Welcome to our spring 2011 Binghamton University Chemistry Department newsletter. After a few years’ hiatus, our students and faculty have come together to produce a new, refreshed electronic newsletter template that will facilitate more regular publication. We plan to bring an updated newsletter to you at the end of each semester.

The past few years have seen some significant changes for Binghamton Chemistry. We have added two new faculty (Christof Grewer and Eriks Rozners) as well as new members of the teaching staff (Catherine Malele and Megan Roppolo). We have rearranged the undergraduate freshman and sophomore courses to decrease the size of the lecture sections, and we have introduced new advanced classes and an advanced laboratory in Organic Chemistry.

The department is also undergoing some physical changes. We have initiated a complete renovation of our teaching laboratories on the first and second floors of the Science 2 building. This includes new hoods, lab benches and shelves to incorporate more computer and data collection equipment in the labs. And, with the support of a National Science Foundation Major Research Instrumentation grant, we are preparing for delivery of a new 650 MHz NMR spectrometer in August.

In this newsletter, you will learn more about several of our students and faculty. We have also included an Alumni Updates section to help you learn more about your fellow Binghamton Chemistry alumni. We hope to include more descriptions in the next newsletter. Please let us know about your successes so we can include your information.

Beginning in fall 2010, we kicked off a new Alumni Seminar Series. With initial support from Joe and Terry Natishan, and John Bisognano, we are working to endow this program to bring alumni back to campus to share their experiences with our current students. If you are interested in supporting this initiative or in coming back for a visit, please let me know.

Finally, I would like to acknowledge the great success of our new graduates. This has been a particularly strong year for us, with over 110 chemistry and biochemistry majors graduating from Binghamton. Several of our graduates were recognized with awards from the Alumni Association, the American Chemical Society and other national groups. In addition, one of our current biochemistry students, sophomore William Marsiglia, was the recipient of the prestigious Barry M. Goldwater Scholarship.

We hope you enjoy this newsletter. And, if your travel plans bring you into the Binghamton area, please let us know. We would be delighted to welcome you back to the department.

Wayne E. Jones
Professor and Chair
Department of Chemistry
Modifying RNAs for novel therapies

Associate Professor of Chemistry Eriks Rozners involves his students in his work.

“Students essentially do all the research, from simple synthesis to building complex molecules,” says Rozners, who supervises their work, writes up results and develops new research proposals.

He and his team of students, ranging from undergrads to post-docs, explore the fundamental properties of nucleic acids, mostly ribonucleic acids (RNAs), with hopes that their research may ultimately lead to new therapeutic measures like antibiotics or anticancer drugs.

There are basically two themes to the team’s research. The first is chemically modifying RNA molecules to change their properties, making them better drug candidates for gene therapy.

The second is designing analogues of nucleic acids that can recognize biologically important RNAs in a sequence-selective manner, which is driven by the notion that many non-coding RNAs involved in important regulatory processes in cell biology are targets for novel therapeutic approaches.

Scientists discovered relatively recently that short, double-helical RNA molecules regulate gene expression. So even though we have the same genes throughout life, certain genes express themselves differently at different times. RNA plays a huge role in what is expressed when.

“The information is all right there in the DNA, but how it is being expressed is frequently being determined by those non-coding RNAs,” Rozners says. “That is why they are called ‘non-coding,’ because they do not encode the proteins themselves, but they regulate how the proteins are expressed.”

One of the challenges in using RNAs for gene therapy is their size. RNA molecules are much larger than traditional drugs such as aspirin and have a lot of negative charge, which makes it difficult for them to cross cellular membranes. So the team modifies RNAs to make them more hydrophobic.

“‘It’s a step-by-step process. You don’t get it all at once. You get one improvement on which you build your way to the next improvement.’

To examine their synthetic structures, Rozners helped secure a $550,000 National Science Foundation grant to buy a nuclear magnetic resonance (NMR) instrument, scheduled to come online by fall semester. Currently, students manipulate RNA then send it off to the University of Rochester for analysis.

“As a training mission, it is very important to have modern technology,” Rozners says. “It is for the research mission, too. Right now we are obtaining the key results through collaboration, which is great, but from the students’ perspective, they are involved in only one side of research — preparing molecules — and sending them away. If the students could do it all, it would be a much richer research experience.”

Though the Chemistry Department had fallen a tad behind in technology, the new NMR instrument puts it a step ahead of peer institutions and is essential to becoming a truly cutting-edge program because it enables the department to hire faculty doing pioneering research. Once that’s in place, the department will be able to demonstrate a need for larger grants for more powerful instruments.

“It’s a step-by-step process,” Rozners says. “You don’t get it all at once. You get one improvement on which you build your way to the next improvement.”

To qualify for most grants, the department depends upon support from the University and donors. In a typical grant, the granting institution requires matching funds, for instance with the NSF grant for the NMR, the chemistry department had to cover 30 percent — well over $200,000 — of the instrument’s cost.

To continue to grow and realize its full potential, the Chemistry Department needs support from alumni and friends.

“Do you make stuff blow up?” the third graders ask chemistry major Dan McCurry, who would like to say no. But there was that one time.

Most of McCurry’s lessons go better. Though he’s only a senior, he’s already teaching labs for Intro to Chemistry. Some of his friends told him he was crazy to teach, that he should concentrate on research or just relax, that teaching would be a waste of time. McCurry found it anything but.

As he’s progressed through his chemistry classes, he’s become more specialized, concentrating on electrochemistry, specifically, the electrodeposition of metals and formation of nano-structured materials. But teaching keeps him focused on the wider field of chemistry.

“It’s really helped solidify some basic chemistry and principles,” he says. “You take Intro to Chem and you go through all your studies saying, ‘Oh yeah, I remember learning about that,’ but sometimes you’ll forget things or they just won’t come to your mind at first. But teaching it pretty much firms up your basics since you have to know how to answer students’ questions, and they’ll ask anything.”

Though his near-perfect grade-point average probably didn’t hurt, teaching also helped him get into his top choices for grad school — the University of North Carolina at Chapel Hill and the University of Illinois at Urbana-Champaign — but he’s having a hard time deciding which to attend. Chapel Hill has the country’s best analytical chemistry program, the field he’s thinking of specializing in, while every chemistry program at Illinois is in the top 10, which would give him even greater exposure to the breadth of chemistry.

“I’ll probably decide April 14, the day before the deadline,” he says with a smile.

As president of the Undergraduate Chemistry Society, McCurry works with Benjamin Franklin Elementary School kids every semester to teach them the basic principles of chemistry. Last spring for Earth Day, he simulated how acid rain corrodes by putting a piece of chalk into a bottle of vinegar. Then he put the cap on.

“That was my mistake,” he laughs. “I held it there and asked, ‘what do you think is going to happen here?’ and all the kids asked, ‘is it going to blow up?’ I said, ‘no, no,’ but then I moved my finger and the top flies off and chalk vinegar flies everywhere. They had a lot of fun with it, though it probably ruined the point of the demonstration.”

What’s Your Favorite Element?
Nickel. It was the first metal I electroplated that resulted in a very shiny surface.

Dan McCurry
After several years in the pharmaceutical industry, Thomas Zengeya realized how a more advanced degree would help him. “To do what I really wanted to do I needed a PhD,” he says as he sits at a desk he shares with other grad students in a loudly humming room just off the research lab. “A PhD opens up more opportunities. I was basically an analyst. Someone told me what to do and I did it.”

With only a master’s, Zengeya figured he’d have to be in industry another decade before he became a research scientist deciding which projects to work on. But a PhD would allow him to make that move much more quickly. “I’d no longer be just a technician.”

Born in Zimbabwe, Zegneya came to the United States in 2001, earned his bachelor’s from SUNY College of Environmental Science and Forestry and his master’s from SUNY Oswego, then went to work for W.R. Grace, where he helped design HPLC columns and sunscreens. Soon he moved to Proctor & Gamble, where he worked as a pharmaceutical chemist doing drug monitoring and discovery, work that he found very rewarding and led to his PhD work with Eriks Rozners. Zegneya’s current research interests are synthesizing peptide nucleic acids targeting non-coding RNAs.

“We are targeting RNA because it has the potential of leading to new cures. I like seeing the results that can help people.”

Upon coming to Binghamton, Zegneya was pleasantly surprised by the accessibility of his professors. “In some places you hear horror stories,” he says. “I’m not sure how many of them are true, but here, if you have a question on a project, they are always very approachable.” He looks across the room and waves his hand to indicate his desk mates. “Just ask any of these guys.”

Zegneya has already published articles in several journals, including “Short Peptide Nucleic Acids Bind Strongly to Homopurine Tract of Double Helical RNA at pH 5.5” in the *Journal of the American Chemistry Society* and “PNA containing isocytidine nucleobase: Synthesis and recognition of double helical RNA” in *Bioorganic and Medicinal Chemistry Letters*.

As a PhD candidate, of course, he’s also taught a few classes, a task he says helped him in his understanding of chemistry. “Just teaching students what you know actually sharpens your own skills,” he says. “At the same time your helping them achieve their goals, and that’s fulfilling.”

Remembering how he felt as a new arrival, trying to learn American customs while tackling college studies, he now tries to help others in similar situations by being president of the Graduate African Student Organization (GASO). “As international students, we all come to America pretty much on the same platform to further our education,” he says. “So just getting together within GASO provides a support system from which we can learn and help each other out with some of the challenges we face.”

### What’s Your Favorite Element?

Oxygen, nitrogen and hydrogen, because they form the basis for his favorite base pairing of nucleotides, the Hoogstein-mediated hydrogen bond base pairing.
A chemistry career can take many paths

As chemistry students face graduation, many wonder what careers lie before them. Throughout college, they’ve worked with academics, asking big questions and drawing fascinating conclusions. But how will that preparation fit into the business world?

Alumni Joe ’88 and Terri Natishan, BS ’85, MS ’88, and John D. Bisognano, MA’84, PhD ’87, are trying to alleviate some of those anxieties. Last fall, they launched the Annual Alumni Lecture Series to bring Chemistry Department alumni back to campus as examples of the many career paths open to students.

“It’s encouraging for them to see things go well after graduation,” Dr. Bisognano says. “As a student, it’s very easy to start thinking that you’re getting nowhere and wondering where all of your work will ultimately get you. So it’s good for them to have an idea of what the future may hold and give them the tools on how to get there.”

The Natishans were the first to share their industry experience. Both have long careers in industry in chemistry labs — Joe as a research analytical chemist on multi-million-dollar projects at Henkel Corporation and Terri as the associate scientific director of analytical development and commercialization for the second-largest pharmaceutical company in the world, Merck, where she helps create new medicines like Isentress, an AIDS drug that she says “clearly met patient needs and made a big difference in people’s lives. To me that’s really rewarding.”

In their talk, the Natishans tried to reach as many students as possible by addressing chemistry issues in broad terms. And they kept it light and enjoyable because they remember thinking as students that industry jobs must be boring.

“We wanted to make sure that our presentation really opened their eyes,” Terri says, “and really made them see that working in industry can be very challenging, that there are issues that need to be solved and solved very quickly.”

The lecture allowed the Natishans to connect with the Chemistry Department more deeply than they had before because afterwards they kept in contact with students who wanted more specific advice. They tell students to not focus too narrowly and remain versatile, and after graduation to get out there and get some experience while taking steps toward that dream position.

The Natishans wish they had this kind of connection to alumni when they were students. It would have made their own transition from college to career easier. But now from the vantage point of experience, they see how influential their time at Binghamton was to their lives and they want to give back by building that student-alumni bridge.

“Binghamton taught me how to do research,” Joe says. “It’s an important thing to know how to think independently, how to get around disappointing results and keep going and take a different approach to solving a problem.”

The Natishans have a lot of causes they could support, but by giving back to the Chemistry Department, they know they are making a real difference.
Alumni Updates

Daryl Bosco (BS '96, Professor Jones) received her PhD in 2003 from Brandeis University, where she used NMR spectroscopy to study enzyme dynamics. From 2003-2005, she completed a post-doctoral fellowship in the lab of Jeffrey W. Kelly at the Scripps Research Institute. After her fellowship, she was an Instructor of Neurology at Harvard Medical. She is currently an assistant professor at the University of Massachusetts Medical School.

George Cernigliaro (PhD ‘77, Professor Kocienski) began his professional career at GAF Corporation in Binghamton. The corporation was later sold to the Shipley Company in Newton, Mass., where he worked from 1978-1998 and held various technical management roles. In 1998, he helped form the company Advanced Nanotechnologies, Inc. Currently, he is working at MicroChem Corp., where he is the Vice President and Chief Technology Officer.

Jared DeCoste (PhD ‘09, Professor Doetschman) moved to Indiana and worked as an Assistant Professor of Chemistry at Ball State University for one academic year. He is currently a post-doctoral fellow with the National Research Council at the Edgewood Chemical and Biological Center in Maryland. His research is focused on the development of novel metal organic frameworks for use as adsorbents or in separations.

John N. Gitua (PhD ’05, Professor Eisch) accepted an appointment as Assistant Professor of Chemistry at Drake University where over the past 5 years he has distinguished himself as an exemplar in the teaching of organic chemistry. John has continued his collaboration with our group here at Binghamton in research on the epimetalation reaction of unsaturated organic substrates. He has been a principal coauthor of 14 publications with our group and one U.S. patent. Recently, he was promoted to Associate Professor of Chemistry with tenure.

Clifford Murphy (PhD ’04, Professor Jones) and Anastasia “Lioubomirov” Murphy (PhD ’06, Professor Ben) are currently living in Massachusetts. Cliff is an Assistant Professor of Chemistry at Roger Williams University in Bristol, R.I. Stacy is working as a Senior Chemist with Cambridge Isotopes Lab in Andover, Mass. They have two children, Rhiana and Nicholas.

Richard Wilson (BS ’00, Professor Doetschman) received his Ph.D. at U.C. Berkeley in 2005. Afterwards, he completed a postdoctoral fellowship in the Heavy Elements and Separation Sciences group at Argonne National Laboratory where he is currently a staff member. Specifically, his research focuses on the structural and coordination chemistry of aequous transuranium complexes, particularly plutonium.

Jun Zhang (PhD ’09, Professor Fang) is now working as a distinguished postdoctoral fellow at the Center for Nanoscale Materials at Argonne National Laboratory. His present research focuses on topics of semiconductor nanocrystal-assisted photocatalysis, solar fuel production/solar energy conversion, and light induced charge transfer across bioinorganic surfaces. The goal of his study is to understand how these functional nanocrystals can lead to a development in sustainable energy applications.

Mogana V. Jayakumar ’12 works with a new temperature-controlled diode array spectrometer in Chemistry 485K, taught by Professor Christof Grewer. The instrument, purchased in the fall semester with the support of donor funds through the Harpur College dean’s office and the Alumni Annual Fund, helps students in the physical and biophysical chemistry analyze difficult samples, developing methods faster and with easier validation. To learn more about how you can help support undergraduates, please contact the department office at 607-777-2517.
The Department of Chemistry is dealing with some pretty tough cuts in funding, just like the rest of the campus. They threaten upgrading our facilities and acquiring grants, which are essential for our faculty and students to conduct their research.

To raise money for the University’s most essential needs, its extraordinary students and outstanding academics, nearly 30,000 people have made contributions to Bold.Brilliant. Binghamton — The Campaign for Binghamton University.

Learn more at bold.brilliant.binghamton.edu.