Skulematters spring '08

Faculty of Applied Science and Engineering University of Toronto

nano engineering

What is nano's potential?

Exploring the nanoengineering revolution at U of T

Nanotechnology requires creative thinking

Neurosurgery & bionanoengineering

Using nanomaterials to power greener homes and automobiles

The world's first nanoengineering undergraduate degree

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Skulematters is published by the Faculty of Applied Science and Engineering at the University of Toronto for alumni, faculty, students, staff and friends of Skule™.

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[DESIGN]
DUO Strategy and Design Inc.

[PRINTING]
General Printers

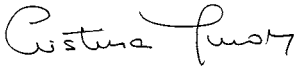
Our Faculty has a distinctive mission and history that set us apart from other schools. In our 135-year history, the world has evolved rapidly and continues to dynamically change, providing extensive opportunities for us as Engineers and Engineering educators. The leaders of Skule™ have embraced these changes and responsibilities, building a forward-looking program that is ranked No. 1 in Canada and among the top 11 engineering schools in the world by the London Times' Higher Education. It is my goal to continue building upon the momentum of this extraordinary Faculty.

One of our areas of great strength is our leadership in nanoengineering research and education. More than a decade ago, we established Canada's first centre for nanotechnology and research and, in 2001 we were the first in the world to offer an undergraduate degree in nanoengineering. The Faculty's leadership and foresight to focus on this multi-disciplinary teaching and research endeavour, one that is still in its infancy today, has enabled us to make exciting discoveries and provide solutions to some of the world's most pressing challenges. As one of our major research priorities moving forward, we will continue to invest in nanoengineering research and education by ensuring our curriculum is progressive, by nurturing our world's top researchers, and by continuing to make new discoveries and innovations with unimaginable and unbounded opportunities to improve our life and our world through advances in human health, the environment and energy systems, technologies, devices, structures and materials. In this issue of *Skulematters*, I am pleased to share some of the accomplishments and achievements of our scholars, researchers, students, alumni and friends who are making important contributions in the world through their innovative nanoengineering technologies and solutions.

In the last issue of *Skulematters*, we highlighted some of our Energy initiatives - another area of exceptional strength for Skule™. We continue to build this area, hire new faculty members, and dedicate resources to new facilities that will further propel our Faculty to be a global leader in Energy research and education. Beginning this year, Engineering Science students will have the opportunity to major in Energy Systems and plans are underway to offer a minor in Energy to all undergraduate students. Unique in Canada, this major will enable our students to make significant leaps, both today and in the future, providing solutions to address the increasing global need for diverse energy generation and better energy utilization. To further enhance our research and education priorities in this field, the Division of Environmental Engineering expanded its mandate to become the Division of Environmental Engineering and Energy Systems. Our research contributions in a wide spectrum of renewable and cleaner energy technologies will be highlighted on June 19, 2008 as our Energy Research Network welcomes members of industry, government and the community to our first external Energy research openhouse.

This has been a remarkable year for our Faculty and I feel energized by the progress we are making and the exciting initiatives we are undertaking. In this past year, our professors received more than 50 top international awards in recognition of outstanding research, teaching and innovation, and our students were recognized for their exceptional leadership contributions.

I encourage you to spend some time reading the following pages, which give an overview of our strengths in nanoengineering, as well as some our of notable accomplishments in the past few months. Embracing this bold agenda will require strong leadership from within the Skule™ community, and the intellectual and financial support of our alumni and friends. Together, we can continue to achieve great things for Engineering at U of T, but more importantly, for the benefit of the world.



Cristina Amon
Dean and Professor

What is Nano's Potential?

The potential market for nanotechnology is enormous. Optimistic market projections abound, including the National Science Foundation's landmark claim of a $1 trillion market by 2014 (subsequently surpassed by Lux Research's figure of $2.8 trillion by 2014, among others). No doubt these projections contain a large measure of hype as they use the total value of any nano-enhanced product (for example, a car with a nano-enhanced paint to wick away rain droplets might be included as the car's total cost) but industry researchers all seem to agree that there is great potential for an explosion of growth in the nanotechnology market in the next few years.

I believe that the low hanging fruit in nanotechnology will come from nanomaterials. AT Kearney, a well respected management consulting firm, forecasts that materials will continue to represent the largest segment in nanotechnology. The potential impact of nanomaterials is analogous to the plastics revolution. Before plastics, materials were selected for physical characteristics like strength and pliability. However, with the invention of plastics, these physical characteristics could now actually be tuned and tailored depending on applications. Initially, the true implication of this advancement was not fully realized and plastics found its first commercial use in billiard balls. As companies grew to fully harness the power of formable, customizable materials, plastics led to another era in materials – resulting in a $379 billion industry in the U.S. alone.

The exciting news is that nanomaterials allow for a far greater level of potential customization. With plastics, you have the ability to manipulate along several physical properties; with nanomaterials, you have the ability to customize virtually any property, including optical, magnetic, conductive, catalytic, anti-corrosive, scratch resistant, combustive, and tensile strength, just to name a few. I expect nanotechnology will be the next disruptive force in materials. And, due to the breadth of applications, the potential impact should be far greater than that of plastics.

So Where Is Nano Today?

We are just starting to realize the promise of nanotechnology. According to the Nanotechnology Consumer Products Inventory, there were only six nanomaterials being used in products as of November 2006: carbon, silver, silica, titanium dioxide, zinc oxide and cerium oxide. We have barely started to scratch the surface of the periodic table!

With all of its promise, it might seem strange that most of nanotechnology's potential is yet to come. The reason is that many of the nanomaterials are: 1) difficult to work with due to agglomeration (which negates the benefits offered by nano); 2) very expensive; or 3) limited in the "menu" of materials available. Companies need nanomaterials that are tailored to their needs, easy to implement and low cost.

What do you do if you are an engineer that sees the need to move to higher value added products? Like a number of corporations, from small businesses to several Fortune 500 chemical companies, you go to Northern Nanotechnologies.

Described by influential Wall Street nanotechnology investment analysis firm Lux Research as "one of the key players in the nanotechnology space", Northern Nanotechnologies (NNT) is a developer and supplier of leading-edge nanomaterials solutions to manufacturers.

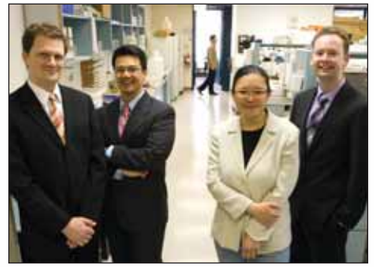
Founded in March 2006 from technology developed by Professor Cynthia Goh's group at the University of Toronto, NNT has raised several million dollars and has a solid business and technical management team in place.

To address the problems I previously mentioned, NNT has created a flexible, inexpensive process for making customizable nanoparticles of a broad menu of materials, including metals, ceramics, semiconductors, and organics. Starting from low-cost inputs, it produces nanoparticles typically less than 10nm in size. NNT can produce kilograms per week with its current line, and is scaling production to allow its partners to deliver nano-enabled products to their customers. NNT is also developing "blockbuster" applications that take advantage of the inherent advantages of its process – the ability to make nanoparticle dispersions with unique compositions, small size, and customizable coatings.

That's why I am excited to be at Northern Nanotechnologies, working to develop products that may spark the next materials revolution. We help deliver on the promise of nanotechnology: making small simple™.

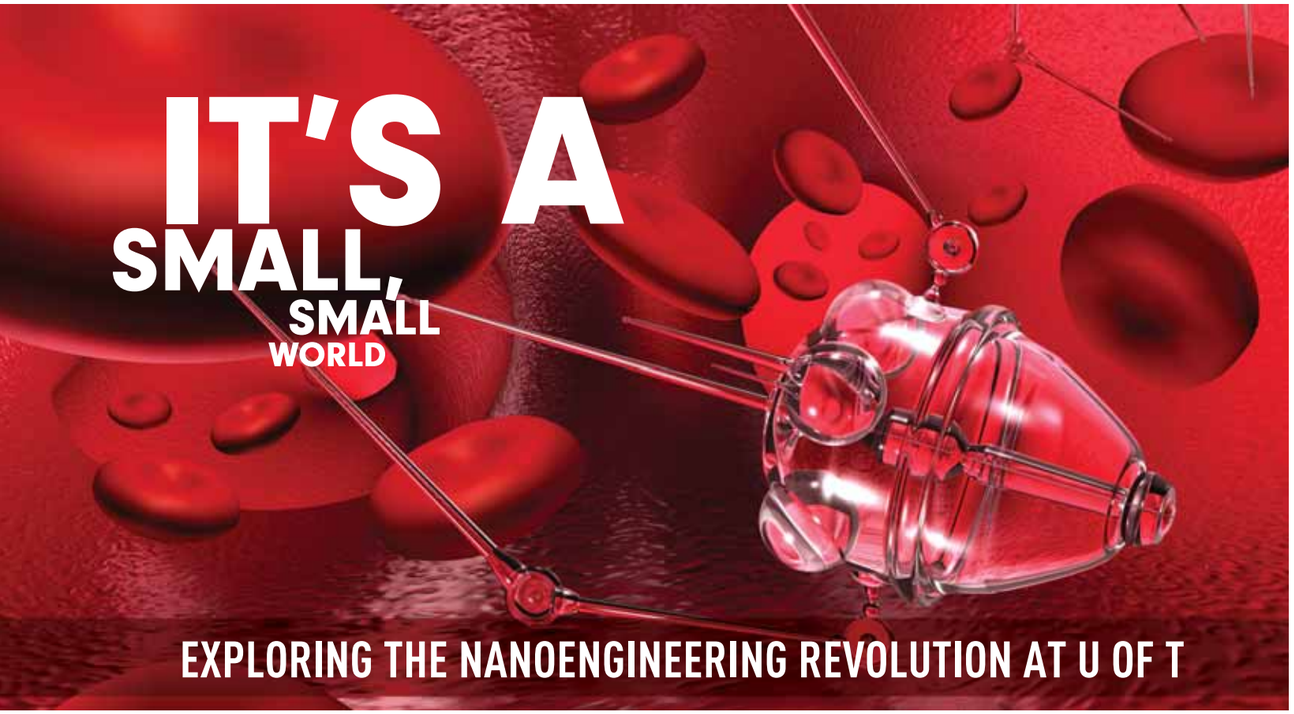
By: Keith Thomas (MIE 8T7)

› (L to R) Keith Thomas and NNT co-founders Jordan Dinglasan, Darren Anderson, and Jane Goh.



We are just starting to realize the promise of nanotechnology. We have barely started to scratch the surface of the periodic table!

Keith Thomas, NNT's President, is a proven entrepreneur and most recently was CEO of Vector Innovations, which was successfully sold after being backed by a number of highly regarded venture firms. Mr. Thomas has led a number of technology start-ups, reorganized companies at a New York based restructuring firm, managed strategy and operations projects at Booz Allen & Hamilton, and completed a number of corporate finance transactions at Citibank in the US and Europe. Mr. Thomas holds an MBA from Columbia University, and an MA in Economics and a BASc from the University of Toronto. NNT is in the process of changing its name to Vive Nano.



IT'S A SMALL, SMALL WORLD

EXPLORING THE NANOENGINEERING REVOLUTION AT U OF T

We've all said it: "It's a small world". Whether you're talking about human connections and relationships or cell phones, mp3 players or computers, it seems the world really is getting smaller these days. With nano-engineering research at the University of Toronto proving that smaller can be stronger and faster when it comes to nano-scaled engineering projects, maybe the world should be even smaller.

According to data reported by the National Science Foundation (NSF), 1.8 million additional workers are needed by the year 2015 to support nanotechnology industries worldwide; this adds to the 20,000 existing workforce in nano. Moreover, in 2003, there were more patents issued in nanotechnology in the cosmetics industry than in any other sector according to Bio Business magazine's 2004 issue.

While nano is booming, it is not entirely new. "What is new are the possibilities of what the development and design of materials and components at that size and scale can actually do for us. Nano simply tries to understand the structure and properties of materials on a tiny scale – one-billionth of a metre. It's about the organization of atoms and molecules and how they behave," says Professor Doug Perovic (MSE 8T6; MASc 8T8; PhD 9T0), Chair of Materials Science and Engineering.

A report from the U.S. Government in the late 1990s compared the field of nano to that of computers and IT in the 1950s. While computing technology has transformed the world in unimaginable ways, what will nano do?

According to Engineering Professor and nanoengineering researcher, Peter Herman, "It will be a lot like the microelectronics revolution - largely invisible yet a huge impact. The silicon microelectronic chip is transitioning from the micron-size world to the nanoscale world where it is becoming increasing more powerful, and yet remains invisible, buried deep inside our computer. Nanotechnology will also be invisible as it penetrates into other products, devices, materials, and processes, but its effect will be equally strong across many other fields of use evolving steadily over several decades like the microchip transistor."

"In the last Industrial Revolution we learned how to make machines and manufacture materials like steel, using a nonscientific heat-it-and-beat-it approach," says Professor Perovic, the nanoengineering researcher who implemented the world's first nanoengineering undergraduate degree in Engineering Science at U of T.

"Now, we're repeating the whole thing learning how to manufacture, but doing it on the nanoscale. We can see what we're doing; know what we're doing; and we can orchestrate what we achieve. It's exciting to be working in the field on the cusp of a new age."

The possibilities with nano-engineered technologies seem truly limitless. For some people, it may seem like a page out of a sci-fi novel, but to many of the nanoengineering researchers at U of T, it's already a reality.

> "Nanotechnology will allow us to do things that would otherwise be impossible."
>
> Engineering Professor Molly Shoichet

IMAGINE WIPING OUT CANCER.

"Nanotechnology will allow us to do things that would otherwise be impossible. In my lab we are taking advantage of the nanoscale size to selectively deliver drugs to cancer cells," says Engineering Professor Molly Shoichet, who was recently awarded a prestigious Killam Fellowship that provides funding in support of research.

The impact on the environment is also hopeful. Engineering Professor and Canada Research Chair, Ted Sargent (PhD 9T8), recently received a $10 million grant toward developing nanotechnology that uses the infrared rays of the sun to provide power for virtually everything that now uses electricity.

While the information technology sector has already revolutionized society, imagine nano IT. Professor Stewart Aitchison, also Vice-Dean of Research for the Faculty, is working to develop integrated optical circuits based on photonic nanowires for application ranging from enhanced communications to optical gas sensing.

"An important characteristic of nano is the properties of materials at this scale – electrical conductivity, optics, and strength change at this small scale, becoming more magnified, which means they are stronger and faster," says Professor Aitchison.

THINK 10X THE STRENGTH OF STEEL, BUT LIGHTER.

While research is booming in nanoengineering at the University of Toronto, there is an equal interest to learn about nano among undergraduate students. **Since offering the world's first undergraduate degree in nanoengineering in 2001, the Engineering Science program is about to graduate the sixth cohort of students.**

"Due it the cross-disciplinary nature of nanoengineering, a nanoengineer can talk to colleagues across the traditional subject boundaries, and can pursue graduate studies in a vast array of subjects. Whether it is quantum computing circuits, chemical self-assembly of photo-voltaics, structural nanomaterials, or biomemetics, a nanoengineer has the exposure to feel comfortable in all areas," says David Deak (EngSci 0T3), who was one of seven graduates from the first class in the nanoengineering degree. He recently completed his PhD at Oxford and works for Siemens Wind Power in Denmark as the Project Manager of Technology.

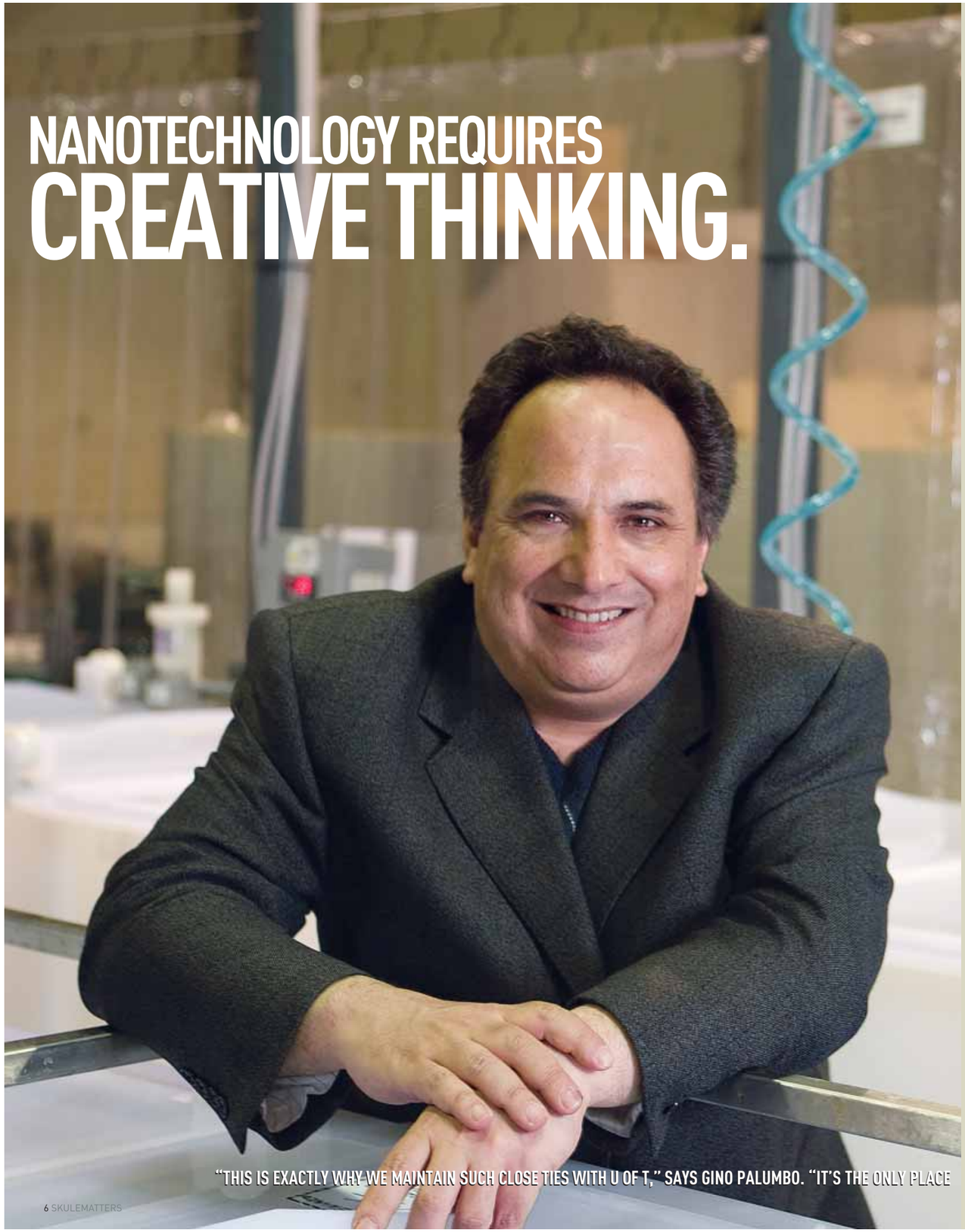
The undergraduate program takes a multi-disciplinary approach, combining seven departments at U of T to provide a world-class nanoengineering degree: physics, chemistry, materials science and engineering, mechanical and industrial engineering, chemical engineering and applied chemistry, computer and electrical engineering, and biomedical engineering. There are currently 12 students enrolled in the nanoengineering.

While nanomaterials have existed as single-celled organisms in nature since the beginning of time, it seems fair to say that the potential of nano-engineered products is still evolving. As the revolution continues, you can rest assured that the Engineers at the University of Toronto will continue to lead these positive global solutions.

By: Kate Brand

ACCORDING TO DATA REPORTED BY THE NATIONAL SCIENCE FOUNDATION (NSF), 1.8 MILLION ADDITIONAL WORKERS ARE NEEDED BY THE YEAR 2015 TO SUPPORT NANOTECHNOLOGY INDUSTRIES WORLDWIDE

NANOTECHNOLOGY REQUIRES CREATIVE THINKING.



"THIS IS EXACTLY WHY WE MAINTAIN SUCH CLOSE TIES WITH U OF T," SAYS GINO PALUMBO. "IT'S THE ONLY PLACE AND TIME IN WHICH YOU CAN THINK COMPLETELY OUTSIDE-THE-BOX. WE'RE ALL AT OUR MOST CREATIVE DURING OUR UNIVERSITY YEARS."

When it comes to nanotechnology research, Gino Palumbo has a simple philosophy: the crazier the better. The President and co-founder of Integran Technologies Inc. has valuable experience to back his thinking; the self-described "pie-in-the-sky" research he completed during his PhD studies in U of T's Engineering Faculty just translated into several major R&D contracts with the U.S. Air Force and NASA. "The technology had been sitting on the shelf for years," he laughs. "At the time, I thought it had no practical application whatsoever."

A three-time U of T Engineering grad (MSE 8T3; MASc 8T5; PhD 8T9), Palumbo spent the better part of the 1980s analyzing and testing the properties of materials in the hopes of better controlling elements that impact performance — like strength, hardness and resistance to corrosion. Only recently have the potential benefits of the technology for jet engine components been recognized.

"By changing the internal structure of engines' materials, we can potentially increase performance and durability, and decrease overhaul and repair costs," he says.

The Air Force and NASA contracts are just the latest in a string of research wins for Palumbo and Toronto-based Integran, a leading supplier of nanotechnology-enabled metallurgical products and processes. The company holds one of the first U.S. patents issued in nanotechnology. It's also among the first in the world to develop a large-scale industrial application for nano materials: the Electrosleeve™ process for repairing nuclear reactors was conceived in the early 1990s while Palumbo was at Ontario Hydro and with help from Professor Doug Perovic (MSE 8T6; MASc 8T8; PhD 9T0) and Uwe Erb, Palumbo's former research colleague, now a U of T Materials Science and Engineering faculty member. More than $12 million was spent developing the technology over two years, making it one of Canada's then-largest research and development efforts.

"It just goes to show that some of the craziest pursuits can pay off in the long run," says Palumbo.

To this day, Palumbo remains a big fan of U of T's Materials Science and Engineering group. A full one-quarter of Integran's 50 Canadian employees (another 50 or more are employed at four spin-off companies throughout the U.S. and a production facility in Mexico) are U of T alumni; a handful of projects are underway in collaboration with Erb, Perovic, Professor Glenn Hibbard (PhD 0T2) and Palumbo's former PhD supervisor, Professor Emeritus Karl Aust; and the company has a steady stream of undergraduate students completing their Professional Experience Year.

It all adds up to a culture ripe for discovery. In 2007, Integran was recognized as Innovative Business of the Year by the Canadian Manufacturers & Exporters Association, an honour Palumbo credits in large part to his alma mater.

"This is exactly why we maintain such close ties with U of T," says Palumbo. "It's the only place and time in which you can think completely outside-the-box. We're all at our most creative during our university years."

"Taking advantage of that is something Integran has done reasonably well."

By: Christine Ward

FOSTERING INNOVATION AT INTEGRAN

Deanna Mendolia had an inkling that research was her thing, but it wasn't until joining Integran last fall that she knew for certain it was the career for her. A third-year Chemical Engineering student, Mendolia is spending her 12-month Professional Experience Year at the leading Canadian nanotechnology research company.

"I knew I wanted to do research and development, but working here has definitely furthered my drive," she says. Mendolia praises Integran's hands-on environment and flexibility to take projects in unexpected directions.

The same culture of innovation and camaraderie is what attracted two-time engineering graduate **Diana Facchini** (MSE 0T2; MASc 0T5), to Integran in 2005. Facchini first learned about the company during a case study taught by Professor Uwe Erb as part of a materials characterization course. Since joining Integran, she has advanced to Project Leader and had the satisfaction of helping to drive a number of projects from conception to commercialization.

"No idea is too zany," she says. "There are a lot of really creative ideas and concepts that come out of here, many of them from Gino."

"Sometimes the most unlikely theories become the winner."

By: Christine Ward

NEUROSURGERY & BIONANOENGINEERING:

CREATING A BETTER WORLD ONE PATIENT AT A TIME

BY: KATE BRAND

Medical Doctor Betty Y.S. Kim wants to better serve her patients.

It was this reason, coupled with an interest in research, that inspired this doctor to pursue a PhD in bionanotechnology in the Institute of Biomaterials and Biomedical Engineering at the University of Toronto, where she will be the first Canadian surgical resident trained in this emerging field.

Graduating with a MD from McMaster University in 2002, Kim decided to meld her two areas of specialty in the hopes of improving patient care in neurosurgery and perhaps, also writing and illustrating a children's book about the brain.

"In the near future, biomedical nanotechnology will affect every clinician involved in patient care," says Kim.

"Unlike many other areas of research, nanotechnology and its applications are truly interdisciplinary. Diverse expertise is required to design, synthesize, and characterize nanostructures based on their size, shape and material composition. By understanding the physical properties of these nanostructures, novel tools can be developed for practical applications in medicine."

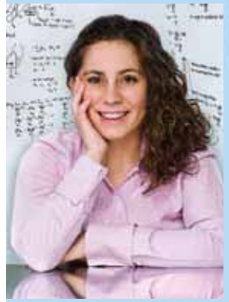
While completing an Honour's Bachelor of Science in Cell Biology and Anatomy at McGill University, Kim participated in the University's study abroad program and travelled to England to study post-colonial literature at Oxford University and biomedical sciences at King's College London. Kim graduated at the top of her class as a Dean's Scholar and received the Golden Key National Scholar award.

She didn't enter medical school with the intention of pursuing an academic career. While as a medical student, she worked with a team of neuroscientists, neurologists and molecular biologists at Johns Hopkins University where she says her interest in neuroscience research flourished. The following year she worked with clinician scientists at Harvard University and was involved in basic science research resulting in clinical trials involving 24 academic centres across North America. The study was published in *Nature* in 2002 and has been cited more than 350 times.

Kim completed three years of her neurosurgical residency training at the University of Ottawa before transferring to U of T to pursue her research interests in bionanotechnology. She is currently working with Dr. James Rutka, Chair of Neurosurgery at U of T and IBBME Professor Warren Chan on the delivery, targeting and imaging of malignant brain tumours using multiplexed nanoparticles.

During the past two years as a PhD student in IBBME, she has garnered numerous international and national awards and distinctions totaling more than $186,000 in research funding, among which includes the prestigious AANS Neurosurgical Research and Education Fellowship, NSERC graduate student award, and The Hospital for Sick Children's Research Training Award for excellence in research. She recently published in the March issue of *Nature Nanotechnology* along with co-author and fellow IBBME PhD student Wen Jiang and supervisors Drs. Rutka and Chan.

After completing her PhD, Kim will still need to undertake two more years of further neurosurgical training to finish her six-year residency training program.



THE WORLD'S FIRST NANOENGINEERING UNDERGRADUATE DEGREE

INSPIRING TOMORROW'S NANOENGINEERING LEADERS

In 2001, the Faculty of Applied Science and Engineering at the University of Toronto introduced the world's first undergraduate degree in nanoengineering to Engineering Science students.

"This pioneer multi-disciplinary program enables our students to tackle the increasingly complex challenges of today's world by incorporating their knowledge of nanoengineering to provide innovative solutions," said Cristina Amon, Dean of the Faculty of Applied Science and Engineering. "Taught by leading nanoengineering experts, our students have the unique opportunity to learn with the professors who author the textbooks and garner international awards for their research."

The Engineering Science nanoengineering program is a combination of disciplines, including physics, chemistry, materials science and engineering, mechanical and industrial engineering, chemical engineering and applied chemistry, computer and electrical engineering, and biomedical engineering. Students have the option to enter into nano after their second year of studies in Engineering Science.

"The nanoengineering program is the epitome of interdisciplinary education. Nanotechnology will once again unify science, such that 25 years from now we will wonder why we divided nature into physics, chemistry and biology," said Professor Doug Perovic, who built the nanoengineering program at U of T Engineering and has served as the program's Chair since its inception. He also Chairs the Department of Materials Science and Engineering.

One of the program's first graduates, David Deak (EngSci 0T3) says, "Nanotechnology has its place in almost every industry that involves developing technologies." He is putting his nanoengineering degree to use as Project Manager of Technology for Siemens Wind Power in Denmark, where he manages and coordinates projects that aim to enhance wind turbine performance as well as mitigating failures in wind turbines. Deak recently completed his PhD at Oxford, where he founded and led the Oxford Chapter of Engineers Without Borders.

"Our nanoengineering graduates have the potential to radically transform almost any imaginable sector utilizing the tools provided in our multi-disciplinary nanoengineering degree, including health care, manufacturing, information technology, energy and transportation," says Professor Will Cluett, Chair of the Division of Engineering Science.

For more information about the world's first nanoengineering degree: www.engsci.utoronto.ca

USING NANOMATERIALS TO POWER GREENER HOMES AND AUTOMOBILES

Professor Steven Thorpe (MSE 8T0; MASc 8T2; PhD 8T5) can create greener electricity.

His research group, which spans from design to development, aims to provide small, economic solutions that could potentially supply clean hydrogen to power homes and vehicles using advances in nanomaterials.

Using hydrogen as a primary source of energy would reduce greenhouse gas emissions, according to the National Hydrogen Association. This is achieved by using renewable energy, such as solar and wind as well as nuclear power to separate hydrogen from water through electrolysis.

Professor Thorpe, based in the Department of Materials Science and Engineering, says his research relies heavily on collaboration. "This area requires such a multitude of complementary skill sets that success will only come through collaboration with others," says Professor Thorpe, who works collaboratively with Professors Don Kirk and John Graydon in Chemical Engineering and Applied Chemistry as well as Professor Francis Dawson in The Edward S. Rogers Sr. Department of Electrical and Computer Engineering.

To make Professor Thorpe's research a reality, a hydrogen-fuel firm based in Mississauga called Hydrogenics Corporation, who recently acquired Stuart Energy, purchased the rights to patents held by Professor Thorpe, Kirk and Graydon to develop new materials that reduce the cost of producing hydrogen through electrolysis.

Professor Steven Thorpe (MSE 8T0; MASc 8T2; PhD 8T5) with Engineering students.

"We are also working with other companies that have needs for novel nanomaterials/amorphous alloys that are also aligned with energy." says Professor Thorpe.

"The hope is that these companies will serve as the vehicles for commercialization of these technologies," says Professor Thorpe.

By: Kate Brand

STUDENT NEWS

ENGINEERING STUDENTS LEADERS HONOURED WITH PRESTIGIOUS CRESSY AWARDS

Eight Engineering students received the prestigious 2008 Gordon Cressy Student Leadership Awards in recognition of outstanding extracurricular contributions to the University and community.

Established by the University of Toronto Alumni Association in 1994, the awards are named in honour of former U of T Vice-President of Development and University Relations – Gordon Cressy – in recognition of his commitment to higher education and his leadership in fundraising and community service. Similar qualities of leadership and dedication are demonstrated among the students who are honoured with this award – students who are committed to making a difference.

Jennifer Lynn Aiello,

Chemical Engineering + MBA Candidate
0T8 (Skoll Program)

Since the beginning of her academic career at the University of Toronto, Jennifer has made significant contributions to student life, first as a student of the Faculty of Applied Science and Engineering and then as an MBA student at the Joseph L. Rotman School of Management.

Since 2006, Jennifer has been a member of the Health Care and Biotechnology Association where she selected speakers to address her fellow Rotman School of Management students about pressing issues within the healthcare industry. In collaboration with the Women in Management Association, this MBA candidate coordinates SheBiz, a day-long symposium that provides young women with an opportunity to learn about the diverse career options available to them in the business industry.

Jennifer continues her involvement in the Faculty of Applied Science and Engineering today as a Faculty Representative for the Engineering Society, representing women's rights.

Alvin Chick,

Mechanical and Industrial Engineering
0T7 + PEY

Alvin's thesis explores the practices and frameworks used to develop a culture of innovation within the financial services industry. A natural innovator within his own right, Alvin brings innovation to each of his leadership roles.

In 2004 he held the positions of Vice-President of Finance and Vice-President, Internal for the Toronto Chapter of Engineers Without Borders, where he raised more than $6,000 to send two students overseas. That same year, he increased registration in the University of Toronto Engineering Kompetition (UTEK) by 262% through implementing effective marketing and communications. In various leadership roles with the University of Toronto Consulting Association (UTCA), he has increased sponsorship by 120% and grew the UTCA annual business case competition by 100%.

Alvin's innovative business acumen has earned him nine prestigious awards and honours from the University and the community.

Henry Cheung,

Engineering Science 0T7 + PEY

From the day Henry walked onto campus, he became involved in student life at Skule™. An active participant in intramural sports, an engaged leader, and a talented musician, Henry's dedication to improving the Engineering student experience is evident.

Henry has been involved with every part of the Engineering student experience through his dedication to F!rosh Week, Women in Science and Engineering, Homecoming, Godiva Week, Skule™ Nite, Eng Soc, Toike Oike, athletics, student recruitment and various musical groups.

He's been actively involved in the Engineering Society for three years, holding roles as Vice-President of Communications, Class Rep and Council Chair Speaker. He recently served as Chair of the Blue & Gold Committee and was the lead organizer for this committee when their Homecoming parade float was awarded Best Overall Entry in 2006.

Tiffany Chow,

Mechanical and Industrial Engineering
0T7 + PEY

A First Degree Black Belt in Shotokan Karate, this Mississauga Young Citizen of the Year recipient participates in the Hart House Symphonic Band and represents 12,000 students on the University's Governing Council Academic Board.

Among hiking the Canadian Rockies and running in the 2007 Cancer Relay for Life, Tiffany is also passionate about community outreach. She was a speaker for Nortel Network's Take Your Kids to Work Day during her Professional Experience Year at Nortel and she was interviewed by CTV about women in technology.

In addition to her plentiful professional and personal accomplishments, Tiffany is currently ranked 15/51 in her program and was named to the Dean's Honour List in the Fall of 2006.

Alexandra Istchenko,

Mechanical and Industrial Engineering
0T7 + PEY

A competitive road racer, Alexandra was honoured by the Engineering Athletic Association in 2007 with the PEY Female Athlete of the Year award for her involvement in intramural sports.

Amidst her athletic involvement, she also coordinated all physical and technical aspects for Skule™ Nite 2007, planned and organized Cannonball, and is currently leading a six-person executive as Chair of the Mechanical Engineering Club.

During the summers of 2003 to 2005, she worked in the House of Commons in Ottawa where she supported the government's daily operations and helped organize and administer weekly caucus meetings and national caucus events.

Alaina Lagrou,

Mechanical and Industrial Engineering
0T8

Throughout high school, Alaina taught piano lessons to 18 students and became the Company President at the Junior Achievement of Canada conference, where she managed a team of 30 peers to create a small business. She has received numerous leadership awards in addition to the Cressy Award.

In the past year as President of Eng Soc, Alaina created and implemented a mandatory summer training program for orientation leaders in Engineering. This new program incorporated a number of important topics, such as: diversity and equity awareness, effective communication, and conflict resolution.

Alaina's well-rounded and high-level leadership experience perfectly suited the academic and administrative leaders who invited her to participate in the Faculty's Leadership Development Program. Here she helped craft the Faculty's vision for incorporating leadership into the Engineering curriculum.

Varuna Prakash,

Materials Science and Engineering 0T8

In high school, Varuna tutored her peers in English, mathematics and science. Today, she is ranked 2/30 in her class and leads the Materials Science and Engineering Club as President and continues to tutor and mentor high school students.

A reporter for *The Cannon* student newspaper, Outreach Officer for Engineers Without Borders, and a student representative for the Engineering Faculty Council, Varuna has received six top awards from Engineering.

A dedicated advocate of enhancing the Engineering student experience through her own leadership, Varuna has worked with the Department of Materials Science and Engineering to ensure a positive future for prospective students through outstanding recruitment events.

Kerolyn Katrina Shairsingh,

Chemical Engineering and Applied Chemistry 0T8

Kerolyn, a member of the University of Toronto Karate Club and Formula SAE Racing Team, has served as an exemplary role model during her four years of residency at New College. In the 2006-2007 academic year, Kerolyn's peers elected her Vice-President of the Residence Council. In this role, she planned social and cultural activities for 800 New College undergraduates. The previous year, she was House Representative for her floor.

In addition to the prestigious awards that Kerolyn has earned during her academic career at U of T, she helped a grade 9 student reach her academic potential through New College's Mentorship Program. Kerolyn is widely respected for her consummate leadership skills, poise, maturity and compassion.

CONGRATULATIONS TO OUR ENGINEERING STUDENTS
WHO RECENTLY RECEIVED THIS PRESTIGIOUS AWARD!

A Nano of Your Time:

REVIEWING THE 2008 UNDERGRADUATE NANOTECHNOLOGY CONFERENCE

"Recent media coverage and paradigm shifts in scientific focus have generated a great amount of interest in anything 'nano', spawning a new breed of young scientists, engineers and businessmen: undergraduate nanotechnologists."

-UNC 2008 website (http://www.unc2008.com)

Ian Stewart and Megan Hostetter. Photo by: Dani Couture

This year's Undergraduate Nanotechnology Conference (UNC) - created by students for students – was the culmination of work by U of T Nanoclub students who were focused on exposing undergrads to the opportunities available to them in the growing field of nanotechnology.

Conference Director, Ian Stewart (EngSci nanoengineering), was amazed at the impact the conference had on the delegates. "One student changed his future education plans after one conversation with one of the speakers."

The day's events included featured talks by experts, workshops, student presentations, a panel discussion and a post-conference reception and dinner. Megan Hostetter, UNC Logistics Coordinator, reported that the panel discussion was a delegate favourite; the panel defined nanotechnology and spoke on topics that ranged from environmental health and safety to careers in the field.

When asked what personal benefits they gained from being involved in the planning of the conference, the two undergrads said that their participation increased their leadership skills and that the entire UNC planning team stepped up in an impressive way to make this unique event happen. Plans are already underway for UNC 2009.

UNC was held on the U of T campus on Saturday, March 8. The conference received funding from a number of groups including the Skule™ Alumni Annual Fund.

Class of 5T3 Recognizes Outstanding Student Achievements

3T5 SECOND MILE ENGINEER

Tiffany Chow

Mechanical and Industrial Engineering 0T7 + PEY

This award was established by the Class of 3T5 to recognize students who are not only professionally competent, but also constantly aware of an engineer's responsibilities to humanity. The graduates who donated to this award had a desire to encourage undergraduates to participate fully in extracurricular activities and to recognize the true importance of the more liberal subjects in the curriculum with the ultimate objective of entering the workforce to become Second Mile Engineers.

This year, the Second Mile Engineer award was given to Tiffany Chow.

In her application for this award, Tiffany wrote:

"Embarking on the journey of the second mile comes from the feeling that going the first mile is fiercely unsatisfying and that one must seek a greater purpose. Defining personal missions and values is like defining alternatives or forming your own path. Like in the poem The Road Not Taken by Robert Frost, the journey of the second mile is like charting your own path. 'Two roads diverged in a wood, and I took the one less traveled by, and that has made all the difference."

5T3 ENGINEERING AWARD

Matthew Zeiler

Engineering Science 0T9

Established in 2003, the 5T3 Engineering Award is given to a third year student with high academic achievement, financial need and leadership qualities. Matthew's cumulative grade point average of 3.91 and his extracurricular leadership involvement certainly meet these expectations.

In 2006, Matthew founded Review-Mate, a company that sells course-specific review booklets to university students. Within the first year, he single-handedly expanded operations to include 450% more product variety and opened a second branch of his company at the University of Manitoba.

An active member of the U of T Blue Sky Solar Racing Team, member of the Hart House Investment Club and U of T Consulting Association, Matthew also finds time to lead the Engineering Business Club and tutor fellow Engineering Science students.

ENGINEERING STUDENTS EARN TOP SPOTS IN ENGINEERING COMPETITIONS

Congratulations to our Engineering students who earned awards at the Ontario and Canadian Engineering Competitions:

Ontario Engineering Competition

1st place in Consulting Engineering
- Godmans Chow
- Tiffany Chow
- Fan Gao
- Ian Pereira

2nd place in Consulting Engineering
- Liane Catalfo
- Vikram Pandit
- Jennifer Sauks
- Cody Wood

3rd place in Innovative Design
- David Choy
- Rouzbeh Rabiei
- Lawrence Sun

Canadian Engineering Competition

3rd Place in Consulting Engineering
- Liane Catalfo
- Vikram Pandit
- Jennifer Sauks
- Cody Wood

U of T Engineering Blue Sky Solar Car Team

Congratulations to Engineering students involved in the Blue Sky Solar Team who finished first overall among Canadian teams, placing fifth out of 18 cars in the Adventure class and 12th overall out of 37 teams in the 20th Panasonic World Solar Challenge in Australia.

Awards and Accolades

Congratulations to members of the Engineering Faculty who received awards and accolades in the past year. We have included a list of award recipients from April 2007 to April 2008.

Fellow, Spanish Royal Academy of Engineering - Dean **Cristina Amon**

KAUST Global Research Partnership Award
Professor **Ted Sargent** (PhD 9T8)

NARSAD Young Investigator Award
Professor **Julie Audet**

President's Teaching Award
Professor **Yu-Ling Cheng**

Top 40 Under 40
- Professor **Peter Zandstra**
- Adjunct Professor **Paul Salvini**

PEO Awards:
- Research & Development Medal - Professor **Milos Popovic**
- PEO Young Engineer's Medal - Professor **Constantin Christopoulos**
- Gold Medal - Dr. **Walter Curlook**, (Metallurgy 5T0)
- Management Medal - **Mark Hundert**, (MIE 7T1)

Fellow, Canadian Academy of Engineering
- Professor **Levente Diosady**
- Professor **Doug Perovic** (MSE 8T6; MASc 8T8; PhD 9T0)

ASEE Campus Representative Award
Professor **Susan McCahan**

CIM Materials Physics Gold Medal
Professor **Doug Perovic** (MSE 8T6; MASc 8T8; PhD 9T0)

Joan E. Foley Quality of Student Experience Award
Professor **Greg Evans** (Chem 8T2; MASc 8T4; PhD 8T9)

Alouette Award - Dr. **Robert Zee**

Killam Prize – University Professor **Michael Sefton** (Chem 7T1)

Wighton Fellowship - **Paul Jowlabar**

Honorary Degree - Professor Emeritus **Donald Mackay**

Killam Research Fellowships:
- Professor **Elizabeth Edwards**
- Professor **Molly Shoichet**

Canadian Manufacturers and Exporters 2007 Award for Innovation - Professor Emeritus **James W. Smith** and Alumnus **Carmine Fontana** (Chem 8T6)

Fellow, Chemical Institute of Canada - Professor and Vice-Dean, Undergraduate **Grant Allen** (Chem 8T1)

Fellow, Engineering Institute of Canada:
- Dean **Cristina Amon**
- Professor Emeritus **Michael Charles**
- Professor **Alberto Leon-Garcia**

Fellow, American Institute for Aeronautics and Astronautics - Professor Emeritus **Peter Hughes**

Founders Award, Society for Biomaterials - University Professor **Michael Sefton** (Chem 7T1)

LaSueur Memorial Medal, Society of Chemical Industry - Professor Emeritus **David Boocock**

American Association for the Advancement of Science (AAAS) Fellows:
- Professor **Peter Zandstra**
- Professor **Jean Zu**

Leadership in Faculty Teaching (LIFT), Ministry of Training, Colleges and Universities - Professor **Yu-Ling Cheng**

Order of Canada - Professor Emeritus **Barry French** (Chem 5T5)

Canadian Environmental Scientist of the Year, by Canadian Geographic - Professor **Miriam Diamond**

2008 IEEE Kiyo Tomiyasu Award - Professor **George Eleftheriades**

Canadian Space Agency's John Chapman Award - Professor **Peter Hughes**

Engineering Hall of Distinction - University Professor **Michael Sefton** (Chem 7T1)

Faculty Award - University of Toronto Alumni Association - Professor **Yu-Ling Cheng**

Faculty Teaching Award - Professor **Raviraj Adve**

Early Career Teaching Award - Professor **Wei Yu**

President's Teaching Award - Professor **Susan McCahan**

Fellow of Canadian Society of Mechanical Engineering
- Dean **Cristina Amon**
- Professor **Hani Naguib**
- Professor **Javad Mostaghimi**

2007 Top 40 Under 40
- Professor **Tom Chau**
- Professor **Brendan Frey**

Guggenheim Fellowship - Professor **Peter Zandstra**

Gordon R. Slemon Award - Professor **Costas Sarris**

Premier's Catalyst Award for Best Young Innovator - Professor **Parham Aarabi**

Premier's Discovery Award for Natural Sciences and Engineering - Professor **Andreas Mandelis**

Visit www.engineering.utoronto.ca for more information

New ELITE Graduate Certificate

Starting this Spring, the Faculty of Applied Science and Engineering is offering a new graduate certificate, called: **Entrepreneurship, Leadership, Innovation and Technology in Engineering** (ELITE).

The first of its kind in Canada, the ELITE certificate complements a range of leadership curriculum and programming offered by Engineering at U of T. The new ELITE certificate is integrated into the existing Master of Engineering (MEng) program.

For more information about the ELITE certificate, please visit: www.engineering.utoronto.ca/explore/elite

U OF T ENGINEERING AMONG TOP 11 INSTITUTIONS WORLDWIDE

The Faculty of Applied Science and Engineering was recently ranked No. 1 in Canada and No. 11 overall in the World's Top 50 Universities for Technology by the London Times' 2007 Higher Education Supplement

The University of Toronto is followed in 2nd place by McGill, ranked 27th overall. U of T ranks 7th in North America following MIT (ranked No. 1 overall), Berkeley, Stanford, Caltech, Carnegie Mellon and Georgia Tech.

CATCH UP WITH YOUR CLASSMATES

Please keep us updated on developments in your life – career news, marriages, births, and more. Email your update to: alumnews@ecf.utoronto.ca

7T2 Indy Steve Petrie Thanks to the engineering mindset that Skule™ professors were able to pound into his adolescent head, Steve earned a professional reputation over the next 30 years, for delivering robust software solutions, to difficult problems. Since 2002 "retirement", Steve has developed an Intelligent Transportation Systems (ITS) concept called Expressway Traffic Optimization (ETO). Pavement-embedded signal lights prevent congestion, by guiding individual drivers in real-time to use appropriate vehicle speed and spacing (headway). Steve is enjoying the non-technical challenge with ETO, of helping Ontario's engineers, politicians and road bureaucrats overcome their fear of change. apetrie@attglobal.net www.gettorontomoving.ca/ITS-ETO.htm


Saty D. Satyamurti

7T5 Electrical Edward M. Conway Edward aimed to be a Biomedical Engineer and thus obtained his MD at U of T in 1979. He digressed a bit from his original plan, with Fellowships in Internal Medicine and Hematology/Oncology at Harvard. Back at U of T and the UHN as a research scientist in vascular biology in 1987, he then migrated with his family to the University of Leuven in Belgium in 1995, where he is now a Professor of Medicine at the VIB and the Center for Transgene Technology and Gene Therapy, seeking innovative means to better treat cardiovascular and neurovascular diseases.

7T6 MEng Saty D. Satyamurti I was at the University of Toronto as a student from September 1971 to May 1976 in the Civil Engineering Department. I graduated with a MEng degree in 1976 from the University of Toronto. At that time I was teaching at the Humber College of Applied Arts and Technology at the Rexdale campus and took my classes part-time mostly in the evening. I moved to Houston, TX in December 1978, and have lived there ever since. I worked for major E&C firms and decided to retire in September 2000. I went back to the University of Texas at Arlington, Arlington, TX, from January 2002 to May 2007, where I graduated with a PhD in Civil Engineering. I did a successful research and analysis using Visual SIMMOD simulation software on the proposed Perimeter Taxiway (PT) or End-Around Taxiway (EAT) system at the Dallas/Fort Worth International Airport. My dissertation was well received by the


Sandeep Mulgund

Management at the DFW Airport and the FAA Runway Safety Team at Fort Worth.

8T4 Mech Alan A. Grant Alan recently joined Pennoni Associates as a Senior Engineer for their Philadelphia Regional Management team. With 16 years of experience in LEED, resource efficiency, renewable energy, new technologies, venture capital, and project finance, Alan will be responsible for new business development in the Green Building, Renewable Energy and other Sustainable Design markets.

"We believe that Alan's experience as a P.E. and LEED AP as well as his background in the venture capital and project finance arenas will be a great asset to the firm," stated David A. DeLizza, P.E., Senior Vice President of Corporate Development. "His skills will contribute to Pennoni's goal of being a market leader in sustainable design projects."

A graduate of the University of Toronto, Grant earned a Bachelor of Applied Science degree in Mechanical Engineering. In 2000, he was honored as the Gubernatorial Appointee to the Commonwealth of Pennsylvania Agricultural By-Product Management Technology Board. To stay active in the industry, Grant is a member of the United States Green Building Council.

8T8 Mech Ron Mantay After working at IBM and Celestica (Electronics Manufacturing Services industry) for 10 years and then at ATI Technologies (Semiconductor industry) for 7 years, I have decided


Pratima Ramkhelawan

to work in the renewable energy field and am responsible for commercial/industrial sales of solar photovoltaic technologies in Eastern Canada. I have been married since 1991; my wife and I enjoying watching our two boys transition into their "teen" years.

8T9 EngSci Sandeep Mulgund Sandeep is a Principal Information Systems Engineer with the MITRE Corporation in Bedford MA. Sandeep's work there focuses on human decision support in next-generation military command and control systems. Sandeep and his wife Karen live in the Boston area with their two daughters. Sandeep recently reconnected with Scott Gibbard 8T9, and they caught up with each other in the New Jersey area after more than 15 years. He welcomes contact from other 8T9 EngSci alums who may be passing through the Boston area: ssmulgund@yahoo.com.

9T4 Geo; MASc Materials Science 9T7 Joseph P. Tortorelli Recently appointed as Senior Advisor, Nuclear Energy Division, Federal Government, Ottawa. We are in the midst of an exciting global nuclear renaissance. After decades in decline, nuclear power is once again emerging as a viable option given the critical importance of reducing greenhouse gas emissions. A new generation of safe and efficient nuclear reactors makes nuclear power a safe and clean energy option. Being a U of T Engineering grad not only provides you with a rock solid knowledge base, but also ensures that you will be held in high


Simone Pisana

regard in both the private and public sectors.

9T7 Chem; MASc Chem 0T0 Pratima Ramkhelawan Pratima gave birth to a healthy baby boy, Liam Gairy, on January 4. Liam weighed 6lbs 12 oz. Mom, baby and dad Wayne Gairy are going great!

0T2 EngSci; MASc 0T4 Simone Pisana Hey guys! Great to see so many of you on Facebook. For those of you who are not up to date, Katherine and I got married in London, England on April 19, 2005. Now, nearing the completion of my PhD at Cambridge University, we are moving back to North America. It would be great to see you soon!

In Memoriam

It is with regret that we have learned of the deaths of the following Skule™ graduates.

We would like to honour each graduate by telling his or her story and we hope you will help. Send us your stories, your memories, and your photos. To submit your story, please email us: alumnews@ecf.utoronto.ca or send a fax: 416-946-3450.

3T9 Engineering Physics
Wilbur Grasham
Died January 16, 2008

4T4 Metallurgy
Douglas Ernest Tough
Died December 30, 2007

4T6 Engineering Science
Dr. Gordon E. Noakes
Died September 1, 2007

4T6 Electrical
Arthur Kenneth Meen
Died March 2, 2008

4T7 Mechanical
Clifford Bruce Harrop
Died December 14, 2007

4T8 Mechanical
Gordon Ian Russell
Died January 7, 2008

5T6 Civil; 5T9 MASc
Georg Rudolf Zethner
Died August 11, 2007

6T8 Engineering Sciece; MASc 6T9
Arnold "Arnie" Rosen
Died September 4, 2007

7T2 Electrical
Paul Wesley Cutler
Died October 20, 2007

To notify us of a death of one of our graduates, please email: address.update@utoronto.ca We apologize if we have printed any inaccuracies.

Adjunct Professor Howard Goodfellow (Chem 6T4; MASc 6T5; PhD 6T8) with his wife, Karen.

GOODFELLOW RECEIVES CANADA MEDAL

Howard Goodfellow (Chem 6T4; MASc 6T5; PhD 6T8) was recently honoured by the Society of Chemical Industry with the Canada Medal.

Goodfellow, who is President of Tenova Goodfellow and an adjunct professor in Chemical Engineering and the Lassonde Mineral Engineering program at U of T, was recognized for his outstanding service to Canadian industry based on chemistry for its processes and/or services.

"It is an honour to be named the recipient of the prestigious Canada Medal from SCI for 2008," said Goodfellow. "I have been fortunate during my career to have an opportunity to collaborate with so many outstanding colleagues who have supported 'a passion for innovation' and encouraged me every step of the way as our team developed world class technology for global markets. I am proud to share this award with all of my friends in academia and industry."

In the Fall, Goodfellow was awarded the Engineering Medal – Entrepreneurship Category from the Ontario Society of Professional Engineers and Professional Engineers Ontario.

New Faculty Member

Yuri Lawryshyn - Assistant Professor
Three-time Mechanical Engineering graduate, Professor Lawryshyn ((Mech 8T9, MASc 9T3, PhD 9T7) applies information technology with analytical and numerical methods to solve complex, but practical, problems. His research areas include: business process optimization, financial engineering, asset management in the municipal environmental sector and environmental research.

"Over the Hill" (and across the beach) Challenge Raises $21,000 for Micronutrient Research

As she approached her 40th birthday, **Claire Kennedy** (Chem 8T9) decided to challenge herself. She decided to compete in a triathlon. If that wasn't enough, Kennedy decided to further challenge herself and others by raising money to support micronutrient research in chemical engineering.

Claire Kennedy (Chem 8T9)

Kennedy, a member of the Department's Board of Advisors and Vice President of the Engineering Alumni Association, wanted to support the work of Professor Levente Diosady. Using mustard seed proteins that dissolve in cola drinks, Diosady is hoping to develop a product that can be distributed throughout developing nations that will provide an entire day's supply of protein, minerals and nutrients.

Kennedy committed to raise $5,000 last Fall by participating in a sprint triathlon. The race involved a 20 km bike, 5 km run, and was to include a 750 m swim, but the water was too treacherous at Wasaga Beach that weekend. Participants instead were instructed to complete another run.

"I received an overwhelming response to my fundraising pitch," said Kennedy. "It is clear that the message of LiveADE™ has really resonated with people, and I think that is great news for the Department."

Kennedy did not only successfully complete the triathlon, but also beat her fundraising goal with over $21,000 raised for Diosady's research. Kennedy's mantra while fundraising: When it comes to hunger, thirst for change: Tri LiveADE™.

To make a donation to support LiveADE™ please contact Liam Mitchell at 416-978-8770 or liam.mitchell@utoronto.ca

Chem Profs Win Killam Fellowship

Chemical Engineering Professors **Elizabeth Edwards** and **Molly Shoichet** have been named Killam Research Fellows by the Canada Council for the Arts.

The Killam Fellowship is one of the most prestigious research awards in Canada. It provides $70,000 a year for two years, which enables scholars to devote themselves to research full-time.

Edwards was recognized for her work in bioremediation, while Shoichet, who is cross-appointed to the Institute of Biomaterials and Biomedical Engineering, was recognized for her work in guiding nerve regeneration. They are among a total of 10 fellows selected amongst 97 applicants.

Only two faculty members of the Faculty of Applied Science and Engineering have previously received Killam Fellowships, with the last one awarded in 1981.

"It is a great honour for any institution to have two faculty members named Killam Fellows in the same year. But for two to be named from one Department is truly remarkable," said Professor Doug Reeve, Chair of the Department of Chemical Engineering and Applied Chemistry.

New Chair of Civil Engineering: Brenda McCabe (Civ 9T4)

It is an honour to be the 16th Chair of the Department of Civil Engineering. One of our strengths is our outstanding alumni. Over the past few years, the Department has hosted several events to which alumni have participated. I had the opportunity to meet several of our 5T3, 5T8, 6T8, and 8T3 alumni at the Annual Alumni Dinner and Dance on Friday, May 30. Our next event will be the Gull Lake Camp Reunion on September 13th. Watch for your invitation! I look forward to seeing you there.

Professor Brenda McCabe, Chair

Researchers Improving the Safety of Our Drinking Water

Professor **Robert Andrews** was recently awarded a Senior Industrial Chair in Drinking Water Research by the Natural Sciences and Engineering Research Council (NSERC) of Canada and has received $1 million in funding from the Ministry of Research and Innovation.

This new Chair will enable Professor Andrews and colleague Professor **Ron Hofmann** (PhD 0T0), whose position was created as part of the Chair, to investigate new technologies to monitor the quality of water supplies in near real-time and allow quicker responses in treatment, leading to safer drinking water and potential cost savings.

Industry partners supporting the Chair include: GE Zenon, Pathogen Detection Systems, Hydomantis, Calgon Carbon, Environmental Bio-Detection Products, the City of Toronto, the Regional Municipality of Halton, Peterborough Utilities Corporation, the City of London, and the Town of Parry Sound.

The Ministry of Research and Innovation recently announced funding of a new initiative "Control of Emerging Contaminants". Professors Andrews and Hofmann will serve as co-investigators and receive more than $1 million in support of the University of Toronto's part of this initiative, which will focus on treatment technologies to address pharmaceuticals and other micropollutants in drinking water.

New Faculty Members

Ron Hofmann - Assistant Professor
Professor Hofmann (PhD 0T0) joined the Department as an Assistant Professor in the Fall of 2007. Professor Hofmann's research is in the field of drinking water treatment and its role in public health. Much of his efforts are directed towards developing and testing new ways to control microbial or chemical threats to tap water quality, and making existing treatment technologies more effective.

Daman Panesar - Assistant Professor
Professor Panesar joined Civil Engineering in January 2008 as an Assistant Professor. Her research interests address cement based materials, durability, destructive and non-destructive test methods.

Interdisciplinary Urban Solutions Forum to Become and Annual Event

The first Interdisciplinary Urban Solutions Forum was held at Hart House on Friday March 28th. The event was initiated by Civil students, but other student groups from across the University were quick to join in as well. The keynote speaker was Thelma Gee, Interim Director of Sustainability at WATERFRONToronto. A discussion panel rounded out the afternoon with participation from Professors **Kim Pressnail** (Civil 7T6), **Chris Kennedy**, **Glen Miller**, and alumnus **Peter Halsall** (Civil 7T7). The Department is very proud of **Katelyn Margerm** and **Kathryn Grond** for organizing this fabulous event. As one of our professors noted "...the future is brighter thanks to your good works, and as others draw upon your spirit and determination, it is a lot easier to be optimistic about "our" future." Well done!

Renovations & Construction

We are currently renovating the entire North corridor of the Galbraith Building, GB 213, to create quality, additional working spaces for our graduate students. Our graduate student enrolment has increased almost 25% over the past 2 years and this renovation is just one step toward improving the graduate student experience.

PETER LEESTI... RETIRING??

On the occasion of my retirement from the University of Toronto, I have been asked to be the subject of a small piece for Skulematters, and if I might be allowed, there is something I would like to say.

My association with the Department began as a mature student in 1981. I obtained my BASc in 1983 and completed an MASc under the supervision of Professor **Peter Marti** in 1985. As a student I received an excellent education, and I could not help being impressed by the quality of the people and the good work being done here. After graduation I was asked by the Chair, Professor **Mike Uzumeri** to join the Department as his Research Associate and administrative assistant, and in a life-changing moment that I didn't fully appreciate at the time, I had the good sense to say "yes." The 22 years that followed have flown by.

Between 1986 and 2003 I was privileged to work as a research associate at various times with Professors Mike Uzumeri, **Dick Soberman**, **Michael Collins**, **Doug Hooton**, and **Michael Thomas**, and gained first-hand, an abiding appreciation for the outstanding scholarship that so distinguishes the University of Toronto. In particular, the uncommon decency and animated, generous spirit of Michael Collins have been and will remain an inspiration to me.

My position as Research Associate eventually morphed into Office Manager, and in January 2004, into Director of Administration and Finance. I have had the honour to serve six distinguished Chairs: Profs. Mike Uzumeri, Dick Soberman, **Barry Adams**, **Eric Miller**, **Paul Young** and **Brenda McCabe**. I am in their debt for the trust they placed in me, for the support and the kindnesses they have shown me, and for the many, many things that they taught me.

I am very proud of and grateful for my time in the Department of Civil Engineering. The work has been challenging but exceedingly rewarding. If I have been able to contribute in some small way to the great teaching and research that are being done here, it was not without a great deal of help. I am indebted to the remarkable faculty, staff and students who have made up my Civil Engineering family, for their unwavering support, and their unqualified friendship. The same is true of the many hard-working people in the offices and departments throughout the Faculty of Applied Science and Engineering and the University at large who have helped me enormously over the years. This is a debt that I cannot repay. I will carry it with me when I retire, but I cannot go without taking this opportunity to extend, to each and every one of you, my heartfelt "thank you."

$10M to Support Nanoengineering Research in ECE

Internationally acclaimed nanoengineering researcher Professor Ted Sargent (PhD 9T8) was awarded a $10 million grant from King Abdullah University of Science and Technology (KAUST) in Saudi Arabia – an international graduate-level research university scheduled to open in 2009.

At 34, Professor Sargent is one of the most celebrated scientists of his generation. In 2003, he was named one of world's top young innovators by MIT's Technology Review and in 2005 was named a research leader in the Scientific American 50.

This grant will further enable Professor Sargent's research to develop nanotechnology that uses the infrared rays of the sun to provide power for virtually everything that now uses electricity. In 2005, Sargent and his research team proved that it is possible to capture and convert the sun's invisible infrared rays into electricity. The team did so using a material that could be simply spray-coated onto any flexible backing.

Professor Sargent will continue to conduct his work at U of T and will also collaborate at KAUST with students and faculty from around the world.

ECE Researchers Receive $8 Million from Ontario Government

Congratulations to ECE Professors who received funding from the Ontario Research Fund Research Excellence program, supported by the Ministry of Research and Innovation.

Professor **Dimitrios Hatzinakos** is the principal investigator of a research project entitled "Self-powered Sensor Networks" where he is developing self-powered mesh and solar-powered wireless networks that will help make high-speed wireless Internet connectivity more reliable, accessible and affordable in urban and remote areas. Professor Hatzinakos received more than $3 million for this research.

Professor **Nazir Kherani** (EngSci 8T2; MASc 8T3) received $5 million to develop more advanced and efficient solar technologies. As principal investigator, Professor Kherani's research project entitled "High Efficiency Silicon Photovoltaics," will enable Ontario to become a global leader in the solar industry. Professor Kherani is cross-appointed to the Department of Materials Science and Engineering.

ECE Gains Canada Research Chair

Can you identify a small number of sentences that accurately reflect the content of a document? Are you able to identify a small number of cities that are most easily accessible from all other cities by commercial airline? How would you identify segments of DNA that reflect the expression properties of genes?

Solving problems like this is part of Professor **Brendan Frey**'s (PhD 9T7) research, recently awarded a Canada Research Chair in Information Processing and Machine Learning.

Professor Frey was named to Canada's Top 40 Under 40 list in 2007, for achieving significant success in developing a new generation of algorithms used for data analysis and summary by organizations ranging from small start-ups to large, established firms, such as Microsoft Corp.

The algorithms organize and summarize data in a more efficient way, and are used to solve problems in genetics research, developing technologies to automatically recognize faces and handwriting and more.

Professor Frey leads the Probabilistic and Statistical Inference Group in ECE with a host of Post-doctoral Fellows, graduate students, faculty associates and alumni.

Welcome New Faculty Members

Joyce Poon, Assistant Professor EngSci 0T2, MS, PhD (Caltech)

Professor Poon joined ECE in the Fall of 2007, (after winning an award for the best PhD thesis at Caltech in 2007) teaching a course on Lasers and Detectors and leading the Micro/NanoPhotonics Lab. Her research involves practical applications of integrating nanophotonic devices with micro-electronics and microfluidics, to create miniaturized platforms for high bandwidth chip-to-chip communication and sensing. Professor Poon also seeks to explore the fundamental physical properties of micro/nanophotonic devices to the quantum level. Her research will drive new applications, such as smarter and more reliable cell phones.

Micah Stickel, Lecturer Electrical 9T7, MASc 9T9, PhD 0T6

Stickel has recently worked as a post-doctoral researcher with Professor George Eleftheriades in the area three-dimensional and volumetric transmission-line based metamaterials. He joined ECE as the Lab Manager for the Electromagnetics Research Group in September 2006. In this position he also worked to facilitate the use of the RF/Microwave and Antenna Test Labs through the Emerging Communications Technology Institute. Throughout his studies he developed a strong interest in the art of engineering education and was very excited to begin working as a lecturer in ECE in July 2007.

"Professor Stickel is a phenomenal professor, who is very dedicated to his work," said Sarah Hossain (ECE 1T0), one of the students in his class. "He redefines interactive learning, through his enthusiastic lectures, well-organized notes, detailed problem sets, frequent office hours and up-to date applications of current course material. I have truly enjoyed being in his class and getting to know him; I look forward to being in more lectures taught by him."

David Wilkinson (EngSci 7T2) Appointed Dean of Engineering at McMaster

World-leading expert in the mechanical behaviour of materials, EngSci 7T2 graduate **David Wilkinson** was named Dean of Engineering at McMaster University effective April 1. Dean Wilkinson served as the founding Director of the McMaster Centre for Automotive Materials, is a Fellow of the Canadian Institute of Mining and Metallurgy, and a Fellow of the American Ceramic Society.

Says Wilkinson, "my Engineering Science degree provided a rigorous foundation that has underpinned everything that came later in my career. I am excited about the possibilities for the future on Engineering education and research in Ontario as we jointly tackle the ways in which Engineering can contribute to the development of a sustainable society".

Dr. Ian Rowe and Dr. Philip Lapp

Giving Back: A Message from Ian Rowe (EngSci 5T8)

Some excerpts from **Ian Rowe**'s message at the 8th Annual Engineering Science Alumni Dinner:

"An eminent graduate of Engineering Physics, Dr. Philip Lapp, knew that Eng Phys grads – now Engineering Science - were prepared to tackle just about any problem that came along. Phil Lapp, an Eng Phys 5T0 grad himself, was Chief Systems Engineer of the Guided Missiles Division of Dehavilland Aircraft. He invited me to join his team of largely Engineering Physics staff working on some very advanced concepts. One day Phil called me into his office. There was a heat build-up problem in some Alouette hardware (Canada's first satellite) and Phil wanted me to solve it. 'But Phil, I'm in electronics!' 'I know,' said Phil, 'current flow, heat flow, it's all the same.' He then handed me one of his textbooks on thermodynamics and bade me out of his office. Of course he was right. And that is the key feature of EngSci grads. If you are well grounded in the fundamentals – physics, materials, dynamics, or whatever – the solutions follow.

Over the years it has been my privilege to have Phil as a friend and mentor. He has served as an example to me as I too have mentored others over the years. This is my message to you, the new alumni to be. You have worked hard to acquire a profound ability: to add to knowledge based on a firm grasp of fundamentals. You will soon have the opportunity to give back: to your colleagues, to those grads who follow, and to the Engineering Science students of the future. Do so. Do give back. Believe me, you will be the richer for it."

Pictures from the 8th Annual Engineering Science Alumni Dinner

Professor Yu-Ling Cheng Inducted into U of T Teaching Academy

Professor Yu-Ling Cheng and Professor Jonathan Rose (EngSci 8T0), Chair of The Edward S. Rogers Sr. Department of Electrical and Computer Engineering, at the 8th Annual Engineering Science Alumni Dinner

Congratulations go out to former Chair of Engineering Science, Professor **Yu-Ling Cheng**, who received the prestigious University of Toronto President's Teaching Award for excellence in teaching, research in teaching, and the integration of teaching and research. Professor Cheng has contributed to the educational mission of the University in many ways. She has taught courses in a wide range of fields. Her Engineering Thermodynamics course was described by one former student as "the stuff of legend". In her role as Chair of the Division of Engineering Science from 2000-2005, her dedication to her students was described as inspiring "loyalty and respect" as well as "affection and admiration". She also successfully oversaw significant enrolment expansion, led the development of an ambitious academic plan, and spearheaded the renewal of the Years 1 and 2 curriculum.

Jun Nogami (EngSci 8T0) Joins EngSci as Associate Chair

A leader in nanoengineering research and teaching, Materials Science and Engineering Professor **Jun Nogami (EngSci 8T0)** recently joined the academic leadership in the Division of Engineering Science.

"My primary role is to assist our excellent student advisors with any issues that may come up, whether it is a student having difficulties with some aspect of the program; the approval of a self-created curriculum; or the consideration of our best students for scholarship nominations," said Professor Nogami. "I am also involved in curricular issues, particularly where it is relevant to the Nano and the Physics Options."

"It has been a pleasure to give back to Engineering Science, which is the program that provided such an excellent launching pad for my academic career. It has also been a pleasure to reacquaint myself with some of my classmates from 8T0 who have stayed here, such as Jonathan Rose and Gabriele D'Eleuterio."

CAN YOU CHANGE YOUR LIFESTYLE TO SPEND LESS AND SAVE MORE?

Earth Hour in Toronto, 2008

A friend of mine was alarmed by how slowly his savings account was growing – he was simply not putting away enough money for holidays, special events or emergencies.

What could he do? His actual answer was simple: he arranged a loan and used the borrowed money to boost his neglected account. The solution is preposterous, producing no gain in what mattered most. Worse yet, he would be poorer, through the inevitable imbalance in interest charges.

Yet in areas touching on energy or the environment we often do much the same thing.

Things may be taken from one context moved to another, and the pieces are prettily rearranged – but no substantial work has actually taken place. The landfill is buried, the river is dredged, the waste is merely put in canisters. It is much more difficult to change lifestyle to spend less and save more. Even when motivated, even when inspired by Earth Hour, it is not easy to tread more softly on the planet.

Interestingly, energy – like money in a bank account – is also conserved. Carefully conducted experimental evidence confirms exactly what the First Law of hermodynamics asserts: energy may be varied in density, changed in form or texture, or transformed between locations, but the total amount of energy in an isolated system remains constant.

In Toronto, as in many places, we were recently encouraged to observe Earth Hour. A great event for awareness and solidarity, but a pity we couldn't do more than turn off a few lights, effectively doing little more than rearranging our bank accounts. Why is this? In Toronto at least, the weather for Earth Hour was quite cold, so turning out the lights might have saved a little electricity, but the loss of the heat from the lights meant that our furnaces simply had to work a little harder.

Switching Canada's light bulbs: the right decision?

For many years the symbol of an idea in a comic strip was a simple light going on; now the image is tarnished and if a light goes on at all, it is a compact fluorescent (CFL). The electrical system benefits, but in a cold country like Canada, particularly if we produce relatively green electricity, it is much less clear whether the atmosphere benefits. We urgently need not transfers between accounts, but integrated solutions, ones that include the energy we use in our wires, in our furnaces, and to move us around.

What doesn't help us to make these connections is that we use so many units to measure energy. We typically measure food energy in calories (technically kilo calories), gasoline energy in litres, natural gas energy in cubic metres, electricity in kilowatt hours, barbeques in BTUs, explosives in tons of TNT, quantum energy in electron volts. And, yet that the SI standard unit is the joule. It's confusing. It is as odd as someone not recognizing that the single person of Jim Carrey lies behind his roles in Ace Ventura, the Grinch, Bruce Almighty, the Mask, or the Riddler.

Our Division is Providing Solutions

What is needed with energy is to translate its myriad of forms and dimensions into terms that make human sense, and then into actions that matter. And this is exactly what the Division of Environmental Engineering and Energy Systems is dedicated to. The challenge is inevitably multidisciplinary, for only then can we begin to confirm that the benefits to one account exceed the inevitable withdrawals from another.

By: Bryan Karney, Chair

Warren Chan Receives $7M Ontario Research Excellence Award

Congratulations to **Warren Chan** who received an award valued at more than $7 million through the Ontario Research Fund Research Excellence program.

Professor Chan's lab will apply the award towards the creation of a portable device that can quickly diagnose whether or not a person has an infectious disease, such as SARS — a first step in better identifying, controlling and containing outbreaks.

As the leader of the Integrated Nanotechnology and Biomedical Sciences Laboratory (INBS), Professor Chan was recently published in Nature Nanotechnology along with PhD candidates Wen Jiang, Betty Kim and Professor James Rutka from the Department of Surgery.

Their paper, Nanoparticle-mediated cellular response is size-dependent shows that nanoparticles can play an active role in mediating biological effects, which may assist in future design of nanoscale delivery and therapeutic systems and provide insights into nanotoxicity.

Professor Peter Zandstra Named Fellow of the American Association for the Advancement of Science (AAAS)

Professor **Peter Zandstra**, Canada Research Chair in Stem Cell Bioengineering and a researcher with both the U of T's Donnelly Centre for Cellular and Biomolecular Research and the Institute of Biomaterials and Biomedical Engineering, has been named a Fellow of the American Association for the Advancement of Science.

Cross-appointed to both the Faculties of Medicine and Applied Science and Engineering, his work integrates engineering and biological approaches. He is cited for distinguished contributions to the field of bioengineering, particularly for fundamental studies into the development of bioprocesses for the production of stem cells and their derivatives.

Professor Zandstra has also received the Guggenheim Fellowship, the Premier's Resarch Excellence Award and the E.W.R. Steacie Memorial Fellowship.

Dr. Noritaka Kawashima Receives Prestigious Fellowship from the Japan Society for the Promotion of Science

Congratulations to post doctoral fellow, Dr. Noritaka Kawashima on receiving the "Superlative Postdoctoral Fellowship for Young Scientists" from the Japan Society for the Promotion of Science.

This is the most prestigious fellowship given in Japan to junior scientists, and was awarded to Dr. Kawashima for his project entitled "Novel Neurorehabilitiation Method for Facilitating Gait Recovery Following Spinal Cord Injury in Humans". The aim of this project is to develop a novel neurorehabilitation strategy for the recovery of locomotive function in patients with spinal cord injury.

Working under the supervision of IBBME Professor Milos Popovic, Dr. Kawashima has been with the Rehabilitation Engineering Laboratory at the University of Toronto since 2006. His current studies focus on the neurophysiological basis of human bipedal locomotion and standing posture. Dr. Kawashima's interests also include the development of a novel neurorehabilitation technique after central nervous system disorders.

New Faculty

Welcome to new faculty member **Jon Rocheleau**, who is an Assistant Professor in IBBME, and cross-appointed to the Faculty of Medicine's Department of Medicine, Division of Endocrinology & Metabolism. He is also a Scientist for Toronto General Research Institute, University Health Network.

Professor Rocheleau began his tenure at U of T in January 2008, leaving his post as a research assistant professor in the Department of Molecular Physiology and Biophysics at Vanderbilt University, in Tennessee.

His research seeks to establish how communication between Beta-cells and vascular endothelial cells directs the proliferation and function of both tissues. To examine Beta-cell-vascular endothelial cell interaction, his lab uses a number of cutting-edge techniques: two-photon excitation microscopy, confocal microcopy, microfluidics, and live cell imaging of fluorescent proteins. His research will advance our understanding of pancreatic islet communication.

Professor Julie Audet Receives 2008 Narsad Young Investigator Award

Professor **Julie Audet** is the recipient of the 2008 NARSAD Young Investigator Award, an international award from NARSAD – the world's leading charity dedicated to mental health research. This award provides financial support for promising young scientists conducting neurobiological research.

Professor Audet leads the Stem Cell Bioengineering and Single-Cell Proteomics Lab and her research focuses on the analysis and manipulation of cytokine synergism in stem cell cultures for the enhanced production of specialized cells.

Professor Michael Sefton Receives Founders Award from the Society for Biomaterials

University Professor **Michael Sefton** (Chem 7T1) has been honoured by the Society of Biomaterials with the 2008 Founders Award. This award is given for long-term, landmark contributions to the discipline of biomaterials and will be presented to Professor Sefton at the World Congress in Amsterdam.

New Centre for Research in Healthcare Engineering

A collaborative Centre for Research in Healthcare Engineering opened in January that will advance the expertise and knowledge in solutions that improve the efficiency and effectiveness of healthcare service delivery.

"Everyone in healthcare is working 110 per cent but working in silos that prevent us from using our critical health care expertise and resources in the best way. We see the resulting problems, such as long wait lists, daily in the media," said the Centre's founder and Director, Professor **Michael Carter** of Mechanical and Industrial Engineering. "Healthcare Engineering is all about replacing silos with a broad system view and getting everyone – people, departments, institutions – pulling in the same direction to make optimal use of our limited resources and taxpayer dollars."

The Centre builds on the 15 years of achievements by Professor Carter's Healthcare Resource Modelling Lab at U of T, which expanded to meet increasing demands for expertise from government agencies and healthcare organizations. Past successes have included predicting demand for hip and knee replacement surgeries, modelling the impact of colorectal cancer screening in Ontario and reducing EMS ambulance delays in Toronto.

Welcome New Faculty Members

Dionne Aleman
Assistant Professor

Professor Aleman joined MIE in 2007 from the University of Florida. Her research focuses on improving how health-care services are delivered. Specifically, she is working on ways to reduce damage to healthy cells when patients are treated with radiation therapy and she is working on improving the success rate of organ transplants. Professor Aleman currently teaches MIE 262: Operations Research I.

Olivera Kesler
Assistant Professor
Canada Research Chair in Fuel Cell Materials and Manufacturing

Professor Kesler joined MIE in 2007 from MIT. Her research focuses on developing fuel cells that are more reliable, cost less and are more flexible in design, material and usability than current fuel cells. The result of her research will help create a fuel cell that reduces greenhouse gas emissions and air pollution as well as the resulting health care costs associated with global warming. Professor Kesler was recently awarded a prestigious Canada Research Chair from the Government of Canada.

A Field Trip to RWDI

In 2007, Rowan Williams Davies & Irwin Inc. (RWDI), commemorated 35 years as a leading firm of consulting engineers and scientists that provides wind engineering, microclimate, ventilation, motion engineering, sustainable design and environmental air quality, noise and risk services to clients around the world. In February 2008, RWDI opened its doors to several dozen U of T Engineering students eager to explore the company's cutting-edge facilities in Guelph.

RWDI Vice President, **Anton Davies**, (Mech 7T2; MASc 7T4; PhD 7T7) led students through labs at RWDI. One of the highlights of the tour was the water flume, a qualitative physical modeling tool that provides a visual indication of snow accumulation, wind patterns, wind flows and emission paths on and around buildings. Scientist Denise Marshall flooded a scale model of the University of Saskatchewan, and students watched as a veritable snowstorm of tiny silica beads accumulated into snowdrift and wind patterns.

When asked how students could break into this industry, Davies replied that many of the graduates who join RWDI have degrees in fields other than mechanical engineering. "Some are aerospace, structural, or environmental engineers, while others are mathematicians, physicists, or chemists. For us the key is a good student who has a willingness to learn. We'll take care of the rest."

Davies relayed that his time at Skule™ was "extraordinary." He became interested in fluid dynamics in his third-year of studies and focused on that area during his graduate studies. "Both my Masters and PhD were in the area of turbulent flow. I undertook studies in both a laboratory setting where I used wind tunnels, and the real world where I took turbulent flow measurements in the lower atmosphere." Davies discovered that his graduate work transferred nicely into his initial work at RWDI where his job was to create simulated small-scale real world wind flows in a wind tunnel. Davies surprised his student visitors when he revealed that RWDI's first wind tunnel fan came from the U of T Mechanical Building and that the fan was still in use.

University Professor Emeritus Ursula Franklin: A Profile

The notion of structure - the relationship between the parts and the whole has always fascinated **Ursula Franklin**, a distinguished alumna of the department.

With x-rays and every form of microscopy as her tools, she joined the Department in 1967 as part of a newly formed Materials Science concentration that also brought Professors Aust, Rutter, Craig and Winegard to the Faculty.

In addition to teaching and research in the structure of metals and alloys, she won claim for her work on characterization of ancient materials. Taking the notion of appropriate structures into its broader content, Franklin worked tirelessly on the inclusion of women into science and engineering, mentoring many of them and helping to ease their working conditions.

As a member of NSERC, the Science Council of Canada, and the Royal Society and many other civic bodies, she attempted to integrate knowledge and commitment into Canadian life. In 1984, she became the first woman to be appointed as a University Professor at U of T. In 1995 Toronto named a school after her – the Ursula Franklin Academy, which follows a special curriculum that seeks to integrate science and the liberal arts and challenges students to develop a sense of social responsibility in addition to skills in science and technology.

In 2002, University Professor Emeritus Franklin received the Pearson Peace Medal from the United Nations Association in Canada in recognition of her contributions to humanitarian causes. A Companion of the Order of Canada and a Fellow of the Royal Society of Canada, she continues to work for appropriate, cooperative, and peaceful social and educational structures that would give room to advance the best in all.

Recently the Trudeau Foundation appointed her as a mentor to their Post-doctoral program. Dr. Franklin continues to stay engaged with the University as senior fellow at Massey College.

She has authored two books *The CBC Massey Lectures - The Real World of Technology* (1999) and the *Ursula Franklin Reader* (2006) as well as numerous technical papers.

CSI:
MSE FORENSIC ENGINEERING

An elevator falls from its path; a space shuttle explodes; a car's suspension fails and leads to a multi-car pileup. Did a product failure cause this destruction? Forensic engineering experts can find the answers.

Forensic engineering and failure analysis is a growing area of interest among Engineers. Professor **Doug Perovic** (MSE 8T6; MASc 8T8; PhD 9T0), Chair of Materials Science and Engineering, has worked on hundreds of cases involving materials failures. From lead in children's jewelry to Kevlar body armour failure, Professor Perovic's experience in the field lends well to teaching forensics in the classroom. "Materials Science and Engineering graduates are really well placed to be forensic engineers," said Professor Perovic who currently teaches Engineering undergraduates about this emerging area.

He also teaches a course to professional engineers DM 1021: Forensic Engineering and Failure Analysis at the Advanced Design and Manufacturing Institute (ADMI) - a program that partners U of T, the University of Waterloo, the University of Western Ontario, McMaster University, and Queen's University through a Master of Engineering in Design and Manufacturing: www.admicanada.com.

Professor Perovic has appeared in court several times in the past 15 years as the forensic engineering expert and continues to investigate cases today. He has recently joined Canada's largest firm Giffin Koerth Forensic Engineering and Science as a consultant.

After the Columbia shuttle disaster of 2003, media around the world consulted with him about the destruction of the heat tiles on the spacecraft. He has also been involved in the forensic investigation of a murder-suicide case in Ontario where a woman, whose boyfriend was wrongfully accused of murder, was actually found to have died by committing suicide.

MSE Grad Teaches Engineers at U of Alberta

Congratulations to **Adrian Gerlich** (MSE 0T3; PhD 0T7) who recently accepted a Faculty position at the University of Alberta. His tenure began in December of 2007 in the Department of Chemical and Materials Engineering. Professor Gerlich's supervisor was Professor **Tom North**. Congratulations Adrian!

AVIATION: The Environmental Challenge

In the last issue of Skulematters, I wrote about the urgent need to make major investments in new research and technology development to reduce the contributions of aviation to climate change. Since then, the European Union has initiated a $2.3 billion research initiative, called the Clean Sky project, "to develop cleaner, quieter airplanes and make air travel less damaging to the environment." The six-year program, which involves 17 universities, aims to reduce carbon dioxide emissions by 40% and nitrogen-oxide emissions by 60%. This investment reflects both the urgency of the issue and the existence of potential technological solutions. UTIAS is also dedicated to the development of technological solutions to reduce the impact of aviation on climate change, and a similar investment in Canada would go a long way toward enabling UTIAS researchers to make rapid progress.

What technological solutions are possible?

On the airframe side, emissions can be reduced through the use of lightweight materials and by reducing drag through novel configurations and active flow control. The blended wing-body concept is particularly promising, leading to an estimated 25% reduction in drag and therefore emissions. The drag reduction relative to current aircraft increases to 50% when the blended wing-body is combined with hybrid laminar flow control. On the engine side, low-emission combustors, high-efficiency designs, such as open rotors, and alternative fuels are all prospective pieces of the puzzle. Many experts project a reduction by a factor of 4 to 8 in greenhouse gas emissions per passenger-km by 2050. Strategic investment in R&D is needed in order to make this a reality.

What is UTIAS doing to address this urgent challenge, which is foremost in its strategic plan?

In the next issue of Skulematters, I will describe some specific research projects underway at UTIAS aimed at reducing the environmental impact of aircraft.

David W. Zingg, Director of UTIAS

NEW CAPABILITIES FOR UAVs

The last several years have witnessed tremendous growth in both research and applications of unmanned aerial vehicles (UAVs) and Multi-UAVs (MUAVs). UAVs are of great interest in military and civilian applications, including mapping, patrolling, surveillance, and search and rescue using on-board digital cameras. Many of these tasks are both repetitive and dangerous for humans, which makes them ideal applications for autonomous vehicles.

At UTIAS, Professor **Hugh Liu** is leading a research group to develop MUAV systems and control technology. His current research is based on motion synchronization strategy, a technique developed by Professor Liu's group to control synchronized formation flight, which they have extended to establish a cooperative platform involving multiple vehicles (both flying and ground).

The proposed autonomous MUAV system has strong potential in both safety and security applications, such as mobile aerial surveillance using multiple vehicles for simultaneous coverage of large areas. This ability makes them of special interest for monitoring civilian areas, such as amusement parks, or for monitoring disaster scenarios such as forest fires.

MOST Project Team Wins Alouette Award

The MOST project team, including Dr. **Robert Zee** of the UTIAS Space Flight Lab, received the 2007 Alouette Award from the Canadian Aeronautics and Space Institute.

The Alouette Award is given annually in recognition of an outstanding contribution to Canadian space technology, applications, science, or engineering. In 2003, MOST launched Canada's first home-built science satellite in over 35 years.

During the first year of operations, the MOST team made improvements to the on-board software which allowed the simultaneous observation of 30 stars, rather than the original goal of observing one star at a time. The MOST mission has achieved unprecedented pointing accuracy and has gained international recognition for its achievements, which include several significant astronomical discoveries.

This is the second Alouette Award for UTIAS in as many years. Professor **Peter Hughes** received the Alouette in 2006.

PROFESSOR CHRIS DAMAREN APPOINTED VICE-DEAN, GRADUATE STUDIES

Professor **Chris Damaren** of UTIAS has been appointed Vice-Dean, Graduate Studies, in the Faculty of Applied Science and Engineering. He began his term on March 1, 2008.

CANADA RESEARCH CHAIR NEWS

Professor **Timothy Barfoot** has been awarded a Canada Research Chair in Autonomous Space Robotics and Professor Joaquim Martins's Canada Research Chair in Multidisciplinary Optimization was renewed.

MEET OUR NEWEST FACULTY MEMBER

UTIAS is pleased to welcome Dr. **Alis Ekmekci** to its faculty as an Assistant Professor. She will initiate a research program in experimental fluid dynamics emphasizing novel concepts for aerodynamic drag reduction.

Calling All Aerospace Alumni!

UTIAS now has an alumni registry on our website dedicated to graduates of the Aerospace Option of Engineering Science and UTIAS. If you want to keep up with developments at UTIAS, share news with other alumni, or just catch up with old friends, join the alumni registry and look for upcoming events on our website: **www.utias.utoronto.ca.**

Nano Researchers
at University of Toronto Engineering

Read about the research pursuits of some of our nanoengineering professors in Engineering at the University of Toronto. For more information about nanoengineering, please visit our website: www.engineering.utoronto.ca

Cristina Amon

Dipl Eng (USB), MS, ScD (MIT)

Our work is focused on nano-scale thermal transport in semiconductors with hierarchical multi-scale modeling by atomistic molecular dynamics, lattice-Boltzmann and phonon Boltzmann transport, for applications to thermo-electric energy conversion, novel nanostructures and thin-film silicon devices.

Susan A. Andrews

BSc, MSc, PhD (Alberta)

Nano-scale sensors are being used to detect substances such as chlorine-based disinfectants in drinking water. We are involved in collaborative research efforts to identify appropriate hemistries for use in these sensors.

Stewart Aitchison

BS, PhD (Heriot Watt, Scotland)

We are working to develop integrated optical circuits based on photonic nanowires for application ranging from enhanced communications to optical gas sensing.

Warren Chan

BSc (Illinois), PhD (Indiana)

Canada Research Chair in Bionanotechnology

We aim to elucidate the cell's molecular dynamics by using recent developments in nanotechnology, microtechnology, and molecular engineering as well as engineering new instrumentation and techniques to address biological questions. A fundamental understanding of molecular processes with technology developments should lead to the design of novel diagnostic schemes and therapeutic strategies.

George Eleftheriades

DIPL (Nat. Tech. U. of Athens), MS, PhD (Michigan)

Velma M. Rogers Graham Chair in Engineering

We are designing and implementing metamaterials: artificial media with unusual electromagnetic properties that transcend those found in conventional materials. These unusual properties are being exploited to engineer new devices at microwave and optical frequencies for a variety of applications including wireless telecommunications, defense, and medical imaging.

Uwe Erb

DIPL, Dr.rer.nat (SAARLAND)

Research interests include microengineered materials, grain boundary engineering in polycrystalline and nanocrystalline materials, electrochemical synthesis of nanocrystalline metals, alloys and metal matrix composites, nanocrystalline soft magnetic materials, and metal/nonmetal interfaces.

Andrew Goldenberg

BSc, MSc (Technion), PhD (Toronto)

Research focuses on the advanced mechanics and control of robotic and mechatronic systems, as well as the design of intelligent systems for automation.

Axel Guenther

PhD (ETH, Zurich)

Our research involves the fluid flow and transport processes through nano-sized confinements to better understand and control the dynamics of complex chemical and biological phenomena.

Amr Helmy

BS (Cario), MSc, PhD (Glasgow)

The group's interest encompasses re-engineering the properties of matter to obtain a range of artificial, technologically attractive optoelectronic materials. This takes place through the use of quantum effects, which can be manipulated via controlling the shape, composition and order of a group of atoms/molecules on a nanometre scale. These artificial structures are then used in the design and implementation of novel devices, which aim of provide solutions to current challenges in numerous vital fields.

Peter Herman

BEng (McMaster) MSc, PhD (Toronto)

Our research group studies and develops novel laser processing technology for defining photonic devices, optical circuits, microfluidic and other devices that approach the nanoscale. The laser enables fabrication in novel two- and three-dimensional architectures to be explored in optical materials for broad impact in today's optical communication networks and lab-on-a-chip microsystems.

Glenn Hibbard

BSc (Alberta), PhD (MSE 0T2)

Nanometer-scale materials design; nanocrystalline cellular materials; nanostructured metal matrix composites; structure-property relationships; interfacial structures; microstructural evolution; phase transformations.

R. Doug Hooton

BASc, MASc, PhD (McMaster)

Our research utilizes nanoscale particle packing to make ultra-high strength cement systems; we also do nano-SEM (well at least sub-micron), and evaluate nano-mineralogy of cement materials and hydrates using XRD.

Nazir Kherani

BASc (EngSci 8T2), MASc (Chem 8T3), PhD (Toronto)

Silicon and silicon-based materials at the nano-length scale are expected to contribute to the realization of high quality materials and novel devices. Using a novel plasma synthesis technique, we are developing novel silicon photovoltaic devices with high energy conversion efficiencies.

Keryn Lian

BASc (Tongji University, China), MSc (Calgary), PhD (Toronto)

Research centers on the applications of electrochemical energy storage and hybrid energy systems using carbon nanotubes (CNT), carbon nanodiamonds (CND) and other forms of carbon materials. Our approach has been focusing on chemically engineering and modifying nano carbon materials by superimposing active materials or functional molecules to enhance their energy storage capabilities. In addition, solid polymer electrolytes have been investigated and utilized to demonstrate ultra-thin, high energy density and power density energy storage systems.

Zheng-Hong Lu

BSc (China), MSc, PhD (Ecole Polytechnique)

Organic semiconductor thin films and devices; organic light-emitting diodes; organic solar cells; novel metal oxides thin-films and devices; science and engineering of material surfaces and interfaces; X-ray and UV photoemission spectroscopy of materials.

Andreas Mandelis

BS (Yale), MA, MSc, PhD (Princeton)

Fundamental optoelectronic studies in semiconductors and process-induced nanolayers (ion implantation, doping) using laser photothermal and photo-carrier radiometry non-contact probes; development of advanced diffusion-wave instrumentation and

Nano Researchers
at University of Toronto Engineering

...continued

measurement techniques for semiconductor and metal/coating nanolayer diagnostics. Novel Solid-State Spectroscopies of semiconductors and thin films; Deep-Level Photo-Thermal Spectroscopy.

R. Ben Mrad

PhD (Michigan), P.Eng.

Research areas include micro-electromechanical systems, microfluidics, and precision actuators.

Hani Naguib

PhD (Toronto), PEng, CEng, FCSME, MIMMM

Canada Research Chair Tier II in Smart and Functional Polymers

Development and characterization of functional polymeric materials with adaptive properties such as: smart and active Polymers; bioactive and biodegradable Polymers; light weight and hybrid polymers. Research focus on Smart materials and structures, biologically inspired materials, dynamics of polymer systems; mechanics of cellular materials and scaffolds, micro and nanocellular plastics, polymer/supercritical fluid systems, modeling and simulation of polymers properties.

Jun Nogami

BASc (EngSci 8T0), MS, PhD (Stanford)

Our research is focused on the synthesis and characterization of nanostructured electronic materials, specifically thin film materials grown on semiconductor substrates that take advantage of self assembly phenomena during epitaxial growth to produce 2D, 1D and 0D materials with various nano-enhanced properties.

Doug Perovic

BASc (MSE 8T6), MASc (MSE 8T8), PhD (MSE 9T0)

Chair of Nanoengineering Option in Engineering Science

Nanostructure-property relationships for electronic/photonic applications. High resolution scanning-transmission electron microscopy/ spectroscopy of nanomaterials structure and chemistry. Semiconducting quantum wells and dots. Mesoporous nanocomposites for nanoelectronics. Defect engineering in photonic band gap materials.

Harry Ruda

BSc (London), PhD (MIT)

Chair in Advanced Nanotechnology

Molecular beam epitaxy of optoelectronic materials and devices; optical and electronic properties of quantum heterostructures including quantum boxes, wires and wells; influence of surfaces and interfaces on performance of photonic/electronic devices; nanoelectronic and nanophotonic devices; microelectromechanical systems for sensing, energy, photonics and electronics.

Ted Sargent

BSc (Queen's), PhD (ECE 9T8)

Canada Research Chair in Nanotechnology

We apply discoveries in nanoscience towards applications relevant to our health, environment, security, and connectedness. We use solution-processed colloidal quantum dots to build optimized devices relevant to four areas of application: (1) Visible and infrared optical sensing (2) Visible and infrared energy conversion: solar cells and thermophotovoltaics (3) Optical interconnect enabled by infrared lasing and (4) Multiplexed ultrasensitive biomolecular detection.

Molly Shoichet

BSc (MIT), PhD (U of Massachusetts, Amherst)

Canada Research Chair in Tissue Engineering

We are focused on enhancing the cell-material interaction through controlled polymer chemistry and engineering. The defining characteristic of neurodegenerative diseases, such as spinal cord injury, is the inability of injured nerve cells to repair themselves or regrow.

Peter Smith

BSc, MSc, PhD (McGill)

Professor Emeritus

Novel nanostructures and devices for future optical communications systems. Photonics; non-linear optical devices and phenomena; optical components for signal processing and communications systems

Eli Sone

BSc (Toronto), MS, PhD (Northwestern)

Our work is focused on systems in biology where organic-mineral interactions play a key role. We use a combination of ultrastructural characterization of native tissues and in-vitro investigations of synthetic systems to study the mechanisms of attachment of biological fibers to inorganic substrates. Currently we are working on two systems in which the nanostructure of the interface is critical: adhesion of zebra mussels to rocks, and the attachment of ligaments to bones and teeth.

Yu Sun

MS, PhD (Minnesota)

Sun established and directs the Advanced Micro and Nanosystems Laboratory (AMNL), which is affiliated with Mechanical and Industrial Engineering, IBBME, and Electrical and Computer Engineering. AMNL's research has a strong focus on bio-oriented micro and nanosystems. Areas of active pursuit include: micro-nano device design and fabrication (MEMS/NEMS sensors and actuators, bioMEMS/NEMS); micro-nanorobotic manipulation of biomaterials and nanomaterials; cellular mechanobiology; intelligent drug delivery; and electromechanical cancer detection.

Steven Thorpe

BASc (MSE 8T0), MASc (MSE 8T2), PhD (MSE 8T5)

Research interests include: electrochemistry and corrosion; production, structural characterization and properties of amorphous and nanocrystalline materials; electrocatalysis; surface science; electronic packaging; and surface modification and corrosion of biomaterials.

Christopher Yip

BASc (Chem 8T8), PhD (Minnesota)

Canada Research Chair in Molecular Imaging

We are interested in understanding how molecules 'self-assemble' into intricate higher-order structures. If we can control these processes, the potential for designing new materials, creating new molecular structures and devices, and understanding protein/protein interactions is tremendous. We are developing both instrumental and computational tools and techniques to probe, measure, and map single molecule structure and dynamics, particularly at surfaces and membrane interfaces.