



Chemistry Department Newsletter

Summer 2004

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<http://www.dickinson.edu/departments/chem>

Remarks by the Chair Professor David Crouch

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The Chemistry Department at Dickinson has enjoyed a most exciting year! New academic initiatives, major grants received, visiting faculty, renovations to Althouse and planning for the next phase of construction at Dickinson have been part of the ways we have spent our time outside of the classroom. The chemistry class of 2004 is moving on to some prestigious graduate and professional programs. One colleague was promoted to full professor and another has become a first time parent. A chemistry alum visited in the fall to tell us of his groundbreaking work in nanotechnology and returned in May to be honored by his alma mater with an honorary degree. This newsletter will fill in many of these details. But I'd like to highlight three of them.

Over the last few years, the possibility of developing an interdisciplinary major in neuroscience has been the subject of informal discussions around campus. In the fall, a committee was formed to formally prepare a proposed neuroscience major and, given chemistry's role as the central science, it's not surprising that two members of the chemistry department were involved. In the spring semester, the new major was officially adopted and the first neuroscience majors are being declared at Dickinson. The major consists of courses in psychology, biology and chemistry and new neuroscience courses at the 100 and 400 level are in development. Although no new chemistry courses have been developed for this major, organic chemistry will be an important feature of the new 400 level lab-based course in neuroscience.

In September, Chad Mirkin '86, Rathmann Professor of Chemistry and director of the Institute for Nanotechnology at Northwestern University, came to Carlisle to describe some of his work in the emerging field of nanotechnology. During his day at Dickinson, he met with members of the chemistry faculty and our discussions prompted us to prepare a proposal for submission to the National Science Foundation to begin introducing nanotechnology into our courses in the chemistry program. Professor Mirkin was very helpful in making suggestions and supporting our proposal and in April we learned that our proposal was funded. The \$100,000 grant will support the development of a new course in nanoscience for non-science majors and laboratory exercises for existing courses in the chemistry major. The first iteration of the course for non-majors will be taught in the fall of 2004 under the Chem 111 rubric.

Last August, Althouse experienced a catastrophic flood when a condenser hose began pouring water onto the second floor late on a Friday night. By Saturday morning when the water was discovered, two offices and a lab had been demolished. The College administration, led by Dean Weissman and Vice-President Stamos, came to our rescue. The damaged rooms were completely renovated and destroyed furniture and

instrumentation was replaced. But the College went a big step further and planned and completed a major cosmetic upgrade of the green block walls and green floor. In January, another lab was renovated and the ground floor was transformed into a beautiful corridor. This summer, the project continues with completion of the second floor and basement halls, painting of the stairwells and renovation of the student lounge in the basement. Althouse does not look like the Althouse you probably remember.

To paraphrase President Durden, the Chemistry department is a department on the move! Indeed, good things are happening in Althouse and we invite you to visit with us when you have the chance.

Faculty Reports

Ashfaq Bengali

I continue to focus my research efforts on elucidating the mechanism and energetics of solvent displacement from organometallic complexes: For the past several years I have primarily investigated reaction kinetics on long timescales (minutes to hours). Now, with a grant from the Petroleum Research Foundation, I have funds to construct a flash photolysis system with infrared detection allowing me to study reactions on the sub-microsecond timescale.

This summer, Robert Fehnel ('05) and I investigated the displacement of silane (Et_3SiH) and tetrahydrofuran solvents from the $(\eta^6\text{-C}_6\text{H}_6)\text{Cr}(\text{CO})_2$ fragment using uv-vis and IR spectroscopy. We were able to estimate the strength of the Cr-silane and Cr-THF interactions from both kinetic and thermodynamic studies. We hope to present the results of these experiments at the spring '05 ACS national meeting in San Diego. If you happen to be attending this conference look for us at the undergraduate poster session!

David Crouch

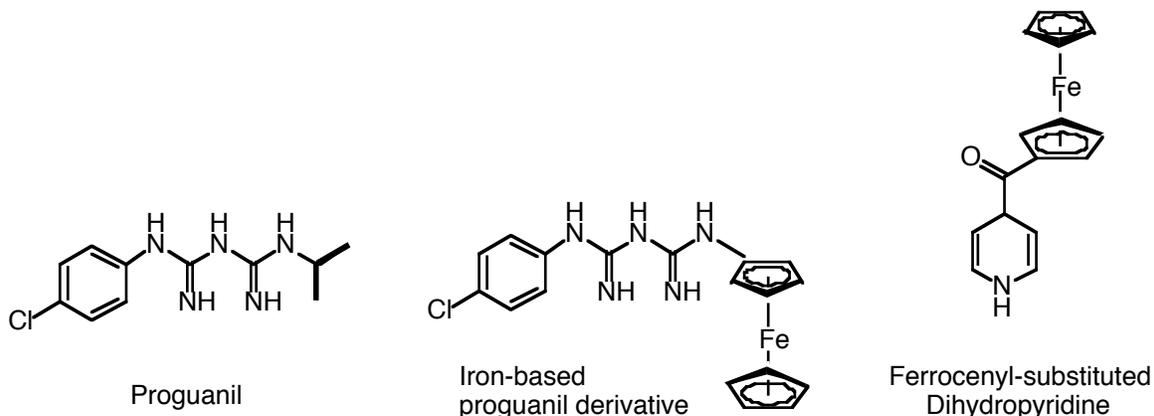
My lab is working on three very different projects: Our work in the area of selective deprotection of silyl ethers continues with a current emphasis on using salts to mediate removal of silyl groups. This year, Karina Menconi '04 worked on using salts absorbed onto silica gel and acidic ionic liquids to deprotect silyl-protected alcohols. Alex Tucker-Schwartz '05 continues this work. Jenn Zile '04, Dickinson's first Beckman Scholar, completes her work this summer on the development of cyclopropane-containing alpha adrenergic agents. Jenn has been working on optimizing conditions to couple to aromatic rings, convert an alkene into a cyclopropyl group and transform an ester into an imidazoline. This has been a very new area for Professor Crouch, too, and the pace has been slow. But, in late July, Jenn presented her results at the Beckman Symposium in Irvine, California. In April, the department received a grant to develop a nanoscience course for non-majors and lab modules for existing chemistry courses. Amie Richardson '05 is working with me this summer to develop a series of labs in material science for use in the fall. This project will continue next summer as nanoscience experiments for the organic sequence are developed.

Mike Holden

My research continues to move into the realm of bioorganometallic chemistry. This summer Natalie Martin '06 worked with me in the lab on two projects – the effort to create an iron-containing analog of the anti-malarial compound proguanil and the synthesis of ferrocenyl-containing 1,4-dihydropyridines

(DHPs). DHPs are used extensively in the manufacture of a number of important compounds, including calcium channel blockers, vasodilators, and Alzheimer's drugs.

Progress was slow on the proguanil project, with the major source of frustration being difficulty in isolating and identifying the polynitrogenated products. As a result, Cody Peer '05 is working during the fall semester on recreating a number of 1940's experiments involving similar compounds in order to get a handle on what we should be looking for in terms of NMR spectra, etc.



The DHP project went well, as Natalie synthesized several of the desired products. Future efforts will focus on improving the yields of these reactions.

On the teaching side, I continue to teach organic chemistry and also have responsibilities for the Bioorganic chemistry class and Foundations of Chemistry. I continue to serve on the College's Planning and Budget committee, serving as chair for the second year. As director of the program in Biochemistry and Molecular Biology, I serve as a member of the Science Executive Committee and as a member of the Clarke Center Steering Committee. I have recently been asked to serve on the search committee for the Vice President for Development and also am, along with Dave Crouch, the department's representative on the new science facility committee. I go to a lot of meetings and am looking forward to the day when I won't have to go to them and will be able to get back to pattering around in the lab.

For those of you who remember my family, son Chris is now a college freshman (at Kenyon College) and daughters Mel (high school junior) and Megan (7th grader) are growing up all too quickly.

Pamela Higgins

I have become fully adjusted to my new position here in the department: After organizing all my courses, I continue to refine my research interests. Caroline Estabrook '04 investigated the expression of TFIIIA proteins using *in vitro* synthesis methods and subsequently studied their ability to recognize and bind nucleic acids. She presented her work at this year's regional meeting of the ACS. This past summer, I was able to prepare and submit two manuscripts: "Teaching the Role of Chemistry in History" to the Journal of Chemical Education (along with Professor Samet) and "*In vitro* Synthesis and Comparison of Activity of Reporter Proteins" to Biochemistry and Molecular Biology Education. This coming year will take on a switch of focus with new research students designing the organic synthesis and studying the properties of ferrocene-based nuclease molecules, based on previous work done in my lab by Micheal Freitag '03 and Chad Talarek '03. In my spare time, I have been enjoying the outdoors with various camping, hiking, and rock climbing activities.

Cindy Samet

I have spent the past year rebuilding my lab after the flood but had a very productive summer with research student Alex Baker (now attending University of Virginia graduate school for chemistry) under her NSF grant. I also found time to prepare and submit an article (along with Professor Higgins) to the Journal of Chemical Education regarding a new approach to our non-majors chemistry class focused on "Teaching the Role of Chemistry in History".

Amy Witter

I have been enjoying maternity leave with the latest Althouse chemist, my daughter Jocelyn. Mom reports: Jocelyn arrived April 16, 2004 at 10:23 am and mom, dad, and baby are all doing well. Joss weighed in at 8 lbs, and she has been reminding mom of what it is like to be a graduate student again, by facilitating a lack of sleep! Have a great year!

Scholarly Research

- R. David Crouch. "Selective Monodeprotection of Bis-Silyl Ethers" *Tetrahedron* 2004, 60, 5833 – 5871.
- R. David Crouch, Michael S. Holden, Candice A. Romany '03. "The Darzens Condensation: Structure Determination through Spectral Analysis and Understanding Substrate Reactivity" *Journal of Chemical Education*, 2004, 81, 711 – 712.
- R. David Crouch, Candice A. Romany '03, Anna C. Kreshock '03, Karina A. Menconi '04, Jennifer L. Zile '04. "BiOCIO₄-mediated deprotection of silyl ethers" *Tetrahedron Letters* 2004, 45, 1279 – 1281.
- Todd D. Nelson, R. David Crouch. "Cu, Ni, and Pd-mediated Homocoupling Reactions in Biaryl Synthesis: The Ullmann Reaction" *Organic Reactions*, 2004, 63, 265 - 555.
- R. David Crouch, Jennifer S. Burger '01, Karolina A. Zietek, Amy B. Cadwallader '01, James E. Bedison '01, Magda M. Smielewska '01. "Removal of Acyl Protecting Groups Using Solid NaOH and a Phase Transfer Catalyst" *Synlett*, 2003, 991-992.
- Ashfaq A. Bengali, Benjamin K. Mezick*, Matthew N. Hart*, and Shahnaz Fereshteh*, "Electronic and Steric Influences on the Rate and Energetics of THF and MenTHF (n = 1,2) Displacement from the LRe(CO)₂ (L = Tp, Tp*, Cp*) Fragments by Acetonitrile", *Organometallics*, **22**, 5436, (2003)

**Research presented at the 35th central regional meeting of the American Chemical Society,
Pittsburgh, Pennsylvania, October 20, 2003:**

Caroline A. Estabrook and Pamela J. Higgins. " Optimization of in vitro Synthesis and Binding Activity of TFIIIA"

R. David Crouch, Anna Kreshock '03, Michael S. Holden. "Bismuth(III)-mediated Allylation of Benzaldehyde Dimethyl Acetal: An Advanced Experiment in Organic Synthesis and Spectral Analysis"

R. David Crouch, Jennifer L. Zile '04 "Progress Toward the Synthesis of Cyclopropane-Containing α_{1A} -Adrenergic Agents"

R. David Crouch, Karina Menconi '04, Candice A. Romany '03, Anna Kreshock '03, Jennifer L. Zile '04. "BiOCIO₄-mediated Deprotection of Silyl Ethers"

Department News

Objective: To report interesting news items from the Dickinson College Chemistry department during the past year.

Introductions:

Katie Barker (adjunct professor) welcomed a baby girl, Kelly Anne, on August 29, 2003. Katie's husband Sam and daughter Kristy were excited about the new addition. Katie has returned to teaching organic chemistry labs in the department, while Kelly brightens the downstairs lounge of Althouse with her laughter and by wearing her custom-made safety goggles fashioned by the senior chemistry students.

Amy Witter (assistant professor) also welcomed a baby girl, Jocelyn Elena, on April 16, 2004. Amy's husband George and Sam (their adorable golden retriever puppy) are both vigilant observers in awe of this newborn. Amy returns to 'active duty' this fall. Jocelyn also visits Althouse on occasion (much to the delight of faculty, staff, and students).

Itamar Burak of Tel Aviv University joined the chemistry department in the spring of 2004 as a visiting professor, teaching Chem 490: Symmetry and Spectroscopy. Prof. Burak recently retired from Tel Aviv University and had spent the fall of 2003 at Oxford University. He is an experimental physical chemist whose interests lie in the field of reaction dynamics and his research has taken him to Cornell and Harvard Universities over the years as well as Oxford and Tel Aviv. Now, Dickinson's chemistry department joins that distinguished list! His wonderful personality and sense of humor were enjoyed by all in the department. He captured his experience of the Carlisle winter and spring seasons through some vivid photography...one of his many hidden talents. We are pleased that Prof. Burak will return to our department in the spring of 2005.

Methods and Materials

Essential tools for enhancement of the chemistry courses here at Dickinson College:

Professors R. David Crouch and Cindy Samet have received a \$100,000 grant for the department from the Division of Materials Research of the NSF under the Nanotechnology in Undergraduate Education (NUE) Program to develop a program in nanoscience. The program has three components: the development of a new course for non-science majors in nanoscience, the introduction of elements of nanoscience into existing courses and the offering of a workshop for local secondary teachers. The grant will also allow us to purchase equipment including scanning tunneling microscopes to image individual atoms in an array and an atomic force microscope to image slightly large systems. The first version of the course for non-majors will be offered in the fall of 2004 as Chem 111. Some modules for Chem 141 and 241 may be available for use this year, but will certainly be ready for the 2005-06 academic year. And, a summer workshop will be offered in mid-July of 2005 for local high school science teachers.

A new strategy for improvement of science facilities has recently been unveiled at Dickinson College. The formation of a "Priestley Science Campus" will be created upon introduction of a multi-phased program that will result in the building of some new structures as well as renovation of existing science buildings. In September, Professor Crouch joined a team including 2 members of the biology dept, 2 members of psychology, Assoc Provost Walt Chromiak and Ken Shultes, director of the physical plant at the Project Kaleidoscope meeting in Appleton, Wisconsin. The current plan now calls for "phased" construction of new facilities rather than the long-discussed construction of one large building to house the three departments. The construction of a Priestley Campus is envisioned like the John Dickinson and Rush campuses and will include two or three new facilities as well as New Tome Science Building. Construction could begin within two years.

Results:

The hard work of students and faculty of the department led to an increasing trend of recognition for their valiant efforts:

The first-ever chemistry honor society at Dickinson college was installed this year to allow formal recognition of outstanding academic achievement in our chemistry program. The ceremony for the creation of the Rho Epsilon chapter of Gamma Sigma Epsilon (a nationally recognized chemistry honor society) was held on May 6th and overseen by a national representative of the society. Gamma Sigma Epsilon (est 1919) has over 30 active chapters and 11,000 members in the United States. Professor Cindy Samet (Honorary Inductee, Class of 1982) serves as advisor for the honor society, but it was the tireless efforts of three senior chemistry students (Alexander Baker, Caroline Estabrook, and Andrew Rosenthal) that resulted in the founding of the Rho Epsilon chapter for Dickinson College. Following induction of the first ever members, the officers of the society for next year were introduced (Table 1).

Table 1. Gamma Sigma Epsilon Inductees 2004

	Name	Major(s)
Class of 2004	Alexander Baker	Chemistry/French
	Caroline Estabrook	Chemistry /BMB*
	Karina Menconi	Chemistry
	Andrew Rosenthal	Chemistry
	Jennifer Zile	Chemistry/BMB*
Class of 2005	Casey DelConte	BMB*
	Tasha Kouvatso	BMB*
	Shannon Lilly	BMB*
	Melissa Moidel	Chemistry/BMB*
	Michael O'Malley	BMB*/Biology
	Cody Peer	Chemistry
	Amie Richardson	Chemistry
	Alex Tucker-Schwartz	Chemistry
Class of 2006	Jennifer Abrams	Chemistry/BMB*
	Eleonore Werner	BMB*

*BMB = Biochemistry and Molecular Biology

This past fall, a contingent of Dickinson chemistry seniors (Caroline Estabrook, Karina Menconi, and Jennifer Zile) and faculty (Professors Crouch and Higgins) attended the 35th ACS Central Regional

meeting in Pittsburgh, PA. The fruits of multiple student-faculty research projects were presented involving topics ranging from advanced organic chemistry experiments, synthesis of adrenergic agents, deprotection of silyl ethers, and *in vitro* synthesis of TFIIIA proteins. (See 'scholarly research' for more specific titles.)

Michael Holden, esteemed organic chemistry professor and the Alfred Victor duPont Chair in chemistry, was elevated from associate professor to the rank of Professor in the spring of 2004. Mike is well known for his pleasant demeanor and his ability to make the most difficult concepts seem simple. Student praise of Mike as a teacher, advisor, and mentor was universally positive. But, you may not know that, behind the scenes, Mike has become a major figure in recent years on the Dickinson campus. In 1997, he was one of the two architects of the Biochemistry & Molecular Biology major, the fastest growing science major at Dickinson. He's become the department's go-to guy on global education. And, in 2002, he was elected to the Planning & Budget Committee and, last summer, became the committee's chair. This is the group that sets the College's budget. Mike is a 1980 graduate of Allegheny college and received his Ph.D. from Colorado State in 1985. He was a postdoctoral fellow in the labs of Professor Anthony Pearson for two years. After a two year stint on the chemistry faculty at Earlham College, Mike joined the chemistry department at Dickinson in 1989 and was promoted to associate professor in 1996. Mike is our first full professor since the retirement of Bob Leyon in 1998.

Conclusion:

Another successful year for students and faculty of the chemistry department at Dickinson College!

2004 Departmental Awards

ACS Outstanding Senior Chemistry Major Award	Andrew Rosenthal ('04)
ACS Division of Polymer Chemistry Award	Natalie Martin ('06)
AIC Outstanding Senior Major Award	
Chemistry	Jennifer Zile ('04)
Biochemistry	Caroline Estabrook ('04)
The Merck Index Award	Karina Menconi ('04)
ACS Undergraduate Award in Analytical Chemistry	Alex Tucker-Schwartz ('05)
John E. Benson Handbook Award	Missy Moidel ('05)
CRC Freshman Chemistry Achievement Award	Michele Kondracki ('07)
Horace E. Rogers Scholarship Award	Alex Tucker-Schwartz ('05)
Richard Sheeley Memorial Scholarship	Missy Moidel ('05)

Class of 2004 Graduates

Biochemistry & Molecular Biology

Abir Abla
Eric Biondi
Caroline Estabrook
Sally Gerges
Travis Monnell
Treasure Walker
Jennifer Zile

Chemistry

Alexander Baker
Carly Drahus
Caroline Estabrook
Karina Menconi
Andrew Rosenthal
Andrew Schwerin
Jennifer Zile

Where will they go from here?

Alexander Baker – enter the Ph.D. program in chemistry at the University of Virginia

Carly Drahus – attend the Lake Erie College of Osteopathic Medicine

Caroline Estabrook – attend the nursing program at the University of Virginia

Karina Menconi – attend Temple University School of Medicine

Andrew Rosenthal – enter the Ph.D. program in chemistry at Johns Hopkins University

Andrew Schwerin—employment with an organic farming company

Jennifer Zile – enter pharmacy program at the University of Maryland

Graduate Spotlight

Chad Mirkin – '86

Good Things Do Come in Small Packages

It was truly a “year of the Chad” on campus: a Metzger Conway Fellow who delivered a lecture in September titled “Nanotechnology: Small Thinking or Thinking Small”, a featured chemist (along with five other chemistry alumni) in Dickinson Magazine (Spring 2004) that was “Sweating the Small Stuff”, and the recipient of an honorary degree of Doctor of Arts and Sciences during this year’s Commencement Exercises on May 23. So just who is “the Chad”?

Chad Mirkin is a 1986 Dickinson graduate from the department of chemistry who completed his doctorate in chemistry from the Pennsylvania State University before moving on to the Massachusetts Institute of Technology as a National Science Foundation Postdoctoral Fellow. Chad is currently the George Rathmann Professor of Chemistry and director of the Institute for Nanotechnology at Northwestern University where he has been a faculty member since 1996.

Chad's accomplishments are very large and extensive, the molecules that are the basis of his multiple papers, patents, and awards are quite miniscule. Chad and his colleagues are busting open the doors to the world of nanotechnology and nanoscience...the newest revolution in the field of chemistry. The ability to manipulate individual molecules on a scale of one billionth of a meter allows for unlimited applications in various interdisciplinary fields. His research involves the development of applications for the emerging field of nanotechnology. One of his creations is the invention of Dip Pen Nanolithography that allows individual molecules to be placed in specific patterns in much the same fashion that ink is patterned using a pen. He is also credited with the development of nanodetectors of bacteria such as anthrax. These devices use gold nanoparticles which change color in the presence of a specific bacterium

As a Dickinson College honorary degree recipient, Chad was invited to participate in the Commencement weekend Colloquia, a series of informal talks held in the Waidner-Spahr library on the Saturday of Commencement weekend. This year Chad had agreed to participate and even prepared and shipped a series of posters and vials containing gold nanoparticles and silver nanoprisms that were to be used as part of his presentation. Unfortunately, a series of storms passed through the Chicago area and Chad and his family did not arrive in Carlisle until late Saturday afternoon. So, Professors Cindy Samet '82 and David Crouch gave it the college try and used some of the demonstration materials to present an outsiders version of nanotechnology from Chad's lab.

Chad continues to travel to various parts of the world giving lectures on his research and newest breakthroughs. His charismatic personality has also landed him on the pages of Esquire magazine among the "Best and the Brightest" in a 2002 issue. The sky is the limit($\approx 4.0 \times 10^{13}$ nm above earth's surface) for what lies ahead for one of Dickinson's true "stars" of science.
