ChemNotes

{ TUFTS UNIVERSITY CHEMISTRY DEPARTMENT }

2010 • WINTER

Education and Research

The Tufts University Department of Chemistry continues its dual mission of education and research

RESEARCH

Clay S. Bennett

Complex carbohydrates and glycoconjugates possess enormous potential as therapeutic agents. In the body, these molecules play a number of critical roles in biological systems, including protein folding, cellular adhesion, and signaling. This diversity of function is directly the result of the molecular complexity of these molecules. Unlike nucleic acids and proteins, carbohydrates are highly branched biopolymers whose synthesis is not template directed. Rather, their synthesis is under control of a variety of different enzymes, whose level of expression is highly dependent on cellular environment. As a result the structure of these molecules can vary not only between different species, but also between diseased and healthy cells from the same individual. A consequence of this molecular diversity is that it is extremely difficult, if not impossible, to isolate complex carbohydrates in pure form. This shortage of pure material for biophysical characterization has proven to be a major impediment to the study of glycobiology.

An alternative approach to isolating complex carbohydrates relies on chemical or chemoenzymatic synthesis. In this approach an activated monosaccharide (the donor) is reacted with a suitably functionalized monosaccharide nucleophile (the acceptor) to

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Chair's Corner

Krishna Kumar

The last three years have ushered dramatic changes in the department, especially so in the last few months. I'm pleased to announce that three new faculty members have joined the department. Professor Clay Bennett started in September of 2008 and came to us from the Scripps Research Institute in La Jolla, California and received his doctoral degree from University of Pennsylvania. His research focuses on glycobiology and synthetic organic chemistry. Drs. Joshua Kritzer and Samuel Thomas joined us in Fall 2009. Dr. Kritzer is starting a research program focused on chemical biology, genetics and biophysics after having finished his postdoctoral work at the Whitehead Institute for Biomedical Research/MIT and Ph.D. from Yale. Dr. Thomas works at the interface of organic, materials and biological chemistry. He has just completed postdoctoral work at Harvard University after receiving his Ph.D. from MIT. These

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RESEARCH

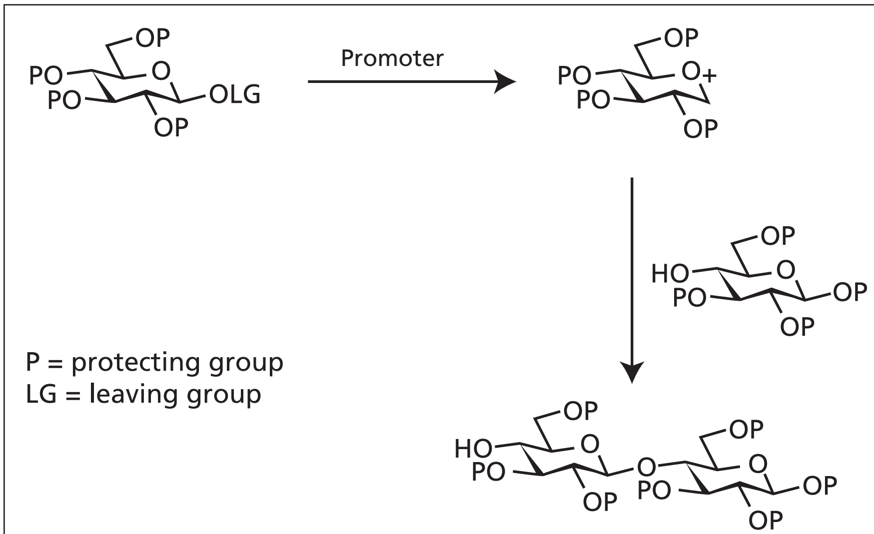
Continued from page 1

form a new glycosidic bond (figure 1). While chemical approaches to carbohydrate synthesis have been known since Arthur Michael first reported the synthesis of a natural glycoside in 1879, the construction of complex carbohydrates and glycoconjugates remains a challenging endeavor. This is due in large part

While chemical approaches to carbohydrate synthesis have been known since Arthur Michael first reported the synthesis of a natural glycoside in 1879, the construction of complex carbohydrates and glycoconjugates remains a challenging endeavor.

to the fact that it is necessary to subject monosaccharides to extensive protecting group manipulation prior to the glycosylation reaction in order to ensure proper control over regio- and stereoselectivity. Thus, while the synthesis of other biopolymers such as peptides and nucleic acids is a process that takes hours or days, using current technologies the construction of a novel oligosaccharide is an undertaking that can take months or years to complete.

Figure 1: Mechanism of glycosidic bond formation



I first became interested in developing new methods for carbohydrate synthesis as a postdoctoral researcher at The Scripps Research Institute, where I learned firsthand the challenges of modern carbohydrate chemistry while working on synthesizing homogeneous glycoproteins. Later, I would also become involved in a project aimed at alleviating some of the problems with carbohydrate synthesis by developing enzymatic methods for the regioselective functionalization of monosaccharides. Our current research involves developing methods, based on asymmetric catalysis, to streamline carbohydrate synthesis. Two of the major thrusts here are the development of catalysts to control the stereochemical outcome of glycosylation reactions, and reagents to permit regioselective deprotection of peralkylated monosaccharides. We believe that such methods will permit the rapid and routine construction of complex carbohydrates over time scales of hours or days. Ultimately, we wish to apply these technologies to the construction of novel glycan based therapeutics for the treatment of HIV and cancer.

My most interesting research to date involved work at Scripps where we (in collaboration with Professor Frances Arnold at the California Institute of Technology) evolved several mutant cytochromes p450 to regioselectively unmask globally methylated monosaccharides. This work represented a new approach to carbohydrate construction where it was possible to produce a protected monosaccharide for carbohydrate synthesis in two chemical transformations, as opposed to seven to nine steps required using traditional methods. This work lays the foundations for novel approaches to oligosaccharide synthesis and has potential to open up new areas of chemical space for drug discovery.

Professor Clay S. Bennett obtained a B.A. in Chemistry from Connecticut College in 1999 before moving to The University of Pennsylvania to study natural products synthesis with Professor Amos B. Smith, III. After receiving his Ph.D. in 2005, he moved to The Scripps Research Institute, where, as a postdoctoral researcher under Professor Chi-Huey Wong, he studied bioorganic chemistry and carbohydrate chemical biology. He joined the Chemistry Faculty at Tufts University in August 2008.

RESEARCH

Elena Rybak-Akimova

The results obtained by our group contribute to the understanding of the chemical reactivity of metal-containing compounds at a microscopic level and provide new tools for the rational design of useful, environmentally friendly reagents and catalysts.

Small molecule activation is one of the seemingly simple, yet still unsolved problems in chemistry. Every freshman knows the electronic structure of second-period diatomic molecules, such as dinitrogen or dioxygen—the main components of air. Many industrial processes would benefit from reactions incorporating oxygen or nitrogen atoms in target products "out of thin air." However, chemists still have little control over reactivity of dinitrogen or dioxygen. In contrast, living organisms, ranging from bacteria to humans, successfully evolved various metalloenzymes that catalyze and direct very efficient and selective transformations of these small molecules. Chemists need to learn from nature how to modify a given molecule in a specific place and to obtain a pure target product without producing many undesirable byproducts and generating harmful wastes. Our group is using a biomimetic approach to achieving selectivity of small molecule binding and activation with transition metal complexes.

Oxygen binding and activation in biology occurs at low-valent copper or iron centers. Synthetic complexes that resemble immediate environment of these metals in oxidative enzymes are known, and these complexes rapidly react with dioxygen. However, these reactions often result in complete oxidation of the metal centers, affording very stable products which are incapable of transferring an oxygen atom to substrates. In order to avoid this "bioinorganic rust," we need to retain some additional features of protein structures in our model complexes. With sufficient (but not excessive!) steric bulk around the active sites, we can follow and intercept metal-oxygen intermediates. Instead of falling all the way into the thermodynamic sink of "bioinorganic rust," the reactions proceed via a series of "stops" along the way: the path from the starting materials to products goes through a series of intermediates. In order to identify reactive intermediates, detailed mechanistic studies are necessary. The group is capable of performing unique experiments, where unstable iron-based intermediates are formed at –800°C on a millisecond time scale, and then the substrates are added to the mixing cell and their reactions are observed. These studies allow us to clarify the mechanisms of oxygen activation by important biomolecules, including bleomycin (an antibiotic and an anti-cancer drug) and the enzymes responsible for cellular response to hypoxia (insufficient oxygen concentration typical of tumor tissues). A NSF-funding instrument for these mechanistic studies was installed at the Department and is actively used by Tufts researchers and by our collaborators from MIT, Boston University, University of Minnesota, University of Goettingen (Germany) and other schools.

Understanding the reaction mechanisms suggests design principles for preparing new reactants and catalysts. For example, the group established that one of the major bottlenecks in oxygen activation is the formation of the initial metal-oxygen adduct. When all coordination sites at the metal are occupied, the incoming oxygen molecule has to replace the already coordinated ligand. Such ligand substitution takes time and energy. In contrast, oxygen binding to a "naked" iron center is fast. Indeed, creating vacant sites in iron complexes dramatically speeds up reactions with oxygen. Furthermore, vacant sites can serve another purpose: they allow for substrate binding at the active site. Bringing organic substrates in close proximity to the metal-oxygen site facilitates and directs subsequent oxygen atom transfer, and leads to efficient and selective oxidation of coordinated molecules. This approach works particularly well for aromatic hydroxylation, where iron promotes rapid incorporation of a hydroxyl group right next to a carboxylate in benzoic acid, yielding salicylic acid (a precursor to aspirin and other drugs). Importantly, non-toxic and relatively cheap hydrogen peroxide is the oxidant in this reaction, and water is the only byproduct.

The group is also interested in non-covalent recognition of organic substrates by metallocomplexes. This supramolecular recognition was mastered by enzymes. We are designing and synthesizing metal-containing molecular receptors ("molecular tweezers") that contain specific, properly positioned recognition sites. Substantial length- and shape selectivity of guest binding was already demonstrated for dicarboxylates and for diammonium salts. When the guest molecules are too long, they fall through the receptor arms; when the guest molecules are too short, they do not fit between the receptor arms. The molecules that are "just right" fit nicely, and can be selectively captured. Combining these selective, switcheable molecular receptors with our metal-containing oxidation catalysts shows promise for creating functional models of metalloenzymes. The results obtained by our group contribute to the understanding of the chemical reactivity of metal-containing compounds at a microscopic level and provide new tools for the rational design of useful, environmentally friendly reagents and catalysts. The research in Rybak-Akimova group is supported by the grants from the National Science Foundation and the Department of Energy.

EDUCATION

In with a Bang—and Out with One, Too!

Meredith Knight

Chemistry 94 was designed to explore the origins of the Universe, the formation of Earth and its structure, the chemistry of life, the development of complex organisms, and the development of modern humans.

On April 29, 2008, the normally neutral walls of Pearson 104 were transformed by multicolored posters with titles such as "Quasars: Windows to a Younger Universe" to "Stem Cell Research: A New First Aid Kit?" and "The Big Whack: The Dramatic Formation of our Moon." This poster session was the culminating event for Chemistry 94 "From the Big Bang to Humankind," a course which debuted in the spring of 2008. During the session, the eighty students who took the course had the opportunity to select one of the many topics covered during the course and explore it in greater depth. The six professors, two TAs and course coordinator served as judges, evaluating each poster on content, poster presentation and oral presentation.

Chemistry 94 was designed to explore the origins of the Universe, the formation of Earth and its structure, the chemistry of life, the development of complex organisms, and the development of modern humans. The goal of the course was to understand these topics by examining the scientific evidence and the scientific arguments that enable us to have confidence in this knowledge. The course was conceptualized by Professor David Walt as one of many projects associated with his Howard Hughes Medical Institute Professor's Award. Professor Walt recruited the faculty and set the basic outline for the course in consultation with the other faculty.

Professor Eric Chaisson started the course in January by explaining the evidence supporting "The Big Bang," as well as how galaxies, stars, and planets form. Professor Chaisson, a noted astrophysicist who currently heads the Wright Center for Science Education at Tufts, also showed fantastic images of the surface of the Sun and of developing stars. Professor Andy Kurtz from the Geology Department at Boston University then described the formation of the Earth and Moon, and gave the students an understanding of important processes on Earth such as plate tectonics, glaciations, and deep ocean currents.

In the chemistry section of the course, Professor Jon Kenny discussed the importance of free energy in driving chemical reactions and introduced the students to the controversial ideas of James Lovelock. Professor Walt introduced the students to the famous Urey-Miller Experiment, introduced the Central Dogma of Proteins, DNA and RNA, and also discussed how organisms get energy through photosynthesis and metabolic pathways.

Biology Professor Kelly McLaughlin used the technologies of stem cell research as a starting point for her series of lectures. She discussed how the cells differentiate even though all cells have the same DNA, discussed how a single egg can develop into a multicellular animal, and how features such as feathers or scales are created in an organism. Professor McLaughlin also cleverly demonstrated how science is sometimes misrepresented by the media by showing slides with science "headlines" and having students gauge whether they were true or false. (It was not always easy!)

The final stretch of the course was covered by Anthropology Professor Lauren Sullivan. After introducing the students to the tools of anthropology, Professor Sullivan discussed the evidence for early humans, how humans traveled out of Africa, and concluded by exploring the differences and similarities between humans and Neanderthals. Professor Sullivan also shared stories of her own research on the Maya deep in the jungle of Belize, causing many of us to contemplate career switches to anthropology.

Covering four billion years in twenty six class sessions with a group of non science majors might seem like a very ambitious goal for one course. However, if there is one recurring theme in Chemistry 94, it is the importance of evidence based reasoning. I consider the posters I saw during the poster session as excellent evidence. The quality of the posters and the enthusiasm which the students displayed in describing them clearly demonstrated to me that the Chemistry 94 made a significant and a positive impression on these students.

Chemistry Degrees and Awards

Presented 2006–2007

The R.M. Karapetoff Cobb Chemistry Fund
Rebecca Lambe
Camille Petersen

The M.D. Angell & H.B. Durkee Scholarship Fund
Nina N. Sainath

The Durkee Scholarships
Cory D. Rillahan
Stacey M. Watkins

The Max Tishler Prize Scholarship
Rebecca Lambe
Camille Petersen
Martha A. Simmons

The Class of 1947 Victor Prather Prize
Corry D. Rillahan

The Audrey Butvay Gruss Science Award
Nina Sainath

The Alex Elias Memorial Prize Scholarship
Stacey M. Watkins

Summa Cum Laude Graduates
Grace L. Ker
Cory D. Rillahan
Nina N. Sainath
Jennifer L. Torpey
Stacey M. Watkins

Magna Cum Laude Graduates
Michael Chen
Jae R. Cho
Katherine M. Dunn
Julie M. Nogee
Tri M. Trinh
Millicent C. Yee

Cum Laude Graduates
Anish K. Agarwal
Seth R. Croll
Simina R. Grigoriu
Ryan B. Hastie
Jeffrey B. Holzberg
Po-Chang Hsu
Stephen C. Jensen
Alexandra Kunin
Mariya A. Pindrus
Darya D. Rudym

Doctoral Degrees

Viatcheslav Azev (d'Alarcao)
"Synthesis of Protected 1,2-Diamino- 1,2-Dideoxy-Myo-Inositol and its Derivatives and Synthesis of Palitoylated Inositol Glycans"

Sandra Bençic-Nagale (Walt)
"Adaptive Sensing With a Microsphere Array-Based Electronic Nose"

Gregory Hall (Kenny)
"Chemometric Characterization and Classification of Estuarine Water by Multidimensional Fluorescence"

Daniel Killelea (Utz)
"Bond-Selective Control of a Gas-Surface Reaction"

Ivan Korendovych (Rybak-Akimova)
"Macrocyclic Amides as Platforms for Oxygen Activation and Anion Recognition"

David Rissin (Walt)
"Single Molecule Detection: Analytical Applications and Fundamental Studies"

Master's Degrees

Casey Cable
Olga Voronina

Bachelor's Degrees

Anish K. Agarwal
Edward J. Arous
Alan J. Becker
Michael Chen
Jae R. Cho
Seth A. Croll
Katherine M. Dunn

Simina R. Grigoriu (d'Alarcao)
Honor Thesis Title "Synthesis of a Quinone-Based Electrochemically Degradable Polymer Cross-Linking Agent"

Jocelyn H. Halim
Ryan B. Hastie
Nguyen Hoang
Jeffrey R. Holzberg
Po-Chang Hsu

Stephen C. Jensen (Sykes)
Honor Thesis Title "Adsorption, Interaction, Self-Assembly and Manipulation of Thioethers on CU {111}"

Grace L. Ker
Alexandra Kunin
Ryan H. Lee
Julie M. Nogee
Mariys Pindrus
Cory D. Rillahan

Darya D. Rudym (d'Alarcao)
Honor Thesis Title "Preliminary Foundation for In Vitro Autosomal Domianant Polycystic Kidney Disease Model"

Nina N. Sainath

Jennifer L. Torpey (Walt)
Honor Thesis Title "Developing a DNA Microarray for Human Ancestry and Migration"

Tri M. Trinh

Stacey M. Watkins (Walt)
Honor Thesis Title "Use and Development of Microarrays as an Education Tool and for Bacterial Identification"

Millicent C. Yee

Presented 2007–2008

The Durkee Scholarships
Jordan B. Jastrab
Rebecca J. Lambe
Meredith Jill Posner
Martha Ayre Simmons

The Max Tishler Prize Scholarship
Sebastian M. Jara
Derek K. Kong
Vikram M. Kumar

The Class of 1947 Victor Prather Prize
Jordan B. Jastrab
Rebecca J. Lambe

Outstanding Academic Performance Award
Laila Dafik
Nicholas C. Yoder

Graduate Student Research Award
Noelani K. Kamelamela

Summa Cum Laude Graduates
David C. Boclair
Steven M. Fatur
Stanislav Henkin
Jordan B. Jastrab
Andrew R. Jensen
Daniel P. Katzman
Camille I. Petersen
Meredith Jill Posner
Dipak Balaji Ramkumar
Martha Ayre Simmons
Vincent S. Weisband

Magna Cum Laude Graduates
Evan Michael Barnathan
Thomas J. Plumridge
Amal A. Rahman
Peter J. Riviello
Jennifer W. Siu

Cum Laude Graduates
Michael Thomas Cronin
Caitlin C. Gallagher
Brian P. McPartland
Steven Kwok-Cheung Poon
Carly A. Therkelsen
Kathryn B. Wulster

Doctoral Degrees

Brian P. Comeau (Kounaves)
"Plasticizer Alternatives for use in Polymer Membrane Ion Selective Electrodes"

Laila Dafik (Kumar/d'Alarcao)
"Chemical Tools for Glycoengineering and Therapeutics"

Henning Groenzin (Shultz)
"Sum-Frequency Studies of Single Crystalline Ice Ih"

Qun Gu (Kenny)
"Improvement of Fluorescence Inner Filter Effect Corrections Based on Determination of Effective Geometric Parameters"

Irene Li (Shultz)
"Macrocyclic Amides as Platforms for Oxygen Activation and Anion Recognition"

Nicholas C. Yoder (Kumar)
"Bioorthogonal Self-Assembly: Two Candidiate Systems"

Master's Degrees

Chak Him Chow
Brian Goulart
Po-Chang Hsu
Noelani K. Kamelamela
Shinji Suzuki
Timothy M. Wilson-Byrne

Bachelor's Degrees

Evan Michael Barnathan
David Boclair
Joshua A. Brand
Andrew N. Cai
Stella Yoo-Jin Chung
Michael Thomas Cronin
Steven M. Fatur
Caitlin C. Gallagher
Stanislav Henkin
Mussadaq Ijaz
Jordan B. Jastrab
Andrew R. Jensen
Daniel P. Katzman
Caitlin I. McDowell
Brian P. McPartland
Camille I. Petersen
Thomas J. Plumridge
Steven Kwok-Cheung Poon
Meredith Jill Posner
Amal A. Rahman
Dipak Balaji Ramkumar
Peter J. Riviello
Martha Ayre Simmons
Jennifer W. Siu
Matthew M. Symer
Carly A. Therkelsen
Vincent S. Weisband
Alan M.V. West
Kathryn B. Wulster

Chemistry Degrees and Awards

Presented 2008–2009

The M.D. Angell & H.B. Durkee Scholarship Fund
Rebecca Lambe

The Durkee Scholarships
Walter T. Barry
Derek Kong

The Max Tishler Prize Scholarship
Justin Quatararo

Summa Cum Laude Graduates
Walter T. Barry
Sebastian M. Jara
Sarah D. Kalin
Derek Kong
Vikram M. Kumar
Monica R. Mugnier
Justin S. Quartararo

Magna Cum Laude Graduates
Matthew C. Christie
Nahvid M. Etedali
Jason B. Richards
Jonah A. Schey

Cum Laude Graduates
Prakhar Agarwal
Sze Ham Chan
Jeffrey A. Wacks

Doctoral Degrees

Timothy Michael Blicharz (Walt)
"Fiber-Optic Microsphere-Based Antibody Arrays for use in Salivary Diagnostics"

Hao Chen (Kenny)
"Multi-way Fluorescence Studies: 1) Humic Substances 2) Fluorescence Resonance Energy Transfer in Micelles"

Margaret Hsin-Jui Kuo (Shultz)
"Interactions of Aqueous Nanodrops in a Hydrophobic Environment: Carbon Tetrachloride"

Irene Li (Shultz)
"Sum Frequency Studies of Single Crystal Ice (Ih) as Related to its Lattice Orientation"

He Meng (Kumar)
"Therapeutic Peptides Containing Fluorinated Amino Acids"

Olena S. Rabotyagova (Kaplan)
"Structure to Function: Spider Silk and Human Collagen"

Ragnhild Dragoey Whitaker (Walt)
"Single-cell Analysis Using an Optical Fiber Microwell Array"

Master's Degrees

Christopher Karl Albert
Kyle D. Bake
Zhen Liu
Maureen R. Regan

Bachelor's Degrees

Walter Thomas Barry Guarente, MIT)
"A Possible Link between Ab42 Production Associated with Alzheimer's Disease and Sirt1"

Sarah D. Kalin (Shultz)
"FT-IR Study of Propane Clathrate Hydrate Formation"

Derek Kai Kong (Kumar)
"An Inducer of Matrix Metalloprotease 9, Is Required for Transcription of /FOXG1/an Apparent/MMP9/Repressor"

Rebecca J. Lambe (Kumar)
"Synthesis and Examination of Unnatural Mannosamine Derivatives"

Prakhar Agarwal
Sara N. Bell
Sze Ham Chan
Matthew Colin Christie
Katherine Chui
Nahvid M. Etedali
Zachary M. Friedman
Lauren R. Gelmetti
Sebastian M. Jara
Glenn D. Katz
Vikram M. Kumar
David M. Lichtman
Monica R. Mugnier
Dat T. Nguyen
Dinah F. Pu
Justin S. Quartararo
Jason B. Richards
Jonah A. Schey
Jonathan I. Segal
Saumini Shah
Mariko Shimada
Ryan B. Sugarman
Laura M. Truhlar
Namita Vaidya
Jeffrey A. Wacks
Tijani Warren

Chair's Corner

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dynamic young faculty members bring infectious energy to the department and a diverse research portfolio.

Radical changes to the physical plant have mirrored the increase in faculty numbers. A new world-class organic teaching laboratory welcomed undergraduates this fall. The laboratories housing the Bennett, Kritzer and Thomas research groups have been renovated according to their specifications. A new 500 MHz nuclear magnetic resonance spectrometer was added to the NMR facilities with support from a grant from the National Science Foundation, and a new MALDI mass spectrometer will help with large molecule analysis.

The department remains true to its dual mission of research and teaching. Student enrollments in chemistry and extramural funding (total committed is now $19 million) are at an all time high. New curricular offerings such as the wildly popular "From Big Bang to Humankind" developed by David Walt have widened the umbrella of majors who enroll in a chemistry course. Faculty members have been recognized by numerous awards this past year including the ACS Award for Creative Invention (Walt), NSF CAREER (Sykes), DARPA Young Faculty Award (Thomas) and the Massachusetts Columbus Quincentennial Award (Kounaves). Our students always been front and center in the department's flourishing research program. This year was no exception. Many of them have been awarded national and international prizes. The staff have contributed in great measure to the success of the department and continue to be best on campus.

I welcome you to come and have a look at the changes in the department and meet old friends and new members. If you wish to participate in the alumni group, please mail the form on the last page to indicate your interest. The future of the department looks bright and certain to continue this upward trajectory.

d'Alarcao Symposium

Arthur Utz

Tufts Chemists gathered at the Museum of Science on July 14, 2007 to recognize Professor Marc d'Alarcao's many contributions to the department and to wish him well in his new faculty position at San Jose State University. Marc joined the Tufts faculty in 1988 and has had a profound impact on the department's teaching and research missions. Fifteen graduate and thirty undergraduate students have passed through his research lab at Tufts, and he has taught thousands of Tufts students in courses ranging from first semester introductory chemistry to advanced organic synthesis. In recognition of his commitment and dedication to his students, he was the 2002 recipient of the University-wide Lillian and Joseph Leibner Award for Distinguished Teaching and Advising. Marc also served the department as chair and was an active member of innumerable committees. Students and colleagues alike have benefited from his perspicacious advice and insights.

> The symposium focused on Marc's impact on members of his research group and their accomplishments since leaving Tufts.

The symposium focused on Marc's impact on members of his research group and their accomplishments since leaving Tufts. Eight current and former d'Alarcao group alumni presented talks. They described their current scientific interests and shared anecdotes about their time in the group. Tufts faculty and current students also attended. The speakers, their connection to the d'Alarcao group, their current affiliations, and the titles of their talks were:

Alexander Kornienko (Ph.D. 1999, New Mexico Inst. of Mining & Technology), "Some Unfamiliar Ideas in Natural Product-Based Drug Discovery"

Robert Plourde (Ph.D. 1992, Cirrus Pharmaceuticals), "Developing a Novel Powder Inhalation Device for Infant Vaccination"

Hien Nguyen (B.S. 1996, Montana State University), "Exploring Transition Metals in Carbohydrate Synthesis"

Laila Dafik (Ph.D. 2008, Tufts University), "Biosynthetic Flourination of Cell Surface Glycans"

Greg Beutner (B.S. 1998, Merck Pharmaceuticals), "A Practical Method for Preparation of 4–Hydroxyquinolinone Esters"

Phieng Siliphaivanh (B.S. 1992, Merck Research Laboratories), "Histone Deacetylase Inhibitors"

Nilanjana Chakraborty (Ph.D. 2005, VisEn Medical, Inc.), "Chemistry and Biology of Four Anionic Inositol Phosphate Glycans"

Pericles Calias (Ph.D. 1996, Shire Human Genetic Therapies), "Size Isn't Everything: An Eye on Drug Discovery"

Following the technical presentations, Professor David Walt shared his recollections and perspectives on Marc as a colleague and friend, and Prof. d'Alarcao thanked the attendees and reflected on his time at Tufts. A reception and dinner at the Museum of Science followed.

Tufts University "Chemistry Explorers" at the Cutting Edge of Research and Education

Mahnaz El-Kouedi

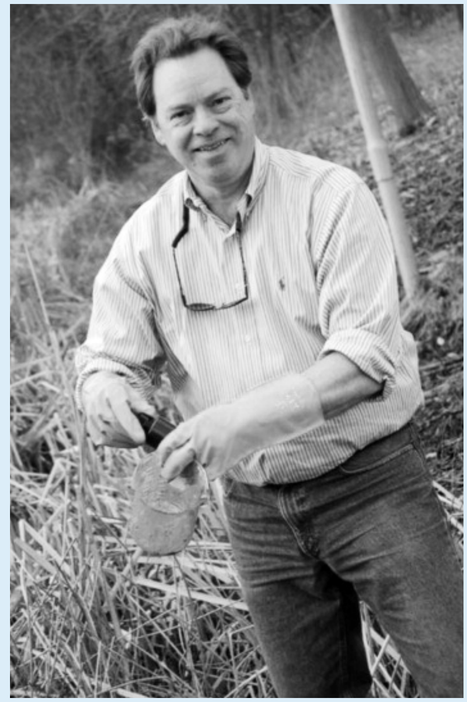
Members of the Sykes Group in front of their image featured by ACS Nano

The chemistry department at Tufts has a long tradition of attracting the highest caliber teachers and scholars. That is why it is no surprise that two professors are featured in segments entitled "Chemistry Explorers" in the latest edition of the text book *Chemical Principles,* by Steven Zumdahl. Full Professor Jonathon Kenny and Assistant Professor E. Charles H. Sykes are among nine researchers highlighted in the textbook.

The "Chemistry Explorer" sections are a new addition to the 6th edition of the widely used general chemistry textbook, *Chemical Principles*. They are meant to bring attention to some of the very exciting cutting edge research that is being performed in institutions around the country, with particular emphasis on relating the research projects to concepts being introduced in the chapter.

Professor Sykes' research, focusing on probing nano-scale surface structures and phenomena, is featured to highlight some of the applications of quantum mechanics. The Sykes group utilizes Scanning Tunneling Microscopy (STM) to investigate surface topography and electron density of atoms and molecules with specific interest in self-assembly, catalysis and single molecule reactivity. The microscope used for these experiments operates based on "tunneling electrons" that produce an image with atomic-scale resolution. Images of atoms on surfaces and electron waves are great tools for teaching students the abstract principles of quantum mechanics. Professor Sykes and his group are working on using this state of the art instrumentation to solve complex research problems, but also to help students visualize the wonderful world of quantum mechanics. STM images from the group have attracted national attention winning awards in Science as Art competitions, and are being made into publicity posters for the new American Chemical Society journal, *ACS Nano*.

Professor Kenny's research is highlighted as a practical example of molecular spectroscopy. Research projects in the Kenny group are not confined to a laboratory setting; instead equipment


Professor Kenny performing field work

is often taken into the field to analyze real world samples such as ground water contaminants. Spectroscopic signatures of different water samples can also be used to determine the geographical origin of the water. Professor Kenny is well known for his expertise in the field of fluorescence spectroscopy and spectroscopic applications to environmental issues. He has used his extensive knowledge in the field to develop an environmental chemistry course aimed at non-science majors that integrates all facets of science.

Professors Kenny and Sykes are both excited to be featured as "Chemistry Explorers," and hope that their stories will inspire a new generation of students to continue in the field of chemistry.

Research projects in the Kenny group are not confined to a laboratory setting; instead equipment is often taken into the field to analyze real world samples such as ground water contaminants.

Establishing a One-of-a-Kind Chemical Technology Program for Deaf and Hard-of-Hearing Students

Todd Pagano

Upon returning to Rochester, NY, in 2002 with a master's degree in Chemistry from Tufts University, I knew that I wanted to make a significant contribution to the education of students by making science as interesting, relevant, and rewarding as it was to me. I accepted a job at the National Technical Institute for the Deaf (NTID), one of eight colleges of Rochester Institute of Technology (RIT), mostly due to the opportunity that it offered in the creation of a new Laboratory Science Technology program for its students.

What did I know about the world's largest technological college for deaf and hard-of-hearing students? Not much. What did I know about communicating with students with hearing loss? Even less. What I did know was that these students should have the same chance for receiving a quality chemistry-based education and obtaining meaningful careers in the field, regardless of whether they could hear or not.

Years later, the program is thriving. In many ways, it is a program like any other—students discussing molecular bonding, solving stoichiometric problems, and operating analytical instrumentation. But it is also a program like no other—where all students have various extremes of hearing loss. I use my newly acquired skills in sign language, in conjunction with voice and visuals, to communicate chemical information in the classroom and laboratory. I have seen these students embrace chemistry as I do, and become productive and valued members of the profession.

The success of the Laboratory Science Technology program is largely due to the fact that it was built after evaluating industry's needs for laboratory technicians. We produce graduates with strong foundations in chemistry (general, organic, analytical, and instrumental analysis), biology, and mathematics. Students must also complete a cooperative work experience/internship anywhere in the country as part of their graduation requirements. Students have worked with Eastman Kodak, Novartis Pharmaceuticals, U.S. Navy, Stanford University, FDA, and NOAA—to name but a few organizations. A flagship of the program's curriculum involves a newly renovated, well-equipped, and modern instrumentation laboratory.

Our program has hosted two Presidents of the American Chemical Society, executives from international science companies, congressional/governmental leaders, and prominent deaf scholars. We have been written up several times in Chemical & Engineering News and continue to grow at an astounding rate. However, nothing speaks to its success more than the number of deaf and hard-of-hearing students that have obtained a top-notch chemical education through enrollment in the program. I am extremely proud to be at the helm of program that seems to be as rewarding to me as it is to the students.

What I did know was that these students should have the same chance for receiving a quality chemistry-based education and obtaining meaningful careers in the field, regardless of whether they could hear or not.

Todd Pagano is an Assistant Professor and program Director of Laboratory Science Technology at RIT/NTID. He was awarded RIT's top teaching award, the Richard & Virginia Eisenhart Provost's Award for Excellence in Teaching, NTID's Dawan L. Albritton Faculty Humanitarian Award, RIT's Delta Sigma Phi's Faculty Humanitarian Award, ACS's ChemLuminary Award, and ACS's Stanley C. Israel Medal for Advancing Diversity in the Chemical Sciences. He is also Co-Editor of the Journal of Science Education for Students with Disabilities. *More information about RIT/NTID's Laboratory Science Technology program can be found at: www.ntid.rit.edu/current/departments/lst.*

Semester Achievement Awards

The awards for Outstanding Achievement are given semi-annually to a teaching assistant, staff member and faculty member for extraordinary contributions to the department.

FALL 2006	SPRING 2007	FALL 2007	SPRING 2008	FALL 2008	SPRING 2009
FACULTY	FACULTY	FACULTY	FACULTY	FACULTY	FACULTY
Mary Shultz	Charles Sykes	Sergiy Kryatov	David Walt	Elena Rybak-Akimova	David Walt
STAFF	STAFF	STAFF	STAFF	STAFF	STAFF
Roger Winn	Sarah Iacobucci	Larry Aulenback	Celeo Guifarro	Dawn Marie Hefron	Larry Aulenback
TEACHING ASSISTANT	TEACHING ASSISTANT	TEACHING ASSISTANT	TEACHING ASSISTANT	TEACHING ASSISTANT	TEACHING ASSISTANT
Gizem Akcay	J. Tres Brazell	Yulia Ivanova	Brian Goulart	Jennifer Rego	Yongli Huang

CGSC Update

Erin Iski

The Chemistry Graduate Student Council (CGSC) has had a wonderfully productive and fun filled year. The goal of CGSC this year was to continue the long tradition of bringing together members of the chemistry graduate department beyond the labs and classrooms to create a vibrant community. This year old traditions carried on and new ones were initiated. The 7th annual white water rafting trip in mid September was a great success. The rafting trip is the first event of the season and an excellent way for incoming students to meet the current graduate students. Rafting is surely one of the biggest events of the year. The weekend was filled with camping, laughs and fun while we surged down the class 5 rapids of the Penobscot River. Café chem is another staple of the Tufts chemistry department. Cafe Chem is a great chance on Friday evening to relax after a long week, enjoy some refreshments, catch up with one another, and get to know other members of the department. It is a tradition that will surely not fade any time soon.

The first chemistry department food drive donated 112 pounds of food to the Greater Boston Food Bank in December.

Two new events were kicked off this past year, the department wide food drive and the winter fun excursion in Lincoln, NH. The first annual winter fun excursion at Loon mountain ski area brought together members of the department on the slopes for skiing and snow tubing. The fresh air and winter fun was a great way for all to embrace the wonderful New England winter season. We are also very excited to announce the first chemistry department food drive donated 112 pounds of food to the Greater Boston Food Bank in December. The food was disturbed to charitable organizations in Eastern Massachusetts that feed people in need. The goal for next year is to double the amount of food collected. Thank you all who were able to support our cause. The CGSC attributes the success of this year's event to the involvement and enthusiasm from all members of the department. The CGSC looks forward to support the chemistry department tradition of working hard and playing hard.

ChemNotes

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The Tufts Chemistry WEB Site!

http://chem.tufts.edu

OUR SITE PROVIDES INFORMATION such as course listings, current course materials, degree requirements, faculty/staff/student info, the graduate program, special events, links to other chemistry resources, an online historical archive, back issues of *ChemNotes*, and more detailed information about the exciting and ongoing research being carried out by our faculty.

A current list of speakers for the Spring 2010 Seminar Series can be found on the web site. Visitors are welcome. All seminars are held in the Pearson Chemistry Building, 62 Talbot Avenue in Medford, room P106 at 4:30 PM unless otherwise noted. Refreshments served on the 3rd floor of Pearson thirty minutes before the seminar.

Pearson Chemistry Building

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