Spring/Summer 2016

ELEMENTS

The Alumni Magazine of the Department of Chemistry at Virginia Tech

IN THIS ISSUE

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TELL US YOUR STORY!

Do you have an interesting story that might be featured in Elements? Do you know someone who should be featured?

Contact the Department Chair, Prof. Jim Tanko (jtanko@vt.edu) or
Laurie Good, Elements Editor laurieg@vt.edu)

Please share your news!

Welcome to the Spring/Summer 2016 edition of the Chemistry Department's alumni newsletter Elements!

The overarching theme of this edition of Elements is celebratory! From this Spring's Commencement, where 28 students earned a B.A. in chemistry, and another 24 earned a B.S., to the chemistry awards banquet, to news articles in the popular press, and more, this issue celebrates the outstanding accomplishments of our students, alumni, staff, and faculty.

Starting with student awards, on April 22 the Department held our annual awards ceremony banquet, which also coincided with the spring meeting of the Department of Chemistry Advisory Council (DCAC). At this dinner, we recognize the outstanding accomplishments of students in academics, research, teaching, and service. A partial list of award and scholarship winners, and photos from the ceremony, can be found on pages 4 – 5.

While on the topic of student awards, it is well worth mentioning that many of the student awards we offer are possible because of your generosity through donations to the *Chemistry Enhancement Fund.* For example, our Academic Excellence Award, which consists of a certificate and a cash award, goes to undergraduate chemistry majors who have demonstrated excellence and exhibited a sense of professionalism in their academic studies (see photo on page 5). These simple tokens of acknowledgement and appreciation go a long way in fostering the spirit of camaraderie that is a cornerstone of our department, and your help and support in enabling us to do this is most sincerely appreciated.

Since DCAC was mentioned, The Spring 2016 meeting was an outstanding success. As you know by now, DCAC is taking the lead in organizing a Davidson Hall Rededication Ceremony. The hard work, creativity, and dedication of DCAC members in this effort, and in general for helping make the Department of Chemistry a better place, are all pivotal to our success. Regarding the timing of the rededication ceremony: Initially, we were hoping for this event to occur in Spring 2017. Unfortunately, bids for the project came in well over budget and at this point, Fall 2017 is looking more likely. Sometime in mid-June we will have a better idea of the expected completion dates, so as the cliché goes… watch this space.

This year's commencement ceremony was (once again) held in downtown Blacksburg at the Lyric Theatre. As part of the ceremony, we invite two of our graduating students to speak; this year they were Ms. Valerie Mensah (B.A.) and Mr. Dallas Mann (B.S.) The thoughts and reflections of these students were touching, poignant, and funny. I am happy to say that as representatives of our next generation of leaders, our future is in good hands. Our "main" Graduation speaker was someone who nearly all of you will recognize: Prof. Emeritus Harold M. McNair. Harold is highlighted in this issue of Elements as part of our ongoing series about former department chairs, so my comments will be brief. In his address, Harold demonstrated, through personal example, how an interest in and passion for chemistry can help address real-world problems such as efforts to combat terrorism. His personal reflections and anecdotes touched the audience, and not unsurprisingly, he received a standing ovation. The number of parents, grandparents, and others who spoke with me after the ceremony to express their appreciation was touching, and I think they truly got a sense of what makes our department so special. (*con't next page*)

Once again (for the second year in a row, and for the third time since 2009), the Department of Chemistry received the 2015 *University Exemplary Department Award.* For this cycle, we were recognized "for effectively linking research and scholarship with teaching, with particular concentration on innovative programs." An impressive number of our alums and current students helped in putting together a compelling nomination package through their supporting letters. One, in fact, was so compelling that it was included on the cover of the package. This letter came from Jeff Watkins (a physics major, incidentally), who did undergraduate research with Ray Dessy: "Any department can teach fundamental principles, hold recitations, conduct laboratory exercises or host colloquia. It seems, however, that few Departments are capable, or even attempt to, integrate undergraduates in fundamental research and expose them to an interdisciplinary research setting. The experience I had as an undergraduate was the result of an innovative approach to linking research and scientific inquiry with instruction, and it succeeded not only in driving home fundamental principles and scientific method, but it ignited my curiosity and exposed me to new ways of approaching problems and analyzing problems from the perspectives of various disciplines." It is also worth mentioning that as part of this award, the Department received $15,000… and all of these funds were used to provide stipends to three of our undergrads so they can do research this summer!

Finally, starting July 1, the College of Science will have a new Dean. Sally Morton, who is currently a professor and chair in the Department of Biostatistics at Pittsburgh, will succeed Dean Lay Nam Chang. I believe both the College and Science, and Department of Chemistry will do well under Sally's leadership and I look forward to working with her. I also want to acknowledge Dean Lay Nam Chang for his efforts and accomplishments on our behalf. Through my years as department chair (six as of this writing!), I found that Lay Nam was at his best when the problems we were facing were the most challenging. I appreciate his help and support.

Prof. Jim Tanko, June 2016

Faculty HIGHLIGHTS

Prof. Amanda Morris was named a 2016 Camille Dreyfus Teacher-Scholar, an award that honors emerging young leaders in the chemical sciences. Morris is one of 13 honorees this year to be selected by the Camille and Henry Dreyfus Foundation. In its announcement, the foundation highlighted Morris's research work with artificial photosynthetic arrays.

Morris's work in this field has already garnered her a five-year, $605,000 National Science Foundation CAREER Award to fabricate artificial photosynthetic assemblies that can convert solar energy into chemical fuels, such as methane, for long-term storage and use. Making up the assemblies will be 3-D polymers known as metal-organic framework thin film arrays. The long-term goal of her work: *Create solar energy gear for houses that can store energy for later use when the sun is down or on a rainy day.*

Established in 1946, The Camille and Henry Dreyfus Foundation is a nonprofit organization devoted to the advancement of the chemical sciences. The Camille Dreyfus Teacher-Scholar Award is the Dreyfus Foundation's flagship program. Awardees are selected based on their independent contributions to both research in the chemical sciences and education." Among Morris' more recent awards are a $55,000 Alfred P. Sloan Research Fellowship, a $450,000 U.S. Department of Energy grant in 2014, and a Ralph E. Powe Junior Faculty Enhancement Award from Oak Ridge Associated Universities in 2013 for research involving oxidation of water, a critical step in artificial photosynthesis, as well as the development of cheap, efficient solar cells.

Prof. Lou Madsen can now add National Public Radio to a list of media sources publicizing his research on ion gel electrolytes and their potential use in next-generation batteries. In April, he was interviewed by WVTF (Blacksburg's local NPR station) when he discussed the possibilities for these intriguing materials. Prof. Madsen and colleagues have just published their work, "Highly Conductive and Thermally Stable Ion Gels with Tunable Anisotropy and Modulus," in the high-impact journal, *Advanced Materials*. This publication describes a new "ion gel" electrolyte based on a Kevlar®-like polymer and an ionic liquid. This gel has high conductivity and widely tunable stiffness, properties required to build safe and practical rechargeable batteries that use Li-metal electrodes. Such batteries have much higher energy density than conventional Li-ion batteries.

Profs. David Kingston and **Paul Carlier** represented Virginia Tech as members of the Steering Committee (pictured here) for the fledgling **Virginia Drug Discovery Consortium**. The VDDC seeks to bring together researchers on brain diseases from Virginia universities, research institutes, and pharmaceutical companies to highlight the challenges and opportunities for drug discovery in the Commonwealth for targeting brain diseases. The first event sponsored by VDDC was the VirginiaBrainRx Symposium in Richmond, May 23-24, which attracted nearly 200 scientists. Plans are under development to make VDDC a fully functioning Consortium. Also pictured to the right are co-organizers John Lazo (UVA) and Richard Glennon (VCU).

"Going Paperless"

Contributed by Instructor Victoria K. Long

The theme of the recent Spring 2016 American Chemical Society (ACS) meeting in San Diego was *Computers in Chemistry.* At an Education Division symposium, a presenter asked two significant questions: "*How many of you go to a physician that handwrites your information? How confident are you of a physician that handwrites?*" These two key questions, coupled with the desire to increase our greenness in the laboratories, solidified the decision to go paperless in the general chemistry laboratories. We are moving toward using an e-manual, updating our methods of collecting data during lab, and submitting all lab assignments online.

Students will purchase the e-manual directly from the publisher and use their computers, ipads, or cell phones to access the e-manual during the lab. With an approximate enrollment of 2400 students in the fall 2016 semester, the conversion from a paper manual to an e-manual will eliminate using 240,000 sheets of paper in just one semester! Further, using an e-manual allows for a fully colored manual with reference hyperlinks and videos of common laboratory procedures and concepts. As an example, Chem 1045's e-manual contains an animated tutorial explaining the concepts of exothermic and endothermic and a video depicting the correct method to titrate using the phenolphthalein indicator! Further, the e-manual includes live hyperlinks to ACS journal references that support several of the experiments. The e-manual contains interactive animation tools so students can easily highlight and comment in their e-manual. Other features include a search field for key words, five different annotation tools, a built in dictionary, and drawing tools!

Students will enter their data from laboratory experiments directly into their personal computers. Today, more than 8 in 10 doctors across the country have adopted electronic healthcare record systems, according to a new report from the Office of the National Coordinator for Health IT (6/9/16). Our students must keep abreast of current trends, and learning to collect and organize their data directly into their computer will help in this goal. While commercial Electronic Laboratory Notebooks (ELN) exist, students will use specifically designed word files that mimic ELNs; this will decrease the lab cost for the students. Students will submit the ELN simulated files online at the end of each lab into Canvas.

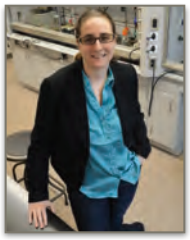
Canvas, VT's new Learning Management System (LMS), has a new grading feature, Crocodoc, which easily allows teaching assistants (TAs) to view, grade, and make comments on student submissions. Crocodoc has made online submissions practical for the general chemistry labs! Thus online submissions eliminate all student pre- and post-lab paper submissions. With 12 experiments during the semester, and estimating an average of 6 pages of submissions per student per experiment, this eliminates approximately 173,000 sheets of paper each semester! Further, implementing online submission is more efficient for the TAs than collecting and grading paper submissions.

Therefore, going paperless in the general chemistry labs benefits our students, aids our TAs, and increases our green objectives by providing an e-manual, using an online simulated ELN, and submitting assignments online.

Pictured: Example simulated ELN for acid base titrations experiment

2015-2016 Department of Chemistry AWARDS

Prof. John Matson received the 2016 Jimmy W. Viers Teaching Award, which each year is presented to faculty for outstanding performance in the classroom. In part, John was lauded for his use of a "flipped classroom," whereby students view concise videos he prepares prior to the actual class period. During class, they spend most of the time in class working through worksheets. Mason has worked over the past three years to develop and refine these worksheets to methodically step students through new concepts to enhance understanding.



In recognition of her outstanding research contributions in the field of solar energy conversion, **Prof. Amanda Morris** was awarded the 2016 John Schug Research Award.

Laurie Good received the Harold McNair Staff Service Award for 2016. To quote from one of the nomination letters, "She has done an amazing job with all aspects of department media (newsletters, website stories, digital signage, and connecting faculty to University-wide media)."

Prof. John Morris was awarded the 2016 Alan F. Clifford Faculty Service Award for his "contributions to undergraduate and graduate instructional programs, students, and faculty colleagues, which are judged by peers to exemplify high standards of selfless service."

For the second consecutive year (and the third total since 2009) Chemistry has received the Exemplary Department Award! This year, the award recognized the work of programs and/or departments that maintain exemplary teaching and learning environments for students and faculty, and, in particular, accomplish this through collaborative, group efforts.

On March 30th, the CoRec soccer team, **Chem Grad FC**, ended its season 6-0 (wins-losses), defeating all challengers to claim the title of **USOA Indoor Soccer Ad*Advanced League* Intramural Championships!**

(Left to right) FRONT: Rachael Parker (Grove), Ashley Paralta (Santos), Rui Zhang (Riffle), Spencer Arhenholtz (A. Morris), Kristen Felice (Moore)

BACK: Joe Rittenhouse (Moore), Mike Guardino (HNFE), Andy Ondek (MSE), Filip Gouglev (CS), Justin Grams (Josan), Jie Zhu (A. Morris), Shaoyang Lin (A. Morris) Not pictured: Jennifer Rowe (A. Morris), Christina Kim (Grove)

In Memoriam

Former Chem Professor, George Sanzone, died peacefully on May 2, 2016. Born in 1934 in Brooklyn, N.Y., George was a self-made man, from his stint in the U.S. Navy to his years of study culminating in a PhD in Chemical Physics from the Univ. of Illinois. George studied architecture at the Pratt Institute in Brooklyn. During his service in the Navy, he served on an Admiral's staff in London and helped design naval bases in Scotland. After returning to the U.S., he worked at Bendix Corp., where he helped develop time-of-flight mass spectrometry. At Burton & Rodgers he worked on development of a flight simulator for the B-58 supersonic bomber. In 1969, Dr. Sanzone joined the Chem faculty of Virginia Tech. From 1969 - 1989, he enjoyed teaching and research and his many students, friends and colleagues along the way. After retiring, George began a new phase in his life, filled with travels, learning and 3-D puzzles, all in the company of his beloved companion of 27 years, Therese Martin. His cancer diagnosis in 2001 did not quench his spirit for life; if anything it made him all the more grateful for the years he continued to have.

Graduate Student Awards

Graduate Research Awards	Spencer Ahrenholz (*advisor Dr. A. Morris*), Molly Congdon (*advisor Dr. W. Santos*), and Jeffrey Foster (*advisor Dr. J. Matson*)
Graduate Teaching Awards	Christina Kim (*advisor Dr. T. Grove*), Fabijan Pavosevic (*advisor Dr. E. Valeev*), and Jose Rodriguez-Corrales (*advisor Dr. J. Josan*)
Graduate Service Award	Christopher Presley

Undergraduate Scholarship Recognitions

Dr. Roy H. Bible, Jr. '48 Memorial Scholarship	Bethany Nicole Stratakes
Julius P. Bilisoly Endowed Scholarship	Joseph Gene Badlato, Sean Patrick Dillon, and Samuel Scott Welborn
John Williams May '42 Memorial Endowed Scholarship	Matthew Thomas McGuire
John B. and Sarah Hopper Harvie Endowed Scholarship	Taylor Nicole Zurick
Dallas A. Kinser & Robert T. Johnson Scholarship	Brandon Meerscheidt
Charles B. Walker Endowed Scholarship	Dallas Mann

Undergraduate Student Awards

Academic Excellence Awards	Tony Dahbura, Sally Lewis, Dallas Mann, Brandon Meerscheidt, Melissa Mohnal, David O'Neil, Bethany Stratakes, Sam Welborn, and Taylor Zurick
Timothy E. and Victoria K. Long Undergraduate Science Scholarships	T.J. Winker Sarah Wollman
James E. McGrath Undergraduate Research Award	Emily Smith
Harold M. McNair Undergraduate Student Award	Steven Miller
Ogliaruso Family Scholarship	Linda Allworth
Viers Achievement Award	Elizabeth Bose, Natalie House, James Owens, and Nisana Siman-Tov

Undergraduate Summer Research

Summer 2016 Summer Undergraduate Research Awards	Noah Griggs (*advisor Dr. G. Yee*), Matt McGuire (*advisor Dr. P. Carlier*), and Sarah Wollman (*advisor Dr. L. Madsen*)
Walter B. Ellettt Memorial Scholarship	Donald Clark (*advisor Dr. J. Josan*)
Chemistry Friends Scholarship	Erin Soderstrom (*advisor Dr. A. Morris*)

FACULTY SPOTLIGHT: Prof. Timothy E. Long

"A man who dares to waste one hour of time has not discovered the value of life"—Charles Darwin.

It was exactly one year ago that **Prof. Timothy E. Long** agreed to assume the directorship of the Macromolecular and Interfaces Institute (MII), which was established years ago to unite faculty from the College of Science, the College of Agriculture and Life Sciences, and the College of Engineering around research topics that could be addressed more strategically through a cross-disciplinary approach. Since that time, he has wasted not a single hour in putting his stamp on the newly renamed ***Macromolecules Innovation Institute,*** while at the same time continuing to teach and lead an active research group.

Says Long about this assignment: "It remains an honor to lead a passionate group of 60 affiliated faculty and over 200 graduate students and postdoctoral fellows for the advancement of macromolecular science and engineering. MII continues to be a highly sought destination for a rich educational experience, interdisciplinary research programs at new intersections of macromolecular science and engineering, and collaborative partnerships with leading industries across the globe."

One exciting offspring from the MII is the Macromolecular Materials Discovery Center (MMDC) — a soon-to-open analytical testing lab serving as a state-of-the-art facility for research and exploration for MII affiliated Departments, faculty, and students (and industrial partners). From the only rheological solids analyzer on campus, to the differential scanning calorimeter with photocalorimetry capabilities (DSC-PCA) and the Fox-50 thermal conductivity instrument, the MMDC will provide cutting-edge instrumentation that is not readily available elsewhere on campus. The MMDC will facilitate key analytical capabilities to Chemistry, leveraging the Department's core strengths in polymer characterization and establishing structure-property relationships. The MMDC ensures that Chemistry faculty will have access to state-of-the-art instrumentation to enable more competitive proposal preparation.

Dr. Long is also now heading an NSF-funded Research Experience for Undergraduates (REU)—representing the 28th consecutive year that the MII has been awarded REU funding. This summer's program is training rising juniors and seniors under the umbrella of "Materials Innovation in Emerging Food-Energy-Water Systems (FEWS) Technology." REU MII-FEWS research will provide enabling polymeric materials for food distribution, water efficient crop production, real-time monitoring devices, advanced manufacturing concepts to print the next generation of membranes for water purification, and novel synthetic methods to understand predictable transport and diffusion through materials. Many of the Chemistry faculty are REU mentors, and Chemistry faculty will leverage many exciting research directions with some of the best undergraduates across the country.

Before returning to Virginia Tech as a professor 16 years ago, Long spent nearly a decade as a research scientist at the Eastman Kodak Co. Long has received more than $43 million in research funding and he maintains a 20-member research group focusing on macromolecular structure and polymerization processes for the development of advanced technologies including drug and gene delivery, sustainable food stocks, adhesives and elastomers, and biomaterials for health and energy. Currently, the Long Group (shown during one of their classically inventive summer group meetings) continues the rich tradition of the Department (thanks, in part, to Prof. Jim McGrath) in high performance engineering thermoplastics, including new families of polyimides, polycarbonates, polysulfones, polyesters, and polyurethane which have applications in aerospace, automotive, and energy applications. Adhesive chemistry continues to offer broad impact, especially as environmental regulations demand the removal of volatile organic solvents and the discovery of novel click-type reactions which occur at room temperature in the absence of a by-product.

One of three *Virginia Scientists of the Year* for 2015, Long was also inducted as an ACS Fellow, received the ACS POLY Mark Scholar Award, and was recently elected as a member of the AAAS. He is credited with than 40 patents in macromolecular science and engineering; has published 22 book chapters and more than 220 peer-reviewed publications. Most recently, Prof. Long was elected as Vice President of the Adhesion Society.

"We are excited to be located within the Institute for Critical Technology and Applied Science (ICTAS) as our administrative home. ICTAS brings new mechanisms for MII to embrace, enabling us to impact every corner of our campus with new directions in macromolecular materials and chemistry. I personally invite you to attend our MII Technical Conference and Review on October 10-12, 2016; I think you will be impressed with our many new directions!"

Commencement 2016 Scrapbook

Prof. Harold McNair: Life After Retirement

Department Head, 1989-1992

This is another installment in a series of articles about Chemistry's former heads

Somewhere around age 70, Larry Taylor—then Department Head and a longtime friend and tennis buddy—asked me if I was thinking about retiring. I actually had been and talked to my wife, Marijke, about that possibility. Her reply: "FINE, as long as you do not come home before noon." So I calculated my VT pension plan and social security and RETIRED…at least for a while.

All that changed was when I no longer received a salary, no longer sat on any committees, and did not go to any faculty meetings. I still came to work every day, which included getting my last two PhD students, Kevin Schug and Jennifer Brown Smith, off to their careers. Additionally, I continued my research for Homeland Security: training dogs to smell bombs and compiling a GC/ECD and GC/MS C.I. library (like a fingerprint) for all suspected terrorist bomb residues in NATO countries over the last 10 years. Our work showed that many major terrorist attacks (e.g., PanAm 103, both US Embassies in Africa, nightclubs in Berlin and Bali as well as most IRA bombings) were assembled using the plastic explosive known as Semtex, one of the more energetic plastic bombs. Based on our GC "residue library," we determined that this Semtex came from Col. Gaddafi of Libya, who bought the entire annual supply of Czech Factory #9, estimated at 100 tons.

Fortunately, even post-retirement I enjoyed good federal funding: $1.8M for ten years, which supported at least 1 postdoc and 2-4 undergraduate students—most of whom became excellent researchers. My most accomplished postdoc was Dr. Bob Boggess from Radford University who became an expert chromatographer. Our work was confidential, no open literature, just 40 quarterly reports over 10 years, many of which could easily have been published in leading chromatographic journals. Our last report was in 2008, and although funding was still available, Bob and I both wanted to shift our interests elsewhere — hence, he retired and I moved to Mining Engineering.

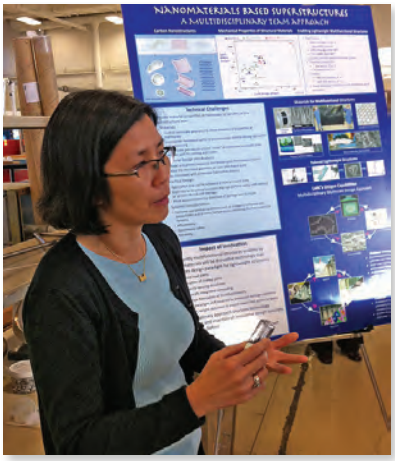
Bob and I had been doing GC/ECD (pro bono) for tracer gases for Mining Engineering Professor, Kray Luxbacher, for several years. She was eager to continue so I asked permission and was able to donate both GC systems to Mining Engineering in 2009—the same year during which I served as a minor co-PI with her on a five-year NIOSH grant of $1.25 million. I am actively working part-time in Mining and have contributed to six publications in related journals for which GC played an essential role.

In addition to chemistry, I have always enjoyed sports, and still play tennis (doubles ONLY) two or three times a week. I may not be getting any better, but I still enjoying it. Also still traveling, but like many former frequent fliers— it's bordering on being more trouble than it's worth! Nonetheless, in May of this year I presented a lecture at the Minnesota Chromatography Forum in Minneapolis, delivered a commencement speech at my old high school (graduated there in 1951) in Miami, Arizona, and spent one week in Riva del Garde in Italy, during which I celebrated my 83rd birthday with former students, Vince Remcho (now at Oregon State University) and Kevin Schug (now at the University of Texas)!

I was honored in 1983 to be one of two recipients of Virginia Tech's Alumni Teaching Award (the other being Prof. Scott Geller in Sociology). And now, 33 years later I received the ACS Analytical Division's 2016 Research Award for Chromatography. Both awards have made me very happy: the A to Z of Academic Life. Due to the unexpected passing of my wife of 55 years, Marijke, late last year I was unable to deliver my lecture and accept the award. Prof. Vince Remcho generously stepped in to present my lecture talk, and Prof. Jim Tanko (pictured with McNair) just "unofficially" presented the plaque.

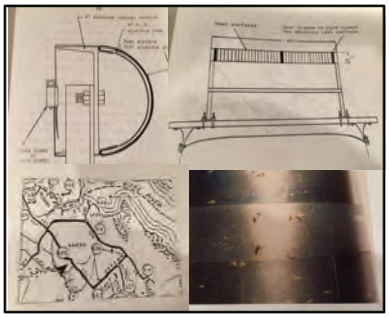
I am still an occasional presence in the department and am particularly proud that the endowment I established years ago continues to fund a small award every year — one for staff (the most recent recipient being the editor of Elements!), and one for a deserving first-year chemistry major.

Coincidence or fate? **Dr. Mia Siochi** (*MS with Prof. Jim Wightman and PhD with Prof. Tom Ward*) found herself alone in her lab over the lunch hour when Dr. Ward brought a seminar speaker in for an impromptu tour, which was not uncommon. However, that visitor happened to be the head of the Composites and Polymers Branch at the NASA Langley Research Center—who *also* happened to be looking for someone to support the division's polymers characterization needs. He very nearly recruited her on the spot. Thus began Dr. Siochi's journey to NASA, where she currently leads efforts to develop super-strong structural materials based on carbon nanomaterials. These materials have the potential to change how lightweight structures are designed, especially when this multifunctional material is used in conjunction with 3D printing. Her multidisciplinary incubator team is developing a multimaterial 3D printer capable of laying down continuous carbon nanotube (CNT) yarn filaments to enable topologically optimized multifunctional structures.



Dr. Siochi has also worked on designing engineered surfaces that prevent insects from sticking to aircraft wings in order to enhance fuel efficiency. This is a research problem she first encountered as an MS student, where experiments for her thesis included Dr. Wightman driving around his Mobjack Bay vacation home in 1984 with Mia's samples attached to his car to collect bug splats (the graphic saved for posterity in Mia's chem notebook and included)!

In a subsequent attempt to come up with a solution for the pesky bug residue adhesion problem, her team designed and tested over 200 coating compositions, downselecting five promising coatings that flew on a Boeing 757 ecoDemonstrator last year. The best surfaces were shown to contribute to the operational benefits of natural laminar flow wings. Self-healing material systems, energy harvesting and materials for accelerated wound healing are all part of her current research portfolio. In many ways, NASA has given Dr. Siochi opportunities to make what sounds like science fiction a reality.



And to think it all started from what she refers to as the "happy accident" of deciding to work though lunch.

MIT Assistant Professor of Chemistry **Matthew Shoulders** (*summa cum laude* Chem BS, 2004) was named a recipient of the National Institutes of Health (NIH) Director's New Innovator Award, which supports "exceptional investigators pursuing bold research projects that span the broad mission of the NIH." Shoulders received $2,340,000 for his project entitled, "Continuous Directed Evolution of Biomolecules in Human Cells for Medical Research." The award provides the Shoulders Lab with opportunities and resources to pursue research that uses the human cell as a factory for the design, creation, validation, and optimization of functional biomolecules. Shoulders was also recently named MIT's Whitehead Career Development Assistant Professor in recognition for his outstanding contributions to both education and research.

The Shoulders Lab at MIT studies the processes of protein folding and quality control in living human cells. Dysregulated protein homeostasis is inextricably linked to disease states such as Alzheimer's, diabetes, cystic fibrosis, and many types of cancer. Proteome repair achieved by targeting the cellular mechanisms that regulate protein folding could transform the therapeutic options for broad swaths of protein folding-related disease, but much more must be learned about how proteins fold in the cell before such therapies can be realized. The Shoulders Lab employs a multi-disciplinary approach to (1) develop chemical and chemical biologic tools to manipulate and monitor cellular protein folding, (2) understand at the molecular level how the cell remodels itself to address challenges to protein homeostasis, (3) elucidate the pathophysiology of protein folding-related diseases with poorly defined etiologies, and (4) target the biological processes discovered for the development of new small molecule probes, tools, and (ultimately) drugs.

CATALYSIS is at the heart of many chemical processes. To make it more cost-effective and sustainable, chemists have set out to replace precious-metal catalysts such as palladium, platinum, rhodium, and iridium with more abundant iron, cobalt, and nickel.

Prof. Paul J. Chirik (B.S., Virginia Tech, 1995) of Princeton University has provided a classic example of this trend by discovering a new class of hydrosilylation catalysts to make silicone compounds and polymers. These iron, cobalt, and nickel catalysts are less expensive, easier to use, and environmentally friendlier than the platinum catalysts they are replacing, Chirik says. And they often offer better performance. For his team's work, Chirik was awarded the 2016 Presidential Green Chemistry Challenge Academic Award.

Platinum-catalyzed alkene hydrosilylation is one of chemistry's understated reactions. Although it's a simple process in which a silicon hydride (RSi-H) is added across the double bond of an alkene (C=C), the reaction is critical for making silicones that are ingredients in many chemical products, from car tires and hair conditioner to releasable adhesive coatings on postage stamps and kitchen utensils such as spatulas.

The new catalysts operate on the principle of metal-ligand cooperativity, a concept pioneered by Chirik's group in which first-row transition metals that typically promote one-electron radical processes can be used in place of traditional second- and third-row transition metals that operate via two-electron redox processes.

In collaboration with silicone manufacturer, Momentive Performance Materials, Chirik's group has shown that the iron, cobalt, and nickel catalysts are more stable and selective than platinum and work at room temperature with both terminal and internal alkenes instead of only terminal alkenes. The reaction mixtures also don't require distillation to remove unwanted isomerized side products, as is sometimes a necessity with platinum.

Momentive engineers have estimated that if the Chirik catalysts were used to replace the world's platinum hydrosilylation catalysts—which use some 5.6 metric tons of platinum each year, according to industry data—they would reduce energy use by 85 billion Btu per year, cut waste by 8.5 million kg per year, and reduce CO_2 emissions by 21.7 million kg year.

"This recognition highlights the importance of collaboration between academia and industry to produce chemistry that spans the fundamental to the applied," Chirik says. "Using earth-abundant elements in catalysis is often overlooked as a key component of sustainable chemistry. Hopefully our success will get more people thinking about how to use the elements on the periodic table more responsibly."

From Chemical & Engineering News, 20 June 2016, by Senior Correspondent, Stephen K. Ritter, as part of a series about winners of the 2016 Presidential Green Chemistry Challenge Awards

Newly-minted Chem 2016 BS graduate **Rachel Warnock** is now at Perugia University in Italy as one of sixteen national ACS international IREU award winners. Her undergraduate research began in the Plant Pathology lab studying parasitic plants, which evolved into a summer at Duke University's Center for the Environmental Implications of Nanotechnology (CEINT) Mesocosms Facility—a collection of 30 complex replicated wetland ecosystems that include different types of soils, sediments, insects, plants and fish. Warnock's work centered on developing an attachment coefficient program to predict nanoparticle uptake by terrestrial plants. Back at VT Rachel then worked with Prof. R. Heflin (Physics) on the nonlinear optical / optoelectronic properties of nanoparticles, as well as a rotation with Prof. M. Mitchell on platinum nanoparticle catalysis in Geoscience's Center for Sustainable Nanotechnology. Rachel has also recently explored plasmonic effects in algal photosynthesis under one of eight national Dreyfus Senior Scientist Chemistry Mentorships under the direction of Prof. Ray Dessy.

Prof. Joseph DiSimone: From Lab Bench to Marketplace

It wasn't so very long ago that **Dr. Joseph DeSimone** earned his 1990 VT PhD under the direction of the late Prof. Jim McGrath. Since that time, his scientific career has revolved around creating utilitarian technologies. With every innovation — engineering materials for a drug-eluting, dissolvable cardiac stent, the creation of new 3-D printing methods, revolutionizing the development of next-generation vaccines and medicines (to name just a few!) — the ability to apply his work to the real world and make an impact on lives has always been the focal point.

"For us, it's all about serving and doing," said DeSimone, Chancellor's Eminent Professor of Chemistry at UNC Chapel Hill. "You can do a lot of things in a laboratory, but if it doesn't get outside the lab, it really doesn't do anyone any good. So we're very interested in trying to find better and more effective ways for taking what we do in the lab and trying to impact people, improve their lives and increase their livelihood and create jobs."

On May 19, DeSimone's work both in the classroom and in materials science research and entrepreneurship was honored by President Barack Obama with the National Medal of Technology and Innovation. The country's highest award for technology and innovation, the medal was created in 1980 and recognizes those who have made lasting contributions to America's competitiveness, quality of life, and the strength of the Nation's technological workforce. "As president, I'm honored to award each of you for your contributions to our nation," Obama told the recipients. "As an American, I'm proud of everything you've done to contribute to that fearless spirit of innovation that's made us who we are and doesn't just benefit our citizens, but benefit the world. We're very proud of what you've done."

From inventing environmentally safe processes to manufacture everyday materials (e.g., Teflon), to creating the world's most sophisticated 3-D printer using light and oxygen, Joe's unparalleled knowledge of polymer science and its potential applications—his "toolbox"—helped DeSimone develop the technologies for which he was honored with this capstone award. "It's humbling and exciting," said DeSimone of the latest of his many honors and awards. "It's surreal. It certainly adds wind to the sail. I think there's still so much to do, and this is not a point to look back." (The award ceremony can be viewed on YouTube at the following link: https://www.youtube.com/watch?v=ND-5yGlOMo4).

DeSimone is one of less than 20 individuals who have been elected to all three branches of the National Academies: National Academy of Medicine (2014), National Academy of Sciences (2012) and the National Academy of Engineering (2005). He is also a member of the American Academy of Arts and Sciences (2005). DeSimone has received over 50 major awards and recognitions including the inaugural $250,000 Kabiller Prize in Nanoscience and Nanomedicine; 2015 Dickson Prize from Carnegie Mellon University; 2014 Industrial Research Institute Medal; the 2014 ACS Kathryn C. Hach Award for Entrepreneurial Success; 2012 Walston Chubb Award for Innovation by Sigma Xi; 2010 AAAS Mentor Award in recognition of his efforts to advance diversity in the chemistry PhD workforce; 2009 NIH Director's Pioneer Award; 2009 North Carolina Award; and the 2008 $500,000 Lemelson-MIT Prize for Invention and Innovation.

Prof. DeSimone also received Virginia Tech's 2016 University Distinguished Achievement Award, which was presented during the 2016 Spring Commencement. The award recognizes achievements of national distinction in any field of enduring significance to society. It's doubtful that 26 years ago, DeSimone could have imagined the arc his career would take. "I have very fond memories of my time at VT! We took more extensive courses when I was a graduate student than I think graduate students take today, at least at Carolina. My classes spanned chemistry, chemical engineering, material science and surface chemistry and I think that prepared me really well for my career. Also, I think the utilitarian dimensions of the faculty who almost all had extensive partnerships with industry, spilled over beautifully into the classroom and the ACS short courses and it made graduate school at VT particularly rewarding! And group meetings on Saturday morning with Jim McGrath were always a very special time…a real privilege to be under his mentorship and apprenticeship! Finally, the faculty across the board were fabulous teachers….really amazingly talented teachers!"

Elements is grateful to Mr. Brandon Bieltz and Ms. Crista Farrell at UNC for contributions to this article.

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