CAPSTONE

Université Concordia University

GINA CODY
SCHOOL OF ENGINEERING
AND COMPUTER SCIENCE

Capstone Magazine is published twice a year by the
Gina Cody School of Engineering and Computer Science
at Concordia University.

Design and Photography: University Communications Services
T21-67935

Submit all editorial queries to:

Concordia University
Gina Cody School of Engineering and Computer Science
Communications Advisor, Sir George Williams Campus
1455 De Maisonneuve Blvd. W., Montreal, QC H3G 1M8

Email your feedback to vincent.allaire@concordia.ca

Please visit our website: concordia.ca/ginacody

DEAN'S MESSAGE

In May, we bade a fond farewell to Amir Asif and I became the interim dean of the Gina Cody School of Engineering and Computer Science (GCS). For this, I am honoured and also inspired to continue setting new benchmarks in research, industry collaboration and engaging education at the Gina Cody School.

While the pandemic is changing working habits the world over, faculty and staff at the school have diligently pivoted operations to enhance teaching for the online environment. It's a priority across the university, as we not only adapt to new realities but thrive using new technologies.

With experiential learning at the core of GCS's mission, new opportunities for hybrid and inclusive learning are on the horizon. The goal is to help students stay engaged, focused and socially active, while giving them access to a high-calibre education.

Despite the challenges of COVID-19, research is ongoing, with more than 200 labs re-opened—social and temporal distancing, of course, are safely in place.

Our research collaborations with industry partners remain robust, enriching the relationships with the public and private sector that make the Gina Cody School such a relevant training ground. Faculty and researchers are creating partnerships with organizations in both the public and private sectors, highlighting GCS's research strengths in smart cities and resilient communities, applied artificial intelligence, cybersecurity, software engineering.

While prioritizing these research strengths, the development of complementary graduate programs continues. Future plans at GCS include creating recruitment strategies to attract top-drawer talent. The school's proven ability to rise to the demands of the COVID-19 crisis surely play a part in any success beyond 2020.

Mourad Debabbi

Interim Dean and Professor
Gina Cody School of Engineering and Computer Science
Concordia University

HOW DO WE MAKE WORK SURFACES SAFER FOR FRONTLINE STAFF?

A CANADA-WIDE RESEARCH NETWORK BASED AT CONCORDIA INVESTIGATES COPPER AND TITANIUM OXIDE SPRAY COATINGS

BY JOANNE LATIMER

These days, everyone thinks twice before touching a door knob or a shopping cart.

The virus that causes COVID-19 can live on many surface materials — plastic, stainless steel, aluminum and other metals, wood, glass — for as long as three days.

That's why the Green-SEAM (Surface Engineering for Advanced Manufacturing) Network based at Concordia is stepping up to promote antiviral metallic and ceramic coatings as a way to slow the transmission of the virus.

"Copper and titanium oxide, we know, are active in killing bacteria and viruses, so they are effective materials to spray on surfaces to fight the spread of COVID-19," notes Christian Moreau, director of Green-SEAM and Canada Research Chair in Surface Engineering.

"We have a unique network of experts in surface engineering from 11 universities across Canada, 14 industrial companies and government laboratories including the National Research Council who specialize in coating materials."

CONSIDER COPPER AND TITANIUM OXIDE

Moreau and his Green-SEAM colleagues see how their resources can be applied to the pandemic.

"Any public space with high volumes of people circulating — like hospitals, industrial kitchens, nursing homes, public transport — is vulnerable to contaminated surfaces," says Moreau, who is also director of the Concordia's Thermal Spray and Surface Engineering Research Centre at the Gina Cody School of Engineering and Computer Science.

"We want to do everything in our power to connect frontline workers with industrial coating companies and research laboratories who have solutions — be they short-term or long-term solutions. We have partners who can accommodate large-scale production, as well as custom surfaces applications, from hand rails and door handles to countertops or much larger surfaces exposed to germs."

INSIDE GREEN-SEAM

Established three years ago as a Natural Sciences and Engineering Research Council of Canada (NSERC) Strategic Network, Green-SEAM is on a mission to integrate Canada's surface engineering leaders into a cohesive community.

And the pandemic, above all else, has brought the collaborative expertise of the network into focus.

"Imagine all the food trays in a nursing home or the arm rests on emergency room chairs," says Simon Durham, Green-SEAM network manager. "Our partners are in a position to take advantage of network technologies and can be made ready to make these kinds of surfaces less likely to spread contaminants."

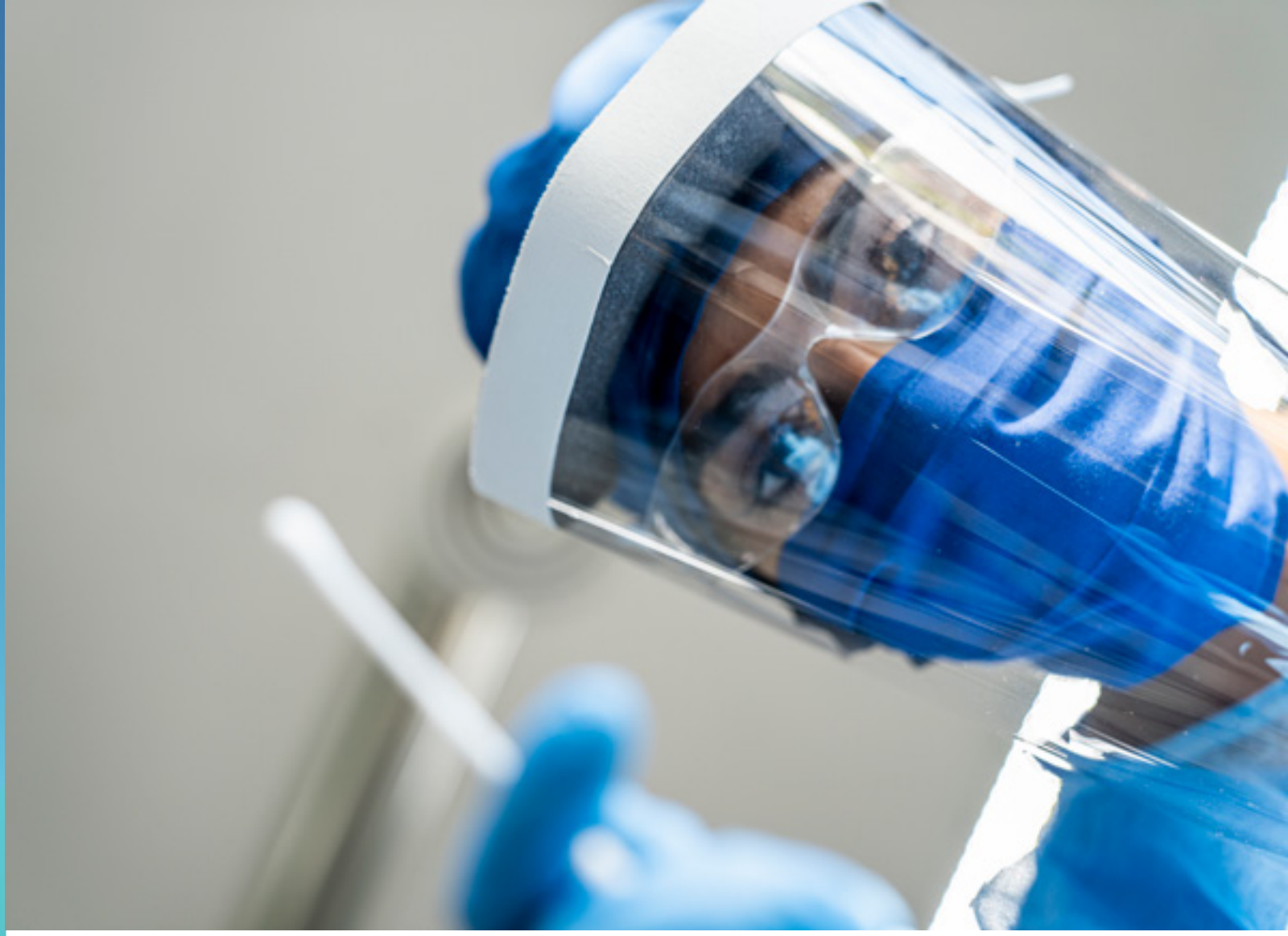
While healthcare isn't one of their primary fields, Green-SEAM has pivoted to apply its technological expertise in that direction to identify coating opportunities in hospitals and clinics.

"We're pioneering the development of technologies that ensure environmentally responsible practices and solutions by the entire Canadian coating and surface engineering community — a community that can contribute its skillset to help flatten the curve," Moreau adds.

For the past five years, experts at the Gina Cody School have been tailoring the nano-sized structure of titanium oxide coatings to optimize their photocatalytic and filtration properties that can now be deployed for their antibacterial and antiviral capabilities.

"We're well positioned to play a contributory role this pandemic," Moreau concludes. "We're currently developing projects for the NSERC Alliance COVID-19 program to look at innovative surface engineering solutions to fight this coronavirus."

For enquiries about the Green Surface Engineering for Advanced Manufacturing Network, email Simon Durham or call at 514-848-2424, ext. 5788.



GINA CODY SCHOOL JOINS THE FIGHT AGAINST COVID-19

STUDENTS AND FACULTY USE AT-HOME 3D PRINTERS TO SUPPORT FRONTLINE WORKERS

BY JOANNE LATIMER

"Need your help!" The email subject line caught Anthony Tkalec's attention right away.

Tkalec is a computer engineering student at Concordia. He didn't hesitate when Wael Saleh, assistant professor in the Department of Mechanical, Industrial and Aerospace Engineering (MIAE), put out the call for anyone with a 3D printer to manufacture the support pieces for protective visors used by frontline workers at the Centre hospitalier de l'Université de Montréal (CHUM).

"When you see that people are dying all around the world, you want to do anything you can," Tkalec says. And so he immediately moved his 3D printer to his parents' garage in the Montreal West Island municipality of Dollard-des-Ormeaux and got to work.

In the week that followed, he made 45 of the flexible support pieces that attach transparent visors to people's heads.

BETTER TOGETHER: A NETWORK OF 3D PRINTER OWNERS

Tkalec is one of 23 people — undergraduate and graduate students plus professors — at the Gina Cody School of Engineering and Computer Science who formed a network of 3D printer owners to coordinate their efforts to supply personal protective equipment (PPE).

"We were approached by École de technologie supérieure (ÉTS) to help them manufacture the visors for the nursing staff and others at the CHUM," says Rolf Wuthrich, associate professor in MIAE.

"Our lab has one 3D printer, but we knew some of our students would have them at home. The response was incredible. Students are buying their own printing materials and are really pitching in."

Wuthrich is leading the network, along with Lyes Kadem, associate professor and curriculum director, and Tsz Ho Kwok, assistant professor, both in the MIAE.

These Gina Cody School faculty members join colleagues across the Concordia community in addressing the growing demand for PPE.

MANUFACTURING IN ISOLATION

Each printed component takes two to four hours to make, depending on the machine. Students wash the completed pieces and seal batches of 20 in a Ziploc bag before delivering them to designated drop-off locations across town.

"The ABS filaments needed to make the parts aren't expensive and they're easy to order online," says the MIAE graduate student. "It feels good to help."

Antony Rizk, a third-year mechanical engineering student, concurs. From his parents' home in the Montreal borough of Pierrefonds-Roxboro, he's working on his second batch of 20 support parts.

"Doing something concrete to help with the pandemic is better than just worrying and sitting around," Rizk says.

"When buildings collapse or lean, the problem usually isn't the concrete. The problem is the ground."

ADEL HANNA KEEPS THE FOCUS ON FOUNDATIONS

FOR 40+ YEARS, THE CONCORDIA PROFESSOR HAS RESEARCHED SOIL CONDITIONS AND HOW THEY IMPACT CONSTRUCTION

BY JOANNE LATIMER

Geotechnical engineers focus on the design and construction of foundations — among many other things.

And, aspiring engineers with an interest in soil mechanics find themselves drawn to study at Concordia under one man: Adel Hanna.

Over the last 42 years, Hanna has single-handedly driven the effort to develop the Foundation Engineering Research Lab at the Gina Cody School of Engineering and Computer Science.

Hanna moved to Canada from Egypt in 1974, completed his PhD in 1978 and arrived at the university in July 1978.

"When I came to Concordia, there was no geotechnical program at the graduate level, certainly no research facility and no internet to source these materials," recalls Hanna, who today is a fellow of the American Society of Civil Engineers and member of the Ordre des ingénieurs du Québec and several other engineering societies.

Inside the Department of Building, Civil and Environmental Engineering, Hanna set about creating the province's first foundation engineering research lab while building the university's reputation as a leader in the field.

BUILDING A LEGEND

Hanna learned from the best. After earning his BEng in structural engineering and MEng in geotechnical engineering from Cairo University in Egypt in the early 1970s, he came to Canada to study under the internationally esteemed geotechnical scholar George Geoffrey Meyerhof at Dalhousie University in Halifax.

In 2010, Hanna was touched to receive the 2010 G. Geoffrey Meyerhof Award — named after his mentor—from the Canadian Geotechnical Society.

Hanna's PhD on layered soil is considered an industry manual on the subject and is cited in countless papers, as well as referenced in popular textbooks.

"His professional stature — in both academia and industry — gives him undeniable authority and credibility," notes Mourad Debbabi, interim dean of the Gina Cody School and holder of the NSERC/ Hydro-Québec/Thales Senior Industrial Research Chair in Smart Grid Security.

"He has enhanced the school's reputation and recognition by developing geotechnical engineering as one of our core strengths."

ARTICLES, MANUALS AND MORE

Hanna has published more than 250 technical articles in respected journals and international conferences.

In 1992, he participated in the development of the second edition of the Canadian Foundation Engineering Manual.

The American Society of Civil Engineers appointed Hanna co-chair of the 2003 ASCE Shallow Foundation Committee, created to develop the ASCE Manual of Practice for the Site Investigation for Shallow Foundation, which he co-edited from 2004 to 2007.

In 2003, Hanna organized and chaired the 32nd International Conference on Housing Science at Concordia, where over 40 countries participated.

That same year, he received recognition for his outstanding contribution to the IEEE Guide for Transmission Structure Foundation Design and Testing.

A TRADITION OF MENTORSHIP

Hanna carries on Meyerhof's tradition of mentoring his students, especially international students who may be away from family for the first time, as he once was.

At the undergraduate and graduate level, Hanna's courses are always packed — a point of pride for the professor.

"The room is full, I think, because my courses are a good balance of theory and application," says Hanna.

"I also like to inform the public about the condition of buildings and bridges. If there's any possibility of a collapse, the problem usually isn't the concrete or steel. The problem is the ground."

A SOUGHT-AFTER EXPERT

Hanna's engaging style and expertise in how soil conditions impact construction challenges above ground makes him a frequent media commenter.

"If there's a giant sinkhole on Saint Catherine Street or a bridge collapse, the journalists ask me what's happening," Hanna says. "If public projects have huge cost overruns and delays, like the metro in Laval, people want answers."

Hanna has been asked to consult for the United Nations in Egypt, the government of Haiti and national construction companies. He has penned 200-plus consulting reports, not to mention Hanna's work as a court expert in legal disputes and construction claims.

"Oh, the lawyers know me, but I don't work for them," says Hanna. "The truth is what they get. The ground doesn't lie."

Hanna is happy to continue solving problems related to foundations and soil mechanics.

"Ultimately, we are here to serve people, to serve humanity," he says. "If there's a way to make things better or safer, let's find it."

"We want students to come to the realization that Indigenous self-determination is important."

KASIM ALI TIRMIZEY INTEGRATES INDIGENOUS KNOWLEDGE IN HIS COURSE CURRICULUM

THE DRIVE IS UNDERWAY TO DECOLONIZE ENGINEERING AND COMPUTER SCIENCE COURSES

BY JOANNE LATIMER

As a child growing up in a Cree community in the James Bay region, Lichid Tent hunted and trapped alongside his family.

"If we didn't catch anything, we didn't eat," says Tent, an independent student at Concordia who is in the process of applying to the Gina Cody School of Engineering and Computer Science.

Tent wants to realize his dream of integrating traditional Cree architecture into modern civil engineering design.

"I had my eyes opened when I took a course through the Centre for Engineering in Society," says Tent, a survivor of the residential school system. He was also rounded up in the Sixties Scoop, when Indigenous children were taken from their families and placed in white foster homes or put up for adoption.

"For the first time, I heard terms like 'design justice' and 'social justice' spoken in relation to my community. It was like having a curtain pulled back — even though I'd already lived it — and this gave me a whole new perspective on engineering and how I can help my community."

‘TECHNOLOGY IMPACTS PEOPLE IN DIFFERENT WAYS’

Impact of Technology on Society (ENGR 392) was the engineering course that opened Tent’s eyes. It’s taught by part-time faculty member Kasim Ali Tirmizey, who is one of the professors leading the effort to decolonize the curriculum at the Gina Cody School for Engineering and Computer Science.

To further this effort, GCS developed a teaching workshop to show engineering and computer science faculty how Tirmizey revamped his curriculum.

Tirmizey and Donna Kahérakwas Goodleaf, director of decolonizing curriculum and pedagogy for Concordia’s Centre for Teaching and Learning (CTL) will discussed how they reconceptualized Tirmizey’s course by deconstructing the syllabus and realigning it by meaningfully integrating Indigenous perspectives and worldviews.

“Given that technology impacts people in different ways, we look at what impact technology has had on settler communities and Indigenous Nations and communities, women and men, the Global North and the Global South,” says Tirmizey.

IS A BRIDGE JUST A BRIDGE?

Tirmizey notes that engineering students often think of objects like bridges, for example, as politically neutral, if not positive.

“But with things like pipelines, hydroelectric dams, air bases, mines — people across society benefit disproportionately from them,” Tirmizey says. “What some see as progress can erode someone else’s way of life.”

THE INDIGENOUS DIRECTIONS ACTION PLAN AT WORK

Goodleaf helped Tirmizey integrate Concordia’s territorial acknowledgment into the course. She also suggested themes pertinent to issues faced by Indigenous nations and articles that match his topics each week.

Donna Kahérakwas Goodleaf, director of decolonizing curriculum and pedagogy.

Lichid Tent (in the foreground) created a mobile app that recommends emergency evacuation procedures for residents living around the Robert-Bourassa power generating station in the James Bay region.

Last September, Goodleaf and Tirmizey did a presentation to share their process and provide practical tips to faculty and graduate students at the CTL.

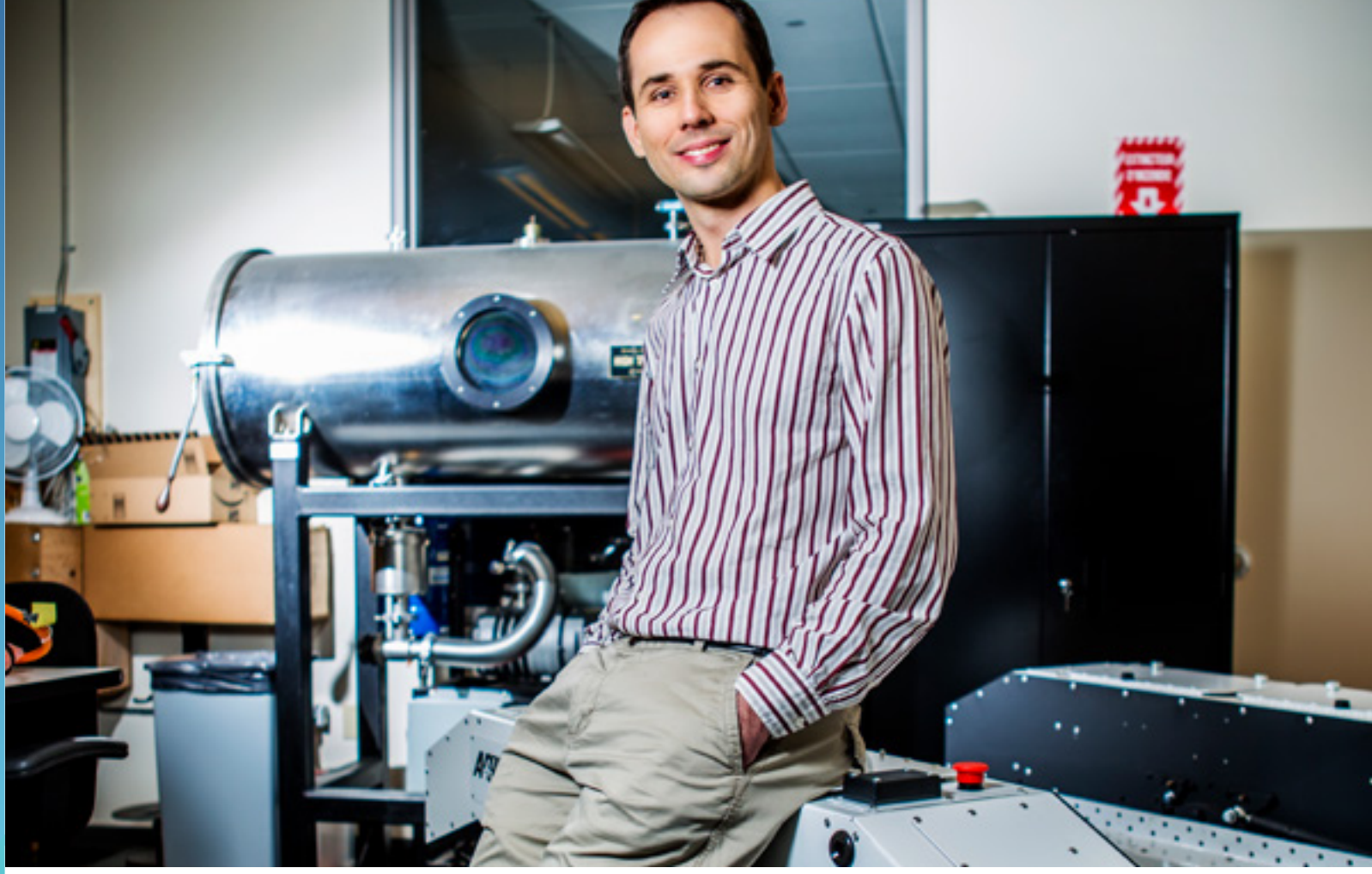
“The idea is to get every member of the Concordia community to take a serious look at Concordia’s Indigenous Directions Action Plan, which came in response to the Truth and Reconciliation Commission’s recommendations to address institutional racism in education and the erasure of Indigenous voices and perspectives,” Goodleaf says.

Goodleaf notes that Tanja Tajmel, associate professor at the Centre for Engineering in Society, is joining Tirmizey in working toward positive change.

A physicist by training, Tajmel questions the colonial assumptions in the Western science in her project Decolonizing Light.

“We are teaching this content to our students without sufficient historical context and geopolitical awareness,” she says.

Goodleaf agrees, adding: “There’s a great need for faculty across all academic disciplines to question any misconceptions they may have about Indigenous peoples. Furthermore, there’s a need to address their lack of awareness and understanding, lean into discomfort and divest from perpetuating Western canons of thought in the sciences.”



"People joke about not needing to reinvent the wheel, but we did."

WHAT'S DIFFERENT ABOUT NASA'S NEW MARS ROVER? BETTER WHEELS!

CONCORDIA RESEARCHER CHRIS SKONIECZNY HELPED DEVELOP THE DESIGN GUIDELINES TO INCREASE TRACTION

BY JOANNE LATIMER

When the next mission to Mars blasts off from Cape Canaveral in Florida on July 30, 2020 the rover on board will be sporting a new wheel design — thanks, in part, to Concordia researcher Krzysztof "Chris" Skonieczny.

Skonieczny and his collaborators at NASA and Carnegie Mellon University developed guidelines and equations to optimize the rover's metal wheels.

"We came up with ways to improve their performance on Mars's loose and rocky soil," explains Skonieczny, associate professor and Tier 2 Canada Research Chair in Aerospace Robotics in the Department of Electrical and Computer Engineering at the Gina Cody School of Engineering and Computer Science.

"People joke about not needing to reinvent the wheel, but we did."

PERSEVERANCE ON MARS

The Mars 2020 Mission spacecraft and its new rover named Perseverance will take flight on an Atlas V-541 rocket — the same type of rocket that launched Curiosity, the last rover, in 2011.

"To cut down on costs, this new rover was supposed to be a clone of Curiosity, which is considered an overall success," explains Skonieczny.

"But the one main upgrade relative to Curiosity was the wheels. They were too light, we learned, and the metal was prone to dent, puncture and tear on the jagged rocks, limiting their lifespan."

Using Curiosity as a case study, Skonieczny and his fellow researchers collected their accumulated knowledge of wheels on Martian terrain and determined that the metal wheels needed more "grousers" — which are like metal cleats — and the grousers needed to be closer together in order to gain more traction.

The grousers' height, too, influences performance, as does their pattern.

"Results showed that chevron-patterned grousers achieve efficient motion on benign terrain while straight grousers are better for steep slope ascent," says Skonieczny.

Skonieczny, along with his collaborator Scott Moreland at the NASA Jet Propulsion Laboratory in Pasadena, California, and researchers Hiroaki Inotsume and David Wettergreen from Carnegie Mellon University in Pittsburgh, Pennsylvania, published their findings last year in the Journal of Terramechanics. Those findings were incorporated into the new wheel design at NASA.

"We needed to take into consideration the fact that the soil is much looser because Martian gravity is lower, at 38 per cent of Earth's gravity," adds Skonieczny, who says he dreamed of working with NASA since he was a child.

"The wheels need to be able to handle sharp, jagged rocks, but we can't simply make the wheels heavier because every gram counts when you're launching in a rocket. And, each rover covers new terrain, so there are always variables. We got better results in the lab by redesigning the grousers and changing their placement."

MISSION GOALS

The Mars 2020 Mission's goal is to collect soil samples, in search of possible past microbial life.

"This mission will collect samples and stash them for the next mission to retrieve," says Skonieczny, who is a member of the Concordia Institute of Aerospace Design and Innovation. "We want to help them get where they need to go as efficiently as possible."

After blast off, it will take up to two years to get results about Perseverance's new wheel design.

"In this business, you have to be patient," says Skonieczny.

He recalls watching the SpaceX launch in late May 2020, under quarantine, while his six-year-old son played with a toy rocket.

"There's a chance this could run in the family", says Skonieczny.

GINA CODY SCHOOL PROFESSOR WINS 2 TOP YOUNG COMPUTER SCIENTIST AWARDS

EMAD SHIHAB'S WORK IN SOFTWARE ENGINEERING AND DATA ANALYTICS EARNS HIM A NATIONAL AND INTERNATIONAL DISTINCTION

BY JOANNE LATIMER

The summer of 2020 will be memorable for many reasons, but Emad Shihab will always recall it as the year he received two coveted computer science awards — the 2019 CS-Can|Info-Can Outstanding Young Computer Science Researcher Award and the MSR (Mining Software Repositories) Early Career Achievement Award.

It's the first time a Concordia professor has won the CS-Can|Info-Can Award, a national distinction, or the international award, let alone both.

"I'm honoured to receive these two prestigious awards," says Shihab, associate dean of research and graduate studies at the Gina Cody School of Engineering and Computer Science and holder of the Concordia University Research Chair in Software Analytics.

"Past recipients of these awards are now world leaders in the field, so I'm humbled to be in such great company."

Shihab is one of 2019's four winners being recognized across the country for their excellence as faculty members in Canadian computer science departments, schools and faculties within the first 10 years of completing their PhD.

MINING SOFTWARE AWARD

Shihab is also the solo winner of the 2019 international award given by the Mining Software Repositories conference for Early Career Achievement.

"These awards are the perfect way to acknowledge the excellence of Emad's research, his students' contributions and his work setting up Concordia's Data-driven Analysis of Software Lab, among other important achievements," says Mourad Debbabi, interim dean of the Gina Cody School.

Shihab attributes much of his success to the diverse, large and talented team he leads.

"They are my inspiration to pursue novel and challenging problems and I attribute much of my success to them."

Shihab has secured more than $1.1 million, as principal investigator, to support his research, including a competitive NSERC Discovery Accelerator Supplement.

One of the tools he's known for creating is Commit.guru, which performs risk analysis of software changes.

"We've analyzed over three million software changes through this tool to date," says Shihab, who is thrilled to be at Concordia University, which is consistently ranked as one of the top software engineering schools in the world.

Shihab and his team often collaborate with world-renowned researchers from Australia, Brazil, China, Europe, Japan, the United Kingdom, Singapore and the USA and adoption of his research is done in collaboration with some of the biggest software companies, such as Microsoft, Avaya, BlackBerry and Ericsson. He is a senior member of the IEEE.

INSPIRING YOUNG WOMEN TO CHANGE THE WORLD

CAROLINA GALLO SCHOLARSHIP FOR WOMEN IN ENGINEERING AND COMPUTER SCIENCE HONOURS STRONG ROLE MODELS

BY DONNA VARRICA, BA 81

In the early 1980s when Carolina Gallo, BA 84, studied political science at Concordia, she was an advocate for social justice.

More than 35 years later, not much has changed.

As vice-president of Government and Institutional Relations Canada for global engineering firm ABB Power Grids, Gallo combines her energy and passion with her commitment to the environment to help navigate her industry towards sustainable solutions.

Following graduation from Concordia, Gallo set her sights on a law degree at the Université de Montréal, knowing it would put her in a better position to champion the causes close to her heart, particularly the promotion of women.

In serving on the advisory board of the Gina Cody School of Engineering and Computer Science, Gallo found inspiration in the School's chief supporter and namesake. She credits Gina Cody, MEng 81, PhD 89, for galvanizing the university through her $15-million gift in support of students and research, while encouraging inclusiveness and diversity.

"She has flipped perceptions about women," Gallo said. "Her commitment, her passion, her leadership, her message of positivity, is a beacon of light."

MOTIVATED TO PAY IT FORWARD

Gallo recently acted on a long-held desire to not only pay tribute to the university that shaped her social conscience, but to honour Gina Cody as well.

She established the Carolina Gallo Scholarship for Women in Engineering and Computer Science to encourage young women to study in fields still dominated by men. The scholarship honours the grandmother after whom she is named.

“My grandmother was a strong and beautiful woman,” Gallo said. “She lived and suffered through the war and came to Canada to make sure we had all the opportunities available to us. It is in gratitude that I created this scholarship in her name.”

Gallo hopes the scholarship inspires and supports young women in engineering and computer science to become agents of change — and she believes Concordia is the best place to start.

“I am very proud of what Concordia has become,” she said. “It made me who I am and it continues to demonstrate what it means to be progressive, open and inclusive. These are the three values that you need to survive in this world. In 2020, Concordia is the coolest place to be.”

HOW THIS CONCORDIA GRAD BECAME ONE OF THE MOST INFLUENTIAL WOMEN IN AI

BAHAR SATELI: 'USE YOUR BRAIN FOR CREATIVE THINGS A COMPUTER CAN'T DO'

BY CHARLIE FIDELMAN

Bahar Sateli, MSc 12, PhD 18, always knew she wanted to be a programmer. When she wrote her first line of code as a pre-teen in Tehran, she had to bug her older brother to show her the basics.

It was a momentous first step that has culminated in a number of recent professional honours, from a spot on 2019's most influential women in AI list to a nod as one of the most brilliant women concerned with AI ethics.

The field of artificial intelligence had attracted Sateli, now a Montreal-based senior data scientist at PwC Canada, long before she knew it had a name. As a child, she read science-fiction novels by authors like Isaac Asimov; stories about robots that do chores, play with children and "obey laws on not hurting humans."

It's a passion that Sateli has brought to data science, where she contributes to an international toolkit devoted to the responsible and ethical development of AI applications.

'MY FASCINATION WITH ROBOTS ENDED UP IN MY DISSERTATION'

At the Gina Cody School of Engineering and Computer Science, Sateli discovered that she cared less about what robots could do physically and more about "the minds of those robots."

As a graduate student, she specialized in natural language processing, or teaching computers to read and understand text.

At the heart of every AI application is data — obtaining, manipulating and transforming data so a computer can understand and solve a problem at hand. It's a fast-moving domain, however, with research published daily.

"You can never catch up with that kind of pace," observes Sateli.

Enter her clever workaround: a virtual research assistant. Sateli programmed it as a doctoral candidate at Concordia to do repetitive, mundane tasks, like highlighting crucial sentences, summarizing important articles and scanning the Internet for similar documents.

"My fascination with robots finally ended up in my dissertation. I believe you should use your human brain for creative things that a computer can't do."

Sateli credits her supervisors René Witte, Sabine Bergler and Leila Kosseim for her success at Concordia and beyond. The respected computer science professors provided top-notch training and support, she says, noting that many of their students now hold AI-related jobs at companies like Amazon and Google.

Sateli took her virtual tool a step further and launched a startup that she struggled to keep financially viable. "I'm a techie," she says. "I don't have a master's in business."

LIFE AFTER ACADEMIA: 'CONNECTING TWO WORLDS'

When a former classmate referred her to PwC Canada, which had put out a call for a data scientist with in-depth knowledge of AI, Sateli's life irrevocably changed.

Now she rubs shoulders with "an army of MBAs," learning the business aspects of the industry while designing AI models for prediction and automation of complex tasks. Sateli describes it as both "the art of the possible, connecting two worlds to land on a solution" and "the sexiest job right now."

As to the current benefits of AI, the COVID-19 pandemic has demonstrated what it can do for public health and safety. This includes gathering and parsing huge amounts of data quickly to get a sense of what's going on. There are ethical concerns around privacy, however.

"In our haste to get to the conclusion," Sateli says, "are we tracking people without their consent?"

As a woman in tech, the accomplished Concordia alumna still sees a discrepancy between the number of female graduates and the number of women who find work in the industry.

She advises women who want to consider STEM careers to set aside their fears. If she could give them one piece of advice, it would be the following: "You're as ready as you can be today. Go for it."

"Processing closer to the sources of data and end-users, at mobile edges will lead to better outcomes across the board."

CONCORDIA RECEIVES $2.67M TO BUILD THE DIGITAL HIGHWAY TO 5G — AND BEYOND

THE GINA CODY SCHOOL PARTNERS WITH ENCQOR 5G AND ERICSSON

BY JOANNE LATIMER

Buffering, slow downloads, frozen computer screens — a wonky internet connection can frustrate even the most Zen person.

"But it's a matter of life and death when we're talking about something like remote robotic surgery. Every millisecond counts," says Roch Glitho, a professor and cloud network expert at Concordia's Gina Cody School of Engineering and Computer Science.

"Having fast, reliable communications is a necessity to enable the next generation of 'smart' Internet of Thing (IoT) devices for our increasingly interconnected world."

This June, Glitho was appointed the holder of Canada's first Ericsson/ENCQOR 5G Industrial Research Chair in Cloud and Edge Computing for 5G and Beyond. He is also a Tier II Canada Research Chair in End-User Service Engineering for Communications Networks

Edge computing is when some processing tasks are distributed and processed closer to the source of the data on local servers, instead of all tasks processing in the cloud. It's faster than sending all the data back and forth to the cloud, and decreases the chance of delays and/or dropped messages.

5G is the emerging digital infrastructure needed to accommodate the coming wave of IoT devices, such as autonomous cars, self-repairing wind farms, ambulance drones and smart HVAC systems, to name a few.

Concordia partnered with Ericsson and ENCQOR 5G to create the new chair, valued at $2.67million over five years.

It brings together industry and academia, including a team of 10 graduate students and three post-docs, alongside industrial researchers and subject matter experts to proactively develop the networks of the future.

“We’re honoured to partner with ENCQOR 5G and Ericsson to tackle these research and deployment challenges,” says Mourad Debbabi, interim dean of the Gina Cody School and holder of the NSERC/Hydro-Québec/Thales Senior Industrial Research Chair in Smart Grid Security.

“Together, we aim to strengthen Canada’s digital backbone through the support of cloud computing systems critical infrastructure, cyber-physical systems, and Industry 4.0. We also intend to train highly-qualified personnel for these sectors.”

CLOUD AND EDGE COMPUTING

Glitho and his team are focusing on two main research areas related to cloud and edge computing:

“We’re asking ourselves how to build the new cloud and edge computing of the future,” says Glitho, who is part of the Concordia Institute for Information Systems Engineering (CIISE) and a member of Concordia’s Security Research Centre and of the Software Engineering Research Centre.

“To do that, we’re working on ‘intelligent clouds’ in which artificial intelligence (AI) will drive all the management tasks. Edge clouds featuring intelligent management would be particularly helpful to connect first responders during a disaster scenario, like an earthquake.
The idea is to expand the cloud as close as possible to data sources and end-users, make it autonomous.”

The chair’s other area of interest is developing 5G applications, which rely on cloud and edge computing for their success.

“We’re working for instance on remote robotic surgery, and remote phobia treatment using virtual reality,” says Glitho.

“In the case of remote robotic surgery, we’re looking at how AI can be used to determine which computer processing tasks should be performed closer to the surgeon using edge computing and which processing tasks can occur in the cloud without risking latency, or delays. In the event of delays between the robotic arm and the surgeon, we can use AI to predict the missing message.”

INDUSTRY PARTNERS IN ACTION

The chair co-funder ENCQOR 5G (Evolution of Networked Services through a Corridor in Québec and Ontario for Research and Innovation), is a transformational $400M Canada-Québec-Ontario partnership focused on innovation in the field of 5G disruptive technologies, adoption initiatives and system uses.

The ENCQOR 5G partnership is made possible in part by funding from the Canadian government and the provincial governments of Quebec and Ontario.

Their ENCQOR 5G project established the first Canadian pre-commercial corridor of 5G digital infrastructure — the key to making the digital economy a reality.

“Our program brings together large companies, SMEs and academia, to contribute to the advancement of research, innovation and demonstration of applications through collaborative research and development in 5G and the use of a pre-commercial testbed in Québec and Ontario,” says Pierre Boucher, general manager of ENCQOR 5G.

“The Concordia research chair with Ericsson offers the potential to become a flagship in our research co-development program in Québec.”

Glitho's team will be working from his Telecommunication Service Engineering Research Lab at Concordia while remotely accessing the Ericsson and ENCQOR 5G network. They will also be working in Ericsson's lab in Saint-Laurent and accessing on-site ENCQOR 5G equipment.

"Ericsson has constantly promoted the research collaborations with academia and, in particular, with Concordia University. We believe these partnerships represent a great opportunity to benefit from the unique expertise and innovative mindset at Concordia," says Sorin Georgescu, research leader, Ericsson Research, CSP Cloud Intelligence.

"Dr. Roch Glitho's strong research results and know-how in cloud and edge technology makes us confident that our research objectives will be fully met." Magnus Frodigh, Vice President, Head of Ericsson Research, concurs.

"At Ericsson Research we see that future networks with deeply embedded computing will build up what we call a network compute fabric, providing a unified, integrated execution environment for distributed applications," says Frodigh.

"The chair position on Cloud & Edge Computing in 5G and Beyond at Concordia will be one important vehicle to explore many research questions along the journey to such a network compute fabric."

Paula Wood-Adams, Concordia's interim vice-president of research and graduate studies, notes that the university's new chair is the first of its kind in the country.

"As well as creating the next cloud architecture and making it mobile, the chair's research will develop applications like remote robotic surgery and self-driving cars that require a solid backbone of 5G infrastructure," says Wood-Adams.

"With the significant increase in complexity of edge cloud architectures for 5G, new paradigms are required to ensure its proactive management and operation. We're excited to embark upon this cutting-edge project with Ericsson and ENCQOR 5G, building upon our history of collaborative innovation."

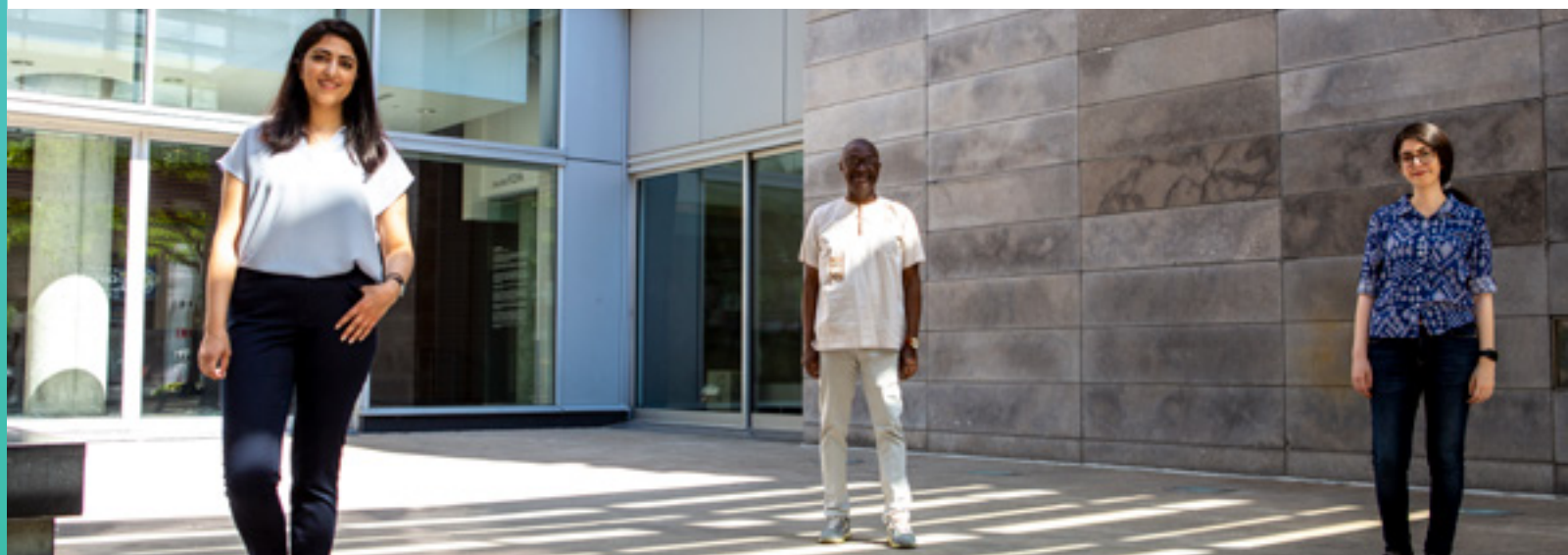
POISED FOR DEPLOYMENT

At this point, most 5G networks are experimental.

"What we want to do is build a better 'highway' for 5G now, create new apps for that infrastructure to best leverage the technology and more important look into what will happen beyond 5G — for example, 6G," says Glitho.

"In some cases, like remote robotic surgery, the potential outcome can democratize the surgeon's skills regardless of location. Processing closer to data sources and end-users at mobile edges will lead to better outcomes across the board."

From left: PhD student Seyedeh Negar Afrasiabi, professor Roch Glitho and PhD student Behshid Shayesteh.



"I'm delighted and honoured to represent Concordia at the national level."

CATHERINE MULLIGAN BECOMES PRESIDENT OF THE CANADIAN SOCIETY FOR CIVIL ENGINEERING

THE ENVIRONMENTAL ENGINEERING PROFESSOR ALSO BECAME A FELLOW OF THE CANADIAN ACADEMY OF ENGINEERING EARLIER THIS YEAR

BY JOANNE LATIMER

Contaminated soil, polluted harbours, toxic sediment — these are all-too-common problems for a society that's struggling to clean up the environment while searching for eco-friendly energy supplies.

Thankfully, environmental engineers like Catherine Mulligan are on the job.

Mulligan, professor in the Gina Cody School of Engineering and Computer Science, is a pioneer of green remediation technologies as well as internationally recognized expert in the decontamination of water, soil and sediments.

Now, she is the first Concordian to become president of the Canadian Society for Civil Engineering (CSCE) — and the third woman in that role.

"I'm delighted and honoured to represent Concordia at the national level," says Mulligan, a Concordia University Research Chair in Geoenvironmental Sustainability.

Mulligan wears the honour humbly, as she did when she became a fellow of the Canadian Academy of Engineering earlier this year. In 2018, she also received the coveted John B. Stirling Medal for career achievement from the Engineering Institute of Canada.

"Decontamination — soil washing to remove metal — put Dr. Mulligan on the map in the field of geoenvironmental engineering," says Mourad Debbabi, interim dean. "Then she gained more than 25 years of research experience in government, industrial and academic environments. I can't think of a more dynamic, deserving candidate. Her appointment raises Concordia's profile as an institution that supports innovation."

ROLLING UP HER SLEEVES

As the founding director of the Concordia Institute for Water, Energy and Sustainable Systems (CIWESS), Mulligan researches new systems, technologies and solutions for water, energy and resource conservation.

The institute has trained more than 70 students into highly qualified personnel. It's home to 12 researchers at Concordia.

"We're looking at low-energy water treatments, how to make methane from wastewater and how to design water treatment in collaboration with communities," explains Mulligan, who works in the Department of Building, Civil and Environmental Engineering.

"In gold mining areas, where they use cyanide to leach gold from ore, we're researching how to remove nitrogen from wastewater using microorganisms. This past summer, we focused on at-risk lakes in Quebec.

"It's what electrical engineers aspire to."

NEW FELLOW: THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

CHADI ASSI IS THE YOUNGEST ACADEMIC AT THE UNIVERSITY TO HOLD THIS HONOUR

BY JOANNE LATIMER

For electrical engineers, becoming a fellow of the Institute of Electrical and Electronics Engineers (IEEE) is a notable career accomplishment.

So, when 44-year-old Chadi Assi received word of his IEEE fellowship this fall, he was delighted.

Assi is a professor with the Concordia Institute for Information Systems Engineering (CIISE) and a Tier I Concordia University Research Chair in Broadband Wireless Networks at the Gina Cody School of Engineering and Computer Science.

He became the youngest academic at Concordia to hold this honour and the only one in the CIISE.

"Being elevated to a fellow in the IEEE is what every electrical engineer aspires to," says Assi, who is part of the institute's communications society. Its members and fellows share a common interest in advancing all communications technologies.

To become a fellow with the IEEE is to be internationally recognized for outstanding contributions to the field and for having an impact on society.

"It's thanks in part to Assi that Netflix and YouTube stream so effortlessly at home," says Mourad Debbabi, interim dean. "The cornerstone of his fellowship is recognition for the work he did on the management of bandwidth over optical and wireless networks over the 'last mile' into residential homes."

His bandwidth management methods are used by major carriers — such as Bell and Dutch Telecom — to provide broadband residential access to customers.

SECURING THE FUTURE

Over time, Assi's research interests have expanded dramatically to network security, smart grids, micro grids, electric vehicles, drones, network virtualization, the Internet of Things (IoT), 5G and beyond. "As part of the Security Research Centre at Concordia, my current work is on network security in our IoT era — an age of network-connected thermostats, baby monitors, light switches, door locks and more," says Assi.

"Once you connect these devices to the network, anyone who can hack into your network can control them. We look for new vulnerabilities and analyze the type of malware to know more about how to detect and stop, for instance, denial-of-service attacks."

Assi's research has earned funding from the Natural Sciences and Engineering Research Council, the Fonds de Recherche du Québec – Nature et technologies, Hydro Quebec, Mitacs, Qatar Foundation and Concordia.

"We want to help transfer the traditional construction industry into the digital age."

CONCORDIA LEADS THE CONSTRUCTION INDUSTRY'S DIGITAL TRANSFORMATION

A NEW CENTRE FOR INNOVATION AIMS TO OPTIMIZE PUBLIC SPENDING TO IMPROVE CIVIL INFRASTRUCTURE

BY JOANNE LATIMER

Although it's still early days, the construction industry has begun to automate and digitize.

It's also starting to use sensing technologies, big data and deep learning, among other things, and the results could revitalize our cities' infrastructure — roads, water, power — and the way it's managed.

CONCORDIA IS DRIVING THAT TRANSFORMATION IN CANADA

With the leadership of Osama Moselhi, a pioneer in infrastructure engineering management, the university is front-of-mind for anyone in the field.

The professor in the Department of Building, Civil and Environmental Engineering is director of Concordia's new Centre for Innovation in Construction and Infrastructure Engineering and Management (CICIEM) at the Gina Cody School of Engineering and Computer Science.

"Here at Concordia, we have a critical mass of expertise in sustainable and resilient civil infrastructure systems," says Moselhi, who is known throughout the field for his patented use of artificial intelligence (AI) in the diagnostics of sewer defects and his work on value-driven methods for optimized asset management in this field.

"We want to be an agent of change that helps transfer the traditional construction industry into the digital age."

The CICIEM is working with an advisory board comprised of executives from Hydro-Québec, Canam Group, Hatch and SNC-Lavalin.

"These companies are visionary leaders in their fields who have influence on the entire industry," says Mourad Debbabi, interim dean of the Gina Cody School.

"We are in discussions with them now to establish their needs and discuss collaboration opportunities."

TAXPAYERS HAVE A STAKE

For Moselhi, a key outcome is the protection of our collective investment in the existing infrastructure. As taxpayers, we all have a stake.

“There is a saying that politicians don’t want to spend money below ground because the public can’t see it. So we have a deficient investment in that kind of civil infrastructure,” he explains.

“But if you want to keep the same water pressure in your shower and kitchen sink, we need to continuously invest.”

DRONES, SEMI-ROBOTIC EXCAVATORS, UTILITY TUNNELS AND MORE

As a hub with more than 17 faculty members and five laboratories, the CICIEM has five main areas of research:

- big data analytics
- automation and robotics in construction
- sensing technologies and Internet of Things (IoT) applications in construction engineering and management
- industrialization of construction
- reliability analysis and condition assessment

Amin Hammad, the CICIEM’s associate director, believes there’s a better way to manage work on construction sites and civil infrastructure.

“We have projects that use deep learning for equipment detection and activity recognition, as well as safety monitoring. In the area of asset management, we have projects to optimize the energy usage in smart buildings based on occupant requirements,” he says.

“We also use virtual and augmented reality to improve building inspection and maintenance operations.”

THE NEW ERA OF 4D BUILDING MODELS

For Mazdak Nik-Bakht, communication and outreach director of the CICIEM, the future of construction is digital twinning — something called building information modelling (BIM).

“BIM is a 3D model of a building plus additional relevant information such as time, making it a 4D model, and cost, making it a 5D model,” explains Nik-Bakht, assistant professor in the Department of Building, Civil and Environmental Engineering.

“A 4D model, for example, is an animation created in the planning stage that tells me what’s expected to happen on each day at the job site. When construction begins, we can create another digital model at the job site using laser scans, digital images and drones fitted with cameras and scanners,” he says.

“Those two models can be mapped and compared to show progress. At the end of construction, the BIM can be handed over to the facilities manager for monitoring and managing building operation, using sensing devices and IoT devices, linked back to the digital model.”

TRAINING DAYS

Another raison d’être of the CICIEM is to train highly qualified personnel.

“We have the largest graduate program in construction and civil infrastructure in the country,” says Moselhi.

The training environment is enriched by the interdisciplinary nature of the hub, which is accessible to faculty and researchers from across the Concordia community.

“By all means, we would welcome researchers from the Faculty of Arts and Science, for instance, who want to look at the social aspects of infrastructure and how it impacts quality of life,” says Moselhi, whose door is always open for discussion with colleagues. “I encourage you to reach out.”

THE DEPARTMENT OF CHEMICAL AND MATERIALS ENGINEERING MOVES LABS TO LOYOLA

THE DEPARTMENT OF CHEMICAL AND MATERIALS ENGINEERING MOVES LABS TO LOYOLA

BY JOANNE LATIMER

Alex De Visscher is taking inventory, after recently moving his department's labs to bigger and better quarters in Concordia's new $62-million Applied Science Hub.

"We have a state-of-the-art high-pressure thermogravimetric analyzer — not a lot of universities in Canada have that — and an atomic force microscope, among other new pieces of key equipment," notes De Visscher, chair of the Department of Chemical and Materials Engineering (CME) at the Gina Cody School of Engineering and Computer Science.

"The characterization lab allows us to do research at a competitive level. Thanks to $1.5 million in funding from Concordia, we won't have to wait years to build up our equipment."

De Visscher, a specialist in chemical engineering fundamentals, founded the CME department in 2017.

He's in the process of hiring more faculty and promoting cross-disciplinary research.

"When you look at the top chemical engineering and materials programs — at MIT, Stanford, Minnesota and Berkeley — they're typically merged with a non-engineering field, such as biomed, chemistry or physics," De Visscher says.

"With our labs located inside the new Applied Science Hub, we have proximity to the departments of chemistry and biochemistry, biology and physics, the PERFORM Centre and the Genome Foundry. That not only lets us grow in size but also in reputation through collaborative, high-impact research."

NEW RESEARCH IN CME

Supported by more lab and office space, the department has the capacity to tackle new research projects that address our post-carbon world, among other things.

"Sustainable electrochemical engineering is a hot new area, asking, how do we convert carbon dioxide back into fuel to close the loop?" De Visscher says. "And, how do we use electricity more directly to replace existing chemical processes with greener ones?"

ORGANIC BATTERIES, CANCER AND VACCINE STABILIZERS

Next-generation battery research is another department priority, led by Zhibin Ye at his Polymer and Nanomaterials Lab. There, he's also working with functionalized gold nanorods to possibly help in the fight against cancer.

His colleague Sana Anbuhi at the Anbuhi Research Group is stabilizing enzymes and bioreagents to prolong the shelf life of things like vaccines.

She continues to work on developing easy-to-use, low-cost, reliable ways to perform environmental monitoring, such as the detection of pollution, pesticides, E. coli and heavy metal in soil and water.

The CME chair, De Visscher, is part of an elite working group within the International Union of Pure and Applied Chemistry that's addressing Henry's law constants—the law that describes the distribution of chemicals between the gas and the aqueous phase.

Now that the hub is open, De Visscher splits his time between the Loyola and Sir George Williams campuses.

"It'll be great to have a presence on both campuses," he says. "The Loyola hub will be more about research, and that attracts top-quality faculty."

NEW EQUIPMENT HIGHLIGHTS IN THE CME CHARACTERIZATION LAB

- High-pressure thermogravimetric analyzer: determines the reactivity of materials by measuring mass changes due to heating in a gas stream.
- Differential scanning calorimeter: measures the heat capacity of materials.
  It can detect structural changes resulting from heating of materials.
- Gas adsorption analyzer: measures surface properties of porous materials such as catalysts and nanomaterials.
- Atomic force microscope: scans the surface of a sample on a molecular scale with a probe and composes a synthetic image of the surface as if it was photographed through a microscope with extreme magnification.

NEW HIRES

Eugene Belilovsky specializes in machine learning—specifically multi-task and sequential learning problems. He was previously a postdoctoral fellow at the University of Montreal and the Quebec Institute of Artificial Intelligence (Mila), after obtaining his PhD from the University of Paris-Saclay.

Po-Han Chen is specialized in project management and construction IT applications. He comes to Concordia from National Taiwan University. Prior to that, he taught at Nanyang Technological University. He received his PhD from Purdue University.

Deniz Meneksedag Erol specializes in the field of biomolecular simulations, specifically studying polymers, nanomaterials and disease-associated proteins. She did her postdoctoral training at the University of Toronto, after obtaining her PhD from the University of Alberta.

Ghazanfarah (Farah) Hafeez comes to Concordia University after she received a PhD from The University of Ottawa. Her research focuses on timber buildings.

Melanie Hazlett is researching sustainable chemical process engineering – specifically catalysis for fuels, chemicals, and emissions. Her PhD is from the University of Houston. Before coming to Concordia, she taught at the University of Waterloo.

Yaser Khojasteh earned his PhD from McMaster University. His research focuses on the design, lifecycle analysis and optimization of process systems, with a focus on the development of renewable processes.

Xia Li focuses on the development of next-generation energy storage devices, such as Li-ion, Li-S and all-solid-state batteries. She obtained her PhD. degree from Western University, followed by four years as a postdoctoral fellow.

Jonathan Liscouët comes to Concordia from Bombardier Aviation. He received his PhD from INSA Toulouse (France). His research focuses on the design of high reliability cyber-physical systems.

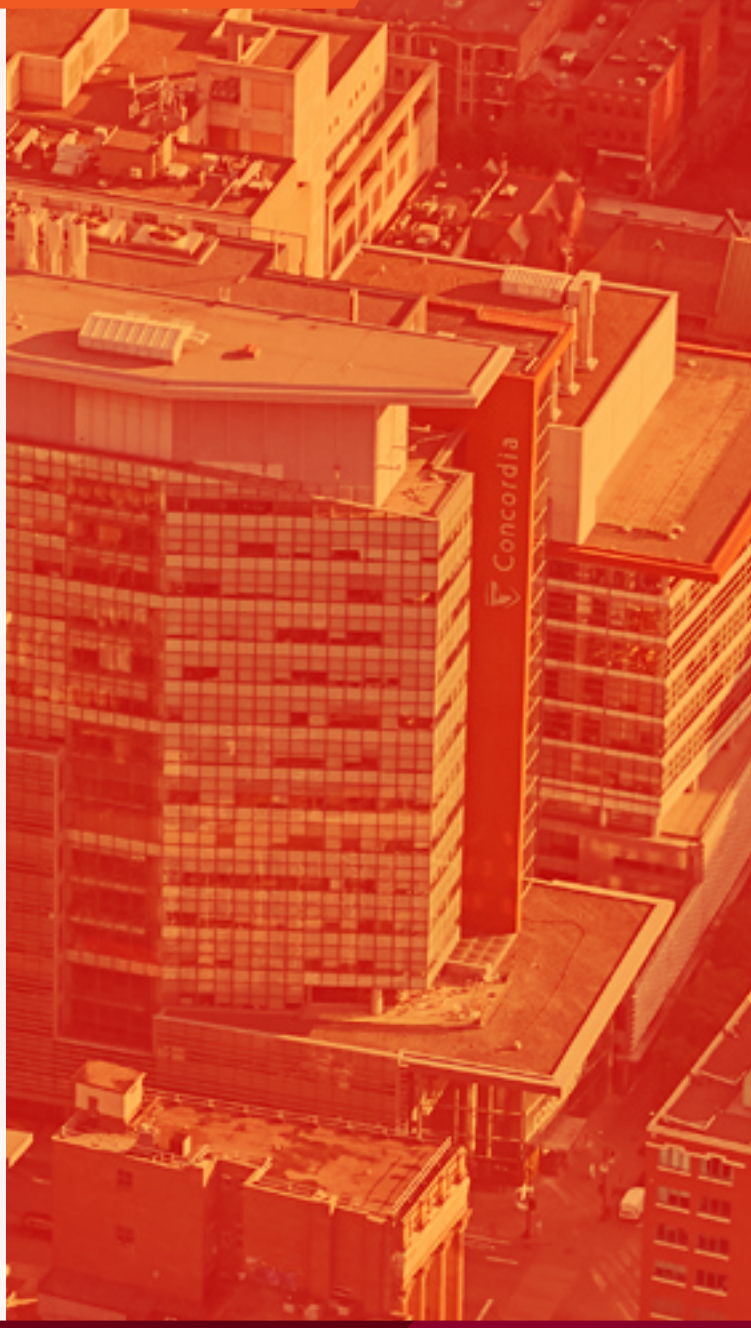
Suryadipta Majumdar specializes in cybersecurity, specifically security and privacy of emerging technologies, e.g., cloud computing, Internet of Things (IoT). He was an assistant professor at the University at Albany, after obtaining his PhD from Concordia University.

Heena Rathore specializes in cybersecurity of cyber-physical systems. She was previously with the University of Texas, San Antonio, USA. She received her PhD from Indian Institute of Technology, India.

Pantcho Stoyanov specializes in aerospace materials with a focus on thermal spray coatings and tribology. He was previously a principal engineer at Pratt & Whitney, after obtaining his PhD from McGill University.

Yiming Xiao comes to Concordia from the University of Western Ontario. He received his PhD from McGill University. His research focuses on medical image computing in clinical diagnosis and surgical planning.

START YOUR JOURNEY TODAY



DEPARTMENT OF BUILDING, CIVIL AND ENVIRONMENTAL ENGINEERING

- Building Engineering (BEng / Grad. Cert. / MASc / MEng / PhD)
- Civil Engineering (BEng / MASc / MEng / PhD)
- Construction Engineering and Management (MEng)
- Environmental Engineering (Grad.Cert. / MEng)

CENTRE FOR ENGINEERING IN SOCIETY

- Innovation, Technology and Society (Grad. Cert.)

DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

- Computer Applications (BCompSc)
- Computer Applications- Computation Arts (BCompSc)
- Computer Applications – Mathematics and Statistics (BCompSc / BSc / BA)
- Computer Games (BCompSc)
- Computer Science (Minor / GrDip / MApCompSc / MCompSc / PhD)
- Computer Science General Program (BCompSc)
- Computer Systems (BCompSc)
- Information Systems (BCompSc)
- Software Engineering (BEng / MASc / MEng / PhD)
- Software Systems (BCompSc)
- Web Services and Applications (BCompSc)

CONCORDIA INSTITUTE FOR INFORMATION SYSTEMS ENGINEERING

- Information Systems Security (MASc / MEng)
- Information & Systems Engineering (PhD)
- Quality Systems Engineering (MASc / MEng)

DEPARTMENT OF CHEMICAL AND MATERIALS ENGINEERING

- Chemical Engineering (Grad. Cert. / GrDip)

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

- Computer Engineering (BEng)
- Electrical Engineering (BEng)
- Electrical and Computer Engineering (MASc / MEng / PhD)

DEPARTMENT OF MECHANICAL, INDUSTRIAL AND AEROSPACE ENGINEERING

- Aerospace Engineering (BEng / MEng)
- Industrial Engineering (BEng / MASc / Meng / PhD)
- Mechanical Engineering (BEng / Grad. Cert. / MASc / MEng / PhD)

FACULTY-WIDE

- Individualized Program (MA / MSc / PhD)
- Science and Technology (Cert.)

HELP INSPIRE THE NEXT GENERATION OF ENGINEERS AND COMPUTER SCIENTISTS.

To make a donation, please contact Michelle Miatello, Principal Director of Development, Gina Cody School of Engineering and Computer Science at michelle.miatello@concordia.ca or at 514-848-2424, ext. 7026.

concordia.ca/alumni-giving

UNIVERSITÉ Concordia UNIVERSITY

GINA CODY
SCHOOL OF ENGINEERING AND COMPUTER SCIENCE