said. "And I think there are others who let discrimination get to them."

The issue of discrimination in the sciences came to the forefront in 1999, when the results of a four-year study at the Massachusetts Institute of Technology (MIT) showed that women were allotted less laboratory space than male faculty. The study also identified discrepancies in salary and the distribution of awards. MIT addressed the problem openly, and the ACS responded by establishing a women's committee and following up with annual reports.

Their findings show that proper support structures are critical for the success of women chemists in their careers, whether industrial or academic. The standing shortage of women in the field increases the difficulty of finding a mentor. If the professional development of a new female recruit is not cultivated in her workplace, whether due to neglect or outright discrimination, it is far more likely she will fall by the wayside.

Aitken and Gawalt both consider themselves fortunate for being supported

*continued on page 6*

## Women in Chemistry Come Together

Duquesne's women in chemistry are now coming together in a new group launched by Drs. Jennifer Aitken and Ellen Gawalt.

"When I was a student, the women in chemistry started a group, and we found it had a very positive effect on our outlook on science," recalled Gawalt. "It gave us a space to communicate and mentor each other as women, because that was something we did not have with a mostly male faculty."

According to Aitken, about 25 people showed up at the initial meeting in October. "Virtually every graduate student showed up, and some undergraduates as well," she noted. "We also had some of the male faculty come to the first meeting just to show their support. It was wonderful."

Aitken pointed out that when women in chemistry come together, the goal is not excluding men, but rather helping women find more support in their personal and professional lives.

At the male-dominated professional meetings in Aitken's area of solid state chemistry, the older women in attendance initiate informal gatherings of their female colleagues, sometimes sharing chilling stories of the barriers they faced in their own careers.

However, she added, "Those kinds of stories are always a very minor part of our meetings. Mostly we just want to come together as women and talk about things that affect us as people, like how we deal with stress and balance family and work."

*continued on page 6*



*continued from page 5*

and encouraged by male mentors throughout their chemistry careers. Both women honed their research and teaching skills as graduate students, Aitken at Michigan State University and Gawalt at Princeton, building on that experience with post-doctoral fellowships.

However, “when you first come into the job, it’s hard to know where to start,” explained Aitken. “You have long-term goals — you know that you eventually need to get papers published, write grants and get good teaching evaluations so you can get tenure — but when you arrive in the first month, you ask yourself, ‘What should I do right now?’”

Her colleagues in the Bayer School helped her answer that question. “Everyone in our department and the school has been very supportive in helping me set up my laboratory and advising me on where I should focus my efforts,” Aitken said. “Our chair, Jeff Madura, has been very helpful. He’s one of the three people on my mentoring committee.” A small team of mentors was created for each of the new professors to help them navigate the challenges of becoming full-time faculty.

Despite the demands of their new

Virtually every female graduate student in chemistry chose to participate when the women in chemistry group was launched in the fall of 2003.

positions, both professors are enjoying the opportunity to break new ground as women in chemistry. “It was never so easy to get up in the morning!” joked Aitken. “I wake up thinking, ‘I get to go to *my* lab, to do *my* research in the way *I* want. And I am going to class to teach chemistry the way *I* think it should be taught.’ It’s a lot of fun.”

Gawalt decided to come to Duquesne because she found it to be a place where she could expect to be treated as an equal. “It was clear to me that Duquesne was not bringing me in just because I am a woman,” she explained. “They told me they wanted to hire the best candidate, and that I was one of the best because of the strength of my research and my experience in teaching.”

Aitken shared those sentiments: “When I asked them during the interview process why they were interested in me, and they told me they liked both my research and my teaching ideas, I knew Duquesne was the right place.”

—LVM

*continued from page 5*

Personal growth outside the laboratory is important to the Duquesne group, and Aitken said they plan to sponsor regular presentations on topics that can benefit the young women. At their first such session, a staff member from the University Counseling Center discussed stress management and guided the group through relaxation techniques.

Although the young women just began working on their official charter in the spring semester, some clear goals for the group began to form early on. They began to participate in the Pittsburgh section of the American Chemical Society’s women’s committee by attending a dinner and panel discussion about career transitions in the fall.

Outreach is another emerging goal for the women in chemistry group. With Aitken and Gawalt serving as role models, the younger women are discovering their own capacity for leadership. Several group members visited the Ellis School, a private girls’ school in Pittsburgh, during Science Week to do chemistry demonstrations.

The children had a blast in the lab, but can this type of activity really make an impact on their image of women in science?

For Gawalt, the answer is clear. “The Ellis School had different people coming in each day to talk to the girls for Science Week, and it was already Thursday by the time we came,” she said. “We learned that we were the first women scientists they had seen that week.”

—LVM



Chemistry professors Ellen Gawalt (above) and Jennifer Aitken support the professional development and outreach activities of the new group.



## Women in Science: Money Matters

*Median annual salaries of full-time employed doctoral scientists in all sectors*

TOTAL .....	\$70,000
MALE .....	\$75,000
FEMALE .....	\$60,000

Notes: Salaries are rounded to nearest hundred.

SOURCE: National Science Foundation/Division of Science Resources Statistics, 2001 Survey of Doctorate Recipients

## S h e W r o t e t h e B o o k o n B a c t e r i a

*continued from page 3*

Determined to keep the cost of the textbook as low as possible, the authors elected to print in two-color process rather than full-color. As a result, students can purchase *Fundamental Bacterial Genetics* for about \$65.

All science majors at Duquesne University are required to select a course in genetics. Why choose bacteria?

Although different from the cells of complex organisms, bacteria have enough

in common with them to be applicable to a variety of human conditions. For example, Trun noted that basic studies in bacteria helped inform a breakthrough in cancer research. "It turned out that an entire system for repairing DNA errors that had been studied in bacteria for 30 years was present in human cells, and it is the basis of one of the major types of colon cancer," she said.

If there is strength in numbers, bacteria

win hands down. They outnumber every other cell type on Earth. Trun likes to share the wonder of bacteria by divulging this fun fact. "What most people don't realize is that in the human body you have 10 times more bacterial cells than human cells!" she exclaimed. "Bacteria are really cool."

*Fundamental Bacterial Genetics has a Web site with resources for educators, including illustrations and four animations, at [www.blackwellpublishing.com/trun](http://www.blackwellpublishing.com/trun).*

—LVM



Ayers Rock in the Australian Outback photographed by Dr. Barbara Manner.

## From Teaching Science to the Science of Teaching: One Woman's Journey

Dr. Barbara Manner believes that learning about the earth can take place in the Australian Outback or a New Zealand fjord, as well as in the classroom.



### A Woman in Science *In her own words...*

“When I first graduated in biology in 1965, I noticed that there seemed to be one accepted science for females, and that was biology. If you were in chemistry, physics or especially geology, there were not a lot of other women. In the last 10 or 15 years, as I’ve gone to professional meetings, I have noticed a gradual increase in young female geologists. But it’s still very much a male-dominated field.

We’ve seen that young girls up until about the sixth grade do equally as well, or better, than boys in science and math, and then there is a sudden drop. Students who are being taught to teach science today will definitely have to be risk takers. They are going to have to teach in ways they have never been taught.”

**T**he geologist has always been something of an explorer, explained Dr. Barbara Manner. The nature of the field can send a scientist out to sea, through the wilderness or into the depths of the earth. That may explain in part why geology has long been considered a “man’s science.”

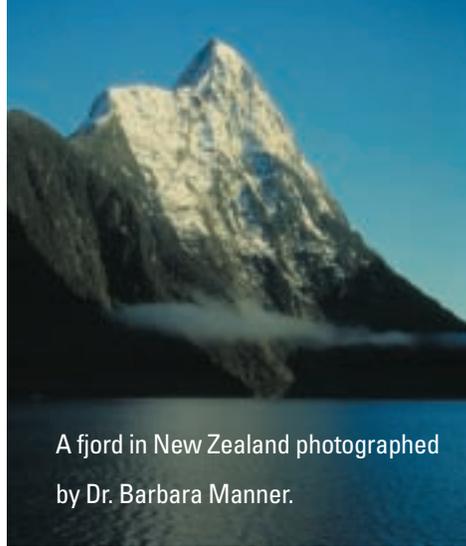
Yet Manner is something of an explorer herself. An associate professor with joint appointments in the physics department and the School of Education at Duquesne University, she has charted a unique course throughout her career, from teaching science in the beginning, to changing the science of teaching today. Her journey has included several stops around the world.

Born and raised in Akron, Ohio, Manner

used her bachelor’s degree in biology working for several years as a laboratory technician, then moved to teaching science in the Akron Public School System. A shortage of earth science teachers in the school district sent her back to college with a free pass for advanced study in geology. “Once I started, I was really hooked,” she said. “When a program came along at the University of Akron where I could combine secondary education and geology in a doctoral degree, I thought, ‘This is for me.’ I’ve had my feet in both fields since then.”

Manner traversed the wilds of Cayuga Valley National Park in Northeastern Ohio to research her doctoral dissertation, an environmental atlas of the area. She

*continued on page 9*



A fjord in New Zealand photographed by Dr. Barbara Manner.

*continued from page 8*

surveyed the soils, vegetation, wildlife and water resources of the area, using well logs to draw a topographical map that was deemed more accurate than the original map drawn by the state agency.

While completing her doctorate in 1989, Manner began teaching geology part-time in what was then Duquesne University's department of physics and earth science. When geology was eventually removed from the curriculum and the department was restructured, Manner was not deterred. It became yet another step in the ongoing evolution of her career path.

"I decided that I should introduce a core class in Earth Science in 1995, because students could take core physics, biology or chemistry, but they were learning nothing about the earth," she noted. Her proposal was successful, and she's been teaching the popular course ever since.

Manner redirected her skills and interests into an entirely new line of research: the science of teaching. She holds a joint appointment in the Duquesne University School of Education, where she leads the courses in science teaching methods for undergraduate and graduate education students.

"The joint appointment can be challenging at times, but from my perspective it is a definite advantage in both areas," she said. "In the School of Education, I am a science teacher who is teaching them how to teach science. And in the Earth Science class, I use best practice methods in teaching."

Manner's classroom has become her laboratory, where she studies the inquiry method of teaching science. "In Earth Science, we do an inquiry on the formation of minerals, and it goes through various steps until they finally devise an investigation to

answer one of their own questions about how minerals crystallize," Manner explained.

"I feel very strongly that until they have their own experience of inquiry, they will not be able to do it with their own students," she added.

Manner also focuses her research on the importance of content acquisition for science teachers. She keeps her own knowledge current through regular attendance and participation in scientific meetings and conferences. At the last national meeting of the Geological Society of America, Manner organized a session on "Science Content Acquisition by Elementary Science Teachers."

While her laboratory of choice is the classroom, Manner's favorite classroom is one without walls. During a typical semester, outdoor teaching is restricted to local jaunts like her famous "Rock Walk." But sometimes her lectures get a little wilder.

"The first couple of years I was here I took some students to the Grand Canyon and Hawaii," she recalled. "More recently, I took students twice to Costa Rica, to Belize, twice to Australia, and to New Zealand. We look at the geology of the area, talk about water resources, and observe the different habitats. We also immerse ourselves in the cultures of these places." The trips frequently draw students from the sciences and education, although majors in business and liberal arts have also enjoyed the experience.

Manner described the first trip to Australia, where the group spent a lot of time hiking in the Outback around the magnificent Ayers Rock. "Here was the geology right in front of us," she marveled. "It was a living lecture."

A true pioneer, Manner plans to venture out again this summer, when she will return to the rain forests of Costa Rica. This time she hopes her students will include some teachers — science teachers from the public school system, where she began her own exciting journey in science.

—LVM



*The Missing Link* by Courtney Brajercik

## Unique Venture Unites Art and Science

A challenging assignment was given to the oil painting class: incorporate two seemingly different disciplines — art and biology — into one painting.

This assignment resulted from a unique collaboration between Richard Elinson, Ph.D., Chair of the Department of Biological Sciences, and the Studio Arts Department. Elinson visited the oil painting class and presented "images that are important for biologists." Elinson explained, "Replication — such as DNA replication, cell division — are central themes in biology. The students' task is to portray it in their art."

The artwork was displayed in conjunction with the Biological Sciences' Super-Lab poster presentation — an event that showcases the projects and experiments of juniors taking the intensive lab course.

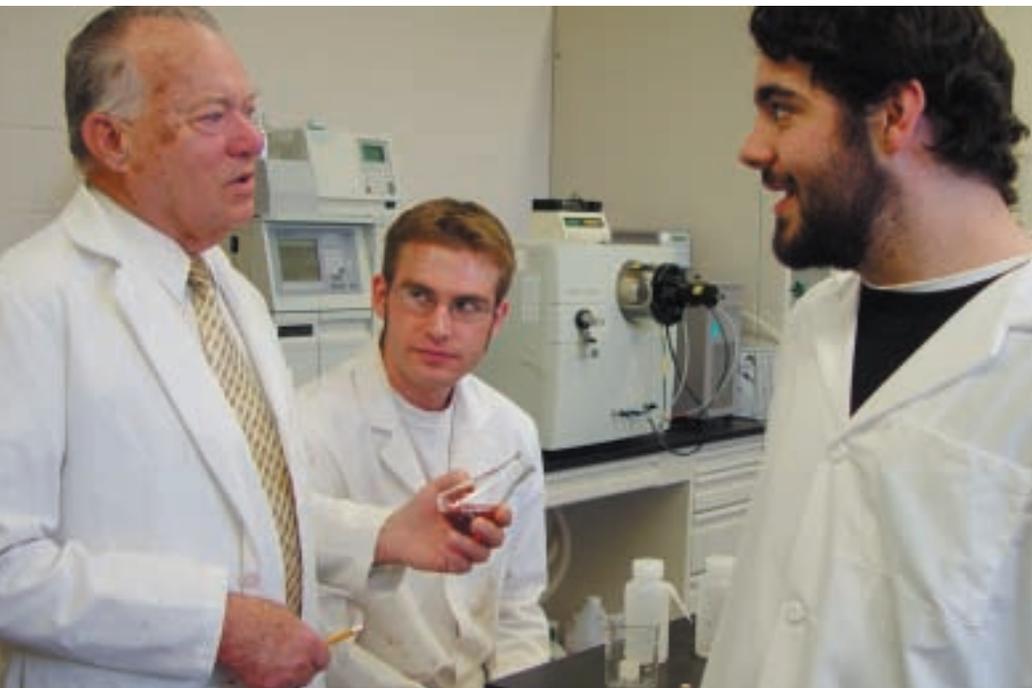
Translating scientific images into art is intensive, and takes an enormous amount of creativity. "Normally you don't think of those two areas coming together," says Courtney Brajercik, who earned First Place Overall in spring 2003 with her self-portrait painting entitled *The Missing Link*. "We usually see pictures of biological images, but this is taking those images and making them art."

Her painting depicts "actual images of human compact bone, pyramidal cells from human cerebral cortex, and human epithelial cells of the cheek cavity." She pointedly used the puzzle pieces to show that underneath it all, we share certain biological materials that aren't solely proprietary to any one organism.

Brajercik is pursuing a double major in studio art and math.

—SB

## "Science Never Stops"



**A**fter 50 years in laboratories, Dr. Theodore "Ted" Weismann is still excited about science. When he was the lead geochemist at the former Gulf Research and Development laboratory in Pittsburgh, he could get so involved in his work that he sometimes did not want to stop.

"I worked as many as 20 hours a day at Gulf," he admitted. Far from a lonely workaholic, however, Weismann enjoyed the camaraderie of his dedicated research team. "We would even sleep in the lab on occasion," he recalled. "You just worked until the work was done."

Weismann's work continues to this day. An adjunct professor of chemistry, he coordinates the activities of Duquesne's Student Affiliate Chapter of the American Chemical Society (SAACS). Since he became the group's faculty advisor in 1982-83, Duquesne SAACS started a 20-year winning streak, earning national awards from the American Chemical Society each year. This March, he accompanied students to the national convention in Anaheim, Calif., where they claimed yet

Dr. Theodore Weismann advises members of Duquesne University's award-winning student chapter of the American Chemical Society.

another award for Commendable Service.

Weismann himself was a student at Duquesne, earning his bachelor's, master's and doctorate degrees in chemistry in 1952, '54 and '56, respectively. He said, "When I was at Duquesne, I learned something from Dr. H. Harry Szmant, who was a professor in chemistry. 'Ted,' he said to me, 'Science never stops.'"

He identified Dr. Toby Dunkelberger, former chemistry department chair, as another memorable mentor on the Bluff. "He was not only a good teacher, but he was interested in people," Weismann said. "He took a personal interest in each of us."

The same has been said of Weismann in his current position. Dr. Paul Johnson, an assistant professor of chemistry who also works with SAACS, remarked, "The

reason our students have achieved so much is because they have someone like Dr. Weismann to guide them. He has a unique ability of seeing the special talent in a young person and helping them develop it."

When Weismann returned to teach at Duquesne, he brought 30 years of experience in guiding young chemists. His many lines of research at Gulf included isotope mass spectrometry and age dating with potassium-argon geochronometry. "We dated materials from all over the world," he said, "and I've saved many of the samples of core we tested. I have a sample of core taken from what was the deepest well in the world, and it turned out to be more than four billion years old."

Immensely successful in his career, Weismann was nevertheless happy to depart from the industrial research world so that he could serve his alma mater. "I retired from Gulf one day and started at Duquesne the next day. I had a plan, but it didn't work out quite the way I thought," he reflected.

In January in 1983, after one semester of teaching, Weismann had a debilitating stroke. Fortunately, he recognized the same symptoms his own father had experienced during a stroke at the same age, and checked himself into the hospital. Completely bedridden and unable to speak at first, Weismann eventually made a comeback that he and his doctors can only describe as miraculous.

"I was back on the job about six months later," he said. "I couldn't drive at first, but I took the bus into the city. In fact, I was elected divisional president by the American Chemical Society that same year. We won the award for the best division later that year, in spite of everything."

As he continued his steady recovery over the next two decades, Weismann adjusted his work-load. However, his responsibilities as an advisor and professional activities keep him moving around the clock. Endowed with an unstoppable spirit and great love of chemistry, Dr. Ted Weismann will surely have an impact on science at Duquesne for years to come.

—LVM

# Kabala Pioneers Environmental Research Collaboration

Faculty members often profess the importance of group projects, how learning teamwork in the classroom is relevant preparation for budding professionals. Dr. Stan Kabala practices what he professes.

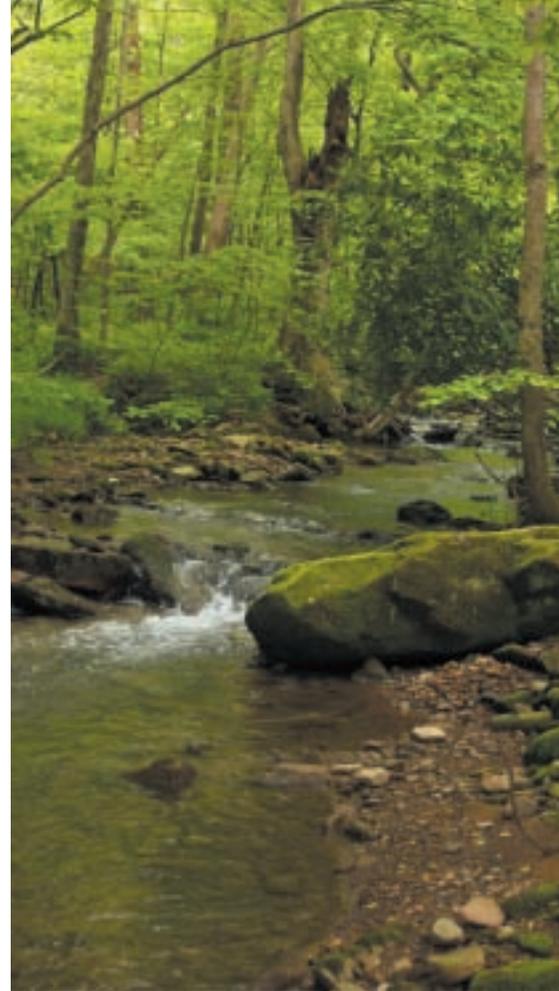
The teamwork of Kabala, adjunct research professor with the Center for Environmental Research & Education, and colleague Peter Niederberger of Michael Baker Corporation, has established three related grant projects

The third project, *Best Management Practices for Water Quality: A Multi-Municipal Stormwater Management System for the Turtle Creek Watershed*, is funded by the Heinz Endowments, and is carried out by the Pittsburgh East Communities Inter-Municipal Environmental Forum (IMEF). The IMEF is an inter-municipal partnership organization formed with CERE's help to address common environmental problems on a cooperative basis.

"The fact that we received such a positive response and active commitment of time from quite busy municipal officials told us that our approach was right," stated Kabala.

To the best of his knowledge, Kabala finds their approach virtually unique in the country. EMS has been applied to municipal operations before, but not at the multi-municipal level, not explicitly to watersheds, and certainly not with this large number of prospective municipal stakeholders. He claims credit for these projects giving rise to a new term—the watershed management system.

Interestingly enough, the projects arose out of volunteer activities Kabala and Niederberger



Stan Kabala and Diane Selvaggio discuss the effects that stormwater run-off has had on the Turtle Creek Watershed. At this bend in the creek, run-off has caused erosion, resulting in removal of twelve feet of hillside.

totaling \$375,000. The projects apply the Environmental Management Systems (EMS) approach at the multi-municipal level to address water quality and watershed protection by reducing non-point sources of pollution and managing stormwater.

Two of the projects — *A Watershed Management System for Murrysville, Pennsylvania*, and *Using Environmental Management Systems To Reduce Non-point Source Pollution from Municipal Activities in the Turtle Creek Watershed*, are funded by Growing Greener grants from the Pennsylvania Department of Environmental Protection.

conducted by contacting potentially interested municipalities in 2001 and 2002, which ultimately led to the formation of IMEF in mid-2002. What began as an earnest interest — an interest in discovering, along with the municipalities, the Best Management Practices (BMPs) that would allow them to tackle an expensive and intermittent problem — led to CERE taking on the role of facilitating this innovative partnership.

"Storm water as non-point source pollution is the number one environmental and financial issue facing these municipalities. It made sense then to find a way to assist them to address the

issue jointly and cost-effectively," Kabala said.

Kabala and Niederberger's responsibilities in the projects include consulting with municipal Environmental Advisory Committees, creating watershed action plans in the context of often limited municipal resources, identifying BMPs for implementation, and recommending demonstration projects for joint implementation. A demonstration project might be as direct, immediate, and site-specific as installing permeable pavements to enhancing ground absorption of stormwater to reduce the volume that flows into sewers, or it might expand to consideration of major institutional changes such as establishing a stormwater management public utility.

Diane Selvaggio, executive director of the Turtle Creek Watershed Association and current ESM student, remarked, "From my perspective, the ecological point of these projects is really to allow the water cycle to function as closely as it can to normal. In doing that, we will actually reduce our own long-term problems of poor stream water quality." Kabala added that the projects "amount to acting on the recognition that improving the quality of our region's streams will improve our region's quality of life."

—SB



Harvard astronomer Dr. Robert P. Kirshner, who pioneered the discovery of the accelerating universe and dark energy, lectured at Duquesne in March.

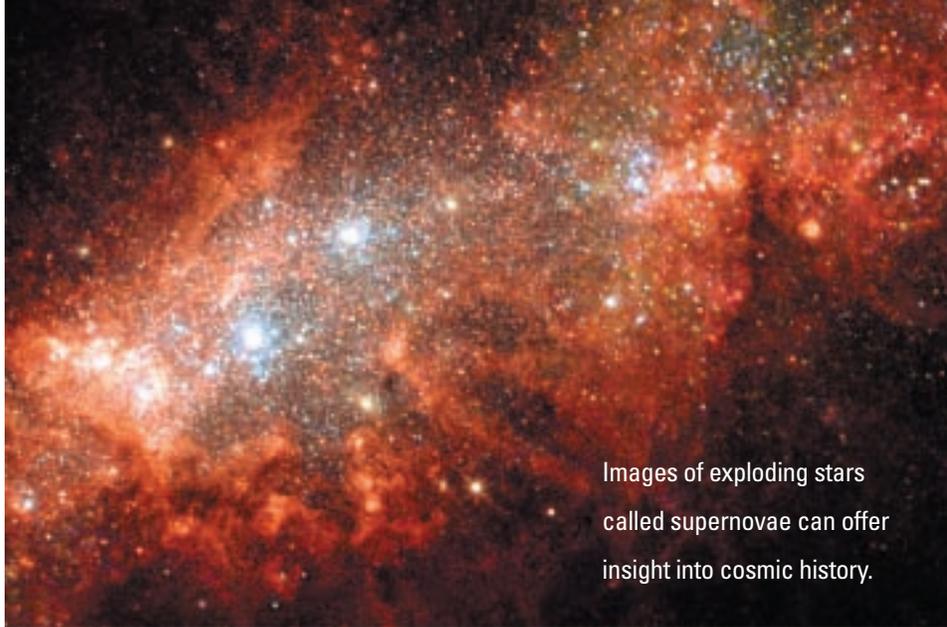


Photo credit: NASA/ESA Hubble Space Telescope with Peter Anders, Göttingen University.

Images of exploding stars called supernovae can offer insight into cosmic history.

**H**arvard astronomer Dr. Robert P. Kirshner rattled the foundations of modern physics when he first presented a startling discovery about the nature of the universe.

Kirshner discussed his famous findings at the Duquesne University Distinguished Scientist Lecture, sponsored by the Bayer School of Natural and Environmental Sciences. The lecture was presented to approximately 300 faculty, students and guests in the Duquesne Union Ballroom on March 29.

Scientists have known for more than 70 years that the universe appears to be expanding. What we know of gravity tells us that this expansion should be slowing down.

In 1998, however, Kirshner told the world it was apparently wrong. By observing images of distant exploding stars known as supernovae, Kirshner and his colleagues gathered evidence that the cosmic expansion is not slowing down — it's actually speeding up.

The accelerating universe was dubbed the "Science Breakthrough of the Year" by Science Magazine in 1998. Kirshner described the journey to discovery in his book, *The Extravagant Universe: Exploding Stars, Dark Energy, and the Accelerating Cosmos* (Princeton University Press, 2002).

"The universe is even wilder than we imagine: we keep underestimating how weird it really is," wrote Kirshner. His wild discovery points to the existence of a weird element that is interfering with the expected effects of gravity by pushing galaxies away from each other. Now referred to as "dark energy," according to

## Distinguished Scientist Speaks of "Extravagant Universe"

Kirshner's measurements, it accounts for 60 percent of the universe.

In *Extravagant Universe*, Kirshner described how cosmic history is revealed in supernovae, "exploding stars that shine with the light of a billion suns." Light travels one foot in a nanosecond, or one billionth of a second. The delay is undetectable when one flicks on a lamp, "but on the astronomical scale, the effects of time ticking by while light travels are very important." Because the stars are so distant, their visible light acts like "a slice through time and space."

According to Kirshner, "Light from the most distant supernova so far observed carries information about the way the universe has been expanding over the past 10 billion years, about two-thirds of the way back into the origin of time at the Big Bang." These distant astronomical objects appear to be moving more slowly than objects in galaxies closer to our own, suggesting that the universe has accelerated in the interim.

Scientists generally embrace the principle

known as Occam's razor — the simplest solution is usually the best, and it follows that universe should conform to the simplest rules of design. However, the picture of the universe that is now emerging shows it to be something much wilder and weirder — one could even call it "extravagant."

—LVM

### Proving Einstein Wrong...and Right

In effect, the man said Einstein was wrong. How would you react?

Dr. Simonetta Frittelli, associate professor of physics, assumed a leadership role in the Distinguished Scientist Lecture, inviting Dr. Robert P. Kirshner to speak at Duquesne. However, she was not nearly so enthusiastic about his findings when she first heard him speak at a symposium, shortly after his research was made public.

"He got an incredibly negative reaction from everyone there," Frittelli recalled. "When you hear something so outrageous, you would expect he is making a mistake. But since then, the acceleration of the universe has been verified by other scientists using other types of measurements."

Have Kirshner's former critics reconciled themselves to the accelerating universe?

"It's disturbing!" said Frittelli, lamenting the implications of the discovery. "It means we have to revise all our theories

*continued on back cover*

Mary El-Shammaa, outside her office at the U.S. Patent and Trademark Office, Alexandria, Va., uses her science and math background to evaluate about four new applications every week.



## Physics Alumna Uses “Technical Edge” for Patent Review

**B**ayer School faculty and alumni who seek patents for their work may like to know that their applications could be reviewed by one of their own. Mary El-Shammaa, B.S. Physics, 2002, is a patent examiner at the U.S. Patent and Trademark Office, Alexandria, Va.

The USPTO employs 3,500 Patent Examiners and receives about 300,000 new applications every year. According to Mary, a Duquesne education helped her secure an excellent position the summer after she graduated, even during a time when “the job market was awful.”

“Essentially no one was hiring,” she recalled. “I was fresh out of college, and I thought finding a job would be nearly impossible! My degree in physics was key in getting the offer at the PTO.”

A background in science is necessary to review patent applications, due to their highly technical nature. “I’m required to understand the inventions,” Mary explained. “Without the physics and math background, I would not be able to understand the full scope of the applications. Because of my physics degree, I had a technical edge, a scientific advantage.”

The USPTO classifies applications by discipline; Mary’s specific technology is radiant energy. “I deal a lot with medical technology — radiation treatment, new ways of treating cancer, scanning electron-microscopes,

magnetic resonance imagers (MRI), and spectrometers,” she said. “When I get an application for a spectrometer, I would never understand any of it without having studied electricity, magnetism, thermodynamics, and all of the physics courses I’ve taken at Duquesne.”

Patent examiners also need the ability to read and interpret technical writing. “We don’t actually receive the physical inventions,” Mary explained. “We receive a description of the invention — which can be anywhere from a few pages to several hundred! The average is thirty pages.”

Because filing for a patent is as legal in nature as well as technical, Mary credits her background in physics as keeping her focused on her understanding of the invention and the legal aspects of the application. “My physics background has allowed me to communicate with patent attorneys concerning issues of patentability and not be led astray by any lengthy or confusing legal language,” she noted.

Mary holds the utmost respect for the lawyers with whom she works — in fact, her most immediate goal is law school. She said, “I couldn’t ask for a better job before law school; this job incorporates physics and law in such a way that I feel I have an advantage for any future legal endeavor.”

Mary is researching law schools in a similar

fashion as she did her undergraduate education — carefully. She applied to fifteen undergraduate institutions and was accepted to almost all of them. She chose to attend Duquesne because she knew she’d receive a personal education after meeting Dr. Davies, the chair of the physics department. “I could tell by the way that he ran the department that he was willing to do whatever it takes to help the students get what they need to learn,” she recalled. “I gave them my deposit check that very day. Dr. Davies sealed the deal on the spot.”

She identified the small size of the physics department as a competitive advantage. The class size impacted her success both academically and professionally. “Not being just a number in a class, being able to approach the instructor — that made it more personal, and I could tailor my physics education and get what I wanted out of it,” she said. “The physics program offers a nurturing environment, yet it taught me how to challenge myself and rise to those challenges. I learned things at Duquesne that I never knew I could learn!”

The individual attention has created camaraderie among faculty, students and alumni: Mary, like most of the Duquesne physics community, has attended Dr. Davies’ infamous physics Halloween party every year since graduation. “Wherever we are, we come,” she said. “He’s touched our lives so much. When you are studying something you want to learn about, it’s important to have people who want you to learn. Dr. Davies and all the instructors in the physics department are a great asset to Duquesne.”

—SB

# Student Profile

R y a n N e w t o n



"Twenty years from now you will be more disappointed by the things that you didn't do than the ones you did do," wrote the great American author Mark Twain. "So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore. Dream. Discover."

**R**yan Newton, a sophomore and forensic science major, would have made Mark Twain proud. He charted his own unique course after graduating from Perry Traditional Academy in 1997. Instead of enrolling in the traditional course of undergraduate studies, Ryan decided to become a boat captain.

During high school, he worked as a busboy for Pittsburgh's Gateway Clipper Fleet and moved up to deckhand. He enjoyed the experience and decided to aim for the top slot. He received his license from the United States Coast Guard to pilot motor vessels of not more than 100 gross tons, and now pilots the Gateway Clipper on a part-time basis.

Knowing that he would eventually go to college, but undecided about a major, Ryan tested the waters by enrolling in some classes at the Community College of Allegheny College. He dreamed of a career in

science, and when he discovered the Forensic Science & Law program offered by Duquesne University, he applied and was accepted.

Having taken a few years off from school, Ryan finds life on campus to be quite a contrast from the working world. "I appreciate it more," he explained. "I don't think I would have appreciated the experience as much had I gone straight to college."

One of the things that Ryan likes about being back at school is the interaction with the faculty. "I like that fact that every one of my chemistry professors has encouraged us to get involved with the research program. They take the time to push the students when they themselves have so much on their plates. It shows they care about the students."

Ryan is taking the chemistry professors' advice and will begin work with Dr. Jeff Evanseck, associate professor of chemistry, on a drug design project to tackle the prevention of anthrax infection. He will continue this project through summer 2004.

By working in a research lab, Ryan hopes to explore the many different possibilities of a science career. "This experience will help me decide between a career in lab work or non-lab work," he said.

He knows that many exciting opportunities await, and he is eager to discover them. In thinking about the future, Ryan intuitively knows his interests will evolve over time and through experience. "I am interested in exploring field work, especially reconstructing a crime scene," he said. "I would also like to teach and see that as a definite possibility in the future."

With a proven ability to explore, dream and discover, Ryan will surely keep the wind in his sails throughout the journey of a lifetime.

—CR

# Faculty Highlights

## Recent Grants

**Mary Alleman** received a Faculty Development Fund award for a project entitled "Paramutation in Maize: An Example of Epigenetic Silencing"

**Mary Alleman** received a supplemental award from the National Science Foundation on a project entitled "RUI: Genetic and Epigenetic Mechanisms Generating r1 Gene Complexity in Maize".

**John Doctor** received funding from the Pennsylvania Infrastructure Technology Alliance in collaboration with Carnegie Mellon University to continue research on a project entitled "Tissue-engineered Nerve Guides".

**Peter A. Castric** received a new five-year grant from the National Institutes of Health, National Institute of Allergy and Infectious Diseases for a project entitled "Pseudomonas aeruginosa 1244 Pilin Glycosylation".

**Richard Elinson** received a new three-year grant from the National Science Foundation for a project entitled "Amphibian Endoderm Evolution".

**Richard Elinson** received two supplemental awards from the National Science Foundation on a project entitled "Change in Vertebrate Early Development".

**H.M. 'Skip' Kingston** received funding from Advanced Vision Research in the amount of \$8,000 to analyze and evaluate samples provided by the company.

**H.M. 'Skip' Kingston** received funding from Science Applications International Corporation in the amount of \$7,200 to analyze and evaluate data provided by SAIC.

H.M. 'Skip' Kingston received funding from the Department of Energy/National Energy Technology Laboratory in the amount of \$120,000 to research carbon sequestration by the ammonia scrubber process.

David J. Lampe received funding from The National Science Foundation to continue research on a project entitled "RUI: Structure/Function Analysis of the Himar1 Transposon".

David J. Lampe received funding from the USDA in collaboration with Dr. Thomas Miller, University of California, to continue research on a project entitled "To Conduct Research on Insect-Symbiotic Bacteria Inhibitory to *Xyella fastidiosa* in Sharpshooters".

Jana Patton-Vogt received funding from the National Institutes of Health, National Institute of General Medical Sciences to continue research on a project entitled "Regulation of Glycerophosphoinositol Transport in Yeast".

John Pollock received additional funding from the Pittsburgh Tissue Engineering Initiative, Inc. to be used to produce an interactive planetarium show entitled "Tissue Engineering for Life".

Kyle Selcer and John Pollock received funding from the Commonwealth Universal Research Enhancement, Pennsylvania Department of Health to complete research entitled "Screening Human Breast Cancers for Steryl Sulfatase Status: A Potential Diagnostic Tool."

John Stolz received a grant from The National Science Foundation for a project entitled "U.S. Egypt Cooperative Research: Microbial Arsenic and Selenium Transformation in the Nile Delta".

John Stolz received a grant from The National Aeronautics and Space Administration for a project entitled "Investigation of 'Alternative' Anaerobic Biogeochemical Redox Cycles in Volcanic, Hypersaline Environments: Earth, Mars, and Europa".

## Recent Publications

Almaguer, C, Mantella, D, Perez, E and Patton-Vogt, J (2003) Inositol and Phosphate Regulate GIT1 Transcription and Glycerophosphoinositol Incorporation in *Saccharomyces cerevisiae*. *Eukaryotic Cell*, 2:729-736.

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Beckham YM, Nath K, and Elinson RP (2003) Localization of RNAs in oocytes of *Eleutherodactylus coqui*, a direct developing frog, differs from *Xenopus laevis*. *Evolution & Development* 5:562-571.

Bender M, Bennett JM, Waddell, R, Doctor JS, Marra KG (2004). Multi-channeled biodegradable polymer/CultiSpher composite nerve guides. *Biomaterials* 25:1269-1278.

Bhandari, S; Kingston, HM; Rahman, GMM (2003) Synthesis and characterization of isotopically enriched methylmercury (CH<sub>3</sub>201Hg<sup>+</sup>). *Appl. Organometal. Chem.* 17:913-920.

Boylan, HM; Cain, RD; Kingston, HM (2003) A new method to assess mercury emissions: a study of three coal-fired electric generating power station. *Air & Waste Manage. Assoc.* 53:1318-1325.

del Pino EM, and Elinson RP (2004) The organizer in amphibians with large eggs: problems and perspectives. In: The vertebrate organizer (H. Grunz, editor). Springer Verlag, Heidelberg, Germany pp. 359-374.

Elinson, RP and Ninomiya, H (2003) Parallel Microtubules and other conserved elements of dorsal axial specification in the direct developing frog, *Eleutherodactylus coqui*. *Dev. Genes Evol.* 213:28-34.

Fiumera, AC, Porter, BA, Looney, G, Asmussen, MA and Avise, JC (2004) Maximizing offspring production while maintaining genetic diversity in supplemental breeding of highly fecund managed species. *Conservation Biology* 18:1-8.

Fletcher, DE, Dakin, EE, Porter, BA, and Avise, JC (2004) Spawning behavior and genetic parentage in the pirate perch (*Aphredoderus sayanus*), a fish with and enigmatic reproductive morphology. *Copeia* 2004:1-10.

Oremland, RS and Stolz, JF (2003) The Ecology of Arsenic. *Science*, 300:939-944.

Suttkus, RD, Porter, BA and Freeman, BJ (2003) The status and infraspecific variation of *Notropis stoneri* Fowler. *Proc. Amer. Philosophical Soc.* 148:354-376.

Trun, N and Johnston, D (2003) Folding Chromosomes in Bacteria: Examining the Role of Csp Proteins and Other Small Nucleic Acid-Binding Proteins. *Current Topics in Developmental Biology*, 55:173-201.

Waddell RL, Marra KG, Collins KL, Leung JT, Doctor JS (2003) Evaluation of poly(caprolactone) and collagenous microcarriers for applications in nerve guide fabrication using PC12 cells. *Biotechnology Progress* 19:1767-1774.

## Achievements

Peter Castric is the recipient of the 2004 Presidential Award for Excellence in Scholarship.

Barbara Manner received a Creative Teaching Award.

John Pollock produced and directed the second edition of the educational movie "Tissue Engineering for Life." In nationwide distribution, both the first and second editions are now playing at the Henry Buhl, Jr. Planetarium at the Carnegie Science Center. More information is available online at: <http://ptei-brains.cfa.cmu.edu>.

Brady Porter was appointed to serve on the Endangered Species Committee, American Fisheries Society.



*continued from page 12*

about why things don't actually have to lose momentum in the universe." A devoted disciple of Einstein, she pointed out that the new findings could even revolutionize his famous theory of relativity.

Although Sir Isaac Newton pioneered the concept of gravity, in the early 20<sup>th</sup> century, Einstein observed that some of the planets in the solar system, especially those closest to the sun, did not move exactly the way Newtonian physics predicted.

"Einstein invented a theory that is highly geometric," Frittelli said. "It's really a beautiful theory, and it makes a lot of sense, although it does require a leap of the imagination. He found a way to associate the geometry of space and time with the content of mass in space and time. This led to a better notion of gravity."

Just as Einstein built on the work of Newton, Frittelli conceded that there could be a place for Einstein within the accelerating universe. "When gravity is not very strong, the two theories of Newton and Einstein coincide admirably," she said. "If we come up with a new theory, one would hope that it coincides with Einstein in the same way. In that case it would be an improvement, rather than a revolution. So we are at a crossroads for the Einstein theory."

Whether or not the accelerating universe eventually explodes Einstein's theory, in a strange twist, it could also recast what was once described as his "greatest blunder." In 1917, Einstein was advised that the universe was static, but his own theory indicated that gravitational attraction would set the universe in motion. So he reluctantly threw a "cosmological constant" into the equation, which represented a compensating force to keep the universe still.

Years later, when new observations revealed that the universe is expanding, Einstein tabled the cosmological constant.



Dr. Simonetta Frittelli is a devoted disciple of Einstein.

However, Kirsher now recognizes that Einstein, in his proposal of an unknown cosmic force, came the closest to grasping the possibility of dark energy.

For Frittelli and other admirers of the great genius, it is tempting to say that, at least in this case, Einstein was right after all.

—LVM