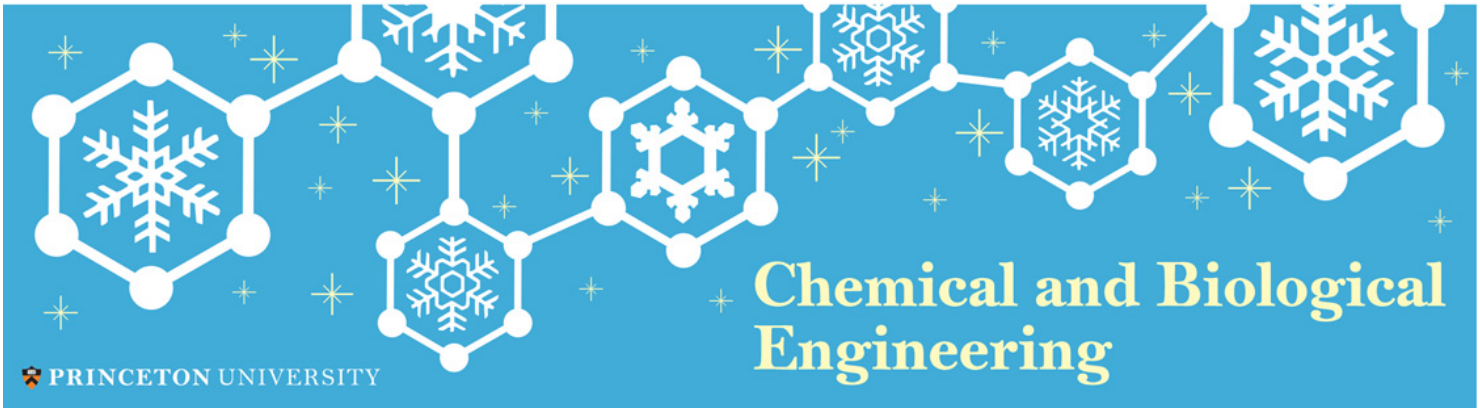


Greetings from the Chair by: Richard A. Register December 2014

Holiday greetings to all department alumni! As I write this, we're well into the process of strategic planning, at the department, School of Engineering, and University levels—at once both exhausting and invigorating! But it does give us an opportunity both to look back at how far we've come, as the department and profession have evolved, and to think broadly about the future. Stay tuned!

With the new year, shortly after you receive this, José Avalos will join the department as Assistant Professor, in a joint appointment with the Andlinger Center for Energy and the Environment. Fresh from a postdoctoral appointment at MIT and the Whitehead Institute, José broadens our research in synthetic biology and metabolic engineering, with a particular interest in the production of biofuels. José's lab will join those of the Brangwynne, Brynildsen, Link, and Nelson groups in Hoyt Laboratory, with José inaugurating the ground floor of the renovated building.

Indeed, construction seems to be everywhere on campus. Next to Hoyt, 20 Washington Road (the old Frick Laboratory) is being turned into an office building for Economics and International Programs; next to the EQuad, the exterior of the Andlinger Laboratory is essentially complete, with occupancy projected to start in summer 2015; and by the time you read this newsletter, a new Dinky station has opened, integrated into the new "Arts and Transit" neighborhood off Alexander Street. (And, perhaps more importantly, the Wawa will have relocated to a new building nearby, without any interruption to operations!)

As usual, the Saville and Wilhelm Lectures were scholarly highlights this past year—made all the more so by the happy coincidence that both lecturers were department alumni! In April, we hosted Ryan Hayward '99 from the University of Massachusetts as our 2014 Dudley A. Saville Lecturer, speaking on "Tuning Interactions and Self-Assembled Structure in Polymer Heterojunctions and Nanocomposites", and in September, Enrique Iglesia '77 from the University of California at Berkeley spoke on "The Chemistry and Engineering of C_1 Molecules: Methane Conversion and Beyond" and "Nanoparticles, Nanospaces, and the Catalysis Toolbox", and spent the better part of a week with our faculty and students, as the 2014 Richard H. Wilhelm Lecturer. Please check the department webpage for the 2015 events—you're all invited!

Last year, I made a push (and a plea) to collect together information on summer opportunities for our BSE students. As I wrote then, my own summer experiences as an undergraduate (at companies who manufactured everything from communications satellites, to power plants, to polyurethane chemicals) each taught me very valuable things that I could never have learned at any university, and I know that students today could benefit similarly. So if your firm (regardless of the nature of the business) might have summer positions for Princeton CBE students, please take a few moments to let us know by sending back page 19 of this newsletter (by US Mail, fax, or email—information on permanent positions, for BSE or PhD students, is certainly welcome as well!). And of course, I'm always eager to read any news you'd like to share! Meeting our alumni—both those I knew when they were students, and those who graduated before I arrived at Princeton—is truly the best part of being department chair. So if you do happen to come to campus—whether to see the new Hoyt or Andlinger Labs (or Dinky station or Wawa), or to revisit places that haven't changed—please do stop by my office (A217 EQuad) to introduce yourselves or get reacquainted!

Best to you and yours for 2015,

C&BE

2014 Dudley A. Saville Lectureship

Ryan Hayward
University of Massachusetts, Amherst

April 9, 2014

"Tuning Interactions and Self-assembled Structures in Polymer Heterojunctions and Nanocomposites"

2014 Richard H. Wilhelm Lectureship

Enrique Iglesia
University of California at Berkeley

September 15, 2014

"The Chemistry and Engineering of C_1 Molecules: Methane Conversion and Beyond"

September 17, 2014

"Nanoparticles, Nanospaces, and the Catalysis Toolbox"

Congratulations to the 5th and 10th year reunion classes!
See you at Reunions 2015!!

Class of 2010

Class of 2005

WELCOME

José Avalos

Assistant Professor in Chemcial and Biological Engineering and the Andlinger Center for Energy and the Environment

CONGRATULATIONS

Clifford P. Brangwynne
Howard B. Wentz, Jr. Junior Faculty Award
Sloan Research Fellowship

Pablo G. Debenedetti
Bird/Stewart/Lightfoot Lecturer
Warren L. McCabe Lecturer
Benjamin Garver Lamme Award

Christodoulos A. Floudas
Honorary Doctorate at Abo Akademi University

Celeste M. Nelson
SEAS Distinguished Teacher

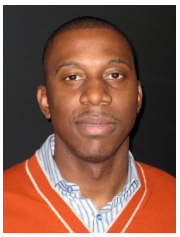
Athanassios Z. Panagiotopoulos
AIChE Fellow

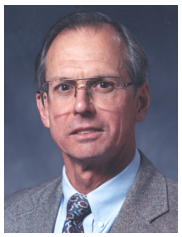
Rodney D. Priestley
Camille Dreyfus Teacher-Scholar
Sloan Research Fellowship
Mellichamp Lecturer

Richard A. Register
AIChE Fellow

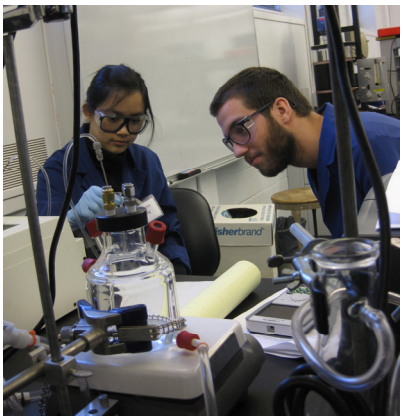
William B. Russel
AIChE Fellow

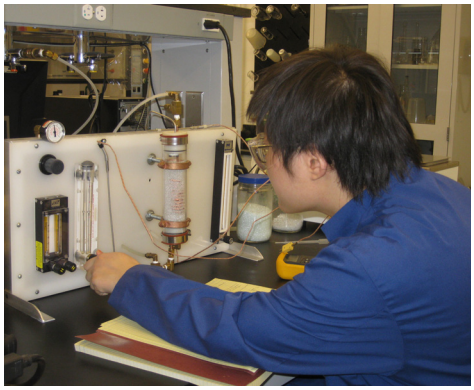
Sankaran Sundaresan
Technical University of Hamburg-Harburg Colloquium Lecturer
Humboldt Research Award

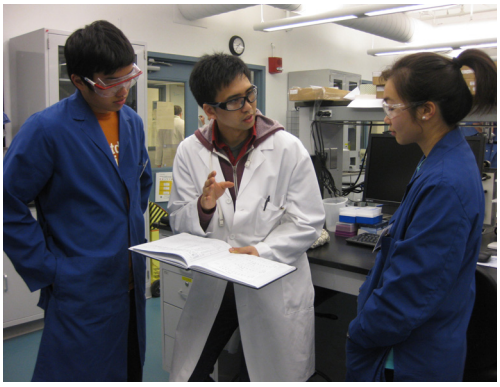




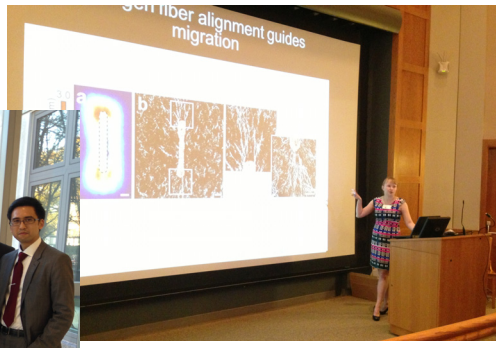
Class of 2014 — Undergraduate Core Lab







Ice Cream Social at Reunions 2014



GSS 2014

In addition to maintaining busy teaching and research activities in the department, **Ilhan A. Aksay** has continued to work with John Lettow '95 in Vorbeck Materials Corp's Vorbeck Princeton Research Center (VPRC) located on Route One. 2014 was a year of transitions both at the University and at VPRC, marked by several people coming and going throughout the year. Stephanie Rumphrey, for several years the cheerful greeter and administrator for the group, accepted a new position as an Assistant Grants Administrator in Princeton's Physics department. Andrew Hsieh completed his Ph.D. this year and moved from one wing of the EQuad to another, becoming a postdoctoral researcher in Princeton's MAE department. Sibel Korkut-Punckt and Christian Punckt left the VPRC and the University to join the Karlsruhe Institute of Technology (KIT) in Germany where Christian is the Associate Director of NanoMat, within the Karlsruhe Institute of Technology. The Punckt couple have recently announced that their daughter, Eda, is entranced with her little brother, Aron, born October 2nd. Joining the procession, Michael Pope also left the VPRC and the University to become an Assistant Professor of Chemical Engineering at the University of Waterloo, Canada. Before leaving Princeton, Michael transitioned from bachelorhood, marrying Eline Boghaert (another Ph.D. graduate of Princeton, working in Celeste Nelson's lab) on July 5th in Princeton.

In the group, the students are keeping busy. After Andrew Hsieh's departure, it now falls onto David Joseph (DJ) Bozym to work on his manuscripts, complete his thesis, and graduate in early 2015. Fourth year students Kevin Sallah and Michail Alifierakis are hard at work on their respective projects, aiming to graduate in 2016. Kevin is supplementing his research by co-mentoring this academic year's senior thesis students, Matthew McDonald and Su Fen Goh (CBE '15). Just starting this year, 2nd year graduate students Ameya Sohani and Betül Uralcan are preparing for their 1st propositions, while taking classes and getting started with their research work. A new visiting scientist, Cem Üstündağ, an Assistant Professor from the Yildiz Technical University in Istanbul, Turkey, joined the group in mid-year and is enjoying his collaborative research.

New members of the VPRC, and working at the University as Visiting Scientists, are Nicholas Szamreta (CBE '14) and a former senior thesis student within the group, and Valérie Alain-Rizzo, a chemist and an Assistant Professor on leave of absence from the École Normale supérieure de Cachan (ENS Cachan) in France. Valérie is very impressed with the French American School of Princeton, with her two sons in attendance. Nicholas and Valérie join Michael Bozlar, a former postdoctoral fellow also from ENS Cachan, in joint research projects involving the VPRC and Princeton. In spite of his busy work schedule, Michael made some time to celebrate his marriage to Caroline Bozlar with family and friends in France on September 27.

As he has for many years, Dan Dabbs is playing a key role in keeping the group and labs going, while working on his research in energetic materials and energy storage. He and Joni are quite happy that their son, daughter and son-in-law now reside in Maryland, much closer at hand and easier to keep an eye on. Joni remains the athletic part of the pair, continuing her rowing with the Carnegie Lakers and medaling in regattas in Pennsylvania and Delaware. Completing another successful race at the 50th Head of the Charles Regatta in Boston, she is looking forward to next year.

Along with his freshman advising duties, Ilhan volunteered to teach CBE 246, Thermodynamics, in the Spring semester, a course no doubt fondly remembered by past CBE and ChE students. He continued his FRS 133 Freshman Seminar on Materials World in the Fall with the help of David Joseph (DJ) Bozym and Dan Dabbs. The laboratory sessions keep getting better from year-to-year with the myriad students, many with non-technical majors, finding the discussions especially stimulating. While Ilhan always enjoys meeting the new students and teaching his classes, he found the teaching of thermo to be particularly invigorating and is looking forward to the Spring of 2015 when he can do it again. During the last few years, along with his wife Isabelle, Ilhan has also been enjoying short retreats to his office with the "best view" at Lac Labelle, Québec mainly during the weekends.

Happy New Year from our research group!

Jay Benziger reports that he and Emily are now grandparents three times over. Tara had a baby girl, Grace, in June. So now the grandchildren are Eli (2), Talia (1) and Grace (0). We continue to have the entire family over every Sunday. Eli is now into mac and cheese, and jello. It's amazing how much mess one can make with jello! Eli and Talia are both walking and talking. Eli is more passive and his cousin is an alpha female and pushes him around. It's always interesting to watch Eli plead for sympathy after his cousin picks up the toys and walks off with them. All the grandchildren are in swimming lessons. Eli is getting pretty accomplished. He jumps in and can pick up things off the bottom of the pool with some help. On Eli's good days he paddles around the pool by himself until they throw him out, or he gets too cold.

Jay has continued to be busy with assorted teaching commitments. Last spring, he was cycled back into the core lab along with Bob Prud'homme and Bruce Koel. He also continued to do an introduction to Chemical and Biological Engineering as part of a Freshman Engineer

course. He has set up labs for energy conversion including making and testing biodiesel. This fall, Jay has been involving Bruce Koel in the Engineering Ethics class. The Ethics course has used case studies to help the students focus on what is the ethical responsibility of members of a profession. We just finished the lectures on planned obsolescence. It is amazing what the consumer electronics industry learned about marketing from the auto companies. Jay is also teaching the sophomore course on energy technologies. It is a challenge to get non-engineering students to understand rudiments of mass and energy balances so they can grasp the challenges of sustainable energy.

Jay also started working with a group of undergraduates developing a solar powered refrigerator as an EPICS project (Engineering Projects in Community Service). The EPICS courses are growing in popularity with the undergraduates. It gives them the opportunity to do real hands-on engineering projects where they organize and assign tasks for the project. Last year, the group Jay assisted worked with an Israeli-Palistinian NGO in the West Bank to develop off-grid technologies. Jay looks forward to seeing the ingenuity of the students as they try to put together an off-grid refrigerator that is inexpensive and robust.

Jay has graduated a large fraction of his group over the past year. They have been involved with research for fuel cells, although the projects don't immediately sound like typical fuel cell projects. May Jean Cheah, Carlos Colosqui and Tommy Hellstern ('12) have examined multiphase flow for water motion in porous electrodes and removal of water drops from gas flow channels. They had done some fascinating work on formation and movement of water drops and slugs from pores emerging into a gas flow channel. May Jean and Tommy have done some wonderfully simple but elegant experiments, leading to such wonderful research papers as "When will my slugs move?". (The title sounds more appropriate for lazy students.)

Jay has continued to be busy with a flurry of publications for the Borexino Solar Neutrino Detector, which came on line during the summer of 2007. This August, the experiment was featured in Nature. It took 20 years, but the experiment succeeded! We have achieved unprecedented low backgrounds for a large scale liquid scintillation detector (1,000 tons of 1, 2, 4-trimethyl benzene). Jay was responsible for developing the purification systems which included a 2 ft. diameter, 25 ft. tall distillation column built with the combination of high purity (pharmaceutical grade material finishes) and high vacuum technology ($<10^{-8}$ mbar-l/s leak rate). It is quite an elegant piece of classical chemical engineering in a very non-traditional application!

Jay has been keeping very busy with his editorial duties with Journal of Power Sources. He finds it is much more time consuming than he imagined. There are too many sets of vastly conflicting reviews that take a great deal of effort to adjudicate. What is good about the job is it greatly expands the literature Jay has to examine. It gives him a greater appreciation of all the minor technical hurdles that make advancing battery and fuel cell technology much more challenging than anyone imagined.

The **Brangwynne** lab had a great 2014. A major highlight was recruiting a trio of absolutely fantastic new Ph.D. students: Lian Zhu, who joins the lab from University of Michigan, Nicole Taylor from UC Berkeley, and Sara Chuang from Columbia. These three have injected tremendous energy, enthusiasm, and spirit into the lab and all three are off to a great start! We also recruited two new postdocs: Steven Wei comes to us from Lehigh and is working on a joint project supported by the Eric and Wendy Schmidt Fund, which funds a collaborative effort with the Priestly, Register, and Arnold groups to develop a novel imaging-based nanorheology technique. We are also looking forward to the arrival of Yongdae Shin, who joins us from MIT starting December 1st.

This year, the lab is grateful for several honors and awards. Cliff won the Sloan Fellowship and the Wentz Junior Faculty Award. Postdoc Nilesh Vaidya won the prestigious Helen Hay Whitney Fellowship, which funds his work in the lab for the next three years. We are particularly proud of Nilesh's accomplishment, since the HHWF was the postdoc fellowship that Cliff himself once held.

One of the big highlights for four members of the Brangwynne lab was spending 7 weeks at the Marine Biological Laboratory (MBL) in Woods Hole, MA. Lian was at the MBL as a student in the famous Physiology course, which involves intensive hands-on research training in cutting edge quantitative techniques (Cliff has fond memories of taking this course in 2006, and helping to teach it in 2008). Sara, Nilesh and Cliff were at the MBL as part of a Howard Hughes Medical Institute-funded Summer Institute focused on dissecting the biophysical rules governing RNA/protein assembly. This was an incredibly productive and fun summer for everyone!

We continue to have a great group of undergraduates in the lab. We said goodbye to graduating seniors Adrienne Fung, Amogha Tadimety, and longtime Brangwynne lab undergraduate William Gilpin, who started in the Applied Physics Ph.D. program at Stanford. Bruna Favetta and Lindsey Bergh came back to the lab this fall, and together with new member, Kevin Liaw, they are working toward their senior theses. We also welcomed undergraduates Jordan Shivers, Paulina Orillac, and Tiffany Richardson (a Princeton

MolBio concentrator who Cliff met at the MBL this summer) as new undergraduate lab members.

This summer Sarah, Leana, and Audrey joined Cliff at the MBL. The girls enjoyed the beaches and the opportunity to be closer to their cousins and grandparents. Audrey's first birthday was celebrated at the beach with a generous helping of sandy cupcakes. Leana turned 4 in October. Since her 3rd birthday she has been talking about how she wants Cliff to make her a "Shark" birthday cake. In the days leading up to the big day she repeatedly reminded him that he has "some hard work to do". Cliff confirms that while being an Assistant Professor at Princeton can be stressful, he has not been quite so stressed, nor worked quite so hard, as during the four hours it took him to make that Shark cake (power tools were involved; it was a masterpiece).

Happy Holidays from the **Brynildsen** lab! Lab highlights from 2014 include an NIH M.D./Ph.D. Pre-doctoral fellowship awarded to graduate student Theresa Henry, a School of Engineering and Applied Science Wu Prize for Excellence awarded to graduate student Stephanie Amato, the Merck & Company Outstanding Senior Thesis Award given to our senior thesis student Sophia Leonard, and a School of Engineering and Applied Science seed grant for our nitric oxide work funded through the Forese Family Fund for Innovation. This Fall we welcomed three senior thesis students, Ismael Catovic, Elliot Horlick, and William Tso, and one junior thesis student, Jason Qin. Over the summer, we also hosted Fabiola Pincay, a Mercer County Community College (MCCC) student who conducted a 6-week internship with us, and Nikita Kedia, a high school student who worked with us through the Princeton Laboratory Learning Program. This year we published articles in the journals Frontiers in Microbiology, PLoS One, and Current Opinion in Microbiology, with another three that are currently in press. 2014 was an eventful year for the Brynildsen lab, and Mark is looking forward to what 2015 holds!

Pablo Debenedetti is enjoying his job as Dean for Research. Communications, technology licensing, corporate and foundation relations, and research compliance are some of the job's many interesting aspects, all of which are directed towards supporting Princeton's thriving research enterprise. An especially interesting activity has been launching and managing several "innovation fund" research competitions for faculty, including New Ideas in the Sciences, New Ideas in the Humanities, New Industrial Collaborations, Collaborations Between Artists and Scientists or Engineers, and The Campus as a Laboratory. Co-chairing one of President Eisgruber's strategic planning committees, The Future of Sponsored Research, is also proving to be very interesting. On the personal research front, Pablo considers himself privileged to work with such a talented group of graduate and undergraduate students, and postdocs. This past year, the group celebrated the graduations of Drs. Yang Liu (now at Air Products), Harold Hatch (National Institute for Standards and Technology) and Zane Shi (Investment Technologies Group), as well as the completion of Jeremy Palmer's very successful post-doctoral tenure. Jeremy is now an Assistant Professor at the University of Houston's Department of Chemical and Biomolecular Engineering. A research highlight in 2014 was the publication of a paper in Nature demonstrating the existence of a liquid-liquid phase transition in a molecular model of water. This work, whose lead author was Jeremy Palmer, was done in collaboration with Princeton colleagues Thanos Panagiotopoulos and Roberto Car (Chemistry), and also involved Yang Liu and Fausto Martelli (post-doc in the Car group). Pablo's family is doing very well. Silvia continues to enjoy teaching science at Princeton Day School, where she chairs the 5-12 Science Department. Gabriel lives in Washington, DC, and enjoys his work as National Political Correspondent at Reuters. Dina is a junior at Princeton, and is especially enjoying her neuroscience courses. Pablo and his family, including Tigger, our Bernese Mountain Dog, send you their warmest holiday greetings!

The **Floudas** family had an eventful, exciting, and major decision-centric 2014. Ismini works as a financial analyst at a major shipping company, Pacific & Atlantic (Ship managers) Inc., in Athens, Greece. Fotini continues her philanthropic and leadership contributions as secretary-elect of the tri-state Metropolis Philoptochos Society. During the month of August, the Floudas family had a wonderful vacation at their summer home in Chalkidiki, Greece.

During the 2014 spring semester, Chris spent his sabbatical at the Department of Chemical Engineering at Texas A&M University. Chris was selected as a Fellow and Eminent Scholar for 2013-2014 of the Texas A&M Institute for Advanced Study, TIAS, and in early February, Chris and Fotini attended a very impressive TIAS induction ceremony and dinner event. They enjoyed very much living in Texas and decided to pursue a move from Princeton University to Texas A&M University. Chris will assume the positions of (a) Director of the Texas A&M Energy Institute and (b) an endowed chair in Chemical Engineering, effective February 1, 2015.

Highlights of 2014 include the completion of doctoral theses by Eric First and Jamie Smadbeck. Chris was selected as a "2014 Thomson Reuters Highly Cited Researcher" for the period of 11 years (2002-2012), and is one of 27 researchers selected from Princeton University. Chris also re-

ceived an honorary doctorate degree from Abo Akademi University in Turku, Finland on May 23, 2014. It was a memorable occasion that Chris and Fotini enjoyed very much.

In January 2014, one new doctoral student, Logan Mathews joined the Floudas research group with a research focus on process synthesis, global optimization and uncertainty analysis of novel energy processes that combine biochemical and thermochemical routes for the production of chemicals and fuels. Neesha Pinnaduwage completed her senior thesis studies in the area of hybrid energy systems. During the summer of 2014, a rising senior high school student, Ananya Joshi, joined the Floudas group working in the areas of force field development for non-canonical aminoacid modifications, and de novo protein design with George Khoury, as well as protein structure prediction with Chris Kieslich and Jamie Smadbeck. During the summer of 2014, a rising junior, Alexandra Koskosidis, joined the Floudas group working towards the structure elucidation of cancer related complexes with Phanourios Tamamis, as well as protein structure refinement with George Khoury. At the end of August 2014, Faruque Hasan completed his postdoctoral studies and moved to College Station where he is now Assistant Professor of Chemical Engineering at Texas A&M University. At the end of September 2014, Eric First defended successfully his doctoral thesis, and joined Google Inc. in October 2014. At the end of October 2014, Jamie Smadbeck joined AspenTech while waiting for his FPO to take place in early December 2014.

Recent success by graduate students and postdoctoral associates is reflected in (a) Logan Matthews receiving a NDSEG Fellowship; (b) George Khoury, James Smadbeck on being awarded second prize at the 9th Annual Innovation Forum for their platform for computational peptide-based drug design with an expanded modified amino acid chemical space; (c) George Khoury on being selected to receive the Wallace Memorial Fellowship in Engineering by the Princeton University Graduate School; (d) Ruth Misener *12 was selected to receive the W. David Smith, Jr. Graduate Student Paper Award from the Computing & Systems Technology Division of the American Institute of Chemical Engineers; (e) The paper "GloMIQO: Global Mixed-Integer Quadratic Optimizer", Journal of Global Optimization, 57, 3-50 (2013) by Ruth Misener *12 and Professor Christodoulos Floudas, was selected as the winner of the 2013 Journal of Global Optimization Best Paper Award; (f) Faruque Hasan taking an Assistant Professor position at Texas A&M; and (g) Ruth Misener taking a Lecturer position at the Department of Computing at Imperial College.

Research highlights from publications in 2014 include: a major review on protein folding and de novo design (Khoury, Smadbeck, Kieslich); the computational discovery and validation of inhibitors for histone methyltransferases (Smadbeck, Peterson; collaboration with Prof. Garcia and Dr. Trojer); discovery of biomarkers for periodontitis (Guzman; collaboration with Dr. Sakellari); a novel approach for protein structure refinement (Khoury, Tamamis, Pinnaduwage, Smadbeck, Kieslich); computational prediction of novel zeolites for natural gas purification (First, Hasan); a novel method for the supply chain of natural gas for the conversion of gas to liquids (Elia, Baliban); elucidation of the complex structure of CCR5 and the V3 loop of gp120 (Tamamis); structure prediction of the complex CXCL12 with CXCR4 which is of major importance for cancer metastasis (Tamamis); a novel study of the CO_2 capture, utilization, and storage via a supply chain network approach (Hasan, Boukouvala, First); a review of the energy supply chain optimization (Elia); introduction of robust optimization in steel making processes under uncertainty (J. Li, Z. Li; collaboration with Prof. Tang and Xiao); global optimization approach for signomials (Misener); global optimization of general MINLP models via ANTIGONE (Misener); computational prediction of the structure of CCL5 (RANTES) in complex with CCR5 (Tamamis); a novel computational method for the prediction and experimental validation of short self-associating peptides (Smadbeck, Khoury; collaboration with Dr. Hauser); a new approach based on coopetition for protein structure prediction (Khoury, Smadbeck; collaboration with Professors Liwo, Baker, Keasar, Levitt, Scheraga, Skolnick, and Crivelli); a new approach that reduces the conservative robust optimization solutions (Z. Li); and a novel approach for the optimal scenario reduction via mixed integer optimization (Z. Li).

This was a good year for the **Kevrekidis** group. Carmeline Dsilva, our "senior member" who is in her fifth and final year has done very interesting work at the interface of data mining and modeling, both theoretically and in a lovely collaboration with Stas Shvartsman's group on organizing cross-sectional images of fly embryos from Bomyi Lim's work. Working with Stas and his group (also involving Mahim Misra, and Henry Mattingly) on several fronts is a real pleasure for Yannis, reminding him of the excitement of Stas' Ph.D. Thesis days (Stas was "driving" a lot of the time then too!). This work also involves collaborations with Applied Math and Computer Science, both in Princeton and at Yale, with the group of Raphy Coifman. Our younger generation have also been making significant progress in their thesis work: Tom Bertalan on the modeling of large heterogeneous networks, with applications in computational neuroscience; and Alexander Holiday, on equation-free analysis (our specialty!) and coarse-graining of large complex

networks, involving collaborations with New Zealand (Carlo Laing) and Canada (Balazs Rath). Dmitry Pozharski has had beautiful results in the modeling of structured materials (engineered granular crystals) in collaboration with the experimental group of Chiara Daraio at the ETH and Yannis' brother, Panagiotis, a professor of Mathematics at UMass. In most of these activities, we all benefitted from the presence of our NSF Mathematics postdoc, Dr. Matt Williams, who had himself a spectacular year and many new results on data based modeling and model reduction (especially in work involving the Koopman operator in collaboration with Clancy Rowley here at MAE). Our postdoc from Germany, Robert Hoelzel, completed his stay and went back to Munich, but he has left us with a wonderful suite of interactive computational tools that we all use in our work, and Yannis also uses, with Matt's help, in his elective nonlinear dynamics class. Finally, we have a new postdoc, Dr. Minseok Choi from Brown, who started with us this September, a large scale computing and uncertainty quantification expert, whose work meshes very well with several directions in the group.

Many travels, conferences, invited talks (notably a visit to Vienna in the summer for ENOC2014); new courses to teach (after many years Yannis teaches again the Differential Equations for Everybody course, MAE305, with 130 or so students !); new proposals starting collaborations (with Penn, on complex suspensions, and with Duke, on multiscale control). But the important things are Stavroula (who makes amazing liposomes for cancer targeting at Rutgers – Yannis helps a little with some modeling, and we even had a joint paper this year); Domna (who was 4 in July, talks thirteen to the dozen, and will start kindergarten next year); and George, who is now a freshman at Princeton (Yannis tries to convince him to be an engineering major, with dubious success so far).

It was a productive year for **Bruce Koel** and his group. Activities of the group continued in laboratories at both the EQuad, including new space in G100, and the Princeton Plasma Physics Laboratory (PPPL). Clark Chen, Manny Scoullos, Dwayne Wang, and Yuxin Yang are graduate students in CBE doing their research in the group. Jie Fu, Peng Zhao, Oluseyi Fasoranti, Steven Wulfsberg (coadvised with Steven Bernasek), and Michelle Hofman are graduate students in the Chemistry department who are working in the group. Yao-Wen Yeh (coadvised with Nan Yao) is a graduate student in Electrical Engineering who joined the group at the start of last summer. Angie Capece, John Roszell, and Coleman Kronawitter continued in their postdoctoral research appointments in the group, and Laura Kraya was promoted to Associate Research Scholar. Jie Fu, as the senior graduate student in the group, has spent much of her time assisting and training the new students, and Peng Zhao has devoted considerable time bringing on-line and learning to operate a major new instrument in the laboratory for determining the composition and chemical nature of surfaces using high-resolution X-ray photoelectron spectroscopy and high-resolution electron energy loss spectroscopy. The group was involved with several projects with other graduate students and faculty at Princeton, including Tanya Gupta from Dan Steingart's group, who worked closely with Jie and Yuxin to initiate studies on the solid electrolyte interphase layer on a Si(100) surface. Bilel Rais from Consorzio RFX, Italy just concluded studies in our laboratory with Peng on surface analysis of boronized and lithiated samples exposed to RFX-mod plasma discharges. Also Clark has continued his work on a subcontract to Texas Tech University in support of an NSF grant investigating reactions at iron-enriched mineral interfaces related to catalytic oxidation of aqueous contaminants. Prof. Audrey H. Moores, Canada Research Chair in Green Chemistry in the Department of Chemistry at McGill University, is spending November and December with the group during her sabbatical studying Fe(0) nanoparticles as sustainable catalysts.

Jie and Michelle have been studying alcohol reactions on nickel and iron alloys with palladium, Yuxin is using scanning tunneling microscopy (STM) for atomic scale imaging of surfaces, and Manny has been installing a new gas chromatograph for measuring kinetics of catalytic reactions. Peng, Clark, and Coleman, who recently published some beautiful results on water nanostructures obtained using STM at Brookhaven National Laboratory (BNL), are pursuing research on photoelectrocatalysis for CO_2 reduction and solar water splitting. Angie, John (who with his wife Andrea welcomed a new baby girl into the world in July), Seyi, and Steven, are carrying out experiments to probe plasma-wall interactions on lithium films relevant to magnetic fusion device research at PPPL. Dwayne and Yao-Wen are also working at PPPL, with Dwayne initiating a new AFOSR project on plasma-surface interactions and Yao-Wen starting a new joint DOE BES project with Yevgeny Raitses at PPPL on plasma-synthesis of nanomaterials. Laura has been busy with experiments on organic thin films and nanodevices. This summer we had six undergraduates participating in research in our laboratories, and Jacob Miller (CBE) and Olivia Watson (Chemistry) are doing senior thesis research in the lab this fall.

This fall, Bruce is co-teaching with Jay Benziger CBE 260/EGR 260 Ethics and Technology-Engineering in the Real World, and he co-taught CBE 346 Core Laboratory last spring with Bob Prud'homme and Jay Benziger. Outside of teaching and research, Bruce is enjoying

serving on the Science Advisory Committee of the Center for Functional Nanomaterials (CFN) at BNL and serving on several Princeton University committees after stepping down as CBE's undergraduate departmental representative.

2014 has been a year of change for **Lynn Loo** and her research group. For starters, Lynn and Philip are now proud parents to a cheerful and rambunctious one-year-old! We brought Andrew (Drew) James Chew home from Taiwan in April and we fun-filled the first summer with Drew. He bobbed around in the Community Park Pool almost on a daily basis with Philip and ended up with quite the farmer's tan by summer's end. Drew started at the UNOW Nursery in September and our family travails with fevers, coughs and colds began as Drew brings home new strains on an almost weekly basis. Despite the illnesses, Drew loves his teachers and classmates and enjoys the many activities at school. At home, Drew enjoys being top "dog" to Cassie and Baxter; he shares his meals with Cass; and Bax is never far away for playtime. Needless to say, we're all exhausted but happy.

On the research front, we welcomed Dr. Petr Khlyabich, who joined us from Barry Thompson's group at the University of Southern California. Petr has spearheaded our venture into the world of organometal halide perovskite solar cells. Tyler Tamasi '15 returned in the spring for his junior independent work and decided to stay on for his senior thesis in the fall. Tyler is working with graduate student Nick Davy to develop new electron donors based on coronenes for solar cell applications. Over the summer, the group expanded greatly, with the addition of Maggie Cutlip '16 (Lewis summer intern), Bristee Das '16, Abby Grosskopf '17 (PEI summer interns) and Jeff Register '18. Maggie is continuing to work with graduate student Anna Hiszpanski on understanding the morphological factors that govern photocurrent generation in polymer solar cells. We said good-bye to Dr. Luisa Whittaker-Brooks, who started as an assistant professor in the Chemistry Department at the University of Utah in August, and senior thesis student Lauren Edelman '14 who now works for Sun Energy.

Anna Hiszpanski is in the home stretch of her research and is now busy writing up her thesis. This year saw Anna publish two first-author papers in Energy and Environmental Science and the Journal of the American Chemical Society. Anna Hailey continues to multitask on several projects. She wrote an analysis package that allows the extraction of crystal lattice dimensions from experimental x-ray diffraction patterns; this tool is particularly useful when the crystal structure is unknown. The software is now in use at the Cornell High Energy Synchrotron Source and by several other research groups in the country. It is publicly available on our website at www.princeton.edu/~loogroup. She is also wrapping up a project that involves the technological and economic analysis of co-firing biomass and natural gas to produce liquid transportation fuels. Geoff Purdum continues to work with researchers at BASF in Ludwigshafen to develop methods to control the crystallization of core-chlorinated naphthalene diimides. In the process, he discovered a new polymorph of the compound, which resulted in the filing of a patent. Melda Sezen, in collaboration with Branko Glisic's group in the Civil and Environmental Engineering Department, is measuring the piezoelectric properties of conducting polymers with which she hopes to develop strain gauges for monitoring structural health. Nick Davy is expanding our efforts in designing and developing new molecular semiconductors. He's developed a suite of heteroatom-containing coronenes for solar cell applications. Post-doc Dr. Yi Ren published two nice papers that detail his design and synthesis of isoindigo compounds for opto-electronic applications. Post-doc Dr. Jia Gao elucidated charge transport in polymer-sorted carbon nanotubes. More excitingly, after three years of effort, Jia has made the first solution-processed graphene nanoribbon field-effect transistors that exhibit ambipolar characteristics!

In 2014, Lynn has been settling into her role as the Associate Director of External Partnerships at the Andlinger Center where she leads the Princeton E-ffiliates Partnership, a corporate program that fosters collaboration and partnership between industry and Princeton faculty. E-ffiliates now boasts partnerships with PSEG, DuPont, Lockheed Martin, and the Southern Company. Smaller companies like Arch(e)wild and Power Survey are also members. As we approach year-end, Lynn is currently leading discussions with a Fortune 100 oil and gas company to bring them onboard in early 2015. E-ffiliates hosted its third annual meeting on November 14, 2014, with former NJ Governor Christine Todd Whitman as this year's keynote speaker.

Philip continues to build upon Dillman Capital's successes with investments in financials, energy and technology. He has been happy to see how powerful everyday consumer technology has become as real-world research and analysis tools, which cost large financial institutions many millions of dollars to build and maintain, have become practically free. Philip feels privileged to have puppy feet warmers as he scours the markets for under-reported themes and the routine of picking up Drew from UNOW with Lynn in the evening.

2014 was another busy year for the **Link** lab. Jamie was on sabbatical for the spring 2014 semester and spent much of February at UCLA, far away from all the snow that New Jer-

sey received. The sabbatical was also a good excuse for Jamie to finally get a dog, Henry, who's a mix between a golden retriever and a poodle. You can see a picture of Henry from back in May on the Link Lab webpage. Just imagine him having doubled in size, and that's about how big he is now. He spent a lot of the summer hanging out in Jamie's office watching the massive construction operation next door, and he still occasionally graces us with his presence at our group meetings.

On the science side of things, the group received a 5-year NIH grant to continue its work on lasso peptide discovery. The group published papers this year on the elaboration of lasso peptides with unnatural amino acids as well as on "protein stapling" with unnatural amino acids. Mikhail Maksimov and Jamie were also honored to be asked to write a review article on genome mining for lasso peptides in a special issue of the Journal of Industrial Microbiology in honor of David Hopwood's 80th birthday.

Personnel-wise, 2014 saw 5 senior thesis students make their way through the lab and graduate. Cathy Chen is pursuing an M.D. at the University of Mississippi, Maria Chen is in an M.D./Ph.D. program at Baylor, Bozhena Lisko is working at Goldman-Sachs, Allyse Terrell is working at Capital One, and Michelle Wu is an NSF fellow pursuing a Ph.D. at Stanford. Mikhail left the lab in early November to start a job at Illumina in San Diego. He'll be back in January to defend his thesis, but the group is already missing his immense intellectual presence in the lab. With Mikhail's departure, the group is down to five grad students: Caitlin Allen and Alan Futran are in their fifth year while Joe Koos, Frank Piscotta, and Chuhan Zong are in their third year.

Happy holidays from the **Nelson** group! 2014 was an exciting year for us. We had one new graduate student, Siyang Han, and one new postdoctoral fellow, Adam Navis, join the group this year. We also hosted a record 11 undergraduate and four high school student researchers this summer. We were sad (but proud) to say goodbye to several lab members. Sriram Manivannan and Eline Boghaert defended their theses and started positions at Vorbeck Materials and the University of Ottawa, respectively. Jason Gleghorn left the group for shinier pastures down south, and began his position as Assistant Professor in the Biomedical Engineering department at the University of Delaware. And Amira Pavlovich moved with her family to Milwaukee, where she started a position as research associate at the Medical College of Wisconsin. We were blessed by the funding gods this year, and now have several federal grants to continue our work on the mechanics of lung development, which is spearheaded by postdoctoral fellows Victor Varner and Adam Navis. Their endeavors are being assisted by two senior thesis students, Dror Liebenthal and Lisa Kojima, and several juniors, Daniel Tzou, Ed Xiao, and Sahana Jayaraman. Graduate students Michael Siedlik and Siyang Han are leading our efforts in mammary epithelial morphogenesis. Our studies on the mechanical regulation of tumor progression are being carried out by postdoctoral fellow Mei Fong Pang and graduate students Alexandra Piotrowski, Allison Simi, and Dena Oravsky; three senior thesis students, Adrija Navarro, Danny Thomson, and Vincent Chu, and junior Ben Spar are working on different aspects of tumor mechanics.

It is hard to believe, but Terry turned five years old and started kindergarten in September. When he's not in school, he enjoys "helping" Joe in our vegetable garden. His help typically consists of picking tomatoes, stomping on worms, and chasing the rabbits away.

Warm holiday greetings to all from **Thanos Panagiotopoulos** and his group. 2014 has been a good year, marked by changes as always. Kevin Daly defended his doctoral thesis on polymer electrolyte membranes in November and has joined ExxonMobil Strategic Research in Clinton, NJ, where (you may recall) Samantha Sanders also has been since her graduation in 2011. Remarkably, Arben Jusufi, a former postdoctoral fellow in the group who has been an assistant professor in the Chemistry department at the College of Staten Island, also joined the ExxonMobil group in Clinton this summer. Phil Lenart (another former Ph.D. student, *06) who works for ExxonMobil in their Houston location, visited campus in the fall to recruit for the company, so the pipeline from the AZP group seems to have a strong chance of continuing. Dr. Gustavo Orozco completed his postdoctoral with the group in August and has returned to his native Colombia.

Two new Ph.D. students joined the group in January. These are Mike Howard from Penn State University, and Andrew Santos from North Carolina State. Mike is the recipient of a National Defense Science and Engineering Graduate Fellowship and is interested in flow effects on the morphology and crystallization of colloid-polymer systems. Andrew was awarded a National Science Foundation Graduate Fellowship in the spring, and is working on self-assembly of surfactants in solution. An undergraduate student, Evaline Tsai, also joined the group – she is working on simulations of CO_2 systems for her senior thesis.

In the early fall, the group welcomed new postdoctoral associate Hao Jiang, who has a Ph.D. in chemical engineering from the University of Wyoming and a B.S. from the China University of Petroleum. Hao will be working on water / CO_2 / electrolyte phase behavior and transport properties for carbon sequestration applications. Another recent arrival is Dr.

Filipe Lima, from the University of Sao Paulo, Brazil, who will be spending a year with the group and is interested in self-assembly of ionic micelles.

Continuing in the group are Ph.D. students Joey Vella (co-supervised by Pablo Debenedetti), who works on simulations of liquid metal properties, and Nate Mahynski, whose thesis is on polymer-nanoparticle systems, Arash Nikoubashman, a PCCM postdoctoral fellow whose research focuses on sheared block copolymer films, and Zoltan Mester, who studies activity coefficients of salts in aqueous solutions. Nate's work on directed crystallization of colloids taking advantage of polymers in the voids between particles appeared this summer in Nature Communications. In another research note from the group, the work on phase transitions in very cold (supercooled) water that is done jointly with Pablo's group and was started by Yang Liu, was continued by Pablo's postdoctoral associate Jeremy Palmer (now an assistant professor at Houston) and appeared this summer in the journal Nature.

On the teaching side, Thanos continues to teach graduate thermodynamics (CBE 503), using notes that may eventually be published as a book, to supplement the successful "Essential Thermodynamics" undergraduate textbook now being used for courses at several departments around the U.S. In the spring of 2014, an undergraduate elective on simulations was offered again after a hiatus of several years.

Family updates: Elektra graduated from Princeton this past May, with a major in Anthropology and a Certificate in Global Health. She is now in Boston, working for a health care consulting company. Ares started in 10th grade at Princeton High School, and is active with cross-country running, tennis, debate, and playing the clarinet, when not busy doing homework. The family dogs, Charlie and Rascal, are having a great time running around the house, in the yard, or on our walks around the neighborhood and the Princeton parks and footpaths. The family continues to enjoy the Greek island of Paros for a few weeks in the summer.

Happy Holidays from the **Priestley** Lab! This past year the group officially welcomed Dane Christie as a new graduate student and Steven Wei as a new postdoctoral fellow. Dane is co-advised with Rick Register and Steven is co-advised with Cliff Brangwynne and Craig Arnold (MAE). Clearly, there are a lot of collaborative research projects being undertaken in the Priestley lab. Dr. Yunlong Guo, the earliest Priestley Lab group member, departed to become a faculty member at the University of Michigan - Shanghai Jiao Tong University Joint Institute and the School of Materials Science and Engineering at Shanghai Jiao Tong University in China. Dr. Chuan Zhang became the group's first Ph.D. graduate in June 2014. Congratulations to Chuan! Chuan is currently co-founder and CEO of a nanotechnology/materials start-up company based in Newark, NJ. We also bid farewell to Dr. Fengli Qu, a visiting professor from QuFu Normal University in China. Continuing group members include graduate students Kimberly Shepard, Colin Neikirk, Chris Sosa, Mary Burroughs and Hyuncheol Jeong as well as postdoctoral scholar Dr. Rui Liu. Jesse Hinricher completed a successful REU program working with Colin. Vivienne Tam completed a one-year junior research project working with Rui; the work was recently published in Chemical Communications. She returns to complete her senior thesis in the lab along with Sunny Niu, Uyanga Tamir and Amy Gonzalez. Our group gave presentations at APS, AIChE and ACS. In addition, group members delivered presentations at several international conferences. Kimberly received the Porter Ogden Jacobus Fellowship from Princeton University and was also selected to participate in the AIChE Excellence in Polymer Research Graduate Student Symposium. Chris and Chuan took first place in the Princeton University Innovation Forum Competition. The group also continued its participation in many outreach activities. Best wishes and Happy New Year!

Robert Prud'homme: Our battle to find good tradespeople continues. Maybe next year I will share the story about the screened porch ("the job will take about two weeks"), which morphed into an 18-month ordeal when the original contractor went bankrupt. We then had to hire another (competent) contractor to repair the structural damage to the house done by the first contractor. One nice thing about the versatility of the ChE degree is that you (i.e. Princeton ChE graduates) can do anything! Jeff Rosedale (my senior thesis student from in 1986) ended up with a law degree. My call to Jeff for (informal) legal advice led to the unfortunate opinion that our claim was too "small"; we were out of luck if we wanted to take legal action. A failed arbitration through the NJ Office of the Attorney General means we have to decide what to do next. Next year I will let you know.

Maybe I am fallible: This story will be about our "cable guy" experience with internet service. Our internet had been breaking down continuously. Dottie called the Comcast people four times for service calls. Each service technician gave a different story, worked on the wiring and left. The connection still crashed. She was fairly frustrated. I asked if we should change from Comcast to Verizon. She said no, because each time she had the technician out, they deducted $20 from our bill. So we were practically getting the internet for free! I happened to be back from a week-long trip to Europe and was at home when

the fourth guy came. He was going on about our coaxial cable being too small in diameter so that the signal couldn't get through it (in his words: "like water going through a hose"). Then he went on about how it must be our router and not Comcast's signals because our computers were so far away from the router (10 feet away, actually). He described how the signal goes straight up in the air and then falls down on the computers like water from a garden sprinkler. (He was big into water analogies.) I told him the router had been working for two years, and I didn't believe it was a signal strength problem – the icons always give us 4 bars. Then he said it was that our modem was getting old, and as they approach obsolescence they get weak and drop signal (i.e. they have some sort of digital premonition of their upcoming demise). I was getting pretty frustrated, and I told him I didn't believe his explanations of the problem. Dottie later told me I was pretty harsh - sorry. I then tried to be nice. He was doing his best (as deficient as it was). Anyway, a few minutes after our last exchange, as he was going outside, he asked, "Are you an engineer?" I said, "Yes." He said, "I knew it. I had to deal with three of you recently." We are a marked breed – and it is not always pretty.

That day I went out and bought a new Linksys router. Since he was claiming it was my older router and not the Comcast side of the equation that was at fault, I wanted to eliminate that as an excuse. For about a week after the installation our internet worked fine. Maybe the fourth technician was right – as he said, the old modem "knew it was going to be obsolete" and "it couldn't get up speed enough to run on the information highway so it got knocked to the side of the road" (that was his one non-water analogy). I didn't believe his explanation; but now the connection worked. Maybe I was wrong, and he was right. I might not understand his explanation, but maybe he was right. Maybe I am fallible. Then it crashed again. A wave of relief rolled over me (again water analogies). I am infallible! The Comcast people came again. This time armed with a "senior" technician. They worked about 3 hours and completely rewired the house (free, I might add). This included pulling the cable out of the walls and the holes in the 2x4 headers I had drilled when I originally installed the cables. I had spliced two old cables together with a union to make a long run. They wondered why someone had spliced two old cables together. They never asked me who the jerk was who did it—"don't ask, don't tell" is my philosophy. The computers and downstairs TV were working when they left. That night I went up to the upstairs TV, and it didn't work. The last thing the young guy, who was with the senior technician, had done was to do something to that cable. The next day we called Comcast. The young guy came back and sheepishly said that he had forgotten to connect the TV cable to that room. We got another $20. This is our new get-rich -quick scheme. The following day he came back and replaced all the cable from the house to the telephone pole in the street. Everything now works.

Birds vs. Squirrels: In previous Christmas notes, I have shared about our "squirrel wars." That is still, sort of, ongoing. But this year there was another twist to the story. We enjoy watching birds at our feeders. We have all three local varieties of woodpeckers (downy, hairy and yellow-breasted), chickadees, nuthatches, gold finches, titmouses (is it titmice ?), Carolina wrens, house wrens, sparrows, and red-tailed hawks (who are not looking for bird seed!). Last late fall, ominously, we had a few grackles. Dottie was delighted to see these new visitors. I was worried. Sure enough, these must have been the scouts. Within a week we had great waves of grackles descending on the feeders each day. They would go through about 10 pounds of seed a day. This was getting expensive. I called them "thugs" because when they came they drove all the other birds away. Dottie solved 90% of the problem by using one of our feeders that had a spring loaded screen shroud around the feeder. The perches were attached to the shroud, and a hole in the feeder lined up with hole in the shroud at each of the 8 perches. The feeder was originally sold as being "squirrel proof," because when a heavier squirrel hung on the shroud it pulled the shroud down and covered up the feeding hole. Birds, being lighter, did not pull the shroud over the hole. Dottie's solution was to counter weight the shroud by hanging chains from it so that the slightly heavier grackle (average weight 7 ounces, versus 1-3 ounces for a songbird) would bring down the shroud, whereas the songbirds could still feed. This was a delicate Hooke's Law calculation. It worked like a charm for about a week. Then one morning I looked out the window, and a grackle had grasped the perch with its left foot to position itself and was flapping its right wing as hard as it could. That decreased its weight on the perch so that the feeding hole was open! Quite amazing. However, soon after that the grackle plague subsided. Dottie's view is that it was just too much work for them; I think the weather forced them South. In either case, our birdseed expenditures returned to normal.

Prud'homme family: We had two vacations this year. The first was a trip to Alaska with three couples. One of the couples was Brian and Giulia Pethica. Brian, as many of you know, has an appointment as a visiting scholar in our department through Pablo, Sundar and myself. Brian has retired about 4 times: Professor at Manchester, then Cambridge, then director of research at Unilever's Port Sunlight lab, then Dean of Arts and Sciences at Clarkson, then a biomedical startup. It was quite amazing to

hear Brian's stories of life in England during the Second World War and Giulia's stories of her father and his brother who were senior figures in the Italian Government during the WWII and who were on opposite sides of supporting Mussolini. These were firsthand accounts of history in the making. The Alaska vacation had its share of wonderful halibut, salmon, and bears.

The second vacation was to Australia where Bob had a conference, which allowed him to visit collaborators in Sydney. Dottie continues to throw herself with passion into the Master Gardeners of Mercer County Association. She is a great organizer and runs their monthly tours. She reached the "1,000 hours of volunteer time" more rapidly than anyone in Master Gardener history. For their big annual bus tour, she wanted to get a memento to hand out. While we were in Australia, Bob had the idea of an embroidered, collapsible umbrella. Dottie has had several things embroidered at a little kiosk in a shopping center in Sydney. Also, there is a Chinese flea market where everything is inexpensive. At the flea market, the stall proprietor blinked when Dottie said she wanted 50 collapsible umbrellas. The proprietor had to contact her warehouse supplier. The transaction was completed with this man meeting us in a side alley two days later. He opened the trunk of the van and showed us the cardboard box, presumably filled with umbrellas. We opened the box and checked the "merchandise." We handed him the cash in small bills. It felt much like a drug score. The umbrellas went to the embroidery store, which had moved to Leichardt. It would take them a week to embroider "Master Gardener Tours" on each umbrella. Dottie was long gone back to N.J. when Bob had to take the bus to Leichardt, pick up the 50 lb. box of umbrellas, and lug them back to the hotel room, and then to the airport the next day. Dottie was the hit of the Master Gardener program when she handed out the umbrellas.

Wendy and Patrick in Kenya had their first child, Eli. They have international travel stories, such as bringing extra clothes for Eli on the flight from Kenya to the U.S., but not for themselves. Eli was hit by diarrhea and vomiting on the flight. At the end of the 26 hour travel time, Eli was fine with his clean new clothes, but they were total wrecks, smelling of baby vomit and poo. Such is child rearing. Michele and Graham in Austin, Texas hosted us on a great trip through Austin fine dining. Graham has started a new job in a startup doing data mining to look at oil and gas leases. Jodie in San Francisco had a climbing accident that hurt her hand, so her vacation to Glacier National Park with her friend, who had a foot cast, was sort of a handicapped "The Road to…" adventure (to those of you who recall the Bob Hope and Bing Crosby road movies). Taylor has a new job working at the same place as his younger brother, Bobby. Bobby was married this spring to Liu in our back yard. Again, the Master Gardener/organizer was at her best. This included adding fake flowers to get the color scheme right. Bradley has entered his final year at Rutgers in biology and is dating the premier ballerina of the Princeton Ballet Company. So watching the Nutcracker this winter at McCarter was especially fun.

Prud'homme Research Group: Our group continues to focus on polymer self assembly for nanoparticle drug delivery and imaging, and on polymers for oilfield applications. The oilfield work involves polymer-surfactant interactions to remediate oil spills. A new project with Prof. George Scherer involves the rheology of fluids used in cementing operations during the completion of oil wells. This year, Long Chen completed his MSE on encapsulation using interfacial polymerization reactions. Nathalie Pinkerton finished her Ph.D. on nanoparticle encapsulation in gel microparticles for delivery of drugs to the lung. She began her research career in Toulouse, France. It appears she is the designated host for group members visiting Europe. Christina Tang finished her postdoctoral appointment in the group and will begin her faculty career at Virginia Commonwealth University. For Bob, the most significant technical meeting of the year was in Melbourne, Australia where he was one of the plenary lecturers for the rheology meeting honoring Tam Shridar's 65th birthday. The meeting was attended by most of the rheologists around the globe who have contributed to the measurement and theory of elongational rheology.

It's been a quiet fall at the home of **Rick Register** and Jean Tom, now that Jeffrey has started college—at Princeton, so he's not too far away. As a potential CBE major, he's currently taking CBE 245 (from Rod Priestley) and MOL 215 (from Celeste Nelson), and comments that "college is much harder than high school". (Both parents had similar reminiscences!) Jeff has made Princeton's club volleyball team, so practices and games will give him occasional breaks from his studies. Other exciting events for Jeff during the past year included: a second summer researching organic electronic devices in Lynn Loo's lab; a "vehicle upgrade" to Rick's 2003 Ford Taurus, when Rick traded in the 1998 Volvo wagon for a 2014 Ford Escape (though the Taurus stays at home in Princeton Junction); and winning seasons ending in the second round of the state tournament for both his basketball and volleyball high school teams (the latter as team-captain).

It's also been a year of changes for Keith, now a freshman at West Windsor-Plainsboro High School South. Keith misses having his big brother at home—not so much because he misses Jeff per se, but more that he misses having someone else to absorb a fraction of his parents' unwanted atten-

tion. Keith enjoyed his tour of Austria and the Czech Republic as part of the Youth Orchestra of Central Jersey, and is now "principal trombone" in his new (freshman) high school band. With no broken bones this year, he's been playing on the high school JV soccer team.

With the end of Jean's sports coaching career (now that Keith has started high school), she is finding new outlets to contribute to the community. Jean is now an ABET program evaluator, set to go on her first school visit in the fall. She is also an educational counselor for MIT, conducting alumni interviews with students applying for undergraduate admission. Bristol-Myers Squibb's transformation into a specialty care pharmaceutical company is keeping Jean busy as the types of compounds in the pipeline diversify. Her Development Engineering group completed another tech transfer to manufacturing this year and had a number of exciting talks at this year's AIChE meeting in the areas of drying, mixing, reaction engineering, crystallization, and data analysis using Bayesian statistics.

The membership in the Register Group has been relatively stable for the past year, with only one departure: former postdoc So Youn Kim is now Assistant Professor in the School of Energy and Chemical Engineering at Ulsan National Institute of Science and Technology (est. 2007), where she's setting up her lab with the help of several undergraduates as the department launches its new graduate program. The "loss" of So Youn is at least partially compensated by two new group members: second-year Ph.D. student Dane Christie from CCNY (jointly advised with Rod Priestley), working on the dynamics of polymer blocks in confinement, and new postdoc Dong-Gyun Kim from Seoul National University, working on new polymers for butanol pervaporation membranes (from synthesis, to structural characterization, to separation performance). Ph.D. student Raleigh Davis, working on block copolymer thin films, is now the most senior group member (and already looking for post-Princeton positions), while continuing Ph.D. students Adam Burns and Will Mulhearn, both working on aspects of crystallizable block copolymers, continue to hold down the fort. Rick, Raleigh, Adam, and Will all attended the Gordon Conference on Polymer Physics this past July, all giving talks or posters and setting a new record for Register Group participation at that meeting.

The conference highlight of the year for Rick was an invited talk at the APS March Meeting, honoring Ryan Hayward '99 on the occasion of his receipt of the Dillon Medal. The rest of the year was peppered with very enjoyable seminar visits to universities (U. Florida, Ohio State, Tulane, Michigan State) and corporate research centers (ExxonMobil Chemical, Promerus, Braskem America), and by several stimulating days in Brazil as a member of the newly-constituted Scientific Advisory Board for Braskem (the Brazilian chemical company).

Finally, continuing our National Park family vacations—perhaps for the last time!—this past summer we visited the Everglades, taking cell phone videos of very large but lethargic alligators. We also spent a couple days in and near Key West, including a visit to Fort Jefferson in Dry Tortugas National Park, the largest masonry structure in the Americas (Google it if you've never heard of it!).

Bill Russel completed his twelfth and final year as Dean of the Graduate School in the spring and once again makes his academic home in CBE. He is enjoying the first of two years of sabbatical leave and will start 2015 with extended visits at Stanford and Cambridge in this winter and spring. Bill collaborates with his graduate student, Ben Landrum, and Roseanna Zia at Cornell; serves on the board of BIOS; and remains active with the NAE. He and Priscilla have moved back into their (now restored) home on Boudinot Street and are once again learning to be self-sufficient. Priscilla continues to thrive in her position as supervisor of world languages for the Princeton schools and in her work with the federally funded critical languages initiative that takes her around the country as a program evaluator. The start of the school year was quite busy and appears to continue on that trajectory. She first hosted a group of high school students from France for a week in the fall and then flew with Italian and French students in Princeton High School to visit students at high schools in those respective countries. Bill joined the trip to Italy.

Last year, we reported that Daniel '99 was still pursuing a career in research in the California Institute of Quantitative Biosciences at the University of California in San Francisco. However, after much thought and a persistent recruiter he decided to join AltSchool, a well-funded educational startup in San Francisco (https://www.altschool.com) where he is the Senior Research Engineer. Lena continues to manage her company that develops financial plans for startups. Meanwhile, little Kai, a fast moving four-year old, speaks fluent Russian and, to a lesser extent, English. Presumably he will pick up the latter quickly when he starts school in September 2015. A highlight of the year for Grandpa and Grandma was a trip to BIOS in Bermuda with just Kai, Uncle Bailey, and Aunt Annika. In Laramie at the University of Wyoming, Annika (Assistant Professor and Assistant Leader - Fisheries,

Wyoming Game and Fish Cooperative Unit) and Bailey (Academic Professional, Photography) are expecting their first child (a little girl) around the end of February.

The **Shvartsman** lab had another good year. Miriam Osterfield, a post-doc in the group, has completed an interesting imaging study of topological transformations in developing cell sheets and is beginning to look for academic positions. The fifth-year students, Bomyi Lim and Alan Futran are getting ready to graduate, after several years of challenging but exciting experiments. Mahim Misra, in his fourth year now, is putting things together for his first publication, on mechanical models of shape bistability in epithelial shells. The third-year students, Granton Jindal, Yogesh Goyal, Henry Mattingly, and Jasmin Imran Alsous, have all defended their thesis proposals and are working on a very impressive range of topics, from germline dynamics in worms, to mitochondrial structure in flies, to heart development in fish, and animal models of developmental disorders in humans. Yonghyun Song, the latest addition to our group, is starting a brand new project on developmental bioenergetics, asking questions about energy demands in early embryos. The lab is involved in a number of collaborations at Princeton (with Jamie Link, Yannis Kevrekidis, Carmeline Dsilva, Trudi Schüpbach, Becky Burdine, Jay Benziger, Amit Singer, and Adam Finkelstein) and elsewhere (Gerardo Jimenez in Barcelona, Giorgos Pyrowolakis in Freiburg, Basile Audoly and Vincent Hakim in Paris, Michal Pribyl and Igor Schreiber in Prague, Alex Fletcher and Ruth Baker at Oxford, Swathi Arur in Houston, and Saurabh Sinha and Hassan Samee at Urbana-Champaign). A number of visitors, from Singapore, Japan, U.K., and Czech Republic, came through the lab this year, to either learn how we do things or to teach us new experimental and theoretical tools. So, overall, things are OK. We wish you a healthy and happy 2015!

Sankaran Sundaresan and his family send their holiday greetings to everyone. He reports that it has been a good year for his research group. Sebastian Chialvo completed his Ph.D. in September, with his research leading to models for granular rheology and associated wall boundary conditions. Ali Ozel, a post-doctoral fellow in the group, has developed a methodology to extract coarsened statistics from Euler-Lagrange simulations of gas-particle flows and is applying the tools he has assembled to formulate coarse models. Greg Rubinstein took a closer look at the old problem of fluid-particle drag in fluidized suspension and discovered a systematic effect of the fluid-particle density ratio affecting the interaction force, which is not recognized in the commonly used models; he is currently quantifying this effect. Yile Gu successfully sustained the General examination; his first project dealing with flow regimes in rheology of cohesive particles has now appeared in a journal, and he is now analyzing avalanche statistics in granular shear flows as well as cohesive particle fluidization using the tools assembled by Ali Ozel. Matt Girardi's simulations of wet particle fluidization are generating insights on how one should formulate effective continuum models. A visiting student from Israel, Ziv Greidinger, is busy analyzing the evolution of agglomerate size distribution and the structure of agglomerates seen in wet particle fluidization. Lichao Cai, working jointly with Professor Pablo Debenedetti and Dr. Brian Pethica, has quantified the kinetics of formation of clathrate hydrates, with an eye towards desalination applications; his work has led to a patent application.

Sundar traveled in May to the Granite City (Aberdeen, Scotland) to deliver the 2014 RV Jone Distinguished Lecture. In September, Sundar and his wife Latha spent ten days in Hamburg, Germany – the first of several visits to come through an Alexander von Humboldt Research Award. Sundar reports that they had a really nice time and that he used the period to cultivate collaborations with researchers at TU Hamburg-Harburg. From there, they went to Graz, Austria to attend the wedding of a former post-doc Stefan Radl, which was very special.

At the home front, Latha had been asking Sundar for several years to get a contractor and remodel a bathroom. This year, he ran out of excuses and found a good contractor in July. It became clear after the assessment by the contractor that the bathroom is the least of the issues in the house; work has been going on for the past four months (on and off) fixing up a long list of other problems with the house. The bathroom remodeling is yet to start…

Sundar's older daughter Hema is studying to become a school teacher, while the younger one Neereja is pursuing graduate studies in Electrical Engineering. They are both living at home now, which has been special for both Sundar and Latha.

Last year, **James Wei** published a research paper: "Knudsen diffusion in channels and networks", Jichang Liu and James Wei, Chemical Engineering Science, 111, (2014) 1-14. This work returns to doing Monte Carlo simulation of a familiar theme, finding that the individual steps follow the log-normal distribution, and finding other features that are not well understood. He continues to do research, and give talks in national and international conferences.

The Chemical and Biological Engineering staff has enjoyed another productive year assisting the faculty and students.

We wish everyone a very happy holiday season!!

Jackie Armstrong: Another busy year at our house, and not entirely sure where it went. Zack departed on his LDS mission to the SLC East area (he has deferred his admission to Brigham Young University for two years), Liz is busy applying to colleges and working, Victoria just started high school and is loving it, Andrew just landed a lead in the school play and is advancing in Boy Scouts, and Bridget is tearing up the field hockey and soccer fields and finding time to play flute as well. Jim and I continue to work on the house; Santa will be surprised to find a beautiful repaired and refaced chimney. We are also ready for winter with a generator and about four cords of wood in the back yard from the trees we cut down! So that should make everyone feel better because of course now that we are prepared, we will have a mild winter and not need any of it. Best wishes to everyone for a joyous holiday season and a terrific 2015!!!

Adrian Cupid: I can't believe it will be almost 2 years since I joined this department… Time flies when you're having fun! I have learned so much, met and had wonderful conversations with some of the greatest students, and continue to enjoy working here at Princeton. Home on the ranch is business as usual, our son Kellan (who I can't believe is in H.S. now) is in an off-Broadway Opera in New York and our daughter Turquoise is at Princeton Ballet preparing this month for her long awaited debut of (drum roll)... "point shoes"!! Many Blessings to you and your family this Holiday season from the Cupids!

Mary Beth Friedfeld: Wow, two years at Hoyt, time sure flies. Aside from taking care of the residents of Hoyt Laboratory (and even some of the EQuad residents), we've had some exciting news at home. My daughter is now engaged to her fiancé, a captain in the U.S. Army. A summer 2016 wedding is planned! Also, my son John graduated from TCNJ with a degree in physics (now if only he had a job). I feel like I should mention Matthew too, who is currently working on a Behavioral Neuroscience degree at Rider University. Over the summer we enjoyed a family reunion on Long Beach Island. My daughter and her fiancé were there, as well as my two sons. It was a nice, relaxing way to spend a week – I only wish there were more vacations like this! Best wishes to all for a wonderful holiday season, and a happy and prosperous new year.

Staff Updates

Sharon Malley: Thank you to the CBE staff for making this such a great department. This year the Malley family became foster parents to a cat and her three kittens, which were dropped off in our neighborhood. Luckily, were we able to find new homes for all of the cats and our house is back to normal. My niece is now an ER nurse at Hackensack University Hospital. My brother and his family moved into their new house in May, their original house was lost to Hurricane Sandy. It was a long time coming, but they are enjoying being home again. Here's wishing everyone a safe and happy holiday season, and many wonderful new memories for the future!

Karen Oliver: Our Graduate program is strong as ever! With our new DGS, Celeste Nelson, taking over the reigns as of the summer, this academic year got off to a great start and is already flying by. We have a wonderful first-year class of 8 – smaller than usual – but a really awesome group! We had a large number of students graduate this year, and move on to bigger and better things – our loss is the world's gain! I continue to love my job, and I am thankful for another year of health and happiness for my family and friends! Wishing all of you a wonderful and safe holiday season, and all the best in 2015!

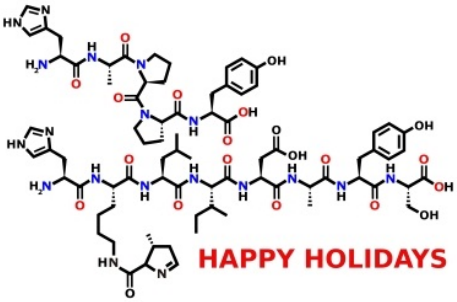
Eric Paul: It has been a quite year for me for the most part. I did move to a new apartment this year after my old place was put on the market by my previous landlord. My family has been OK and we are pressing on. I wish you all Happy Holidays and a very good New Year.

Don Schoorman: Yet another year has passed and the undergraduate lab is still growing, both in enrollment and new experiments. This year we will have a brand new level control experiment. The idea came from Faith Morrison who taught core lab (CBE 346) on her sabbatical from Michigan Technical University a couple of years back. In early April, I traveled to MTU to see how their Unit Operations Lab operated. (I survived a 17" snowfall on top of about 30" already on the ground while I was there.) I got some great ideas that I would like to implement here. We will have a new spin coating experiment on line for the new semester and several other experiments will be upgraded. With the continued increase in enrollment, it has been a little bit of a challenge to keep the lab completely outfitted and all the experiments upgraded and running reliably. The CBE staff, faculty, and School of Engineering and Applied Science have been great with their never-ending support. Between keeping the lab running smoothly and enjoying my new car, I have had a busy year. I wish everyone a happy and healthy New Year.

In the undergraduate office, **Julie Gerek Sefa**, would like to extend the warmest of holiday greetings to all. Congratulations to the class of 2014! I miss you all already. Thank you for keeping in touch. This past July, we welcomed a new undergraduate departmental representative, Professor Jamie Link (ChE '00), taking the reins from Professor Bruce Koel who did a fantastic job. Here's to a happy, healthy, and prosperous 2015. Please do come back and visit "this is your home!"

Patti West, yes Patti's name has changed. Richard and Patti were finally married on October 18th. They had a very small wedding in Hamilton, N.J. with their immediate family members and a few very close friends, then it was off to Curaçao for a week vacation. It was a busy fall with her daughter Melissa also getting married on September 27th on the beach in Spring Lake, N.J. She looks forward to what the new year brings and wishes everyone a very special holiday season and a wonderful new year!

Heather Yacone: The M&M dispenser is full (with new batteries too!) so be sure to stop by and visit! Wishing everyone a very Merry Christmas and all the best for the new year!



2014 Alumni Questionnaire

Please Return by:

Fax: 609-258-7761 or E-Mail: hyacone@princeton.edu or Mail:

Princeton University
Department of Chemical and Biological Engineering
Princeton, NJ 08544-5263

Please take a moment to complete this questionnaire and return it to the department. Thank you!

Full Name: _____

Name while at Princeton : _____

(if different from above)

Princeton Degree: _____ Year: _____

E-Mail Address : _____

Is there any personal news that you would like to share? (Please feel free to use the back)

If your firm offers summer positions for chemical engineers, or is actively recruiting for full-time positions, please provide the following:

Nature of positions:

Name and address of contact person:

Thank you to everyone who contributes to Annual Giving! Your gifts directly benefit Chemical and Biological Engineering by providing funds for:

Graduate student recruitment
Travel to conferences
Laboratory and student office renovations
Computing facilities
Start-up packages for new faculty

You may give online: www.princeton.edu/AG/aggift.html
or call the toll-free, 24-hour gift line 1-800-258-5421 (609-258-3373 outside the U.S.)

Princeton University
Department of Chemical and Biological Engineering
The Engineering Quadrangle
Princeton, NJ 08544-5263