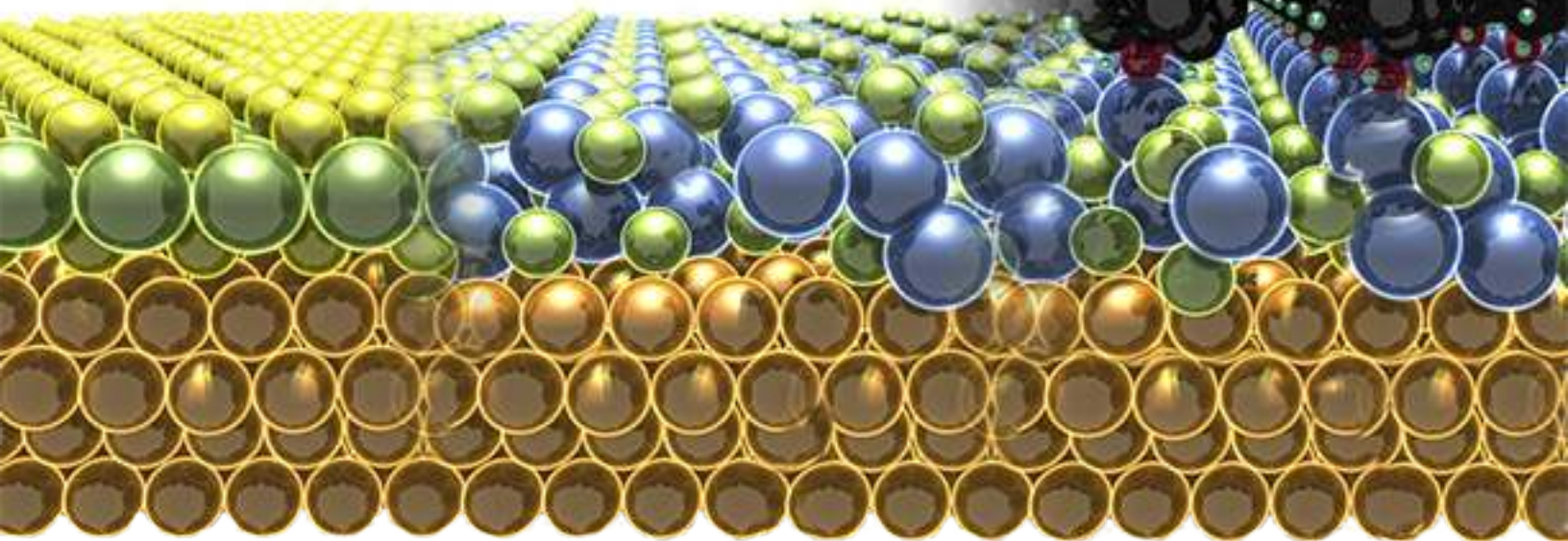
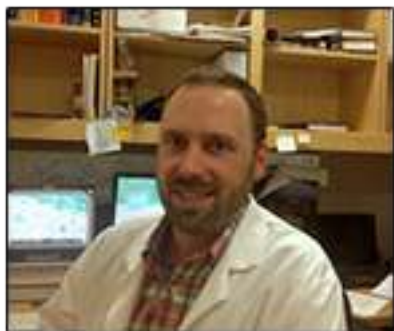


The Department of Chemistry NEWSLETTER



Welcome to our Newest Faculty Member Hill Harman



As a product of public education and resident of California, I am delighted to begin my independent career at UC Riverside. The UC system is the crown jewel of American public higher education, and it is my privilege to be a part of it as we move forward in to the 21st century. Originally from Huntsville, Alabama, I attended college at the University of Virginia where I first developed an interest in

inorganic chemistry while working in the lab of Prof. Dean Harman. Although Dean and I are not related, my time in his lab was formative for me, and his strong commitment to the teaching and mentoring of students remains the standard to which I aspire as an educator. After graduating from UVA in 2004 with a B.S. in Chemistry, I moved to UC Berkeley to begin my graduate studies with Prof. Chris Chang. Working for Chris, I developed my interest in exploring chemical solutions to the problems of renewable energy. After obtaining my Ph.D. from Berkeley in 2010, I moved to Caltech as a postdoctoral fellow in the group of Prof. Jonas Peters, where I furthered my training in synthetic inorganic chemistry and catalyst design.

My research program at UC Riverside will focus on the exploration of transition metal and main group metal chemistry towards the development of economical solutions to problems in renewable energy. In particular, we are interested in CO₂ fixation and the conversion of waste biomass into liquid fuels. Although our focus is on earth-abundant elements such as iron, cobalt, and nickel, we'll explore the entire periodic table as we see fit in order to discover new inorganic reactivity.

In my free time, I enjoy spending time outdoors, and especially mountain biking. Riverside is among the best urban areas in the country in its proximity to excellent mountain bike trails, and I am looking forward to breaking up my time in the lecture hall and laboratory with some trail riding.

Spring 2013
Volume 1 - Number 2

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Chair's Welcome

Greetings from the UCR Chemistry Department! During the Winter quarter, the Chemistry faculty were busy pushing forward the boundaries of science and finding new ways to make instruction more exciting and effective. Highlighted in this newsletter issue are research updates from Professors Michael Pirrung and Ludwig Bartels, and an introduction to our newest faculty member, Dr. W. Hill Harman, who will join UCR in July. The Department is also proud to recognize Professors Eric Chronister, Jack Eichler and Richard Hooley who received grants from UCR's Innovative Use of Information Technology in Teaching program to enhance instruction in our undergraduate courses. In February, we enjoyed a brilliant lecture and insightful discussions with Prof. Wybren Jan Buma who delivered the 2013 Kohler Lectures. This named lecture series recognizes our former colleague Bryan Kohler, and is made possible by generous donations from Bryan's family and friends.

We are especially excited to announce that the first ever Chemistry Alumni Scholarships have been awarded to Kliment Bozhilov, Andrew Carlson, Nicole Godfrey, Christopher Margono and Mary Nguyen. Thanks to the generosity of our donors we were able to award \$500 scholarships to these outstanding chemistry majors. These students were selected from a large pool of deserving applicants, and we hope to be able to expand the number of scholarships awarded next year.

We are also proud to be able to share with you some of the accomplishments of our alumni. Dr. Charlie Gay, a double alum having earned both B.S. (1968) and Ph.D. (1979) degrees in Chemistry from UCR, was elected to the National Academy of Engineering. Congratulations Charlie! Updates are also provided from Dr. Tas Dienes (Ph.D. 2002), Dr. Ryan Pedigo (B.S. 2008), Sarah (Gutierrez) Totten (B.S. 2009) and Dr. Dennis Owsley (Ph.D. 1969). Those readers who are jazz lovers should check out Dennis' public radio show Jazz Unlimited <http://www.news.stlpublicradio.org/programs/jazz-unlimited>. He is one cool cat! If you would like to share your news and happenings please send me an email (clarive@ucr.edu). We look forward to hearing from you.

Dr. Charlie Gay

Elected to National Academy of Engineering

Applied Materials, Inc., the market leader in solar photovoltaic (PV) manufacturing equipment, announced that Dr. Charlie Gay, president of Applied's Solar division, has been elected to the National Academy of Engineering (NAE) for his seminal leadership contributions to the development of the global solar PV industry.

Founded in 1964, the NAE provides engineering leadership in service to the nation. Academy membership honors those who have made outstanding contributions to engineering research, practice, or education and is among the highest professional distinctions accorded to an engineer.

An industry veteran with more than 35 years of solar experience, Dr. Gay's contributions across solar energy technology, manufacturing and deployment have helped the global solar PV market become a \$50 billion industry and enabled the cost of solar to come down by a factor of 50 since 1978. More than 85% of all solar panels manufactured in the last three decades have been made using the groundbreaking metallization and packaging technology solutions developed by Dr. Gay and his teams over the duration of his career.

As founder of the Greenstar Foundation, Dr. Gay has worked continuously to apply solar technology to improve people's lives by delivering solar power to villages in developing countries. The Greenstar model has received recognition from international awards programs as diverse as the World Bank, the Stockholm Challenge, the Davos Conference and the Tech Awards. More recently, Dr. Gay was chairman of a project to electrify all the homes and schools in the rural Shaanxi Province of China.



Innovative Use of Information Technology in Teaching (IUIT)

IUIT proposals address planned research and experimentation to develop and evaluate novel ideas that integrate technology with course curriculum and pedagogy.

This program is made feasible by the new student technology fee paid by all undergraduate and graduate students at UCR. The program goal is to solicit and support creative and effective ideas for improving instruction through innovative use of information technologies. IUIT awards given to Eric Chronister, Jack Eichler and Richard Hooley.



Quantum Mechanical Calculations in Undergraduate Courses: Utilizing a Browser Interface to an Instructional Computational Cluster (Eric Chronister)

The grant will provide funds to purchase a powerful 64 core workstation dedicated to undergraduate instruction and research, plus a graphical web browser interface (WebMO) that will provide remote student access to UCR site license quantum mechanical software (e.g. Gaussian). The initial instructional applications will focus on:

- 1) hands-on pedagogical undergraduate experiences with modern chemical computational methods (e.g. quantum mechanical modeling in Chem1, 112, and 113)
- 2) computational research opportunities for undergraduates (e.g. Chem1H Labs) where student will explore independent research on the wide range of possible molecular conformations associated with hydrocarbons believed to exist as interstellar species. It is also expected that more comprehensive projects in which the research results of many students can be combined and analyzed as a group to evaluate the wide range of similar hydrocarbon species that have been proposed as interstellar molecular species.



Using Information Technology to Create Interactive Learning Environments in General Chemistry Discussion Groups and Organic Chemistry Laboratories (Jack Eichler and Richard Hooley)

The funding will help to put Mathematica on 5 computers in the second floor computer lab. In addition, summer salary and money to pay the Office of Campus Computing, which will allow us to create a website to house all of our case study materials.

The website will be designed in a way that will allow chemistry instructors from any institution to download the case study files and use them in their course management sites (Blackboard, WebCT, etc.). As we publish the cases with the NCCSTS, we will also provide links from our website to our case materials at the NCCSTS site. The summer salary also included a couple months of summer support for a grad student who will develop interactive tutorials using the Mathematica software (these tutorials will be done in the gen chem discussion groups).





New Compound Holds High Promise in Battling Kidney Cancer

Chemists at the University of California, Riverside have developed a compound that holds much promise in the laboratory in fighting renal (kidney) cancer.

Named TIR-199, the compound targets the “proteasome,” a cellular complex in kidney cancer cells, similar to the way the drug bortezomib, approved by the Food and Drug Administration, targets and inhibits the proteasome in multiple myeloma cells, a cancer coming from bone marrow.

Michael Pirrung, a distinguished professor of chemistry at UC Riverside, announced the development of TIR-199 in a lecture he gave on Feb. 19 at the 5th International Conference on Drug Discovery and Therapy, held in Dubai, UAE.

Operating like the garbage dump of a cell, the proteasome breaks down proteins. Drugs that block the action of proteasomes are called proteasome inhibitors, and have been shown to have activity against a variety of cancer cell lines, albeit with mixed results. For example, bortezomib, though effective against multiple myeloma, has many side effects because cells other than bone marrow cells are affected.

“The novel feature of our new proteasome inhibitor, TIR-199, is that it is nearly as potent as bortezomib, but is selective in inhibiting the growth of only renal cancer cell lines,” Pirrung said. “It’s what makes TIR-199 attractive.”

The TIR-199 research project at UC Riverside began about four years ago after a multidisciplinary, international team reported on a class of compounds that act on the proteasome. These compounds are the “syringolin” natural products — such as a compound produced naturally by the wheat-infecting bacterium *Pseudomonas syringae*. TIR-199 is a synthetic relative of syringolin.

“At UCR we began to work on, and completed the synthesis of, two compounds from this class of compounds,” Pirrung said. “Of the two, TIR-199 showed most promise.”

Pirrung’s lab first shipped TIR-199 samples to the University of Hawaii, Hilo, where André Bachmann, an associate professor of pharmaceutical sciences and Pirrung’s collaborator, studied TIR-199 in test-tube assays for how it worked against the proteasome.

Bachmann then tested the compound against a limited number of cancer cell lines that showed that TIR-199 was effective against the cancer cells. What remained unclear, however, was if TIR-199 was toxic to normal cells.

Encouraged by these results, Pirrung submitted TIR-199 samples to the National Cancer Institute at the National Institutes of Health, where the compound was subjected to a rigorous 60-cell screening used routinely to test compounds for their effectiveness in battling 60 kinds of cancer, including leukemia, lung, colon, brain, breast, ovarian prostate and renal cancers.

“We were very excited when the NCI informed us that TIR-199 has excellent potential to be moved to drug development because of its selective activity against renal cancer,” Pirrung said. “This is good news also because the NCI scientists told us there really are no good drugs out there to fight renal cancer.”

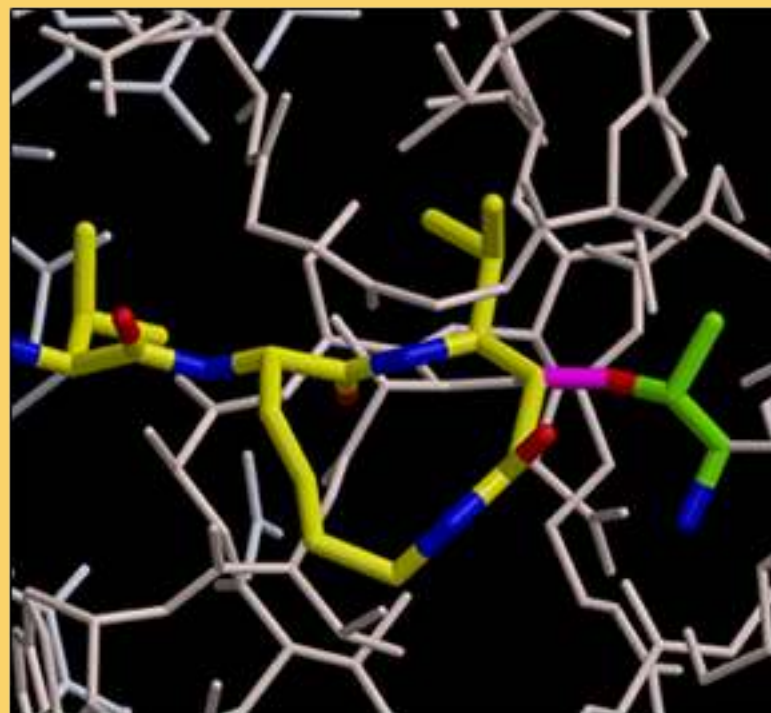
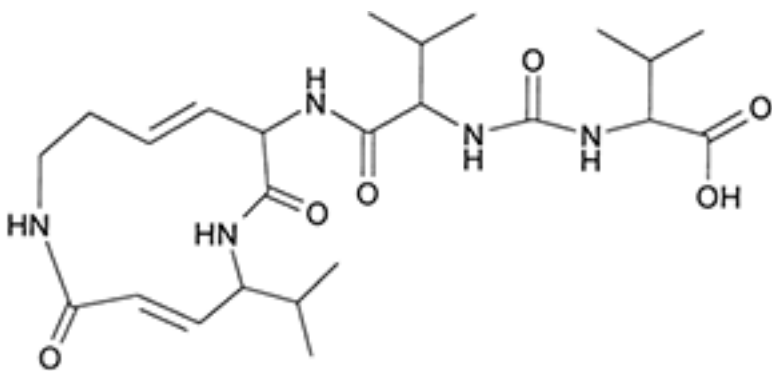
Next, the NCI will test TIR-199 on cells grown in a hollow fiber that partially mimics the body by offering a three-dimensional environment. If the test

results are positive, TIR-199 will be tested on mice.

The UCR Office of Technology Commercialization has filed a patent application on TIR-199 and is currently seeking partners in industry interested in developing the compound commercially. Several biotechnology companies have already shown interest.

“We still have to fine-tune TIR-199 in the lab because some aspects — certain structural elements within it — make it easily metabolized,” Pirrung said. “But now that we have a good handle on how structural changes in the compound affect anticancer activity and how the parent drug binds to the proteasome, we are pretty confident of making a better version — the second generation — of TIR-199.”

The project was funded by a grant from the University of California Institute for Mexico and the United States (UC MEXUS), to Tannya Ibarra-Rivera, a former postdoctoral researcher in Pirrung’s lab who helped discover TIR-199 and after whose initials the compound is named; and to Pirrung from the UC Cancer Research Coordinating Committee.





Dr. Ludwig Bartels

New National Center Devoted to Microelectronics

Three University of California, Riverside scientists and engineers are members of a new national research center — the Center for Spintronic Materials, Interfaces, and Novel Architectures (C-SPIN) — focused on developing the next generation of microelectronics. Led by the University of Minnesota, C-SPIN is being supported by a five-year \$28 million grant, about \$3 million of which is allocated to UC Riverside.

The grant was awarded by the Semiconductor Research Corporation, a global research collaboration of private companies, universities and government agencies; and the Defense Advanced Research

Projects Agency (DARPA). C-SPIN at the University of Minnesota will bring together top researchers from across the nation, such as UCR's Roland Kawakami, Ludwig Bartels and Cengiz Ozkan, to develop technologies for spin-based computing and memory systems.

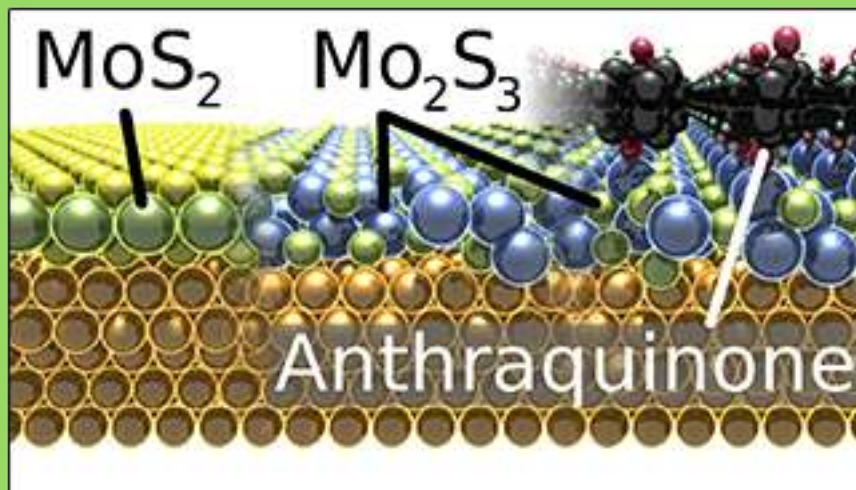
Kawakami's research group will be working on the fabrication and testing of spintronic devices made from two-dimensional crystals, namely metal dichalcogenides (inorganic materials with unique electronic properties) and graphene. Bartels's and Ozkan's research groups will be working on the growth and characterization of two-dimensional metal dichalcogenides.

Spin-based computing has gained considerable interest recently due to advances in a number of areas. It can combine memory and logic at the device and circuit level, thereby leading to much faster operation for data-intensive applications. This is crucial in the information age and includes applications such as searching, sorting, and image recognition.

Especially important is the room temperature spin transport in graphene with high spin injection efficiency, first demonstrated by Kawakami's group. C-SPIN will help develop the graphene spintronic devices as well as explore new two-dimensional metal dichalcogenides, which are expected to allow for more facile spin manipulation. Research at C-SPIN is expected to have an impact beyond the world of computer science and engineering resulting in advances in nanotechnology, materials science, physics, chemistry, circuit design, and many other fields.

Current Research

Recent work in the Bartels group showed the growth of a novel Mo_2S_3 single layer film on a copper surface. This film was found to interact strongly with oxygenate species, much stronger than the basal plane and the edges of MoS_2 islands, which are a common catalyst for the production of alcohols from syngas, suggesting structural diversity in MoS_2 -based catalyst may play a significant role in their catalytic application.



Data obtained in this study include low-temperature scanning tunneling microscopy imaging, high-level density functional theory modeling, as well as X-ray photoelectron spectroscopy and thermal desorption spectroscopy. The article appeared in *Angewandte Chemie*.

Alumni Scholarship Award



The University of California, Riverside's Department of Chemistry has awarded five undergraduate students with the Alumni Scholarship Award. This award is made possible by the support of the Chemistry Department Alumni and is awarded to undergraduate students for their academic achievements, research involvement and extra-curricular activities. The following students have demonstrated such merit and were awarded the scholarship: Kliment Bozhilov, Andrew Carlson, Nicole Godfrey, Christopher Margono, and Mary Nguyen. On behalf of the Chemistry Department, we congratulate them for their achievements.

Senior Kliment Bozhilov has been part of numerous laboratory experiments under the mentorship of Prof. Valentine Vullev and Prof. Francisco Zaera. His latest research involves surface chemistry while using horizontal attenuated total reflection FT-IR to analyze the modifier, cinchonidine. Kliment's future goal is to apply for graduate school and pursue a Ph.D. in physical chemistry.

Senior Andrew Carlson has been involved in research in Prof. Michael Pirrung's laboratory focusing on the synthesis of a small molecule insulin mimic. He also has synthetically engineered luciferin for new biological assays. Andrew intends to pursue a career in pharmaceutical drug discovery, natural product synthesis, or new synthetic methods in graduate school. Andrew will be attending University of California, Los Angeles this upcoming fall to pursue a Ph.D. in Organic Chemistry.

Junior Nicole Godfrey has been part of several laboratory research projects with the mentorship of Prof. Gregory Beran and Prof. Michael Pirrung. Nicole's current research involves the solution phase synthesis of the lipopeptide Fellutamide B. She plans to complete her senior thesis and pursue a Ph.D. in Organic Chemistry.

Senior Christopher Margono has been part of numerous outreach programs that help children that identify as low income to achieve academic excellence. Christopher serves as an Honors Peer mentor, HPAC Peer mentor, Fundraising Coordinator for the Student Run Health Clinic, and recently completed training as a Suicide Crisis Respondent for IMAlive. Christopher's future goal is to apply to medical school and pursue a M.D. in Epidemiology to help rural Indonesian communities.

Junior Mary Nguyen is a co-author in *Angewandte Chemie* for research with Prof. Catharine Larsen on a unique dual catalyst for 1-step syntheses of amines with pharmaceutical relevance. As a CNAS Ambassador, she represents the college internally and externally recruiting new students and being a student voice in the college. One of UCR's two Goldwater nominees, Mary plans to earn a Ph.D. in Chemistry for a career in academia.



Dr. Tas Dienes Class of 02'

Tas completed his Ph.D. in analytical chemistry at UCR in 2002 in the research group of Dr. Kim Prather, working on the design, construction, and characterization of the first field-portable aerosol time-of-flight mass spectrometers (ATOFMS).

Dr. Tas Dienes is currently Chief Technology Officer at SmartAction, a software company providing intelligent call automation systems via a software-as-a-service (SAAS) model. SmartAction provides an automated system that answers phone calls for other companies, and it uses artificial intelligence to do so in a much smarter, friendlier, and more helpful way than the common and annoying touchtone menu driven systems with which everyone is familiar. Most of his work is centered on connecting the AI “brains” to the real world – building the infrastructure that they run on, and getting phone calls and data in and out of them.

SmartAction was started in 2009 for the purpose of commercializing the artificial intelligence technology that has been developed over the previous several years by the parent company, Adaptive AI, Inc. Their ultimate goal is to continue developing the AI technology to make it ever more intelligent and more useful, and to develop other commercial products around this technology in the future.

Previously Tas was CTO of Forval International, a startup which developed an all-in-one network server for small businesses. While at UCR, he was co-founder and Chief Operating Officer of I/O Software, a company which developed information security software that enabled companies to use biometric authentication devices and cryptographic tokens to secure access to computer systems and applications.



Dr. Ryan Pedigo Class of 08'

Dr. Ryan Pedigo graduated from UC Riverside in 2008, receiving his B.A. in Chemistry. During his time at UC Riverside, he taught chemistry through the Learning Center and also participated in research in Dr. Francisco Zaera's lab.

Upon graduating, he was inducted into Phi Beta Kappa and received the Rosemary S.J. Schraer Award for his academic achievement and contributions to the campus. Subsequently, he attended the UCR/UCLA Thomas Haider program in pursuit of his doctorate degree. There, he was president of the Student Run Health Clinic, a clinic serving Riverside County that provides no-cost services to those in need. He received his M.D. from UCLA in June 2012, was inducted into the Alpha Omega Alpha honor society, and is now a resident physician in Emergency Medicine at Harbor-UCLA Medical Center in Torrance, CA.



Sarah Totten Class of 09'

I attended UCR from 2004 to 2009 and majored in chemistry. Studying chemistry at UCR was stimulating and presented a lot of opportunities to participate in undergraduate research. It was here I discovered I had a knack for analytical chemistry and began doing research in Professor Larive's bioanalytical lab where I learned a variety of analytical techniques and their application to biomolecules. While being involved in research at UCR, I learned of many other types of programs and opportunities out there for undergraduates to participate in scientific research, such as the National Science Foundation's Research Experience for Undergraduates (REU) programs. It was through this program that I was able to participate in analytical chemistry research at the University of Cincinnati in Ohio in the summer of 2008.

Being involved in research as an undergraduate inspired me to pursue a PhD degree in analytical chemistry. Having undergraduate research experience was key to succeeding in the graduate program at the UC Davis where I am currently studying. Under the mentorship of Prof. Carlito Lebrilla, I develop mass spectrometry based methods for the analysis of glycans. My research has focused on milk glycomics, which involves the extraction, identification, and quantitation of the free oligosaccharides and glycoproteins that are present in human breast milk. Nearing the end of my fourth year of study, I am excited to see what the future holds! Currently my career goal is to continue with academic research as a postdoctoral researcher in the field of analytical chemistry, specifically in mass spectrometry, with application to glycomics and proteomics in nutrition and food sciences.



Dr. Dennis Owsley Class of 69'

UCR Alumni Dr. Dennis Owsley received his Ph.D. in Organic Chemistry under the direction of Prof. George Helmkamp. After his graduation he started work at Monsanto in St. Louis where over the next 27 years he participated in successful projects in photochemistry, gas phase/solid state chemistry, process chemistry and discovery, enzyme inhibitors, microbiology, and protein chemistry. He also taught college level chemistry as an adjunct professor in the 1970's and 1980's. In 1996, Dr. Owsley retired from Monsanto as a Senior Science Fellow, 1 of 30 individuals to hold that position. He has had a parallel career since 1983 in jazz radio and will achieve 30 years of bringing a jazz radio show, "Jazz Unlimited" to St. Louis on St. Louis Public Radio 90.7 FM. His show has won "Best in St. Louis" six of the last eight years. He also published a book, "City of Gabriels: The Jazz History of St. Louis 1895-1974" in 2006 which has won a national award. Dr. Owsley is also known for his photography of jazz musicians that have landed in album covers, photo exhibits, websites and a music textbook. Occasionally, he writes pieces for St. Louis Magazine and the St. Louis Beacon. On a final note, he has always said, "People trained as organic chemists can do anything" and Dr. Owsley has aptly demonstrated that ideal.



Daniel Tilman Carty

Aug. 19, 1935 - Jan. 24, 2013

In Loving Memory

Daniel Tilman Carty was born in Greenville, Texas on August 19, 1935. He passed away of heart failure in Hospice, Palm Desert, CA on January 24, 2013. His family was with him during his final days to love and support him and that time with him and the love and support he provided to his family throughout his life will never be forgotten and always be cherished.

A retired industrial chemist, Dan received a BA in Chemistry from UC Riverside in the Pioneer Class of 1961, an MA in Chemistry from the University of Hawaii in 1963 and a PhD in Organic Chemistry from Stanford University in 1967. In 1968, he held a post-doctoral position at the Institut für Organische Chemie at Universität Karlsruhe in Professor Doctor Rudolf Criegee's group. Dan worked at three industrial labs during his career: Stanford Research Institute (high stability fluids), Rohm and Haas laboratories (plastics modifiers and acrylic emulsions) and Clorox Research and Development (Consumer Products). He is author/co-author of 21 patents and several journal articles.

Dan was an emeritus member of the American Chemical Society. He was active in the Water Quality Association, serving on its Board of Directors (2002) and as Chairman of the Science Advisory Committee (1999). He also served on the water treatment committee of NSF International 1992-2002.

Dan Served as Scoutmaster of Troop 63, BSA from 1975-1980. He was active in the YMCA Indian Guide/Princess program for 20 years, serving as Chairman of the Board for San Ramon YMCA in 1996.

Dan was also in the National Guard and Army Reserve for almost 20 years, retiring as a Colonel. He was a distinguished graduate from the US Army Armor School, Ft. Knox, KY finishing first among 110 junior officers.

Dan enjoyed life to the fullest and always had a great sense of humor through good times and bad. Dan particularly enjoyed traveling all over the world, skiing, sailing, football, camping, tennis, golf, fishing, reading, driving sports cars and spending time with his family and friends. Dan Carty is survived by Valerie W. Carty, his spouse of 54 years, his three children: Craig W. Carty, Carolyn Carty Barber and Christina Carty-Francis and his seven grandchildren.

Bryan Earl Kohler

1940 - 1997



The Bryan Earl Kohler Distinguished Lectureship was established in honor of our colleague for his professionalism, his dedication to the advancement of science, and for his uniquely human spirit that influenced so many of us as a mentor, peer, and true friend.

The family and friends of Bryan Kohler have established an endowed annual lectureship in memory of UC Riverside's distinguished colleague, Professor Kohler.



Wybren Jan Buma

Wybren Jan Buma received his PhD degree cum laude in 1989 at Leiden University where he performed his doctoral research in both Experimental Physics and Theoretical Chemistry under the supervision of Joan van der Waals and Jan Schmidt. His PhD thesis he was awarded the 1989 Shell Prize. In 1989 he received a fellowship from the Netherlands Organization for Scientific Research (NWO) and joined the group of Bryan E. Kohler at the UC Riverside as a postdoc. In 1991 he was appointed to the faculty of the University of Amsterdam where he became professor by special appointment of the "John van Geuns Fonds" foundation in 2001. Since then he has held the regular chair in Molecular Spectroscopy at this university. His research group aims to advance the fundamental knowledge of the dynamics of excited states in molecules and nano-sized objects, and to contribute with its expertise to applications of the photosciences. He has

been member and coordinator of various European Research Networks. In 2008 he was awarded the EU Descartes Prize for Transnational Research as member of the SynNanoMotors team.

"Photons at Work" presented Feb. 13, 2013 at UCR

Abstract: High-resolution laser spectroscopy provides the magnifying glass that relates molecular structure and dynamics to functional properties. Such studies have for a long time been restricted to small, isolated molecular systems. At the same time, it is more and more recognized that complex molecular systems can give rise to unique properties at the molecular and material level that are impossible to study by using simple, covalent model systems. Taking examples from polyenes to photoactive proteins and molecular machines, this lecture will show how in recent years it has become possible to study such complex systems at the same level of detail as small systems, and how nowadays key elements of a molecular environment are incorporated controllably into high-resolution studies.

