

## Biology and Chemistry Departments, Winning Together

When biology students ask Dr. Jayne Robinson why they have to study chemistry, she knows just what to say: "Biology really is chemistry." Luckily for the University of Dayton, however, the chairperson's interdisciplinary outlook has gone beyond convincing these students of the importance of different sciences. And because of this approach by Robinson and her fellow researchers, UD has received the Merck Institute for Science Education and the American Association for the Advancement of Science award.

These organizations recognized 15 colleges in the nation that demonstrate active support for interdisciplinary opportunities that combine biology and chemistry. Each school will be given \$20,000 per year for three years, and UD has decided to direct its award almost completely toward student research.

To win the award, schools were required to submit a proposal outlining a joint project between biology and chemistry departments. A team of researchers at UD, including Chemistry's Dr. Sean Swavey and Dr. Mark Masthay and Biology's Dr. Yiling Hong, Dr. Mark Nielsen and Dr. Robinson, decided to study the application of porphyrins as photodynamic therapy agents.

"We had this overarching umbrella project, and then all five of us had our own separate piece of that," Robinson said. "This way, students had their own projects, but they also got to see what everyone else was doing and how this was all going to integrate."

Four biology students worked with the researchers on the project this summer. Senior David King, advised by Hong, examined the anti-cancer effects of porphyrins. Robinson advised senior Liz Ohneck in the investigation of the porphyrins' antimicrobial effects. Nielsen advised sophomores Anna McCrate and Amanda Brian in studying the toxicity of porphyrins.

According to Ohneck, the nature of the project allowed her to appreciate the cooperation of scientists across disciplinary borders.

"Collaborating with other students on the project allowed us a chance to share ideas and frustrations," Ohneck said. "Because we were all working with the same compound, we were better able to understand each other's research. It also gave a greater sense of importance to my individual research knowing it was part of a larger project."

Following in the footsteps of Ohneck, King, McCrate and Brian, future undergraduate student researchers will benefit from this program as the funding continues through 2009.

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## Geiger Retiring after a Lifetime of Accomplishments

Modest Brother Don Geiger will discuss the achievements of students he's advised, but he won't tell you that he helped found the Ph.D. program at UD or that he guided over 400 students to their graduate degrees. He'll talk about his fascination with plant physiology, but he won't mention that his publications have been cited thousands of times by his peers. A successful researcher and biology professor for over 40 years and a Marianist brother for over 50 years, Geiger has so many achievements it's difficult to sum them up.

After receiving his B.S. from UD and his M.S. and Ph.D. from OSU, Geiger returned to UD in 1964 where he developed his research program in plant physiology. Geiger's research has made immeasurable contributions to the study of carbon metabolism and translocation, and his work has formed the basis for an entire generation of study.

"His early contributions in this area are timeless," said Dr. John Rowe, a colleague of Geiger's. "They established universal principles in plant physiology."

Geiger said his proudest contribution of his career was when he and his graduate students "discovered the first concept of how organic molecules, which are food in the plant, move around. We published that article in 1975, and many people take that discovery for granted now. Back then, no one had really published anything on it, so that was very exciting."

Former students and faculty will remember the huge "mystery contraption" that Geiger engineered to use in his experimentation. "Don designed and constantly redesigned a Rube Goldberg apparatus that was contained in a closed area where both CO<sub>2</sub> and sunlight could be regulated," Rowe said.



Brother Don Geiger

## Geiger

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In the 1980s, Geiger also began working in ecological restoration. While it began as a hobby, Geiger's interest in restoration peaked when he took on the challenge to convert a gravel pit into a prairie. The former eyesore left from the I-675 construction is now a beautiful tall grass prairie.

Since that time Geiger has completed many restoration projects, including converting contaminated land at the Fernald Uranium Processing Facility into a nature reserve. He is the founding director of the Marianist Environmental Education Center, a co-founder of the Beaver Creek Wetlands Association, and he volunteers his time to several other groups committed to restoration.

Over the years, Geiger has taught hundreds of undergraduate and graduate biology courses and developed courses including

“It was a one-of-a-kind apparatus that was so complicated, no one else in the world had such a device.”

Biological Instrumentation, Global Environmental Biology, and Environmental and Ecological Restoration.

For Geiger, the most personally fulfilling aspect of his career at UD has been seeing his students enjoy their research and make discoveries on their own. It's very rewarding, he said, to know that he led those students into an area of study they have made a part of their lives.

“Great scholars are magnets for great students, and Br. Don falls into this rare category,” said Dr. Jayne Robinson, biology department chair.

Geiger has received numerous awards for his achievements in teaching and research, including UD's Outstanding Faculty and Distinguished Alumni Awards, the College of Arts and Sciences Outstanding Scholarship Award and the Sigma Xi Lifetime Achievement Award.

In May 2008, Geiger will be retiring as a full professor, but he will no doubt be as busy as ever.

## Moredock's Award Sets New Ventures in Motion



Kaitlin Moredock

The experimentation that senior Kaitlin Moredock conducted this summer is only one element of her research experience at UD. After receiving a fellowship for undergraduate research from the American Physiological Society, Moredock spent her summer months observing the expression of aquaporins in the brain during the progression of Alzheimer's disease.

Moredock's interest in Alzheimer's arose from her fascination with brain processes and her previous experiences in the lab of department physiologist Dr. Carissa Krane. One of Moredock's favorite aspects of the research, she said, was forming collaborations with Alzheimer's experts such as John Cirrito at Washington University.

To further her own and others' research experiences throughout the summer, Moredock started the Science Thursday Lunch Club.

“Kaitlin is a natural leader,” Krane said. “She demonstrated that this summer by initiating the inaugural year of the Lunch Club, which involved the participation of approximately 30 undergraduate researchers from around campus in weekly meetings where aspects of research in science and engineering were discussed.”

Moredock hopes to present an abstract of her results at the Experimental Biology Conference next April, and she will share her findings at UD's Stander Symposium.

Moredock's research impacted her career plans as well. “The whole fact-finding process of my research made me realize that I was good at it and I like doing it,” she said. This new appeal fueled Moredock's decision to attend law school after graduating.

## Doug Vonderhaar, High Achiever



Doug Vonderhaar working in a stream in Palau.

Doug Vonderhaar has plenty to show for his four years at UD. Thanks to the guidance of Dr. Albert Burky, the senior biology major has had more research experience as an undergraduate than many have as graduate students.

Burky hired Vonderhaar as a freshman to assist with odd jobs in his aquatic biology research lab. By the end of the year, Vonderhaar had taken a major role in the project.

“Doug was fully integrated into this research project and was a co-author for a poster presentation at the 2005 Stander Symposium,” Burky said. “This was the first time I have had a freshman achieve such

distinguished status through research participation in my laboratory.”

Vonderhaar didn't stop there. By the end of his junior year, he had already presented twice at both the annual meetings of the Ohio Academy of Sciences and the North American Benthological Society. He's presented six posters at UD's Stander Symposium, two posters at the TriBeta regional conference and he's received research grants from several organizations.

Vonderhaar is now completing his senior honors thesis, which is based on stream quality data that he collected this summer in Hawaii and the Republic of Palau. While his research revealed important information about freshwater resources, Vonderhaar said what interested him most was the effect it had on people's lives.

“I liked seeing how everything applies to real people, from developing nations like Palau to locals on Maui. When you see how much it means to them, you can really see the difference you're making.”

# Tribeta Embodies True Spirit of National Honor Society



TriBeta members Morgan Wurtz and Spencer Idstein explain animal anatomy to children at Techfest 2007.

TriBeta's members are experiencing the field of biology in new ways each year. The organization's recent growth has been reflected in all three areas of that mission.

While TriBeta has always offered a variety of opportunities for service, such as Christmas on Campus, TechFest, and the MEEC seed collection, more options have been available to members in the past few years.

The group has started two long-term service projects working with kids in the Dayton area. At Holy Angels Elementary School, TriBeta members volunteer weekly to help

After 55 years on campus, the University of Dayton Theta Kappa Beta chapter of Beta Beta Beta has evolved into an organization that truly represents what a national honor society should be. As a group with a tri-fold mission, TriBeta's members are experiencing the field of biology in new ways each year.

Dr. Carl Friese, the group's academic advisor, describes TriBeta's mission as

socially, academically, and service-oriented. The organization's recent growth has been reflected in all three areas of that mission.

Membership in TriBeta has also seen a dramatic growth spurt. In the past five years, TriBeta has more than tripled its membership to over 100 members. The reason for this, said Friese, is the increase in activities.

“It seems that the more active the chapter becomes, the more appealing it is for students to join.”

So who's behind TriBeta's evolution? Friese attributes all the development to the hard work of former presidents. However, this year's president, Kelly Wedell, gives just as much credit to Friese himself.

“He's very encouraging, and if you ever have a new idea, he always pushes it forward.”

With the nonstop teamwork and commitment this group shows, there's no doubt TriBeta will continue to grow and offer its members new opportunities in future years.

“The group's growth in all three areas of its mission really culminated in hosting the conference,” said Friese. He also said that TriBeta's academic progress will continue - the group will participate in the National Conference for the first time next spring.

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## UD's Tribeta Chapter Breaks New Ground



UD Tribeta members holding chapter awards and individual TriBeta regional conference awards. Clockwise from bottom left: Hanny Al-Samkari, UD Scholastic Programming Award and the TriBeta Regional Conference Hosting Award; Kaitlin Moredock, 2nd place Cell/Molecular Poster; Roua Azmeh, TriBeta Conference Chapter History Award; Mike Karns, 1st place Cell/Molecular Oral Presentation; Mike Hils, 3rd place Environmental Poster; Lynn Waterhouse, 2nd place Environmental Poster; Andria Demosthenous, 1st place Environmental Oral Presentation; Dr. Friese, UD Service Program of the Year and Spirit of UD Award Nominations.

This past April, the University of Dayton's TriBeta chapter had its first opportunity to host the TriBeta Regional Conference. The one-day conference attracted TriBeta members from colleges and universities in five states.

The day included poster sessions and podium talks, both presented by students, along with a keynote address by UD biology professor Dr. Albert Burky discussing the importance of undergraduate research experiences. The student events were divided into two areas: cellular, molecular and microbiology; and evolution, ecology and the environment. Students were judged on their presentations, and awards were given to the top four presenters (see photo for UD award winners).

After submitting a proposal to TriBeta's Regional Committee, UD was chosen to host the conference. According to Dr. Carl Friese, the group's academic advisor, the main reason UD was chosen “was the fact that our chapter had grown so much and garnered some recognition.”

Both Friese and Kelly Wedell, this year's TriBeta president, agreed that hosting the conference meant a lot to the members. “We all worked together to plan it, and we wanted to show other schools that we could do it and that we're a strong organization,” said Wedell. The overall success of the conference showed the strength that UD's TriBeta chapter has gained both socially and academically.

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## Breitwisch Goes from Birds to Berries

Instead of spending this August teaching classes in hot and humid Ohio, Dr. Randy Breitwisch was enjoying berry season on the temperate Oregon coast. After 18 years of teaching, conducting research and training graduate and undergraduate students at UD, Professor Breitwisch has retired and moved to Oregon.

“We’re spending a day at the ocean every week or so... can’t beat the Oregon coast,” said Breitwisch in an August note to his colleagues. “It’s now blueberry and blackberry season, so we are pigging out...blueberry buckle...blackberry pie... blueberries in yogurt...blackberries on cereal...”

Breitwisch joined the department in 1988 and over the years taught numerous courses in introductory biology, evolution, animal behavior, ecology and biometrics.

“Randy was an outstanding teacher, always bringing his own enthusiasm to whatever course he was teaching,” said Dr. Jayne

Robinson, biology department chair. “His course in animal behavior was extremely popular for this reason.”

When not in the classroom, Breitwisch could be found in the field observing the behavior of mockingbirds and cardinals and sharing with his graduate students his expertise and interest in birds.

One of his former graduate students, Dr. Jodie Jawor, now an assistant professor at the University of Southern Mississippi, said Breitwisch’s dedication to research and mentoring students still influences her today.

“Randy had outstanding research ideas, and he was open to you either pursuing your own research or working from one of his ideas, fleshing it out and making it your own,” said Jawor. “He wanted us all to succeed to the best of our abilities and go as far as we could. I try to emulate his actions now with my own students. Working with Randy was probably the best thing I could have chosen for my doctoral degree and career.”



Dr. Amit Singh

as a new master’s student, Singh watched a cluster of the flies escaping as a *Drosophila* researcher left his lab. His curiosity got the best of him, and Singh became a frequent visitor to the lab. Singh’s interest in fruit flies has never stopped. He studied *Drosophila* for his Ph.D. dissertation, and today fruit flies are a central part of his own research.

Singh uses the fruit fly to study the early development of the eye, focusing on birth defects. Since the genetic makeup and structure of the eye are very similar in fruit flies and human beings, Singh hopes to use his results to better understand the genetic factors playing a role in children’s eye defects.

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## Dr. Amit Singh, “Lord of the Flies”

New UD biology professor Dr. Amit Singh described his first experience with *Drosophila melanogaster* as a “case of love at first sight.” Walking down the hallway

“Understanding the molecular mechanisms of complex diseases in model systems like *Drosophila* will provide valuable information for translational research and also lead us toward identifying and testing potential therapeutic tools,” Singh said.

Singh earned his Ph.D. from D.A. University in India. He later traveled to the United States, where he worked at Baylor College of Medicine, first as a postdoctoral fellow, and then as an instructor. Now, as an assistant professor at the UD, Singh said he wishes he had been here sooner.

“UD has a very active and vibrant community,” he said. “The enthusiasm in students and collegiality of the faculty here are very infectious.”

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## New Faces

### Postdoctoral Fellows

- Dr. Nobuyasu Maki and Dr. Kenta Nakamura: lab of Dr. Panagiotis Tsonis.
- Dr. Maqusood Ahamed: lab of Dr. John Rowe.

### Part-time instructors

- Dr. Ben Navia, Dr. Dean Wagner and Michelle Yiling.

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## Thank You for Your Gifts!

Many of the experiences we are able to offer our students are possible only because of the generosity of those who have made donations designated to the Department of Biology. If you would like to designate your future donations to the University directly to the biology department, you may donate online at the University’s alumni site (<http://www.udayton.edu/Alumni/>). Select “a special designation” in the designation box and type in “Donation to the biology department” in the comments section, and your gift will reach us.

## Acknowledgements

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## The Nanotoxicology Group: Thinking Really Small ....

One might expect that after serving as chair of the Department of Biology for 14 years (1992-2006), Professor John Rowe might rest on his laurels and relax a bit. Since stepping down as chair, though, Dr. Rowe has formed a unique interdisciplinary and multi-institutional research team to work in the new field of nanotoxicology - evaluating the biocompatibility and potential toxicity of manufactured nanomaterials especially those currently used commercially and in antimicrobial and biosensing nanomaterials that are being developed at the University of Dayton.

The subcellular size of nanoparticles (1-100 nanometers) and larger surface area-to-volume ratio result in dramatic differences in their reactivity and toxicity compared to bulk material. The potential for incidental nanoparticle exposure is constantly growing as there are over 500 commercially available products containing nanomaterials. However, no standard protocol yet exists for investigating the potential risks of nanomaterials to human health and the environment.

The Nanotoxicology Group is developing and testing a series of assays that is rapid, cost-effective, and applicable to the health of humans and the environment.

"We are using a wide array of model systems, from bacteria to fruit flies," said Rowe, "to gain a global view of the interactions of nanomaterials with living systems."

The group is comprised of biology faculty and students, School of Engineering faculty, and research scientists from the

WPAFB Air Force Research Laboratory (AFRL). The project was initiated by Rowe and Drs. John Schlager and Saber Hussain of the Human Effectiveness Directorate at AFRL and grew from a collaborative research agreement with AFRL to share a laboratory and have access to existing facilities at UD.

"The impact of manufactured nanomaterials on human health is of particular interest to the military," said Hussain, Toxicology Group Leader and Research Scientist at AFRL, "and we are pleased that we can expand our capabilities in this field by collaborating with UD."

In addition to Rowe, Schlager and Hussain, the group includes biology faculty members Dr. Jayne Robinson (Chair), Dr. Mark Nielsen, and Dr. Yiling Hong, and the Wright Brothers Institute Endowed Chair for Nanomaterials, Dr. Liming Dai. The technical team includes postdoctoral research associates Dr. Michael Goodson and Dr. Maqusood Ahamed and biology graduate student Josh Crasto and undergraduate students Crystal Vahrenhold, Alison Desjardins, Ravi Ramasamey, and Derrick Goubeaux.

Funding for the Nanotoxicology Group currently comes from the US Air Force and the Oak Ridge Institute for Science and Education, with additional funding pending from the US Environmental Protection Agency and the National Science Foundation. This research effort has broad implications in diverse areas including public health, occupational safety, environmental protection and homeland security.

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## Doctoral Students Gain from State-Funded Research Assistantships



Biology doctoral students winning research assistantships. Clockwise from front: Meagan Roddy, Tracy Collins and Matt Lunn.

UD is one of 12 universities in Ohio to participate in the state's Economic Growth Challenge/Innovation Incentive funding program. The state of Ohio called on its research universities to boost their doctoral programs in science, technology, engineering, and math (STEM) to help develop Ohio jobs and industries in those areas.

The program works by offering

state money to participating universities that the schools must then match. UD chose to allocate its contribution of the funds to research assistantships for students seeking a Ph.D.

Three doctoral biology students are reaping the benefits of the new funding. Matt Lunn (advisor: Dr. Shirley Wright); Tracy Collins (advisor: Dr. Jayne Robinson); and Meagan Roddy (advisor: Dr. Panagiotis Tsonis) were each awarded research assistantships through the program. The focus areas of the research are tissue regeneration, biomaterials and biosensors. Each student's work involves one or more of those three categories.

Roddy, who is studying stem cells and tissue regeneration, said she is grateful for the focus she can give to her research because of the assistantship.

"Research toward tissue engineering holds great promise for treatment opportunities, and I am proud to be an investigator in this field of study. It is very exciting to work in a field where the clinical implications are important and relevant."

Beyond just enhancing UD's doctoral programs, Robinson said, the state funding will help further the school's reputation as an established research university and help garner future research dollars.

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## Faculty Highlights

- Dr. Carissa Krane and Dr. Mark Nielsen were awarded tenure and promoted to associate professor.
- Dr. Jeff Kavanaugh was appointed as Director of UD's Animal Research Laboratory.
- Dr. Kelly Williams was appointed as Environmental Biology Program Coordinator.
- Drs. Carissa Krane, Margaret Pinnell (MEE) and their team received funding from Ethicon Endosurgery for a Phase 2 bioengineering project. Their Phase 1 research developed an ex vivo ruggedness test for assessing surgical tool performance. Phase 2 will investigate the biomechanics and material properties of mammalian arteries affecting surgical tool performance.
- Dr. Jayne Robinson was awarded a three-year USDA grant to study AHL signaling in *Sinorhizobium meliloti* and the effects of AHL signal mimic compounds from its host *Medicago truncatula*.
- Dr. Panagiotis Tsonis received an NIH grant to use the mouse lens regeneration model in mutant mice (after performing cataract surgery) to identify genes that might be correlated with the development of secondary cataracts. Assays will then be devised to examine the genes' therapeutic value.
- Dr. Jeff Kavanaugh, Br. Don Geiger, Dan Goldman (GEO) and Shuang-Ye Wu (GEO) received two Miami County Park District awards to: 1. Manage and monitor wetland mitigation and restoration at the Hobart Urban Nature Preserve; and 2. Provide a biological and hydrological description of Park District land near Silver Lake.
- Dr. Jeff Kavanaugh, Br. Don Geiger and an interdisciplinary team were funded to monitor mitigation and restoration of wetlands for Miami Valley Hospital.
- Dr. Jeff Kavanaugh received a Malcolm-Pirney, Inc. contract to monitor Little Beaver Creek restoration.
- Kelly Bohrer, Mary Ellen Dillon, Dr. Carl Friese, and geology, were given a College of Arts and Sciences Curriculum Development Grant to develop a field study course at Mountain Lake Biological Station in Virginia.

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## Undergraduate Student Researchers “Do Lunch”

This summer, students conducting biology research took their experiences to the next level by instituting weekly meetings with fellow undergraduate researchers in chemistry, geology and engineering. The student-led “Science Thursday Lunch Club” included 30 students from all areas of the sciences. Funding for this venture was provided by the biology, chemistry and geology departments; the Premedical Programs Office; and the Honors and Scholars Program.

The students hosted speakers to discuss topics of interest for undergraduate researchers. Megan Roddy and Tracy Collins, biology Ph.D. candidates at UD, discussed graduate student life. Biology graduate director Dr. Mark Nielsen provided graduate program admission information, and Dr. Shawn Swavey

enlightened the group about current chemistry research. The students also presented overviews and updates of their own work.

“I really got a lot from the speakers,” said senior biology major Annie Klapheke. “I liked getting the perspective of grad students, and the professors had a lot of good advice as well.”

“Hearing about collaborations between different departments helped me see the bigger picture of research going on at UD and its incredibly beneficial applications,” said senior biology major Kaitlin Moredock.

The undergraduate researchers plan to continue the weekly luncheon program next summer. They are also working on a proposal for an interdisciplinary research reception.



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