

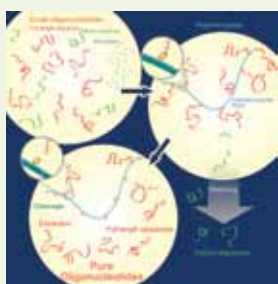


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See Associate Professor Shiyue Fang's research with DNA drugs on page 4.



Letter from Sarah

The snow finally melted, and our students made it through their last classes. They are off to their summer jobs or careers, graduate students are involved in their research, and we are all wondering how the year went by so quickly.

Departmental Scholar Travis Olds will be attending an intensive summer program in radiochemistry at San Jose State. Matthew Schultz and Molly Wiltzius were awarded, respectively, the Pruett and Sandretto-Stackhouse summer research fellowships to pursue projects here while enjoying the UP summer. Nick Bauman '11 has received a fellowship to begin his research before joining the PhD program at Michigan State. Noyce Fellows Sarah Weinreis, Jennifer Rich, and Nicholle Stark will begin their student teaching next fall. These talented students have committed to using their skills to improve science education in high-needs secondary schools.

We also have news from recent alumni. Matthew Reuter '06 has completed PhD studies at Northwestern. We had a wonderful visit from alumna Sarah Carlson '03 who spoke at our annual awards event about her path from Tech to her position as a surgical resident at Harvard's Beth-Israel Hospital.

Last fall, our class of 2014 joined us, with sixteen new chemistry majors, seven new biochemistry/molecular biology majors, one cheminformatics major, and eight new pharmaceutical chemistry majors; nine transferred into the department from other Tech or outside programs, bringing our total undergraduate population to 114. Two members of the incoming class were founding members of Michigan Tech's new women's soccer team (see p. 5).

Our newest faculty member, Tarun Dam, moved here from New York City in August (p. 3). He is adjusting well to small-town life. His laboratory is set up with some unique instrumentation, and he is ready to welcome undergraduate and graduate students into his research group

this summer. In other faculty news, Lynn Mazzoleni is one-quarter of a team that received funding to build a one-of-a-kind cloud chamber to study the chemistry and physics of cloud formation (p. 4). Shiyue Fang is highlighted for his novel method of purifying synthetic DNA without tedious chromatographic separations (p. 4). Pushpa Murthy and Marty Thompson are continuing development of their discovery-based biochemistry lab course, funded by NSF.

We feature Melvin Calvin '31 in this issue on the 50th anniversary of his Nobel Prize. Keep an eye out for a US postage stamp being issued in his honor as part of an American Scientist series.

Thanks to a very generous bequest from Ingrid Kling Markul '45 (p. 2), we now have a welcoming main office and both small and large conference rooms. These rooms are used for student and faculty meetings, and for research group meetings, which link undergraduate and graduate students with their advisors to discuss their data and plan new experiments.

We truly appreciate the generosity of our alumni. Donations have allowed us to support summer research opportunities for students, travel to ACS meetings for graduate and undergraduate students, improvements in the Chemistry Learning Center, and postdoctoral fellowships to help launch research projects. The new giving page on our website is designed to make sure your gift goes to support the programs you choose. Please take a few minutes to read about our "Elements of Success" Periodic Table. We are working toward having every element sponsored.

At the end of our last newsletter we had an old picture for you all to see. We were asking for their names. We included the names this year. Take a look to make sure they are all accurate!

We always look forward to getting alumni updates to share with everyone. Please send yours along if you haven't done so already; just go to our website.

Sarah Green
Department Chair

New Offices, Furnishings, and Spaces, Thanks to Ingrid Kling Markul '45



Above: Chemistry students are shown using the new conference room, improved and furnished by the funds from Ingrid Kling Markul '45. Above, top right: office assistant Margaret Dunstan enjoys the updated reception area. Above, bottom right: Dunstan, office assistant Celine Grace, and new faculty member Tarun Dam are shown in the new sitting area.

Alum Loved to Fly, Remembered the Department



Ingrid Kling Markul '45

Ingrid Kling Markul had a love of education that allowed her to soar among the stars. She also did a little soaring while piloting small airplanes.

And she gave \$100,000 to the chemistry department to help future generations of students fly high.

"She was a very special, very bright person," says Nancy Dionne, her niece who resides in the Keweenaw and who was very close to her. "She taught

chemistry in Los Angeles, Beverly Hills High, and worked in research, too."

Markul counted some Hollywood stars' children among her pupils, but she was never starstruck. Dionne recalled that once, while passing her television, she commented, "Oh, gosh, I taught that kid. Good thing he went into acting." The show was "All in the Family," and the kid was Rob Reiner.

She also chaperoned a dance with Jimmy Stewart once, "but it never made any difference to her," Dionne says. "She was very intelligent and focused on being a very good teacher."

Markul also taught chemistry at the Doelle School in Tapiola, while she was a student at Tech, where she graduated second in her class: one of the rare females on campus in the 1940s.

She visited local family every year, Dionne says, and she taught her young niece many interesting things, including some Tech fight songs that her kindergarten teacher frowned upon.

She got her small plane license, using an old airstrip on the Isle Royale sands southeast of Houghton on the

Keweenaw Waterway, even taking Dionne along for training runs. It was just another example of learning.

"She really valued her Tech education," Dionne says. "She was one of the first women to graduate from Tech and donated to the school every year."

Her final donation will go a long way to benefitting many students in the chemistry department, including some funds already spent on meeting rooms and offices (see above).

"We'd like to focus the rest of the money on undergraduate and/or graduate student support," says Sarah Green, chair of the department. "Sponsoring travel for students would be especially appropriate, given Ingrid's love of flying and traveling."

Green says that the fact the funds are unrestricted is great.

"I'll be looking for faculty input, soon, and start planning on how we can spend the funds on our students," she says.



Tarun Dam

Fall 2010, Biochemistry

We are delighted to welcome our newest faculty member, biochemist **Tarun Dam**, to the department. Dam joins us from the Department of Molecular Pharmacology, Albert Einstein College of Medicine in New York. He is an expert in glycan (carbohydrate) binding proteins and their ligand recognition properties.

He uses biochemical and biophysical tools, especially thermodynamics measurements.

His education includes a master's in marine science, a PhD in Protein Biochemistry from the University of Calcutta, and a traineeship at the Indian Institute of Science. Dam anticipates productive collaborations at Tech, where his research focuses on the mechanistic basis of protein-glycan interactions in immune regulation and pathogen invasion.

Dam discusses his research: "Antigen presenting cells (APCs), that protect our body from internal and external threats, express an array of glycan-binding proteins or lectins. These lectins recognize cancer antigens as well as the surface structures of pathogens and help immune cells interact with tumor cells and invading pathogens. Depending on certain factors, these interactions either help eliminate the detrimental pathogens and tumors (immunity) or lead to a tolerant environment where

tumors and pathogens thrive (immune tolerance). Our lab's main goal is to determine the mechanistic basis of the factors that regulate the balance between immunity and immune tolerance. Many pathogens also express glycan-binding proteins and use them for host invasion.

"We study the structure-function relationship of such pathogenic proteins. The findings of our research would potentially elucidate novel immunobiological pathways and help develop new drugs and vaccine strategies. Our lab also works in the area of plant lectins. We use plant lectins as model and surrogate proteins to study the mechanistic basis of protein-glycan interaction, investigate the nutritional aspects of lectins from edible plants, and develop novel detection and separation devices. Such devices would be useful for glycomics, glycoproteomics and various bio-analytical, and bio-detection techniques."

Student Awards

The department held its annual spring awards banquet in April. Students were recognized for their academic achievements and service to the department. Spring 2011 awardees included—

- **CRC Press Freshman Chemistry Achievement Award** **Madeline Topitzes**
- **Doc Berry Award** **Jennifer Rich**
- **Undergraduate Award in Analytical Chemistry** **Nicholle Stark**
- **Biochemistry Research Award** **Talisha Sutton**
- **Studio Lab Endurance Awards** **Stephanie Bonenfant, Aaron Chartier, Shari Konst, Lance Thurston, Madeline Topitzes**
- **Leslie Leifer Award in Physical Chemistry** **Nicholas Bauman**
- **Outstanding Senior Award** **Hillary Cadeau, Tanya Johnson, Claire Drom**
- **Outstanding Senior Research Award** **Nicholas Bauman, John Maass**
- **Outstanding Lower-Division Chemistry Teaching Assistant** **Katrina Bugielski, Andrew Chapp, Na Hu, Gregg Hasman, Sarah Weinreis, Claire Higginbottom**
- **Outstanding Upper-Division Chemistry Teaching Assistant** **Padmanaban Sasthan Kuttipillai**
- **Outstanding Graduate Student** **Xiaochu Ding**
- **Ray E. Cross and Eleanor K. Cross Endowed Graduate Fellowship in Chemistry** **Ning Chen**
- **David J. and Valeria L. Pruett Summer Undergraduate Research Fellowship** **Matthew Schultz**
- **Sandretto-Stackhouse Fellowship** **Molly Wiltzius**
- **Departmental Scholar** **Travis Olds**
- **Student Employee Recognition** **Tsitsi Hungwe**
- **Department of Chemistry Ambassador Awards** **Gregg Hasman, Karen McKelvie, Molly Gehrls, Stephanie Bonenfant, Madeline Topitzes, Shari Konst, Lynzee Bigelow, Torri Bode, Thomas Schneider, Chelsea Nikula, Jennifer Rich, Nicholas Bauman, Parichehr Saranjampour, Cassandra Radka, Stephen Krieger, Andrew Kennedy, Phillip Olivares, Matthew Schultz**

ACS Student Affiliate Officers

We would like to thank the 2010-11 officers, President **Gregg Hasman**, Vice President **Tanya Johnson**, Treasurer **Andrew Kennedy**, and Secretary **Claire Drom**.

Research Funding

Chair **Sarah Green**, Assistant Professor **Lanrong Bi**, and Associate Professors **Shiyue Fang**, **Martin Thompson**, and **Haiying Liu**, received \$180,000 from the National Science Foundation for a three-year project, "Acquisition of Matrix-Assisted Laser Desorption/Ionization Time of Flight Mass Spectrometer (MALDI-TOF)."

Assistant Professor **Lynn Mazzoleni**, and **Raymond Shaw**, **Will Cantrell**, and **Claudio Mazzoleni** (physics), and **Chien Wang** (geology), received \$1.4 million from NSF for "MRI: Development of a Multiphase Turbulent Reaction Chamber for Laboratory Studies of Atmospheric Aerosol and Cloud Processes."

Assistant Professor **Ashutosh Tiwari** received \$113,519 from the ALS Therapy Alliance for the first year of a potential two-year \$232,693 project, "Characterizing the Surface Hydrophobicity of ALS Mutants of SOD1 by Novel Fluorescent Probes."



Lynn Mazzoleni and PhD student Parichehr Saranjampour.

Cloud Chemistry

NSF funds will build a cloud chamber.

By Lynn Mazzoleni

At first glance, clouds appear to be relatively static, but the cloud droplets are actually dynamic. Aerosol-particle-laden air moves in and out of regions with varied temperature. At certain temperatures, the atmospheric water vapor condenses onto aerosol particles forming cloud droplets. However, the particle-laden air with cloud droplets continues to move, and when the water vapor evaporates, the solutes reform aerosol particles.

This process brings about several interesting questions: How important is the aerosol particle composition for cloud droplet nucleation? What is the mass transfer rate of gaseous components to droplets? And what compositional changes occur as a result of droplet formation and the commingling of soluble species (including soluble gases)? These questions and many more can now be studied at Michigan Tech, thanks to funding from the National Science Foundation to build a state-of-the-art turbulent cloud chamber.

We intend to use the chamber to study the mass transfer of polar gaseous species and the formation of new higher molecular weight products formed in the aqueous phase. The new low vapor pressure products are referred to as

aqueous secondary organic aerosol (aqSOA) because they are too large to return to a gaseous state after water evaporation. There are several biogenic and anthropogenic emissions that may contribute substantially to aqSOA. The most notable biogenic species is isoprene with 440–660 teragrams of carbon (Tg C) emitted annually. Even if very small amounts of aqSOA are formed from isoprene oxidation products, the total contribution of isoprene to the global aerosol burden may be quite significant.

Advanced analytical techniques will be used to understand aqSOA formation in droplets. In recent field samples of atmospheric cloud water, the Mazzoleni research group identified thousands of individual chemical formulas with C, H, N, O, and S elements using ultrahigh resolution mass spectrometry. These analytes represent the products of several atmospheric reactions.

In addition to interesting cloud chemistry questions, physics professors **Raymond Shaw** (lead PI), **Will Cantrell**, and **Claudio Mazzoleni** intend to study aerosol and cloud physics in the chamber. The group plans to conduct experiments in parallel whenever feasible, to better link the chemical and physical properties of aerosols.

Purifying Synthetic DNA Drugs

Associate Professor **Shiyue Fang's** research group developed two methods for the purification of synthetic DNA drugs. They've been issued a patent for "Purification of synthetic oligomers."

According to Fang, single-stranded DNA has the potential to cure many diseases because they can selectively silence gene expression to prevent the production of unwanted proteins. Because of this, large quantities of synthetic DNA are required for clinical trials and patient use. However, DNA contains impurities, which must be removed before they can be used clinically. Known methods are either not suitable or highly expensive for large-scale DNA purification. The two methods developed in Fang's group could solve the problem.

In one method, Fang says the desired DNA is tagged with a polymerizable group on an automated synthesizer. It is then incorporated into a polymer, which is insoluble in water. The impurities are simply removed by washing with water. The pure DNA is cleaved from the polymer. In the second method, all the major impurities are tagged with a polymerizable group during automated synthesis. The desired DNA is not. The tagged impurities are simply removed by incorporation into a polymer. The desired DNA and small amount of untagged impurities are extracted with water. A simple precipitation removes the remaining impurities.

Both methods give highly pure DNA, Fang says. The recovery yields are also excellent. Because these methods do not need any chromatography, and purification is achieved by simple manipulations such as shaking, filtration, washing, and extraction, they can be readily scaled up for purification of DNA drugs at kilogram to metric-ton scales.

Fang's group is now applying the same catching by polymerization concept for purification of other important biopolymers such as peptides. They expect that their technologies will significantly reduce the price of DNA and peptide drugs, and therefore save federal research funding and benefit families' health care.



Talisha Sutton (front) with friends Lindsey, Tyler (left), and CJ.

Chemistry Students Abroad

Talisha Sutton

In Costa Rica, I took a short story class and advanced Spanish, and I really enjoyed my time there. The people were very friendly and helpful. It was scary at first being there and not being able to speak Spanish, but after time went by it became easier to communicate. Costa Rica has a laid-back lifestyle, except when it comes to driving. My mother came to visit for the last week of my trip. She stayed with the host family and me. My mother doesn't know Spanish at all so it was fun translating what she said for them and vice versa.



Wilbel Brewer in front of the Royal Palace in Madrid.

Wilbel Brewer

I recently had the opportunity to study abroad in Bilbao, Spain, at Escuela Universitaria de Estudios Empresariales, where I studied international marketing. While in Bilbao, I also visited Italy, France, and nearby Spanish cities, including Madrid and its eighteenth-century Royal Palace (Palacio Real de Madrid), pictured above.



Katie Pappas (left) and Sarah Hielsberg battle a Northwood University player. Photo by Mariusz Nowak.



Katie Pappas, Number 14



Sarah Hielsberg, Number 9

Soccer Team Has Chemistry

Chemistry is something every team seeks. With twenty-one players coming together for the inaugural women's soccer season, team chemistry had to develop quickly: only a few of the players were familiar with each other prior to the first practice.

"I was curious to see how all the players would get along," said head coach Michelle Jacob. "For never knowing each other prior to the season, the team developed a great attitude."

Two of the players have chemistry in the classroom on their minds as well. Freshmen defenders **Katie Pappas** and **Sarah Hielsberg** are chemistry majors.

"I am happy I chose Michigan Tech," said Pappas. "It is a small school, and it provides many opportunities to get help."

The team missed class time due to travel for matches, but it did not effect the student-athletes' educations.

"One of my professors, Sarah Hill, allowed me take an exam while on a road trip," said Pappas.

Hielsberg echoed Pappas' appreciation

for the academics.

"Michigan Tech gave me the chance to further my soccer career, but the chemistry department also helped my decision to come here."

Both women played a major role in the success of the team that finished 7-10-0 overall and 5-10-0 in conference play. Pappas started all seventeen games and anchored the Tech defensive line. Hielsberg started all thirteen games she appeared in and helped contribute to the team's five shutouts and 1.76 goals against per game average.

"Being a part of the team for its first year was very important to me," said Hielsberg. "Winning our first game over Concordia-St. Paul in front of a big crowd and having our team ranked in the region mid-season were both highlights for me."

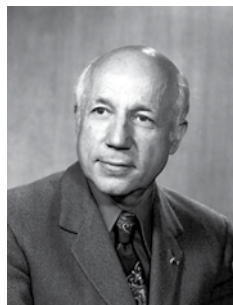
Both women plan to attend graduate school following graduation. Pappas aspires to become a pharmacist; Hielsberg remains unsure of her future plans.

Both hope to keep the chemistry going, in the classroom and on the pitch.

Melvin Calvin BS '31

2011—The 50th anniversary of winning the 1961 Nobel Prize in Chemistry

Adopted from the UC Berkeley website.



Melvin Calvin '31 received the 1961 Nobel Prize in Chemistry for identifying the path of carbon in photosynthesis and was a member of the faculty at the University of

California at Berkeley for more than five decades. He worked in the famous Ernest Lawrence Radiation Laboratory.

Throughout his career, Calvin was the recipient of many awards and honors, including the National Medal of Science from President Bush in 1989, the Priestly Medal from the American Chemical Society, the Davy Medal from the Royal Society of London, and the Gold Medal from the American Institute of Chemists.

Calvin was born in 1911 in Saint Paul, Minnesota. He earned his PhD in Chemistry from the University of Minnesota in 1935.

Following postdoctoral studies in England, Calvin joined the Berkeley faculty, and, according to legend, on the day of the Japanese surrender, was told that, "Now is the time to do something useful with radioactive carbon," the isotope of carbon that had been discovered in 1940. In response, Calvin organized a team of researchers to study photosynthesis, the process by which green plants convert sunlight energy into chemical energy.

Using the carbon-14 isotope as a tracer, Calvin and his team mapped the complete route that carbon travels through a plant during photosynthesis, starting from its absorption as atmospheric carbon dioxide to its conversion into carbohydrates and other organic compounds. In doing so, the Calvin group showed that sunlight acts on the chlorophyll in a plant to fuel the manufacturing of organic compounds, rather than on carbon dioxide, as was previously believed.

Calvin's work in deciphering the role of carbon in photosynthesis led to a lifelong interest in adapting photosynthetic techniques for energy production. In his final years of active research, he studied the use of oil-producing plants as renewable sources of energy. He also spent many years testing the chemical evolution of life and wrote a book on the subject that was published in 1969.

Calvin and his group worked in a "laboratory without walls" concept that inspired the design of a new building at Berkeley. Opened in 1963, the three-story construction featured a distinctive doughnut-shaped exterior and an open interior with radial lab benches to foster cooperative teamwork.

Upon his retirement in 1980, the building, with the Lab's Structural Biology Division, was renamed the Melvin Calvin Laboratory.

Michigan Tech's Melvin Calvin Award is the highest honor that the University bestows upon alumni or friends.

Alumni Updates

Manfred Philipp BS '66 is a professor at City University of New York. He recently stepped down (term limits) after two terms as chair of City University's Faculty Senate and the faculty member on the Board of Trustees.

Kenneth Kok BS '66 and MS Nuclear Engineering '68 is a Fellow Engineer, URS SMS LLC. A new *Nuclear Engineering Handbook*, edited by Kenneth, was recently published by CRC Press. In October he served as the general cochair of the International Conference on Environmental Remediation and Nuclear Waste Management. Kenneth says that, in the 1960s, the nuclear engineering program was part of the chemistry and chemical engineering department.

Doug Karttunen BS '69, MS '70 is president of Karttunen Enterprises Inc., a consulting firm. He retired from International Paper Company in 2002.

Mike Renier BS '89 is the president of Chemmeds, developing database products for the pharmaceutical market and exploring a new method to develop drugs using molecular modeling/properties.

Kim DeClercq BS '91 is not only a chemistry instructor at Kalamazoo Valley Community College, but is also the resident scientist on ABC-affiliate WZZM 13's *Take Five & Company* in Grand Rapids. Featured biweekly on Fridays, "Chemical Kim" presents a blend of smart, fun, and entertaining science concepts with hands-on activities for people of all ages to try at home. Every segment features Kim and a show host doing science activities, providing viewers with fun projects and the

confidence to investigate science in their own world.

Nawana (Lofton) Lawson BS '97, MS Organic Chemistry, University of Missouri, is a hazardous materials specialist at Wayne State University and is married with one child.

Mingde Xia PhD '98 is the senior director at the Johnson & Johnson Corporate Office of Science and Technology and is in charge of the emerging technology collaboration with innovative research centers in Asia in pharmaceutical, medical device, and consumer areas (www.jnjcosat.com/cosat).

Sarah Carlson BS '03, MS '07 UM, MD '08 UM is a resident physician in the Department of Surgery, Beth Israel Deaconess Medical Center at Harvard Medical School and clinical fellow of the Harvard Medical School.

Elements of Success Periodic Table

The Elements of Success Periodic Table honors donors who give \$1,000 or more to the chemistry program. Donors are invited to select an element from the Periodic Table and have their name permanently associated with that element. Our goal is to have all 118 elements on the Periodic Table sponsored.

The Elements of Success Periodic Table is housed in the hallway on the first floor of the Chemical Sciences Building, outside Room 101, and you can see the lists of sponsored and available elements on our website.

**Periodic Table
of the Elements**

*Lanthanide Series

**Actinide Series

24	Cr
CHROMIUM	YOUR NAME HERE
52.0	

For more information, please contact us by phone 906-487-2048 or email chemistry@mtu.edu.

Chemistry Learning Center (3181)

The CLC is an important part of our department. Funding helps to provide quality coaching in a comfortable, supportive learning environment. This service continues to have a substantial impact on student success and retention.

Undergraduate research (3093)

Supports undergraduate student research and the development of valuable professional skills.

Graduate research (2969)

Supports graduate student research, travel, and professional development activities.

Elements of Success (2942)

Educational and research activities are supported along with other special needs in the department.

Pruetts Fund Undergraduate and Graduate Fellowships for a Second Year

The department is grateful for the generosity of David J. '74 and Valeria L. Pruetts for their second year of funding for a postdoctoral fellowship and a summer undergraduate research fellowship. These gifts will enhance the research efforts in the chemistry department.

Michigan Tech
Create the Future

Opportunities for Giving

We have a new web page—www.chemistry.mtu.edu/pages/giving—to make sure your gift goes to the right place. All gifts made to the chemistry department are used to enhance the education of our students. Donations of any size are welcome, and listed above are a few of the areas to which you can direct a gift (with funding codes in parentheses).

To make a gift to one of the choices above, visit www.chemistry.mtu.edu/pages/giving or use the enclosed envelope.

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Names for Photo from 2010 Chemistry Newsletter

Standing, left to right: E. T. Williams, Dean Luehrs, Myron "Doc" Berry, Dallas Bates, Wilson Gulick, Anton Pintar, David Kenny, John Allison, Mike Skaates, Fred Williams, Vernon Sandel, Leslie Leifer, Gladys Dawson, Terry Warrington, and David Leddy. Seated, left to right: Davis Hubbard, Kurt Spiegler, Fred Reynolds, Bahne Cornilsen, Marion Bredekamp, and H. S. Elkhadem (department head). *Photo source is unknown.*