“Keep moving.” Those are the words I say to myself as I step out of my warm car inside the [unheated] Washington Avenue parking ramp on my way into Amundson Hall each morning. My brisk pace reminds me, too, about the department. CEMS keeps moving swiftly, reinventing itself, every day, every semester, every year—as it has for decades—and that’s why it is such an exceptional place to work and learn.

It would not be an overstatement to say that the 2014 fall semester was full of momentous and exciting changes. Clearly, one of the biggest highlights was the November 7th grand opening of the new Gore Annex to Amundson Hall, a 40,000-square-foot addition that provides us with much needed room to grow our research and teaching enterprise. This addition, funded by generous gifts from Bob and Jane Gore, The Dow Chemical Company, and Valspar Corporation expands our available laboratory space for new faculty hires in reaction engineering, energy, polymers, advanced semiconductors, and biotechnology, for example. It also provides expanded facilities for undergraduate instruction, including new tutorial spaces and a totally new teaching laboratory, the Valspar Undergraduate Materials Science and Engineering Laboratory. CEMS is growing – combined undergraduate enrollment for our two programs is approaching 200 bachelor’s students per class – and the opening of the Gore Annex comes just in time to accommodate our expanded student body.

I invite you to read about the grand opening on the following pages and to see a short video clip on the CEMS website. The department also welcomed five new faculty this fall: Professors Samira Azarin, Paul Dauenhauer, Vivian Ferry, Jong Seok Jeong, and Matt Neurock. You will read about them and their exciting research programs inside this newsletter. With due deference to last year’s faculty search committee chaired by Michael Tsapatsis, much of the credit for recruiting this bounty of new talent goes to our colleague Regents Professor Frank Bates, who in his last year as Department Head really put his foot on the gas of our recruiting engine.

CEMS is recruiting faculty again this winter. As always, we are searching for exceptional individuals who combine extraordinary research potential with a passion for teaching. Excellence in both remains central to our department mission.

And, CEMS has a new Department Head. I am honored to step into this role on behalf of my faculty and staff colleagues and the graduate and undergraduate students we train. I am well aware of the great legacies of the department and its former Heads, but I don’t spend much time wondering if I am up to the task. In part, that’s because there is simply plenty to do. But in large part it’s because I know I have the most talented and committed colleagues anywhere in the country. Together, we will continue to capitalize on the synergy between chemical and materials engineering to make new discoveries, to drive change in our disciplines, and to train the next generation of engineering students. CEMS keeps moving, reinventing, and that’s why it is such an exceptional place to work and learn.
Frank Bates honored with recognition events

CEMS celebrates Frank Bates’s 15 years of dedicated service as Department Head.

The Department of Chemical Engineering and Materials Science at the University of Minnesota boasts a unique culture that emphasizes longheld traditions in academic excellence achieved through loyalty, teamwork, and the strong leadership abilities of our Department Heads. With a rich history including past legendary Department Heads like Neal Amundson, Rutherford Aris, and H. Ted Davis, it was only fitting that Frank S. Bates took his place among them and was properly recognized for his successful 15-year term as Head.

Still, planning a recognition event for Frank Bates is no easy task. In a nod to the Bates spirit of not asking for permission and instead asking for forgiveness, we forged ahead. It was a momentous achievement to surprise Bates at a casual CEMS gathering atop the patio of the Campus Club in Coffman Union in May 2014. Yet the celebration didn’t stop there, continuing with “Franktoberfest” in October 2014 to acknowledge Bates and Professor Jeffrey Schott for their contributions to the Gore Annex construction project.

C. Daniel Frisbie, the seventh CEMS Department Head to-date, prepared some remarks for Franktoberfest to appropriately thank Bates for his department leadership. An excerpt is below:

“As I was thinking over the last few weeks about how to appropriately thank Frank for his great leadership over the past 15 years, I was struck with the idea, “What about peer review??” I mean every Department Head must have his/her day of reckoning, right? Why not ask the faculty their opinion? So I asked every faculty member to give me one adjective describing Frank or his tenure as Department Head.

Of all the words people submitted, my favorite is gritty.

Gritty, by definition, means courageously persistent; having strong qualities of tough, uncompromising realism. So I thought about Frank’s life and what makes him gritty...

Frank worked his way through the State University of New York, Albany.
His job was driving garbage trucks. What’s that? That’s grit!

Sometime after college, Frank was still driving garbage trucks. Frustrated with this career path, he drove his garbage truck to MIT. He walked into the chemical engineering department, walked down to the admissions office and demanded an application to their graduate program. The staff gave him the application on a lark. He applied and somehow got in!

Frank finished his Ph.D. at MIT and started as a staff scientist at world-famous Bell Labs. He outpaced many of his peers and became a Distinguished Member of the Technical Staff.

He left Bell Labs for an academic position, but was disillusioned and drove across the country to return to the east coast. His future was uncertain.

What’s that? That’s grit!

A couple of years later, he decided to try academics again. He started at the University of Minnesota. In short order he became a Distinguished McKnight Professor, winner of the APS Polymer Physics Prize, and Head of the Department.

Frank balanced the budget, began a faculty hiring rampage, and nearly simultaneously started a gigantic capital fundraising campaign. Over the course of time, he hired 25 faculty members and raised over $20 million for Campaign First.

His research program steamed ahead. He was elected to the National Academy in his forties, he won the David Turnbull Lectureship Award from the Materials Research Society, became a Regents Professor, and his invited lectures skyrocketed. He continued to teach and inspire his colleagues. All the while, CEMS was growing under his leadership.

What’s that? That’s grit!

In his third term as Head, his conscience and leadership instincts started to tell him he had to turn over the headship. With less than three years to go in his final appointment, he told the President of the University that CEMS must have a major building expansion. He raised $15 million from private donors – a degree of financial leverage that allowed the Department to break ground for the Gore Annex.

This summer, Frank returned to being just a regular Regents Professor. At the age of 60, he is publishing now what he says is his most influential paper ever.

What’s that? That’s grit!

Frank, we can never thank you enough for what you have done. Here’s to your leadership and vision as Head of our Department for 15 years, and to your gritty spirit that has inspired us, motivated us, and built us into one of the greatest engineering departments in the country.”

Frank is...(according to the faculty):

• Frank, as in plain spoken
• Frugal
• Compassionate, imaginative
• Loyal, dedicated, brilliant
• Strategic, thorough, dedicated
• Tenacious, relentless, inspiring
• Intense, irreverent, irrepressible
• Tireless, visionary, authentic
• Influential, exceptional
• Gritty
Gore Annex opens in grand fashion

The grand opening was held on November 7, 2014 and attended by CEMS alumni and friends.

Approximately 150 guests attended the Gore Annex grand opening to officially mark the completion of a 40,000-square-foot expansion of Amundson Hall, named for CEMS alumnus Robert W. (“Bob”) Gore (Ph.D. ChemE ’63) and Jane Gore. The expansion accommodates an increasing demand from highly qualified students seeking admittance to the chemical engineering and materials science programs at both the undergraduate and graduate levels.

About the Gore Annex

The Gore Annex includes offices for faculty, post-doctoral fellows, and graduate students, 60 new laboratory hoods, and a new 3,000-square-foot Valspar Materials Science and Engineering Laboratory outfitted with state-of-the-art materials testing equipment. It has been carefully designed as a separate building with connections to Amundson Hall on each floor in order to maximize space. The new Gore Annex will accommodate numerous research programs, including ultrafast electron microscopy, electronic and magnetic materials, and biochemical engineering. The architectural firm Perkins+Will designed the Gore Annex addition, and Kraus-Anderson served as general contractor on the project. Construction began in March 2013, and the project was completed in November 2014.

A ceremonial ribbon cutting was held on the balcony of the Gore Annex prior to the grand opening event. Featured in the photo (from left to right) are: Karen Haman (CEMS graduate student), Frank Bates (CEMS Regents Professor), Florian Schattenmann [The Dow Chemical Company], Dan Frisbie [CEMS Department Head], Bob Gore, Jane Gore, Eric W. Kaler [President, University of Minnesota], the Honorable Patricia Simmons [University of Minnesota Board of Regents], Cynthia Arnold [Valspar Corporation], Steven L. Crouch [Dean, College of Science and Engineering], and Jeff Ting (CEMS graduate student). Photo credit to Richard Anderson.
1. CEMS graduate student Adam Kelloway helps a guest in the new Valspar Materials Science and Engineering Laboratory during the Gore Annex grand opening. Kelloway was one of 20 graduate student volunteers at the event.

2. Graduate student Shameek Bose explains the research being conducted in the Electronic and Magnetic Materials Research Laboratory. Professor Chris Leighton and his research group will use this new lab space.

3. Assistant Professor David Flannigan showcases the world’s first FEI Tecnai™ Femto Ultrafast Electron Microscope in the new microscopy laboratory. The lab is designed to be extremely quiet and well-controlled in order to conduct sensitive experiments.

4. Teaching Assistant Professor Michael Manno (second from right) is shown with special guests from Hysitron, Inc. and CEMS Professor Bill Gerberich and his wife, Professor Susan Gerberich.

5. Professor Jeffrey Schott was honored for his profound leadership and dedication in overseeing the design and construction of the Gore Annex as well as major renovations to Amundson Hall. Schott served as a liaison between CEMS students, staff, and faculty members and the Kraus-Anderson construction staff throughout the duration of the project. Schott was honored with a plaque at the CEMS “Franktoberfest” event in October 2014. Schott (left) is shown receiving his recognition plaque from Dan Frisbie, Department Head.
CEMS sweeps Dow SISCA Challenge, including $10,000 top prize

Md Ai Mehedi won the competition, with Christoph Krumm and Katherine Vinter placing as runners-up.

CEMS graduate student Md Ai Mehedi won a $10,000 grand prize in the Dow Sustainability Innovation Student Challenge Award (SISCA) competition held December 4, 2014 at the University of Minnesota’s Institute on the Environment in St. Paul, Minnesota. Mehedi’s winning project, “Rare Earth–Free Permanent Magnets,” described a new process for making magnets out of iron and nitrogen that obviates the need to use rare earth elements that are integral to standard magnets used for applications such as motors and generators, but that depend upon extraction processes that are energy intensive, technologically challenging, environmentally hazardous and threatening to human health and agriculture.

The winning project was one of 12 submitted to the Dow SISCA competition at the University of Minnesota, one of 17 colleges around the world participating in the program. Mehedi is advised by Distinguished McKnight University Professor Jian-Ping Wang in the Department of Electrical and Computer Engineering.

CEMS graduate students Christoph Krumm and Katherine Vinter were runners-up in the competition, each receiving $2,500 to pursue the application of novel dehydration techniques to improve the sustainability of production of industrial chemicals from biomass.

The Dow Sustainability Innovation Student Challenge Award (SISCA) is a program of the Institute on the Environment and The Dow Chemical Company. SISCA recognizes and rewards students and universities for innovation and research that encourages and promotes sustainable solutions to the world’s most pressing social, economic and environmental problems. The competition is open to full-time graduate and professional students enrolled at all campuses of the University of Minnesota.

The objective of the challenge is to develop practical and innovative solutions that address global environmental challenges. It encourages action from students — action to reach out and understand how to apply their knowledge to solve important problems in the world. This means identifying and understanding a real problem, developing a solution, and designing a plan to implement that solution.

Judges for the competition included representatives from The Dow Chemical Company, 3M, Metropolitan Council Environmental Services, and the University of Minnesota. The awards are presented as financial scholarships to the students to allow them to further develop their research.

The University of Minnesota’s Institute on the Environment (IonE) seeks lasting solutions to Earth’s biggest challenges through research, partnerships and leadership development. For more information on IonE, visit environment.umn.edu. For more information on the Dow SISCA program, see dow.com/sustainability/studentchallenge.
Undergraduate Scholarships

More than 40 CEMS students received scholarship support in 2014 from named Departmental scholarships.

American Institute of Chemical Engineers Scholarship
Tony Cui

Frank and Janis Bates Scholarship
Stefani Prigozhina

Raul Caretta Scholarship
Tyler Engstrom-Socha

George and Joan Carlson Scholarship
Lyna Anderson

CEMS Scholarship Fund
John Hancock

Tu and Pi-Fang Chen Scholarship
Christopher Cheng, Connie Dong, Collin Holgate, Elin LaBreck, James Lettow

Bobbie Huston Cronquist Scholarship
Melissa Cassel, Erin Hill

Thomas W. Cummins Scholarship
Kelly Kazmerski

Rosalie Sperling Dinkey Scholarship Fund
Yanpu He

Harry Fischman Scholarship
John Dewey

John P. Fridley Scholarship Fund
Erik Anderson, Alyssa Fish, Madeline Forbes, Russell Meyer, Wenshi Zhang

Donald Leask Fuller Scholarship Fund
Rong Deng

Christie John Geankoplis Scholarship Gift
Jacob Thelen

Archie B. Japs Scholarship
Lindsay Carlson

Kempf Scholarship Fund
Cole Stapleton

Kenneth V. Krake Scholarship Fund
Alyssa Bergland

Vincent K. Leung Scholarship
Brooke Jaunich

Charles A. Mann Award/Chemical Engineering (1934)
Daniel Mueller, Brandon Pietz, Nikola Trukov

Wendell and Dottie Manske Scholarship
Michael Stoffel

Joan Mattern Scholarship in CSE
Xiao Shan

Jim and Lorinda Mishek Scholarship
Samuel Duncan, Anne Ploof

Athos J. Monti Scholarship
Alex VanNess

Procter and Gamble Company Scholarship
Albert Wu

Ed and Cora Remus Scholarship
Kenneth Wuollet

Jeffrey and Patricia Schott Scholarship
John Rosenow

Donald and Patricia Sullivan Scholarship Fund
Bishwesh Joshi

Barbara J. and David J. Yarusso Scholarship Gift
Joseph Carlson

Kenneth J. and Kathryn Valentas Scholarship
Emma Abbott

Paula Zoromski Memorial Scholarship
Jennifer Bredemeier

Cui wins 2015 Genentech Outstanding Student Award

Tony Cui, a junior undergraduate student majoring in chemical engineering and chemistry, was awarded the Genentech U.S. Biologics Technical Development (USBTD) Outstanding Student Award for 2015. Cui received the $2,500 award in recognition of his scholastic achievement and passion for biotechnology.

Amplify your support with a corporate matching gift

Many companies offer programs that match charitable contributions from their employees and retirees at rates as high as 2 to 1 or even 3 to 1. To find out if your company has a matching gift program, visit http://give.umn.edu/giving/matching and enter your employer’s name. To learn more about ways you can support the Department, please contact Courtney Billing.
Keller presents 2014 Aris Seminars

Kenneth H. Keller, Professor Emeritus and former University of Minnesota President, highlights intersections of science, technology, and society as Distinguished Aris Seminar Speaker.

The Oxford geographer, Halford J. Mackinder once said, “All knowledge is one; its division into subjects is a concession to human weakness.” That comes close to describing a core belief and guiding principle of Minnesota’s Department of Chemical Engineering and Materials Science, my academic home for more than 40 years. Our faculty members were never comfortable with arbitrary disciplinary boundaries; we were always on the lookout for new connections, for the creative insights that came from exploring the linkages between the ideas of different fields. It made for the comfortable, encouraging, nurturing environment in which the connections between chemical engineering and materials science could be explored, and the fundamental analytical underpinnings of our field could be identified, developed and applied outside our traditional areas of focus.

Rutherford “Gus” Aris set the standard for these kinds of eclectic interests and broad accomplishments. In 1978, the title of University Professor was created especially for him in recognition of his many scholarly involvements and to free him to fulfill his teaching obligations in any department of the University. He offered a course in paleography and was considered a member of the faculty of Classical Studies. He spent a year at the Institute for Advanced Study in Princeton, which resulted, among other things, in his publications on variations in Latin script across Europe during the Middle Ages.

But Gus never weakened in his attachment to the Department. And one of his great contributions was to establish the practice of devoting our departmental seminar series to a theme that would take us beyond the traditional boundaries of chemical engineering and materials science. Gus, of course, is no longer with us, but he and his wife Claire, have given the department an endowment fund to allow this occasional seminar series to continue, and I could not be more grateful or honored than I am to have been asked to present a series of four seminars this past fall as the Aris Distinguished Lecturer.

The 2014 Aris Seminars/Commune Vinculum Omnibus Artibus Lectures, entitled “Science, Technology and Society: Exploring the Linkages, Framing the Questions,” examined the many ways, direct and indirect, intended and inadvertent, in which the worlds of science and technology and our social/political lives are connected. The connections, I believe, are two-way in the sense that developments in science and technology don’t simply serve society, but have the potential to alter its institutional structures and practical realities, changing political and social relationships, sometimes for the better, but sometimes for the worse. On the other hand, for social and political institutions to stimulate innovation and ensure that science and technology serve the needs and values of society, they have to be structured to reflect how the processes of research, development, and innovation actually work—and in that sense they have to be continually updated as the frontiers of science and technology themselves shift.

Let me emphasize, as I hope I did in the lectures, that expanding our perspective to provide a social and political context for analyzing the impacts of science and technology on society is much more than an academic exercise. It’s probably fair to say that science and technology have enormous potential to benefit society. However, the interactions between the worlds of science and technology, and our social/political world, play a major role in determining whether those benefits will be realized. From that perspective, the Aris lectures are not merely a contribution to cultural enrichment, but a recognition that finding ways to “re-integrate” the insights that come from many disciplines often serves the most practical of purposes.

Seeing this lecture series made permanent has led me to reflect on the many ways in which CEMS has not only innovated in many ways, but has followed through, remained committed in succeeding generations to the best ideas of earlier generations, turned successful experiments and practices into traditions. In returning to the Department, I saw many new faces among the faculty, and many new lines of research, but the things that have made the Department special—team teaching, collaborative research between departmental faculty members and across departments, nurturing the next generation of scholars, and the lunchtime gatherings in the faculty club that build relationships and give special meaning to the notion of “shared governance”—remain unchanged. For that, this “anziano” is truly proud and grateful.
Frank Bates and Chris Leighton
Regents Professor Frank S. Bates, along with Chris Leighton, Distinguished McKnight University Professor, and Sangwoo Lee (former CEMS post-doctoral fellow) recently published pioneering research on “Sphericity and symmetry breaking in the formation of Frank-Kasper phases from one component materials” in the journal Proceedings of the National Academy of Sciences (PNAS).

Read the full article here: http://www.pnas.org/content/111/50/17723.abstract

Xiang Cheng
Assistant Professor Xiang Cheng and his research group recently won a Gallery of Fluid Motion Award at the 67th American Physical Society (APS) Division of Fluid Dynamics (DFD) for their research on “Raindrop impact on a sandy surface.” The study was conducted in Cheng’s lab by three undergraduate chemical engineering students including Runchen Zhao (ChemE ’14), Qianyun Zhang (ChemE ’14) and Hendro Tjugito (ChemE ’13). A panel of eminent scholars evaluated and finally selected three award winners out of 75 video submissions, based on artistic value, scientific content, and originality. The winning entries will be published as a special supplement to Physics of Fluids.

Watch Cheng’s winning APS video: http://z.umn.edu/apscheng

Andre Mkhoyan
Associate Professor K. Andre Mkhoyan was recently promoted to the rank of Associate Professor with tenure. Mkhoyan’s research interests include analytical electron microscopy and spectroscopy, nanomaterials, defects and interface. His current research is focused on understanding basic electronic and structural properties of nano-materials, quantum dots and heterostructures using atomic-resolution scanning and transmission electron microscopy, by measuring local densities and crystal structures of materials’ states and developing quantitative interpretation of electron beam interaction with specimens.

Kechun Zhang
Assistant Professor Kechun Zhang won the 2014 Early Innovator Award for his invention of a renewable, sugar-based alternative to petroleum. The inaugural University of Minnesota Innovation Awards sought to recognize the accomplishments of outstanding University innovators who have demonstrated an entrepreneurial spirit, are actively engaged in developing new innovations and transitioning those technologies to the commercial market, and who have made an impact on society.

Watch Zhang’s video: http://z.umn.edu/zhanginnovator

Ed Cussler
Professor Edward L. Cussler presented the 66th Institute Lecture in a special session at the AIChE Annual Meeting in November 2014 in Atlanta, Georgia. The AIChE Institute Lecturer Award is given to a distinguished member of AIChE.
CEMS welcomes new faculty members

The Department continues to expand its world-class faculty with five new hires.

Samira Azarin, Assistant Professor

Samira Azarin earned her doctorate in chemical engineering from the University of Wisconsin-Madison and bachelor’s degree in chemical engineering from the Massachusetts Institute of Technology. Azarin previously held a postdoctoral fellow appointment in the Department of Chemical and Biological Engineering at Northwestern University.

Azarin’s background is in the area of cellular and tissue engineering. Her doctoral research focused development of systems to regulate growth and differentiation of human pluripotent stem cells (hPSCs). She utilized 3-D microwell array systems to evaluate the effects of 3-D culture on cell cycle progression and proliferative capacity of hPSCs and to modulate intercellular interactions in order to design more efficient processes for generating cardiac cells from hPSCs (Figure 1).

She also developed a process to differentiate hPSCs to brain-specific endothelial cells, which has led to the development of the first robust, fully human blood-brain barrier (BBB) model mimicking in vivo barrier properties. This system will enable more accurate pre-screening and development of experimental drug candidates for transport in the brain as well as studies of human brain development and disease. During her postdoctoral fellowship, she developed biomaterial scaffolds that capture metastatic cells in vivo and are coupled with label-free light scattering-based imaging techniques to serve as sensors detecting the earliest events in breast cancer metastasis (Figure 2).

Azarin’s research program at the University of Minnesota is focused on elucidating the mechanisms underlying cellular dormancy and activation in healthy and diseased tissues. Throughout the body there are stem cell populations that help maintain tissue homeostasis. These cells typically remain in a dormant state until injury or growth requires their activation to repopulate cells within the tissue. Disseminated cancer cells can also remain dormant at various sites in the body for years before reactivating and causing recurrence of metastatic disease. Understanding the mechanisms that control quiescence and activation of these cells could have broad implications in translational applications such as mobilizing endogenous stem cells for regenerative therapies and inducing dormancy of disseminated tumor cells to prevent disease recurrence. Accomplishing these goals will require integration of skills from biomaterials, cellular engineering, stem cell and cancer biology, and mathematical modeling. CEMS provides the perfect environment for this interdisciplinary approach.

Fig. 1: Changes in localization of B-catenin (green), an important protein for proliferation and cardiac specification of hPSCs, in 2-D (left) vs. 3-D (right) culture.

Fig. 2: Microporous poly(lactide-co-glycolide) scaffolds (5mm diameter, left) can capture metastatic breast cancer cells in vivo (right, white circle indicates metastatic cluster).

Paul Dauenhauer, Associate Professor

Dauenhauer’s research group studies reaction engineering of carbonaceous feed stocks, with special focus on catalytic transformations in microporous and nano-porous materials. Research in hydrocarbon reactor design has profoundly impacted society. Development of steam cracking, catalytic reforming, catalytic cracking and hydroprocessing in the last century has transformed the world into a highly efficient economy enriched
by high quality, low-cost fuels and a myriad of polymeric materials. The 21st century will require even more chemicals, polymers and fuels (especially diesel) but with the new challenges that come with sustainable manufacturing. New processes focused on limited environmental impact must account for water consumption and carbon emissions while starting from new complex feed stocks including lignocellulosic (non-food) biomass, shale or municipal solid waste. For many of these materials, existing catalysts are neither stable (e.g. water intolerant) nor effective, in that catalytic active sites are designed for the wrong chemistry, thus prompting a focus on new reaction engineering technology specifically designed for the next generation of chemical processing challenges.

Dauenhauer’s research addresses three specific areas at the forefront of reaction engineering. Production of everyday polymers can be made from renewable materials such as woody biomass or prairie grasses. Thermochemical technologies including zeolites and supported-metal catalysts allow for low-cost efficient transformation of biomass-derived carbohydrates into the chemicals and materials identical to those derived from petroleum. New catalyst and reactor designs have already led to new approaches to recovering glucose from woody biomass for conversion to p-xylene, the chemical precursor to PET plastics used for clothing (polyester), plastic bottles, automobile parts, and food packaging.

Renewable and alternative fuels are challenged by the heavy nature of new feedstocks. Large cellulose, lignin and other macromolecules must undergo initial thermal cracking to smaller, volatile chemicals before upgrading and refining to fuels. However, at high temperatures above 500 °C, biopolymers undergo thermolysis to molten oligomers which flow, coalesce and bubble before evaporating in just a few milliseconds. At even shorter timescales (100-200 microseconds), cellulose bubbles burst resulting in ejection of liquid cellulose aerosols as shown in Figure 1. Control via new reactor technology of heat transfer to molten macromolecules, bubble formation and aerosol generation, as well as the millions of chemical reactions occurring at high temperature will determine the future of these materials for replacing conventional fuel sources.

In addition to the reaction-transport problems in solid feed stocks, fuel molecules are upgraded in nanoporous materials such as zeolites. Catalyst active sites including solid acids and supported metals reside primarily within the particle, requiring fuel molecules to diffuse through tortuous pores only slightly larger than fuel molecules themselves. New experimental methods developed within the Dauenhauer group combined with simulations such as molecular random walks depicted in Figure 2 are beginning to reveal the complex relationship between bulk and surface structures in new exotic zeolite architectures, which are currently transforming fuel processing technology.

Vivian Ferry, Assistant Professor

Vivian Ferry earned her doctorate in chemistry from the California Institute of Technology and her bachelor’s degree in chemistry from the University of Chicago. Prior to joining the faculty, Ferry was a joint postdoctoral fellow in chemistry at the University of California, Berkeley and the materials science division at Lawrence Berkeley National Laboratory.

Ferry’s research studies the interaction between light and matter at the nanoscale. Research in the...
Ferry group in nanoscale optics addresses many different and diverse applications, from highly efficient and inexpensive photovoltaic devices to tailored light emission in solid-state lighting components and sensitive detection of biological and chemical reactions. In each case, the Ferry group addresses these problems by tailoring the geometry and environment of nanostructured materials and studying the interaction of these nanostructures with light using a combination of optical spectroscopy and theoretical methods.

Ferry’s research particularly focuses on controlling light propagation using metallic nanostructures, an area of research known as plasmonics. Surface plasmons, the coherent oscillation of electrons on the interface between materials with opposite signs of the real part of the permittivity, are commonly found on the interface of noble metal nanostructures and dielectrics or semiconductors. Plasmonic nanoparticles interact with light strongly, producing highly concentrated electric fields at the surface, and scattering cross sections that may be many times larger than their geometrical cross sections. Surface plasmons may also be supported on planar metal films, exhibiting shorter wavelengths than the incident light and allowing for light to be confined in nanoscale dimensions.

Ferry’s research combines nanoparticle synthesis and self-assembly with advanced optical characterization methods, and seeks to correlate observed phenomena to computational predictions. Ferry’s research group works on three distinct areas. [1] Nanophotonics with application to solar energy conversion. In many photovoltaic devices, light absorbed with energies significantly in excess of the bandgap energy is inefficiently converted to electricity and is mainly lost to heat, while light with energy below the bandgap is not absorbed by the semiconductor. The Ferry group is developing methods to use the solar spectrum more efficiently through the use of spectrally shifting and converting nanoparticles, seeking to use luminescent semiconductor nanoparticles to convert and concentrate incident sunlight onto small solar cells. By incorporating nanophotonics into these light concentrators, the light capture cross section can be enhanced and emitted light can be directed more efficiently onto the solar cell. This type of design improves overall efficiency by more effectively using the solar spectrum, and can reduce cost by enabling the use of thin photovoltaics that may be based on rare elements. [2] A second project focuses on tailoring light emission for solid state lighting applications by using nanophotonic structures to direct light emission from films of highly luminescent nanoparticles. To characterize the interactions between plasmonic structures and light emitters, the Ferry group is using state-of-the-art spectroscopic methods to image and characterize light scattering and emission at the level of individual nanoparticles. [3] Nanoscale chirality. Ferry’s group is also studying the emergence of chiral properties when achiral plasmonic nanostructures are arranged into chiral assemblies, with the goal of developing tunable chiral structures that switch handedness in response to external stimuli.

The overall goal of Ferry’s research is to design new optical materials based on an understanding of nanoscale light-matter interactions.

**Jong Seok Jeong, Research Assistant Professor**

Jong Seok Jeong earned his doctorate in materials science and engineering from Korea Advanced Institute of Science and Technology (KAIST) in 2005. He previously held professional appointments as
a senior scientist in LG Chem, a research professor in Sogang University in Korea, and post-doctoral associate appointments at Tohoku University in Japan and the University of Minnesota.

Jeong’s research focuses on sub-Å science via analytical scanning transmission electron microscopy (STEM) especially in material fields such as complex oxides heterostructures, doped nanocrystals, and two-dimensional materials. Fast development of material synthesis and growth requires precise and robust characterization to understand materials science and improve synthetic method for better material properties. There is no doubt that TEM has been a dispensable powerful tool for materials characterization among various characterization tools available. Recently, FEI Titan™ G2 60-300 (STEM was installed at the Characterization Facility of UMN and is now fully operational with the “state-of-the-art” aberration corrector and monochromator from which ~0.7 Å spatial resolution and ~100 meV energy resolution for spectroscopy are obtainable. Thanks to the great functionality of the microscope, the imaging with sub-Å resolution from materials meeting certain criteria is relatively straightforward now; however, acquiring chemical and electronic information from materials with sub-Å level is far more challenging despite the fact that they are critical to analyze material properties. To reach essential science for materials development, we have to keep pursuing to find the key factors to control material properties. Most of these factors, which have not been well understood, are “subtle features” inside the materials. For example, photoluminescence from lanthanide-ion doped nanocrystals (NCs) is mainly governed by the position and chemical state of dopants, and only full understanding of those individual dopant atoms can lead us to achieve desired optical properties from the NCs (Figure 1).

The challenge to unveil the origin of many material properties is primarily associated with the lack of understanding of the subtle features such as interfaces, defects, doping, and strains. The STEM is one of techniques to visualize the subtle feature with enough precision and resolution, and moreover the interpretation of dark-field contrast in the STEM is relatively simple compared to phase contrast in conventional TEM—the heavier the atoms, the brighter the signal and the relatively weak dependence of dark-field imaging on microscope focusing conditions and specimen thickness allowing quantification of the image with little error. In my group, extensive sub-Å-resolution microscopy and spectroscopy studies in a variety of material systems will be conducted to understand these subtle features, establish fundamental knowledge of them, and get desired material properties.

Matthew Neurock, Professor

Future strategies for the production of fuels, chemicals and materials from renewable as well as non-renewable resources require the development of highly active, selective and durable catalytic materials and catalytic processes. The design of robust heterogeneous catalytic materials that can mimic how enzymes carry out such transformations requires a detailed understanding of the atomic scale structure of the catalyst, its environment and how they work together to control catalytic performance. The tremendous advances that have occurred in development of in-situ spectroscopy, atomic-scale characterization, theoretical methods and high performance computing over the past decade provide an unprecedented ability to track molecular transformations and how they proceed at specific catalytic sites and within particular nanoscale environments.

Neurock’s research group is focused on the development and application of first-principle theoretical and computational tools that can simulate heterogeneous catalytic systems under working conditions for the sustainable production of fuels, chemicals and materials. They are developing and using continued on page 18
CEMS has established a strong reputation for its rigorous curriculum, groundbreaking research, and long list of faculty giants (Amundson, Aris, Scriven, among others). However, legends exist among our CEMS staff as well, and their names should be universally recognized. Teresa Bredahl, Jim Pirie, Julie Prince, Marsha Riebe, and Sue Wermager have dedicated their professional lives to the Department of Chemical Engineering and Materials Science and the University of Minnesota. This academic year, all will mark milestone employment anniversaries.

Leading the pack for 40 years

Marsha Riebe and Sue Wermager have each worked at the University of Minnesota for 40 years. Riebe, an administrative staff member, has worked in a variety of offices around the University, including the President’s Office, Humphrey Institute, and Academic Affairs, just to name a few. Throughout her career, Riebe worked extensively with Professor Emeritus and former University of Minnesota President Kenneth H. Keller. Riebe’s dedicated service to the University will be further marked by another significant milestone this year: her retirement in February 2015.

Wermager is also a faithful CEMS staff member, having assisted hundreds of faculty, staff, and students in the Department over the course of her tenure as the CEMS main office assistant. Wermager reflected on the many changes in office technologies over the past 40 years, indicating that she first used a mimeograph machine for large volume copying. A “mimeo” required typing onto a stencil that was wrapped around a large drum filled with ink. Wermager describes the process of refilling the drum with ink as a “total mess!”

Exciting work environment keeps staff motivated

Not far behind Riebe and Wermager is Jim Pirie, a computer analyst, who has worked in CEMS for the past 35 years. Pirie has always been interested in computing, from programming in assembly language to the emergence of personal networking computers in the Department in the 1980s. He enjoys the challenges that working in an information technology office provides. Pirie noted that, “I enjoy coming to work every day. CEMS is a great place to work because it’s exciting, things are changing, and the people are great.”

Steadfast dedication for 30 years

Teresa Bredahl and Julie Prince have been loyal CEMS staff members for the past 30 years. Having both started in the Department around the same time (only five months separate their employment anniversaries), they are often thought of as a dynamic duo. Bredahl, the CEMS office supervisor, has a tremendous amount of responsibilities but carries them out with such ease and experience that operations in the Department appear seamless.

Similarly, Prince, a program associate for graduate studies, has a plethora of duties related to all crucial areas of the graduate student experience. Yet, she seems unfazed by the thousands of applications she’s reviewed over the years or the large-scale recruitment events she plans and executes (among many other tasks). Prince credits her longstanding employment in CEMS to the personal relationships she’s developed, by remarking, “The faculty are easy to work with, accommodating, and appreciative, and it’s rewarding to meet and interact with so many people from different backgrounds. Students often remember us many years after they’ve graduated.”

Our most devoted staff members echo the same sentiment—CEMS is a cherished department because the people (faculty, staff, and students) provide a sense of purpose and add meaning to the work. It’s easy to work for 30, 35, or 40 years in a place where established friendships also feel like family.
CEMS welcomes new staff

The Department continues to expand with four recent staff hires.

Jo Belvedere
Jo Belvedere joins the CEMS community as the administrator for Industrial Partnership for Research in Interfacial and Materials Engineering (IPRIME). She has worked at the University for more than 12 years, starting out in the Department of Earth Sciences. She interned in the Limnological Research Center for a summer and was able to stay on full-time, enjoying every day playing in the lake muds! Unfortunately, as we all know, grants can be fleeting and a funding change prompted her to move on. Since then, she has worked in a number of areas at the University of Minnesota, including AHC Research Building Management, student services in CEHD, and most recently in the Department of Medicine as the program coordinator for two sub-specialty fellowships.

Jo is also an artist, creating beautifully handmade felted items such as hats, mittens, and slippers and she fashions jewelry from recycled (or as they say re-purposed) old and broken jewelry pieces. She sells her crafts at art shows in the Metro area.

Jo has three children; two adult sons and a teen-aged daughter. She and her daughter recently moved to Maple Grove along with their two dogs and two ferrets.

Katie Deno
Katie Deno, an executive accounts specialist for CEMS accounting and payroll, has been employed at the University of Minnesota for almost 13 years. She started in Employee Benefits as a benefit specialist, and after 11 years there, moved to the Law School for a less stressful position after the birth of twin daughters in 2011.

Fathi Ibrahim
Fathi Ibrahim is originally from Oromia, Ethiopia, which is located on the Horn of Africa. He came to the United States at a young age and completed all of his education in the Twin Cities.

A University of Minnesota alumnus, Ibrahim earned his undergraduate degree in computer science. Prior to joining the CEMS information technology office, he worked at North Hennepin Community College. Ibrahim remarked that, "Having the opportunity to serve and support a world-class department for its information technology needs and getting to know the CEMS faculty, staff and students is an extremely rewarding experience."

In his free time, Ibrahim enjoys spending time reading about history, especially the rise and fall of ancient civilizations, the formation of modern nation states, and historical conflicts of the modern era.

Molly Jokimaki
Molly Jokimaki joins the CEMS staff as an office specialist assisting Professor Wei-Shou Hu and other CEMS biological engineering faculty members. Jokimaki recently earned her undergraduate degree in the studies of cinema and media culture, with a minor in cultural studies and comparative literature from the University of Minnesota. As a student, Jokimaki worked at the University of Minnesota Foundation. In her free time, she enjoys spending time with her two dogs, Ralph and Gaston, baking, “nerding” out on her favorite television shows and movies. Jokimaki also fosters dogs for Secondhand Hounds, a local nonprofit organization.
Not your “typical” chemical engineer

Curiosity drives Dr. Navjot Singh’s dynamic career path.

What would happen if you came up with at least one big idea every day—a game-changing idea for disruptive technology that would propel an industry or a company forward? You might be able to include, among your accomplishments, saving a pharmaceutical company a billion dollars, thereby allowing them to become one of the leaders in their industry, or increasing the operating margin by 50 percent for a services organization, or helping a government regulator develop new processes for approvals, continuous improvement and scientific dissent. These are just a few of the accomplishments Navjot Singh (Ph.D. ChemE ’94), managing partner with the Boston office of renowned consulting company, McKinsey & Company, has under his belt.

A career as a management consultant may not be the first thing that comes to mind for someone with a Ph.D. in chemical engineering, but as Singh aptly points out, there is no such thing as a “typical chemical engineer.” He was drawn into the world of engineering because of his affinity for math and science, but also because he “loved the fact that you can build and shape the future.” In his current role as a leader in the Pharmaceutical and Medical Products Practice in North America for McKinsey & Company, he has opportunities to influence the medical and pharmaceutical industry’s future almost daily. “I don’t know what I’m going to be doing six months from now, so I need to shape that. I need to figure out where I can make a difference, what type of work will drive impact for our clients, what are the problems to be solved, and how best to engage with them.”

Upon completing his undergraduate degree from the Indian Institute of Technology, Singh came to the University of Minnesota to study under former department heads Professor Matthew Tirrell and Regents Professor Frank Bates. He was most attracted to the study of polymers and biology, and quickly found himself spending more time with Professor Bates, whom he identifies as an ongoing influence in his career. Singh remembers the high energy Professor Bates brings to his work, and credits him for influencing his own driven and ambitious attitude.

“I was drawn to engineering because I loved the fact that I could build and shape the future.”
—NAVJOT SINGH

Both of his advisors (whom he admired) suggested he consider teaching upon completion of his Ph.D., which Singh declined because he thought it “looked like too much work.” He laughs about this today, as he typifies his job now as even more demanding, but acknowledges that he “loves every minute of it.”

Upon graduating, Singh went to work for General Electric (GE), first as a staff scientist, and later as an R&D manager. He holds more than fifteen patents from this time period, but also had the opportunity to return to school for an MBA at Rensselaer Polytechnic Institute and obtain more exposure to the business side of things. Through his experiences at GE, he discovered that his true passion was at the intersection of science, technology and business. This is what sent him to McKinsey & Company, which he had heard was the consummate place to gain experience.

“I may be the only partner in McKinsey that was hired off the web at that time,” Singh notes. Initially, his application was declined, but unwilling to be deterred, he contacted McKinsey and told them they were making a mistake. Sure enough, he was interviewed and hired. In 2007, he was elected partner in the firm, and then elected senior partner in 2012. He has created a living for himself at the intersection of business and science, possessing the ability
to communicate effectively with Ph.D.’s and M.D.’s leading research and development, as well as individuals in the C-suite. His unique skillset has enabled him to bridge the communication gap between these two groups, and set both on the course of common goals in a number of organizations. Singh credits his training at the University of Minnesota with providing him the skills and confidence to “seek out the big problems, solve them with teams, have fun, and create excitement for yourself and for others.”

Today, he looks to the University of Minnesota to help drive monumental breakthroughs in the future, and calls his fellow alums to action. “I think we have a fabulous department that has done phenomenal things. As University alums, I believe in giving back, monetarily yes, but also in terms of intellectual capital. How are we helping the department become great? How are we helping steer the type of work that goes on?”

Singh resonates with the notion that curiosity drives progress, a theme of the College of Science and Engineering’s Campaign for Science and Engineering, which launched its public phase July 1, 2014. “I was curious about big ideas - not curious for the sake of being curious.” This curiosity is something he tries to pass on. He reports asking his children, “What’s the big idea today?”, and recording their responses in their “idea notebooks.” Curiosity driving progress is a way of life for Dr. Navjot Singh, one that has allowed him to carve out an extraordinarily successful place in the world of management consulting.

Written by Brenna Sonke, College of Science and Engineering External Relations.

Notable Alumni Achievements

Franklin (Lynn) Orr (Ph.D. ChemE ’76) was confirmed by the Senate on December 4, 2014 as the Under Secretary for Science and Energy at the Department of Energy.

As Under Secretary for Science and Energy, Dr. Orr will oversee all of the Department of Energy’s science research programs, including a majority of the national labs. This position is part of the Department’s recent reorganization, which expanded the Under Secretary for Science role to encompass both science and energy. Dr. Orr’s role will include oversight of research in the Offices of Science, Fossil Energy, Energy Efficiency and Renewable Energy, Nuclear Energy, Electricity Delivery and Energy Reliability, Indian Energy, and the Technology Transfer Coordinator.

"Lynn Orr is an outstanding scientist and has successfully led a major multidisciplinary program on energy sources, technology and analysis at one of the top research universities. This experience will serve him well as the DOE Under Secretary for Science and Energy," said Energy Secretary Ernest Moniz. "I look forward to working closely with Lynn to shape the nation’s clean energy agenda, and to sustain American leadership in science. I thank the Senate for approving his nomination."

For almost 30 years, Dr. Orr has been a member of the faculty at Stanford University. In 2009, he helped create the Stanford Precourt Institute for Energy, which he has led since its founding. Before that, he served as the dean of the Stanford School of Earth Sciences and later helped start the Global Climate and Energy project – a ten-year project to research technology options for reducing greenhouse gas emissions from energy use. Dr. Orr has taken part in various studies conducted by the National Academies’ National Research Council. He is also a Senior Fellow at the Woods Institute for the Environment.


President Kaler meets with CEMS alumni in Korea

U of M President Eric Kaler (Ph.D. ’82) met with a group of alumni and friends, including 10 CEMS alumni, for lunch on November 4, 2014. President Kaler was in Seoul attending the Global HR Forum as a featured speaker. A special thank you to Professor Jaewook Nam (Ph.D. ’09) and Dr. Won-Hoon Park (Ph.D. ’71) who helped organize the event.
ab initio quantum mechanical methods, ab initio molecular dynamic simulations, first-principles kinetic Monte Carlo simulations and course-grained molecular reaction engineering tools to connect the atomic-scale catalyst structure, morphology and reaction environment to catalyst performance and aid in the design of new catalytic materials. Their efforts are focused on the conversion of biomass to fuels and chemicals, electrocatalytic oxidation of water and the electrocatalytic reduction of CO\textsubscript{2} to fuel intermediates, the activation of methane and light alkanes to olefins for fuels and chemicals, the selective hydrogenation and selective oxidation reactions for the synthesis of fine chemicals and pharmaceuticals and selective C-C bond formation and hydrogen transfer paths used in the production of fuels. These reactions are carried out over a range of different catalytic materials including supported metal and bimetallic particles, metal oxides, metal sulfides, metal carbides, microporous materials such as zeolites and hybrid inorganic/organic systems.

Controlling the molecular transformations that occur over these materials requires a detailed understanding of the active site as well as the environment in which the active site resides under actual operating conditions. Neurock’s group is working to determine the effects of metal particle size and shape, surface composition and atomic arrangement of bimetallic and ternary metal surfaces [see Fig. 1], adsorbate surface coverages, metal support interactions and the role of solvents and electrochemical potential on catalytic performance of supported metal particles; develop structure-property relationships; and aid in the design of more active and selective catalytic and durable catalytic materials. Similarly they are exploring the influence of acid site strength, pore size and pore topology and composition for zeolites and other solid acid materials [see Fig. 2]; and surface structure, termination and topology mixed metal oxide, sulfide and carbide catalysts on their catalytic performance. They work closely with different experimental groups to provide a strong synergy between theory and experiment and to guide the development of new catalytic materials and catalytic conversion strategies.

**New faculty enhance department**

With these five recent faculty hires, CEMS is poised to make remarkable breakthroughs in some of the most cutting-edge areas of research, including stem cell and tissue engineering, renewable fuels and chemicals, solar energy conversion, atomic-scale microscopy, and heterogeneous catalysis. Our newest faculty members will not only enhance the innovative research being conducted in the department, but also better serve our students as CEMS continues to thrive and expand.
IN RETROSPECT

CEMS past and present

Former student Jonathan Anderson interviews 101-year-old CEMS alumnus Milan Johnson.

Call it a coincidence or evidence of fate, but when former student Jonathan Anderson learned that his mother was overseeing care for Milan Johnson [ChemE ’37], a 101-year-old resident of Mount Olivet Nursing Home in Minneapolis, he wanted to learn more about Johnson’s experiences as a student. The interview (below) occurred in September 2014, and Johnson remains the only male resident at the nursing home over the age of 100.

When did you graduate?

I graduated in 1937.

I parked behind the School of Mines and walked across the mall to get to the buildings I had classes in.

A funny thing was that I was listed as a civil engineer in the graduation register, but my diploma said chemical engineering. I received a letter of apology afterwards from the University for their mistake.

What was campus like in 1937?

There were no skyscrapers at all in Minneapolis except for the Foshay Tower. Campus was much smaller then, and Northrop Auditorium (not called that at the time) was the northernmost point of campus. Classes were also held six days a week. I had foundry class at 7:30 a.m. on Saturdays.

What professional positions did you have after college? How was the job market at that time?

The depression was still going on at the time (1937) and jobs were scarce. I took a job with Minnesota Gas, as they needed help changing Minnesota heating over to natural gas instead of heating oil. I worked at that for a year until changing to work in Connecticut for a foundry that made valves (anything from small check valves to two-foot diameter gate valves). These valves were used in the war effort (WWII) and the job made use of my foundry class skills. This job had some nice perks too. Gas rationing happened during WWII and at the worst times, the limit was two gallons per week. I had a C-card for work (I had to drive around to customers for war-business purposes) which allowed me to buy as much gas as I wanted to. At one point I drove over into New York City for the weekend for fun and I was the only car on the road! It certainly has changed a lot since then.

I then switched to work for the Dorr Company in Connecticut. I did work with them on improvements in sewage processing and water clarification. They transferred me down to Cleveland and I worked there for a bit before starting another job at Goodyear (moved to Los Angeles) where I worked on formulations with rubber compounding. Every batch of virgin rubber was different and had to be tweaked and altered so that they all came out the same for making good tires.

Shortly thereafter, I got a job with United Technological Center [UTC] in San Jose and worked on a team that made the solid rocket boosters (Titan III-C Rocket) for the first American space craft. The boosters were 20 ft. in diameter and 20 ft. tall. When they tested them near San Jose, they created a plume of smoke 3,000 ft. tall! The boosters traveled by rail to Cape Canaveral, Florida where they were ultimately used with success. They [UTC] moved manufacturing to Florida shortly and continued working until the contract was up. That lasted for six years.

After that, I worked for General Electric, making nuclear and non-nuclear bomb enclosures. I started managing more and more after the initial few years and did less technical engineering work. Most of my jobs were in San Jose or Los Angeles, California.
With strong foundation, CEMS continues to

1949

An architectural rendering of what would be Amundson Hall (above) and construction of the new building [above] in 1949. Images courtesy of the University of Minnesota Archives.

2012

Perkins+Will architectural rendering of a renovated Amundson Hall and Gore Annex addition.


2014


The Gore Annex takes shape in February 2014.
build a lasting legacy of success

1951

Construction of Amundson Hall was completed in 1951. Image courtesy of the University of Minnesota Archives.

1957

A new gamma ray facility opened in 1957 during construction of the Mines and Metallurgy building. Image courtesy of the University of Minnesota Archives.

2013

Excavation occurs in June 2013 to make room for the Gore Annex.

The building’s windows feature the first outdoor application of 3M’s dichroic film product, which cast an iridescent display of colors. Photo credit to Morgan Sheff.

Major renovations to Amundson Hall included the installation of new energy efficient windows. Photo taken in July 2013.

The Gore Annex adds much-needed space for educating future scholars and scientists.
1964

Paul S. Chow [MS ChemE '64]. I attended the CSE 50-Year Reunion, with my wife, Anita. We really enjoyed the events and the campus tour. It was a great honor to see Amundson Hall, home to a prestigious, top-ranked department.

After entering the Department for the 1962 winter quarter, I had taken the course on Transport Phenomena including fluid mechanics, heat transfer and mass transfer, taught by Professors W.E. Ranz, L.E. Scriven, and H.S. Isbin. I also completed the course on Applied Math in Chemical Engineering, taught by the Dept. Head and Regents Professor N.R. Amundson. I was fortunate to take these courses from these talented professors, who started to move the Department on its way to prominence. I am also very grateful to Professor Ranz and Visiting Professor Howard Brenner as my advisors.

My first job upon graduation was working on research and development of fuel cells at the R&D Laboratory of Gould National Batteries in Minneapolis. In 1967, through AIChE, I got a job offer from Nuclear Energy Division of General Electric Co. in San Jose, California, and then I spent most of my career with GE. As a Process Engineer in the Nuclear Fuel Department, I worked on process design and startup of chemical and ceramic operations of a new fuel manufacturing plants. As a Manufacturing Engineer, I performed process development in a pilot plant and design of a production plant. Then, as a Design Engineer, I took part in startup testing of a new fuel reprocessing plant and design of an expansion plant. Then I joined Advanced Reactor Systems in Sunnyvale, California as a Senior Engineer for the systems and components of advanced energy systems including Liquid Metal and High Temperature Gas Reactor.

My wife and I have one son and a daughter. Both our son, Eugene, and his wife, Fotina, earned their Ph.D.’s from Stanford University, in electrical engineering and environmental engineering, respectively. He works for PARC in Palo Alto, a subsidiary of Xerox Corp., and is now leading a team of Ph.D.’s on interdisciplinary research on MEMS [Micro-Electro-Mechanical Systems]. “Micro Chiplet” was reported in the recent September issue of MIT Technology Review. She is an Associate Professor at UC-Berkeley and received a Presidential Early Career Award for Young Scientists, the highest in the nation, for her work on atmosphere fluid mechanics. They have two children (ages 6 and 2). Our daughter, Charlene, earned undergraduate degrees from UC-Davis and San Jose State University. She has served as a grade school teacher and showed her paintings at several art galleries. Her husband, Justin, received a Ph.D. in environmental biology from UC-Santa Cruz. He is now working for Santa Fe Institute in New Mexico. His research on Tsavo Lions in Kenya—using samples from the Field Museum in Chicago—was published in Proceedings of National Academy of Sciences. They had a baby girl in November 2014.

My wife and I are both retired. We keep ourselves active, physically and mentally. In recent years, I have been intrigued by the great potential of solar energy— and have taken classes in solar cell design and photovoltaics for possible professional and household applications. I am an avid tennis player, enjoy reading, and participate in golf and swimming. My wife and I are enjoying our grandchildren and also spend some time traveling. We are having wonderful golden years!

1983

Robert M. Siegfried [Ph.D. Metallurgy and MatSci ’83]. My wife, Kathy, and I celebrated our 20th anniversary in November. An even bigger landmark occurred this past year with our son, Jason, who turned 18 in April and graduated from Oceanside High School. He started Adelphi University this past fall as a computer science major [so far]. It’s a little mind-blowing that I have a son who is legally an adult, but given that some former classmates and other contemporaries are grandparents already, I can’t really talk.

I’m still teaching computer science at Adelphi (that just MIGHT have influenced Jason), and have completed 15 years at Adelphi after 11 years at Saint Peter’s College [now St. Peter’s University] in Jersey City, New Jersey.

2000

Wijaya Martanto [ChemE ’00]. I obtained my Ph.D. in chemical engineering from Georgia Institute of Technology in 2005 and worked at INTEL Corporation as a senior process engineer from 2005 until 2010.

I joined Duke-NUS Graduate Medical School [Singapore] in 2010 and recently [May 2014] graduated with an M.D. degree (a joint degree from Duke University and National University of Singapore). I have also been matched to the Ophthalmology residency training at the National University Hospital in Singapore.

CEMS alumni, we’d like to hear from you! Please send us an update of your personal and professional achievements via email to cemsalum@umn.edu.
Remembering Frank Snowden

In Memoriam


Robert C. Bradley (MetalEng ’49) on July 16, 2014.

Alan Taylor Gorton (MetalEng M.S. ’61, Ph.D. ’63) on July 11, 2014.

Calvin D. Loyd (MetalEng ’50) on Aug. 4, 2014.


Bernard Russell Queneau (Ph.D. Metallurgy and Materials Science ’36) on December 7, 2014. Queneau was 102 years old at the time of his death.

James Matthew Riley (ChemE ’57) on Nov. 15, 2014.

Robert S. Schechter (Ph.D. ChemE ’58) on Oct. 8, 2014. Schechter was a member of the National Academy of Engineering and spent 41 years as a faculty member at the University of Texas-Austin.

Dr. Frank W. Snowden, age 74, passed away on May 22, 2014 after a courageous fight to overcome complications following a heart attack. He is survived by his loving wife Sue Nauschultz, devoted daughters Stephanie and Caroline Snowden, granddaughter Sydney, loyal sister Anne Turnbull, and other extended family members. Frank was a beloved husband, father, grandfather, brother, uncle, friend and mentor.

Snowden served as Associate Director of Education and Human Resources in the Materials Research Science and Engineering Center (MRSEC). He was an esteemed educator and scientist who inspired many students at the University of Minnesota, at the Science Museum of Minnesota, and through his work with the National Science Foundation. His warmth, dedication to family, passion for learning, and extraordinary intellect will be sorely missed. His caring spirit lives on in the hearts of those who know and love him.

“Frank brought CEMS and the MRSEC a lifetime of experience in dealing with the intersection of underrepresented students and the University setting. He possessed extraordinary skills in guiding undergraduate and graduate students through often difficult transitions. His vision for the highly successful outreach activities in MRSEC, including the innovative Native American and REU (Research Experience for Undergraduates) programs, played pivotal roles over 16 years of funding including four competitive award periods. Frank was characterized by a unique blend of wisdom, knowledge and compassion for everyone with whom he interacted. When his colleagues needed reason for optimism, he delivered,” said Frank Bates, former CEMS department head and Regents Professor.

Timothy Lodge, Regents Professor and Director of MRSEC, commented that, “Frank Snowden guided the University of Minnesota MRSEC Education and Outreach Program with remarkable talent and dedication. His skills and achievements were well known and well recognized throughout the National Science Foundation in general, and the 25 MRSECs nationwide in particular. The ongoing strength of our MRSEC undergraduate and K-12 programs is a testament to the care with which they were designed and assembled by Frank Snowden.”
Missed the Gore Annex grand opening event?

Check out these videos:
http://z.umn.edu/cemsgrandopening

http://z.umn.edu/cemsremarks


After a 20-month construction period, the Gore Annex is open to CEMS students, staff, and faculty members.