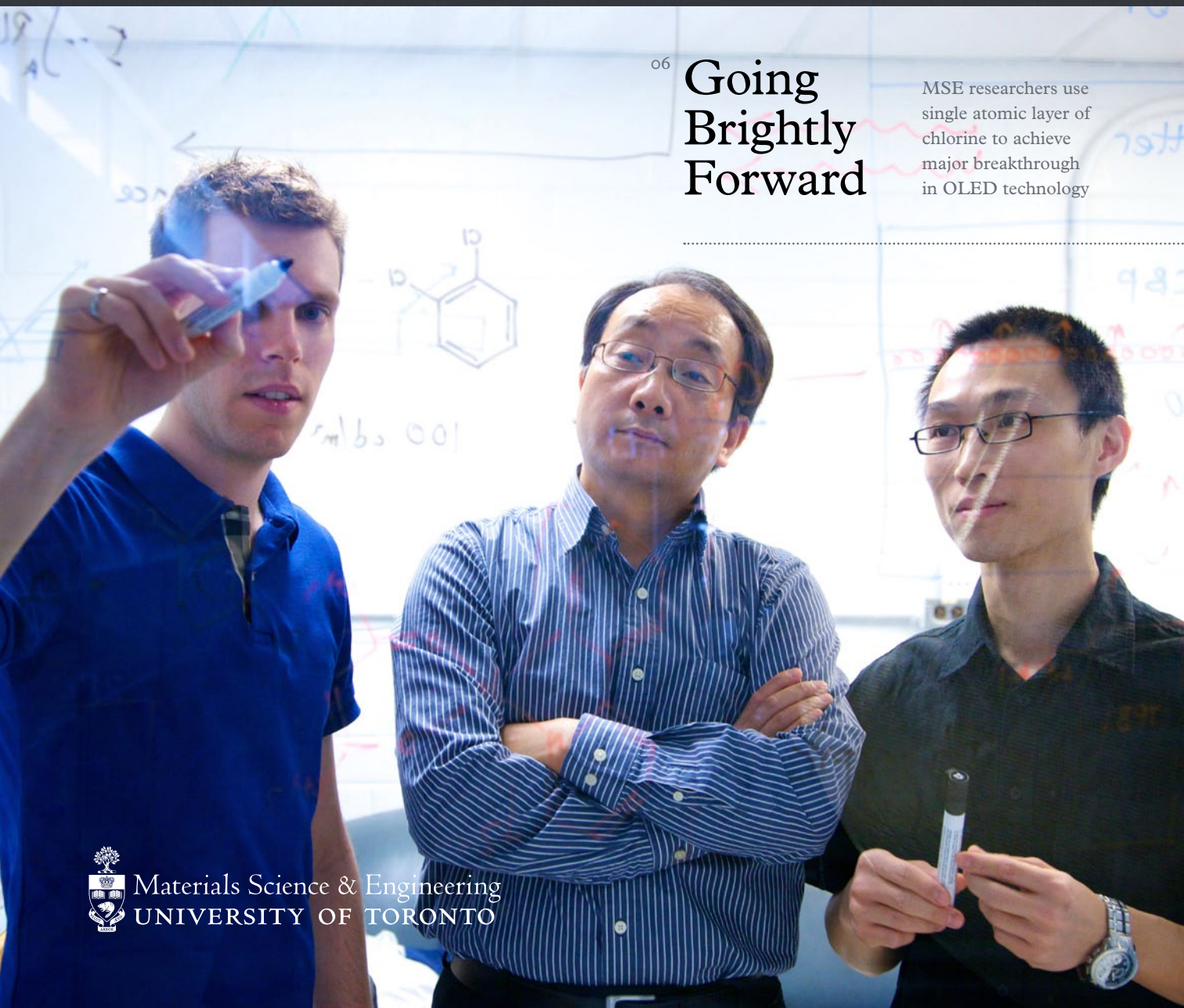
impact

Alumni & Industry Magazine
Materials Science & Engineering, University of Toronto
Volume II, 2012



Materials Science & Engineering
UNIVERSITY OF TORONTO

Publisher's Letter

When I look around and think about what makes our department such a vital place, the bottom line is—it's the people. The exciting research, the new initiatives we are planning for teaching, our talented students, and the connections we have with our alumni, industry, and the greater community. In the end, it all comes down to the experiences we share and the relationships we foster with one another.

In this issue, I chat with two of our preceding Chairs, Professor Emeritus Alex McLean and Professor Doug Perovic to get their perspective on leadership of our department and our discipline. We also bid adieu to Professor Tom North, who shares his thoughts with us before his retirement at the end of 2011. In another feature, we continue to highlight people of MSE in a story about our women faculty and alumnae, their accomplishments, the bonds they have made in their lives and careers, and the paths they have forged for future generations.

Our cover story features Professor Zheng-Hong Lu and his Organic Optoelectronics Research Group in, "Going Brightly Forward." Having recently achieved a major research breakthrough in OLED devices, we see how the dedication of our faculty and the talent of our students can make an impact on the future of lighting and display technologies.

Welcome back to the second edition of Impact, and I hope you enjoy this look into MSE as reflected through the people of our community.

Jun Nogami, PhD, FAAAS, PEng
Professor & Chair

impact
Alumni & Industry Magazine

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Impact is produced with partial support from the Ontario Research Fund–Research Excellence (ORF–RE)

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Shine On

A follow-up with Professor Nazir Kherani and the Advanced Photovoltaics & Devices group

by Anna-Kaisa Walker

On a recent summer day driving through cottage country in northern Ontario, Associate Professor **Nazir P. Kherani** (EngSci 8T2, ChemE MASc 8T3, Physics PhD '94) was struck by an unusual sight: electrically self-sufficient homes.

"They had solar panels and small wind installations, with no power lines connecting them to the conventional grid," he says. "It was encouraging to see."

Seeing small changes like these are part of what inspires Kherani and his team, the Advanced Photovoltaics & Devices (APD) group. Their goal is to develop new advanced materials that will increase the efficiency and lower the cost of solar energy. Since their feature in Impact last year, the team has helped make progress toward grid parity—the point at which solar and conventional power are cost-equivalent.

"Canada's energy needs continue to increase and the price of conventional energy keeps going up," Professor Kherani says. "If we can begin to see renewable forms of energy pick up some of the load, it will ease the demand on conventional sources."

In April 2011, the group published a patent on a novel class of transparent and conductive nanocomposite materials, consisting of tiny silica nanospheres coated with a special transparent conductive material. Because the interconnected pores between the spheres are so small—only 5 nm wide—they do not scatter visible light, making the film appear similar to glass. In the not-so-distant future, a window could not only let in light but harness energy from the sun to power the building.

"These materials have the great potential to enhance the performance of optoelectronic devices," explains MSE PhD Candidate, **Paul O'Brien** (MSE 0T2, MASc 0T7), who has been at the centre of this research and will be receiving his doctorate later this year. "By removing some of the limitations on charge transport through porous nanostructures, we can increase their efficiency."

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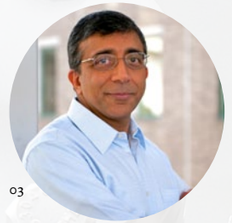
Images by Maloney Aguirre, photographica



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01. L to R: Basia Halliop (ECE MASc 0T8, PhD Candidate) and Anton Fischer (ECE MASc 1T0)

02. L to R: John Zhu (MSE MASc Candidate) and Paul O'Brien (MSE PhD Candidate)

03. Associate Professor Nazir P. Kherani (ECE/MSE)

Thanks to the APD group's work, they were invited to join the NSERC Smart Net-Zero Energy Buildings Research Network, an initiative devoted to integrating renewable forms of energy together with energy efficient technologies to design buildings that on-the-average consume zero energy by relying on on-site energy generation as well as smart materials and systems.

"We're developing novel optical materials that would make net-zero energy buildings practical," Professor Kherani says.

Meanwhile, working closely with industry and other research institutes, the APD group continues to forge links at home and abroad. The team has active collaborations with the University of Paris, fostering an ongoing exchange of PhD students. Earlier this year, Professor Kherani was invited to speak of his group's research at the Canadian Association of Physicists' meeting in St. John's, Newfoundland, and on optoelectronic applications of the novel materials at the IEEE International Conference on Nanoelectronics in Taiwan.

"Our objective for the coming year is to continue developing these technologies," Professor Kherani says. "Taking them to the next step—integrating the novel materials into device applications—is what will help us position it to industry."

To read more about the APD group, including the original feature from Impact Volume I, "Ray of Light," visit www.mse.utoronto.ca.

Chairs' Talk

Q&A

Doug Perovic, **Alex McLean** & **Jun Nogami** sit down for a discussion about dedication, leadership, and change.

Professor **Jun Nogami** (EngSci 8To) is the 8th Chair of the Department of Materials Science & Engineering. He succeeds a long line of distinguished leaders since the establishment of Department Eight, Metallurgical Engineering, in 1913.

Here, the current Chair takes a moment to talk to two of his predecessors, Professor Emeritus **Alexander McLean** (Chair: 1992–1997) and Professor **Doug D. Perovic** (MMS 8T6, MASc 8T8, PhD 9To; Chair: 1997–2008) about dedication, leadership, and change.

JUN NOGAMI: In 2013, the Department of Materials Science & Engineering will celebrate its 100th anniversary. As we approach our centenary, what would you say was one of the most transformative moments in our Department's history?

ALEXANDER MCLEAN: The appointment of Professor Lloyd M. Pidgeon as Department Head in 1943 certainly comes to mind. During his tenure, 77 students graduated with PhDs. Many of these alumni went on to occupy leading positions within academia and industry and had a major impact on the metallurgical and materials engineering community throughout Canada and abroad.

DOUG D. PEROVIC: Although there are a number of seminal events in MSE's past that could be noted, I'd like to highlight a moment experienced first-hand. During my time as Chair beginning in the late 1990s, strategic planning initiatives led by the University's central administration generated forces that would discontinue our undergraduate program and ultimately close the department. News of our uncertain future spread quickly around the world during a time when Metallurgy/Materials programs were being threatened or eliminated at many institutions. In order to harness external perspectives and lobbying power, the first Departmental External Advisory Board in the Faculty was created, bringing together many of Canada's most decorated leaders from industry, government and academia. At the first meeting, the Board took off their jackets, complete with Order of Canada pins, rolled up their sleeves and proceeded to help change the course of MSE's future and solidify one of Canada's leading training grounds for materials engineering teaching and research.

JN: What attracted you to a career in MSE?

AM: In my final year of high school, my father asked me what I planned to do when I left school. I mentioned I would like to be a painter. He asked, "You mean an artist?" I replied, "No, just a painter, somebody that paints walls. When you finish you can look back and see the difference you have made." My dad responded, "Well, you don't need to go to university to be a painter of walls!" Then he asked me, "What subjects do you like at school?" "Math, chemistry and physics," I replied. "Well you should study Metallurgy. I'll arrange for you to visit Colvilles Steel Company and you can discuss it with one of their metallurgists." So he did, and I was blown away.

"… people are more important than publications, and relationships are more beneficial than results."

The thought of studying chemical reactions between liquid steel, molten slags and refractory materials at 1600°C was fascinating. That year, I joined the Metallurgy Department at Glasgow and the rest is history!

DDP: In high school I liked both physics and chemistry and started at U of T in the Physics program. After one year I realized I wanted to do more than pure physics and looked into electrical and mechanical engineering. I recall reading through the Faculty's recruitment pamphlets of the time and what caught my attention in the MSE description was the statement: "studies in metallurgical and materials engineering are founded primarily on math, chemistry and physics." This was long before the term 'interdisciplinary' learning became fashionable leading to fields such as nanotechnology. MSE was ahead of its time! Following undergraduate summer work terms with professors Al Miller, George Weatherly and Ursula Franklin, I was hooked!

JN: What makes a great leader and a dedicated follower?

DDP: A great leader empowers and motivates all members of his/her team by respecting and trusting every person with reasonable responsibilities and expectations for which they are duly rewarded. Dedicated followers will emerge because they want to and not because they have to follow. One should be serious about their work but not take oneself too seriously—to develop respect, build trust and have fun. It has been said, laughing is an instant vacation …

AM: A great leader is characterized by a passion for his/her profession and what can be accomplished through working with dedicated followers. A successful leader provides inspiration for those around them to excel and give off their best. When I moved to U of T in 1970, I had the opportunity to work with Professor Benjamin Alcock, who had joined MSE from Imperial College the previous year as the succeeding Department Chair to Professor Pidgeon. I benefited substantially from his inspirational leadership. He was not only an internationally recognized author and innovative researcher, but also a good friend and wise councillor. I have learned over the years that people are more important than publications, and relationships are more beneficial than results.

JN: Teaching methods have changed in major ways over the past 20 years. In an age of instant technological stimulation and gratification, how do we best engage our students?

AM: I believe it is very important that our students spend time in labs where they can experience hands-on activities with materials processing facilities as well as modern characterization and property evaluation techniques. Our 4th year students must complete a one-year design and research project which provides an introduction to current materials research, interaction with industry, and a possible bridge to graduate school. In the early '70s, our final year students used to spend one week at the ORF Pilot Plant (now Process Research Ortech), working around the clock in three, eight-hour shifts, processing fifteen tons of iron ore using various metallurgical processing techniques, ending up with reduced iron as a product. This provided a marvelous opportunity for students to learn the importance of data recording and working as members of a team in addition to hands-on experience with industrial-type operations.

DDP: Competition with the plethora of gadgets available to students is becoming increasingly difficult. In an age of advanced graphics, virtual reality and portable social networks, chalk talk just does not seem to engage students like it once did. I have found that instead of hyping up lectures using advanced entertainment technologies, it is much more effective to share real world, personal experiences, with passion and emotion, in order to transmit wisdom to young minds and help them see into the future.

Heads/Chairs of the Department of Materials Science & Engineering

Professor Jun Nogami, 2009–present
Professor Doug D. Perovic, 1997–2008
Professor Alexander McLean, 1992–1997
Professor W. Alfred Miller, 1981–1992
Professor James M. Toguri, 1976–1981
Professor C. Benjamin Alcock, 1969–1976
Professor Lloyd M. Pidgeon, 1943–1969
Professor George A. Guess, 1913–1943

Professor Zheng-Hong Lu examines latest OLED design

Going Brightly Forward

MSE researchers use single atomic layer of chlorine to achieve major breakthrough in OLED technology

by Anna-Kaisa Walker

Like many other scientific discoveries, this one came by way of a happy accident. It took an open bottle of cleaning solvent and a little serendipity to produce a new way of manufacturing the most efficient, cost-effective and environmentally friendly flat-panel display technology ever made.

Vanier Canada Graduate Scholar **Michael G. Helander** (EngSci 0T7) and **Zhibin Wang** (MSE MASc 0T8), both MSE PhD Candidates in the Organic Optoelectronics Research Group, were using a UV ozone chamber to clean sheets of indium tin oxide (ITO)—the industry standard material used in all flat-panel displays—when they noticed a curious effect.

"We suddenly noticed that the ITO became much more efficient than it should have been on its own," says Helander. "We had to investigate."

They then discovered that it had picked up molecules of chlorine from a nearby bottle of dichlorobenzene—a cleaning solvent they were using.

From there, Canada Research Chair (Tier I) in Organic Optoelectronics Professor **Zheng-Hong Lu**, Helander and Wang went on to engineer this discovery into a way of drastically reducing the complexity of organic light-emitting diode (OLED) devices. Depositing a one-atom thick layer of chlorine onto ITO, they could maximize the display's efficiency with just one or two organic layers, instead of the 4 to 5 used in current—and costly—industry practice.

"With OLEDs, the major challenge has always been brightness," explains Lu. "That's why this technology is a major step forward—we've achieved high brightness at a high efficiency."

Testing their chlorinated OLEDs against conventional ones, they found Cl-OLEDs attained a record efficiency of 50% at 10,000 candelas per square metre, brighter than a conventional fluorescent light at 8,000 cd/m² and twice as efficient as traditional OLED devices. This represents an overall energy savings of 20 to 50% for flat-panel displays.

The team published their findings in the May 20, 2011 issue of Science, titled "Chlorinated Indium Tin Oxide Electrodes with High Work Function for Organic Device Compatibility." Several technology blogs immediately picked up the article, including the popular Engadget, calling it "good news for manufacturers, but even better news for consumers."

"… this technology is a major step forward—we've achieved high brightness at a high efficiency."

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01. Michael G. Helander, MSE PhD Candidate & Vanier Canada Graduate Scholar

02. Zhibin Wang, MSE PhD Candidate

03. Cl-OLED prototype panel

While it will likely be a while before OLED televisions end up in most Canadians' living rooms, it will soon be easier for manufacturers to cost-effectively bring them to market. As things stand, because of the complexity of multi-layer devices, the chance of defects making their way into the product is high, Helander says. Only a fraction of screens made by any given manufacturer work, making the process very expensive.

"Reducing the number of manufacturing steps and equipment ultimately cuts down on the costs associated with setting up a production line," says Lu. "This effectively lowers barriers for mass production and thereby accelerates the adoption of OLED devices into mainstream flat-panel displays and other lighting technologies."

Researchers have tried to improve the efficiency of ITO for years, he says. While using chlorine allows for improved injection of electrical charge, the hazards posed by chlorine gas made the element very difficult to work with—until Lu's team found a better way.

"Using UV light, we can safely liberate chlorine atoms from the inert dichlorobenzene solvent molecules," Helander says.

The team's breakthrough caps over a decade of work that began after Lu joined the Department of Materials Science & Engineering in 1998. "At the time, OLEDs were a completely new area of research," he says.

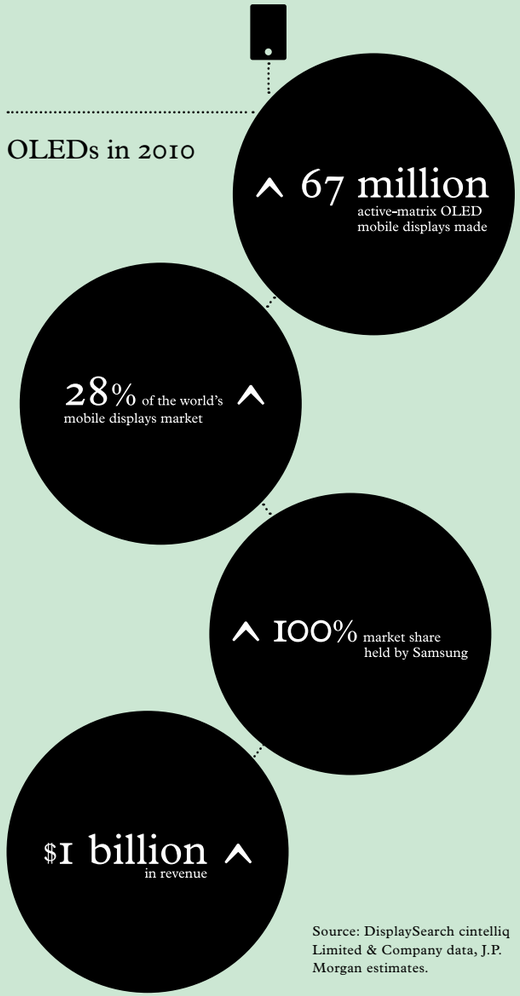
In 1987, Eastman Kodak first pioneered the technology, which at a basic level consists of an electroluminescent layer of organic compounds sandwiched between two electrodes. As demand for thinner, lighter and more energy-efficient electronics grew, OLEDs were soon hailed as the wave of the future. While only a handful of consumer products—such as Samsung's Galaxy S series of smartphones—are currently available, companies are rushing to bring more to the market.

It's been predicted that the technology will be used in everything from small-screen electronics to billboards, architectural applications and even flexible displays that can be rolled up or folded. Solving the efficiency problems of ITO brings the future one step closer, given that the material is industry's transparent conducting material of choice, despite its poor compatibility with OLEDs.

Lu has previously published numerous research papers on OLEDs, including hybrid organic-inorganic optical upconverters for infrared imaging and detection, as well as new ohmic cathode and electron transport materials and new metal anode and hole injection structures for OLEDs.

With the latest development, he estimates the new Cl-OLED technology will be in use commercially in two to five years. While the team is looking forward to working with industry—they have filed a provisional patent and have fielded many inquiries from prospective partners—the most exciting aspect, Lu says, is finding new ways to reduce our impact on the environment.

"With every new technology, we're always looking at the ways it will improve our lives," Lu says. "Health and environmental issues—especially reducing our carbon footprint—are very important to our work. They've been part of our strategy from the beginning."



Source: DisplaySearch cintelliq Limited & Company data, J.P. Morgan estimates.

MSE Welcomes New Faculty

Chandra Veer Singh
Assistant Professor

The Department is delighted to welcome Dr. **Chandra Veer Singh**, Assistant Professor. Having obtained his PhD in Aerospace Engineering from Texas A&M University, Dr. Singh will join us in fall 2011 after completing a post-doctoral associate position with the Computational Mechanics & Materials Group in the School of Civil & Environmental Engineering at Cornell University.

Dr. Singh's expertise is in the area of Computational Materials Science. Using computer simulation, his lab will employ atomistic modeling techniques to develop a further understanding of deformation and failure mechanisms in a variety of engineering materials. Working with a team, his research objectives look to solve concurrent failure issues in many of today's applied materials and to help improve their performance limits.

Some teaching plans are also in the works: Dr. Singh plans to introduce new courses in Computational Materials Science and Atomistic Modeling of Materials.

"I am excited to join U of T because of its world-renowned engineering programs, multicultural heritage, and highly collaborative environment" says Singh. "I hope to make a positive contribution to the University community."

Fare Thee Well a While

Professor Tom North on his retirement

by Robert Hercz, EngSci 7T9

After 25 years with the Department of Materials Science & Engineering, Professor Thomas H. North announced his retirement, effective January 1, 2012, last April. Although his health was a factor, the 67-year-old is robust and energetic during an interview in his Wallberg Building office. His Glaswegian accent sounds as thick as the February day in 1979 when he arrived in Canada, and to converse with him is to get your fill of it, for he's rarely at a loss for words—except when discussing retirement.

"I'm getting attuned to being … what's the word? …"—he inserts the longest pause of our talk, three or four seconds—"… *out of commission.* I'm no longer on the battlefield."

It's an apt metaphor. Amongst the awards and citations that cover his office walls are framed prints of cavalries charging and men in uniform. "My father was in the army for 25 years," he explains. "I've never believed in a defensive strategy. I've always preferred the concept of the attack."

North's carpe diem approach has served him well. In 1979, when Margaret Thatcher came to power, he decided "it'd be so much nicer to watch her from 2,000 miles away," and left Scotland for Canada. The life of an immigrant was hard at first—"the pressure's unbelievable; there is no safety net"—but it's a decision he has never regretted. "Three years later to the day I was a Canadian citizen."

After seven years in industry he was appointed to the NSERC Chair in Welding and joined the University of Toronto. His first discovery was that the ivory tower's easy life was pure myth. "I found the stress level at the university was much higher than industry. It's the guy you meet in the mirror in the morning who really upsets you, the guy who asks, 'What did you do, did you deliver?' It's a self-applied pressure."

A quarter-century later, however, North says the jump from industry to academe was the best move he ever made. "There's only one place to be, that's my feeling as I look back: very happy that I was here, privileged to be here," he says. "I have real trouble considering this job as work."

The topic is important to him, and he warms to it. "I can play classical music anytime I like. I can put all this stuff on the wall. That's why I hated industry. You couldn't put music on, you couldn't put things on the wall. You could be thinking"—he assumes a feet-up, head back, eyes closed pose—"and the boss arrives and says you must be doing nothing. What I love here is that I have freedom. That's the pleasure of the university. That is the university."

Most people measure universities by research output. Not Tom North. "I've always viewed it from a European perspective. I know we've got to do research and I know we've got to get funding, but let's be clear—we produce people."

His specialty is in welding and joining of materials such as metals, ceramics, and polymers, but when asked for the highlights of his research career, he can only summon a few muttered words—"new processes, friction stuff"—before giving up. "The truth is that's irrelevant," he says firmly. "What gives me a kick is that the key professorships in my field in Waterloo and Alberta, they're my former doctoral students. The professors at Hiroshima, Osaka, Tohoku, Kitami—these are all our guys, the people I've mentored."

"I know we've got to do research and I know we've got to get funding, but let's be clear—we produce people."

And they're coming back, he adds with pride. A few days after our talk, his former students will arrive from Japan, Korea, Switzerland, Austria and Canada, for an "inter-university research seminar," which North admits is really an excuse for "a big party at my house." The bottles of (what else?) old Scotch whisky are already lined up and waiting.

"I wouldn't like to be remembered for the research, but the people," Tom North concludes. "What really is important is who did you educate, do they still talk to you, do they send you an email at Christmas? The human connection. That's why these guys are coming."

Women of MSE Generations of Trailblazers

by Anna-Kaisa Walker

Ursula M. Franklin
University Professor Emerita

Mary Ruggiero
MMS MASc 7T9, PhD 8T3

Nicole Martin
MMS 7T9

More women are working as materials engineers than ever before. We asked a few of our faculty and alumnae to talk about their inspirations and role models.

When **Ursula Martius Franklin** became full professor of Metallurgy and Materials Science in 1973, she was the first woman in the Faculty of Applied Science & Engineering to hold that position. An experimental physicist and founding expert in the study of archaeometry, the application of modern materials analysis to archaeology, her research and teaching established a network of interdisciplinary collaboration between academic and cultural institutions, winning her membership as a Fellow in the Royal Society of Canada (FRSC).

Now 90, she is one of the University's most decorated faculty members, having led a long and storied life as a pacifist, humanist, author, educator and advocate for women, with many awards to her name, including the Order of Canada, the Pearson Medal for Peace, the Governor General's Award and numerous honorary degrees. In 1984, she was the first woman appointed University Professor, the University of Toronto's highest academic rank.

She forged a path for many other women in science and engineering, and continues to inspire young people today. But she can still vividly recall how it felt to be the only woman in the room. As one of the only female scientists in her field, the isolation she experienced in her early career only increased her determination.

"It was the absence of women that inspired many of us to persist," recalls Franklin." "We felt we had to hang in there so that we could be around when younger women came to ask us, 'What can I do, and how can I do it?'"

Confronting stereotypes, demanding rights

According to Statistics Canada, the percentage of engineers who are female has doubled since the early 1980s, thanks in large part to the women scientists and engineers who had broken through barriers a generation before. Dr. **Mary Ruggiero** (EngSci 7T7, MMS MASc 7T9, PhD 8T3), vice president of research and development at Datec Coating, says Professor Franklin was the person who inspired her to pursue materials science & engineering.

"I took her course in ancient materials and anthropology, and I was fascinated by her perspective on technology—that it has everything to do with culture," says Ruggiero, who has 28 years of experience in research and development. "She is incredibly articulate, and I wanted to be like her."

But after graduating with her doctorate and taking her first job at an electrical manufacturing start-up, Ruggiero found herself alone in a male-dominated workplace. "When I first started working in industry, I was the only woman at my level," she says. "It was really hard—I had to forge my own way. I spent a lot of time learning things on my own. If I could do it over again, I would seek out more help from others."

Nicole Martin (née Baines; MMS 7T9), corporate ratings director for Standard & Poor's, began her career in nuclear energy at Ontario Hydro, where she says there were many programs in place to promote gender equality and encourage women engineers.

There was, however, one conversation with a workshop supervisor that stood out in her mind. "I was talking to him about how difficult it was to get promoted as a woman—you needed to have operations experience, and few women managers got hands-on training at the power stations," she recalls. "He told me that he felt he had to protect women from a 'harsher environment,' so he never gave them operations responsibilities."

"He had good intentions, but it made me realize that I had to stand up and ask for what I wanted—no one was going to hand it to me," Martin says..

Finding mentors, forging bonds

By the time Associate Professor **Keryn K. Lian** (MMS MASc 9T0, PhD 9T4) came to U of T to pursue graduate studies in 1988, she was lucky enough to have had a strong mentor in the form of her previous supervisor at the University of Calgary, chemistry professor Viola Birss.

"She always told me that women have to work harder to compete with men," she says. "When I was growing up, there were few women role models in science, and even fewer in engineering."

Recently granted tenure, she is the only female full-time faculty member in MSE and leads the Flexible Energy & Electronics (FEE) Laboratory, where her research areas include electrochemical energy storage materials, devices

"I tell them that if they follow their hearts and have confidence, they can succeed at anything."

and hybrid systems, as well as memory functionality in printed electronics. For the increasing number of female undergraduate and graduate students at MSE, who now make up about a quarter of the department, the future is bright.

"Society is much more relaxed and open for women now," says Professor Lian, who spent 12 years working in the electronics industry at Motorola. "Female students here are just as strong academically, and in some ways they're superior—they're often more careful in experiments."

"I tell them that if they follow their hearts and have confidence, they can succeed at anything."

Younger alumnae like **Betty Lin** (MSE oT3, MASc oT5), a project engineer and project manager with HATCH, credits Professor Lian with valuable career advice. "She told me that you need to have good marks, but it's your interpersonal skills that will help you succeed," she says.

"It's important to be a well-rounded person—work is just one aspect of who you are."

Getting support, building the future

Outside of work, encouragement from family and friends is essential. Ruggiero says her husband, who is also a U of T engineering alumnus, was very involved in raising their two children (who are both currently studying engineering). "Having a significant other who understands the demands of the profession was invaluable," she says.

Professor Franklin was buoyed by her close friendships with female scientists outside her own discipline, while Martin was inspired by her own mother, a physician who studied at a time when medical schools were virtually all-male. Lin says she gets her drive from her parents, who gave up prestigious jobs in Taiwan so that their four children could grow up in Canada.

"My parents are both engineers, and for my mom, being the only woman on the manufacturing floor didn't faze her," says **Eva Kosiba** (MMS 9T8+PEY), project manager at Celestica. "Because of her, I never felt that gender would ever be an issue."

While women engineers are still in the minority at many companies today, there's a much more collaborative atmosphere in the workplace. "Everyone works as a team," says **Josie Barbato** (MSE MASc oT9), technical engineer at Ontario Power Generation's Pickering B plant. "You really don't feel the difference. Women are surrounded by a very supportive environment."

Being part of MSE, a small department within the wider University of Toronto, has also given many alumnae a community to return to. "I found a lot of good support there, both from staff and my peers," Kosiba says. "I still keep in touch with my old circle of friends."

Ruggiero says she still consults with the faculty who have encouraged her over the years, and has participated in university-industry partnerships like the Ontario Centre for Excellence for Materials and Manufacturing. "Whenever I've had the opportunity to come back, I've taken it," she says. "I'll always think of MSE as my home base."

Impact Student Choice Awards

In 2011, the Impact Student Choice Awards were created to recognize an outstanding undergraduate instructor and teaching assistant (TA) as selected by the student body.

Named after this magazine, the award refers to a materials testing technique and also reflects the influential effect of professional dedication and excellence on students in our program.

The inaugural recipients for Instructor and TA of the Year are Professor **Zhirui Wang** for MSE 316: Mechanical Behaviour of Materials and MSE 419: Fracture & Failure Analysis, and **Leo Monaco** (MSE oT9, MASc Candidate) for MSE 342: Nanomaterials, respectively.

Professor Zhirui Wang, Instructor of the Year 2011

Leo Monaco, TA of the Year 2011

Material Interest

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Advanced materials shape the way we design, build, and enable the properties and performance of our modern day technologies. They have significant impact on sustainability through energy consumption in their life-cycle: manufacturing, application, and disposal. Below are several technologies made possible by the latest advances in materials synthesis.

01 Pure Quality

How do you get the best sound out of your favourite album? One way would be to ensure you have as little negative effect on the signal as possible. Traditional audio-visual (AV) cables, usually made of high-purity copper, have about 5000 grains per metre, and the signal can be degraded by having to cross all these junctions. In 1986, Professor Atsumi Ohno (MMS MASc 6To, PhD 6T3) of Chiba Institute of Technology in Japan, introduced and patented the Ohno Continuous Casting (OCC) process. Using a heated mould, single crystals of copper wire can be manufactured with grains over 200m long. The result: wire that is ideal for ultra-high fidelity signal transmission. 25+ years later, Pure Copper by OCC (PC-OCC) is still used in the highest grade AV cables you can buy today.

02 Structural Colour

No fumes, no smear, no mess. Say hello to a technology that creates colour without the use of traditional pigment chemicals. Borrowing cues from Mother Nature, layering surface nanostructures on the scale of light wavelengths creates interference effects that influence colour outcome—the same feature responsible for the colour on blue jay feathers and certain butterfly wings. Applying structural colour to paints, coatings, textiles, and most recently, cosmetics, eliminates the need for conventional pigments, creating a whole new class of vibrant, non-toxic, and environmentally-friendly colour technologies.

03 Energize

Send an e-mail, GPS the nearest coffee shop, make a phone call, check your social networks—repeat. Thanks to lithium-ion polymer (Li-Poly) batteries, your newest smartphone has enough power to do this all day and still have a thinner profile than the average wallet. Constructed using a solid polymer composite, Li-Poly cells are lighter than their metal-cased cylindrical cell predecessors, are rugged, and adaptable to a range of compact packing shapes. So what do you say to a long-lasting power source for your mobile device that weighs less than the change in your pocket? We say, carry on, multi-tasker!

Toronto ♥ Tokyo

Celebrating a decade of international research exchanges

2011 marked a special year for the annual UT² Graduate Student Conference. Together with the University of Tokyo, the Faculty of Applied Science & Engineering at the University of Toronto celebrated 10 years of academic exchanges, culminating with this year's theme "**Sustainable Materials & Processing**."

Since 2001, the two departments of Materials Science & Engineering at both institutions have hosted one another to charter new research frontiers in the spirit of globalization. With MIE and ChemE joining the mix in the last few years, the conference has grown to reflect the interdisciplinary nature of the engineering field.

"Our relationship with Toyko is a great opportunity to further our goals in internationalizing our research and programs for our students," says Professor **Jun Nogami**, Chair. "Sincerest thanks to all of the graduate students, faculty, and staff who made our 10th anniversary event a brilliant success. I look forward to seeing our colleagues and friends in Tokyo again in 2012."

01

02

03

01. UT² 2011 co-leaders Associate Professor Kosuke Nagashio (UTokyo) and Professor Jun Nogami (Chair, MSE)

02. Graduate student planning committee (from left): Eric Morris (ChemE), Yuki Kuwauchi (MSE), Leili Tafaghodikhajavi (MSE), Reza Rizvi (MechE)

03. Associate Professor Hani Naguib (MIE/MSE) and Professor Jean Zu (Chair, MIE)

04. 2011 participants in King's College Circle, University of Toronto

04

Lasting Impact

Introduction by Anna-Kaisa Walker
Feature by Jennifer Lancaster & Luke Y. H. Ng

Materials Engineers use impact testing to determine the strength of materials under normal and variable environments. It seems fitting, then, that our last feature is devoted to a few people of MSE who've not only demonstrated strength and perseverance, but commitment to making a difference. By truly giving back, they've inspired their peers and helped make our community a better place.

Chirag Variawa, MSE 0T9, IndE PhD Candidate
Graduate Student Governor, Governing Council 2011–2012

Engineers can do calculus, and then some. Take Chirag, for example, the first graduate student governor from the Faculty of Applied Science & Engineering.

Here, the MSE alumnus and recently-elected governor talks to Impact about his views on engineering and leadership.

You attribute your time in MSE as a springboard for your community involvement. Can you elaborate a bit?

CHIRAG VARIAWA: Earning my undergraduate degree in MSE was particularly worthwhile because of the close-knit community. I had frequent opportunities to speak with my peers and instructors which made me feel integral to the department as a student. Here, I learned to appreciate the importance of inclusivity.

Engineers are playing increasingly important roles in society, far beyond the traditional contexts of technical prowess. How has your education influenced you in your role today?

CV: MSE helped me learn to apply a systems-approach to understand the bigger picture. Technical knowledge in fracture mechanics and nanomaterials challenged me to synthesize concepts into meaningful solutions that can be applied in a societal context. I have been, and continue to be engaged in learning that complements a technical education in engineering; some of these include the Leaders of Tomorrow program, and representative roles in the Engineering Society and the Engineering Alumni Association.

Your campaign is based on the premise that realistic progressive change is possible. How will you carry out your platform to make the most impact?

CV: As Governor, my actions can help influence the academic structure of this institution to be more inclusive. I represent thousands of students, and my actions will impact governance in the same way an engineer has a profound impact on the public. It is with this responsibility that I move in a direction that is in the best interests of its constituents. Specifically, as an appointed member of the Academic Board, I hope to build an institution whose curriculum is more accessible for the increasingly diverse student body.

To learn more about Chirag Variawa, you can visit his website at www.chiragvariawa.com.

LEFT TO RIGHT:
Barry A. Strathdee, MMS 5T5, MASc 5T6, PhD 5T9
Roland "Roly" Bergman, MMS 5T5, MASc 5T6

James M. Toguri Memorial Scholarship

The late Professor James M. Toguri (MMS 5T5, MASc 5T6, PhD 5T8) was a member of the MSE faculty from 1966 to 1998 and served as the 4th Chair of the Department from 1976 to 1981. During his tenure, Professor Toguri contributed immensely to his field, both in the engineering community and as a mentor to countless students.

Here, his two former classmates, Roly Bergman and Barry Strathdee, share a little bit about the scholarship they helped establish in honour of their former classmate and friend.

You have both been dedicated to preserving the memory of, and creating a lasting legacy for Professor James M. Toguri through the creation of a memorial scholarship in his name. Why was this so important to you?

BARRY A. STRATHDEE: Even in his days as a student, Jim was always encouraging others to get involved. We developed a strong friendship that carried on beyond our days at Skule™. His wife Elsie, was also a keen supporter of the Department and Jim's work and we wanted to honour her as well.

ROLY BERGMAN: Jim was a leader in the field of process metallurgy and very human; he supported students, inviting them into his home to celebrate holidays and summer breaks. His numerous contributions should be remembered and his outstanding leadership in the Department celebrated.

Why did you choose a scholarship as a way to remember Professor Toguri?

RB: We wanted to ensure that we paid tribute to Jim by supporting the very students he spent a career educating and mentoring. Helping students in honour of Professor Toguri ensures his legacy for future generations.

BAS: It is appropriate to see Jim's contributions live out in the younger generations. My hope for recipients of this prestigious award is that they go on to make the same lasting impact that Jim has had.

What is next for this scholarship?

RB & BAS: We are continuing our fundraising efforts to increase support for the scholarship. The Ontario Trust for Student Support will be matching each dollar raised between now and March 31, 2012. There is no better time to join us in support of student success.

The James M. Toguri Memorial Scholarship was established in 2004 in memory of the late professor and former Department Chair. The award recognizes a 3rd or 4th year MSE student on the basis of academic achievement, demonstrated leadership qualities, and financial need. Candidates should also have a genuine interest in chemical process metallurgy, as determined by course selection, research experience, PEY placement, and/or final year thesis topic.

Consider making a Lasting Impact. Learn more about supporting students in MSE and at U of T by visiting www.give.utoronto.ca.

impact

Alumni & Industry Magazine

Impact is the Department of Materials Science & Engineering at the University of Toronto's alumni and industry magazine. Named after a traditional materials testing technique, it also describes how members of our community make a difference through excellence and dedication.

Published annually, the magazine features the talent and commitment of our alumni, faculty, students, and staff to engage our external stakeholders, industry associates, and the engineering community-at-large.

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Materials Science & Engineering
UNIVERSITY OF TORONTO

Volume II, 2012
PM 40062475