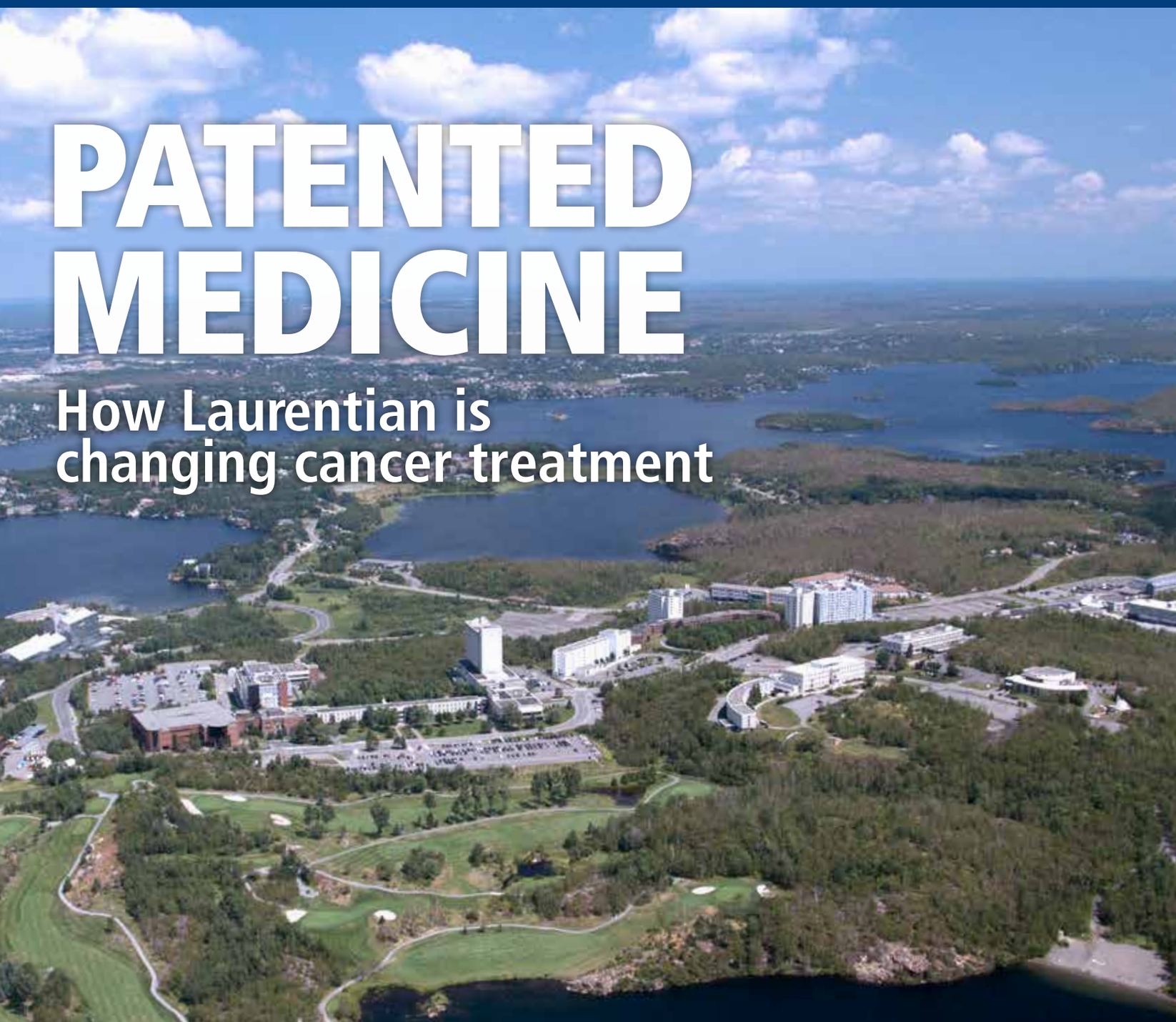
2014

THE KEY

LAURENTIAN UNIVERSITY'S RESEARCH MAGAZINE



PATENTED MEDICINE

How Laurentian is changing cancer treatment

>> Following the footprints of Mineral Wealth

>> Extracting Bio-Energy from the Boreal Forest

LaurentianUniversity
UniversitéLaurentienne

THE FIRST WORD

In this 2014 edition of our research publication The Key, we are proud to outline some examples of the work that is informed by our Strategic Research Themes at Laurentian University.

As the principal research and graduate training centre in northeastern Ontario, we are committed to the integrity and the impact of our research, and dedicated to research that enhances knowledge while bettering our communities.

Our research intensity is built on five pillars, which are illuminated in the features collected here. Laurentian research is focused on Environment and Conservation, Health and Wellness, Social and Cultural Research and Creativity, Engineering, Mineral and Materials Science, and Subatomic Physics (SNOLAB).

These themes are aligned with the University's Strategic Plan, and they flow organically from the particular expertise Laurentian has built over its five decades of growth.

In each of these categories, Laurentian's world-class faculty and superlative graduate students are making real and profound contributions through their research, with innovative approaches, unique collaborations and partnerships, and interdisciplinary initiatives that bring together complementary strands of science.

We salute all of our researchers, and we invite you to learn more about Laurentian University and the research that is changing our world.

Patrice Sawyer
Vice-President, Research and Francophone Affairs,
Laurentian University

GROWTH IN RESEARCH ACTIVITIES

For the sixth year in a row, we have been ranked among the top 40 universities in Canada in terms of research activity. This is a significant achievement for a university of our size.

AREAS OF RESEARCH

While research at the university encompasses many disciplines, Laurentian has identified five areas of strategic focus:

- ENVIRONMENT AND CONSERVATION
- HEALTH AND WELLNESS
- SOCIAL AND CULTURAL RESEARCH AND CREATIVITY
- ENGINEERING, MINERAL AND MATERIALS SCIENCES
- SUBATOMIC PHYSICS

THE KEY

Vol. 4 2014

Publisher: Research Office, Laurentian University

Vice-President, Research and Francophone Affairs: Patrice Sawyer

Editor: Joanne Musico

Design: JoAnn Wohlberg

Contributors: Yves Alarie, Cara Chartrand, Vito Cupoli, Sherry Drysdale, Jonathan Migneault, Tyrone Newhook, Gisele Roberts, Erica Sawula, Ben Williamson

Translation: Jean-Yves Asselin, Prince Macauley, Linda Richard

Research Office
Laurentian University
935 Ramsey Lake Road
Sudbury, Ontario P3E 2C6
705-675-1151, ext. 3944
rdcoffice/bureaurdc@laurentian.ca

Published in collaboration with Communications and Marketing

CONTENTS

2 **ENVIRONMENT AND CONSERVATION**

ALL CREATURES GREAT AND SMALL.....2
Especially the ones that creep, crawl and slither

EXTRACTING BIO-ENERGY FROM THE BOREAL FOREST.....3
How wood chips and soil microbes might change our footprint

4 **HEALTH AND WELLNESS**

PATENTED MEDICINE.....4
Laurentian's licensed diagnostic tool is changing cancer treatment

GIVING VOICE.....5
How one researcher explores children's health issues by listening

6 **SOCIAL AND CULTURAL RESEARCH AND CREATIVITY**

POVERTY, HOMELESSNESS AND MIGRATION.....6
Unique project maps migration, measures homelessness across the North

THE SWEET SCIENCE.....7
Giving athletes a competitive edge through cultural psychology

8 **ENGINEERING, MINERAL AND MATERIALS SCIENCES**

X-RAY VISION.....8
A Laurentian professor's patented technology can help geologist "see" through rock

FOLLOWING THE FOOTPRINTS OF MINERAL WEALTH
Laurentian leads national geo-science research that could change exploration.....9

BUILDING A BETTER BUGGY.....10
Laurentian's Mechanical Engineering students show 'the right stuff'

11 **SUBATOMIC PHYSICS – SNOLAB**

THE WHISPERS OF THE UNIVERSE.....11
The search for dark matter in Sudbury's SNOLAB

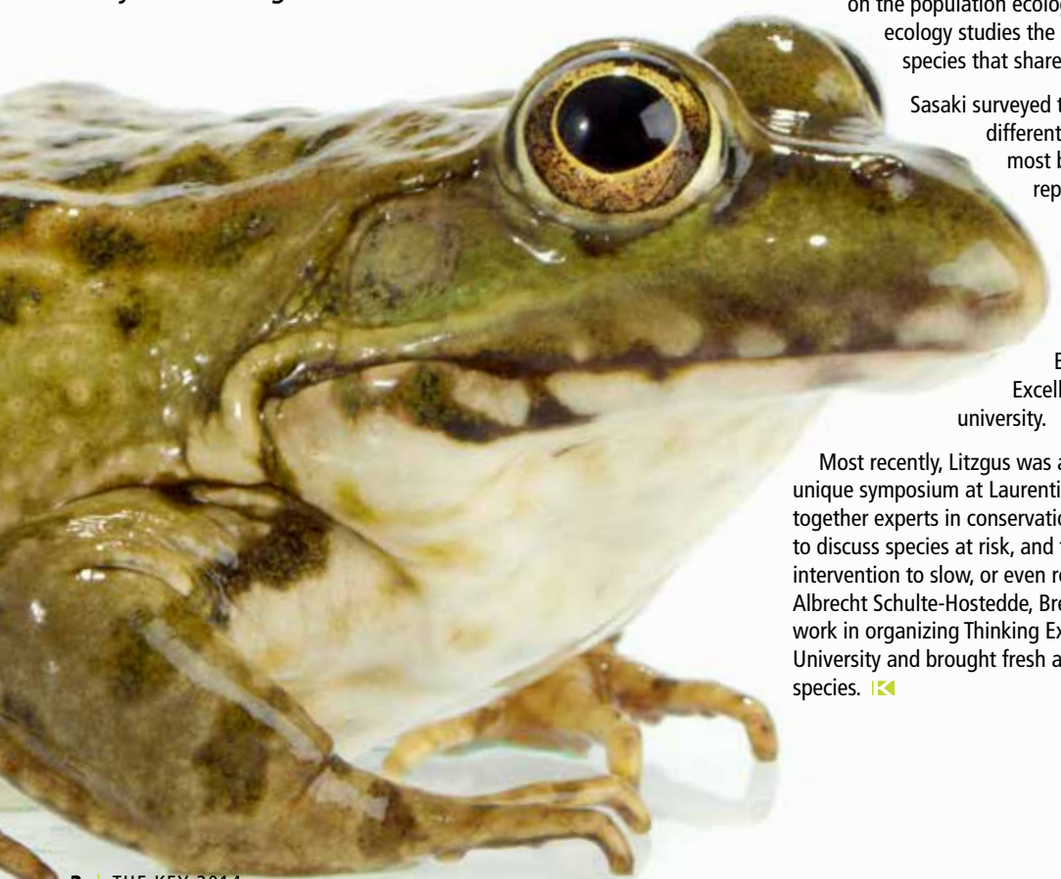
12 **LAURENTIAN UNIVERSITY STRATEGIC RESEARCH PLAN 2012-2017**

JACQUELINE LITZGUS

All Creatures Great and Small

Especially the ones that creep, crawl and slither

By Jonathan Migneault



When Jacqueline Litzgus was a young girl her parents did not allow her to have a pet dog or cat. To get around this restriction, she and her siblings would go to a nearby creek and catch frogs and small reptiles.

Now an Associate Professor of Biology at Laurentian University, Litzgus has dedicated her professional life to the study and protection of the amphibians and reptiles that fascinated her so much as a child.

On her office door Litzgus has a small poster with the names of graduate students she supervises, and research associates with whom she collaborates on a wide range of scientific projects.

Each research project, Litzgus says, includes a strong stewardship component. "I take the stance of the extreme conservationist because nobody else will," she says. "I do it because I care about the animals. I've had an inherent interest and passion for these animals since childhood."

While money and the constant push for development often trump conservation, Litzgus says she and her research associates have worked with industry and government partners to develop compromises to preserve animal populations as much as possible.

When the Ministry of Transportation started to plan its expansion of Highway 69 near Burwash, just south of Sudbury, Litzgus was contacted to plan a mitigation strategy to help reduce the number of animal road deaths.

James Baxter-Gilbert, a Laurentian master's student, has tested the effectiveness of a fence and underpass along that stretch of road meant to prevent animals from crossing. His findings will help the Ministry of Transportation improve those structures and prevent animal road deaths.

Litzgus has collaborated with Vale on another research project, led by postdoctoral researcher Kiyoshhi Sasaki, which looks at the effects of mining on the population ecology of reptiles and amphibians. Population ecology studies the dynamics of population sizes among various species that share the same or adjacent habitat.

Sasaki surveyed the frog and turtle populations at sites with different levels of mining activity and impact. At the most barren sites, there were fewer amphibians and reptiles in terms of both diversity and abundance.

"If we understand what the mechanism is that is impacting these animals maybe we can implement some recovery," Litzgus says.

Laurentian's Faculty of Science and Engineering recently gave Litzgus a Research Excellence Award for her Stewardship work at the university.

Most recently, Litzgus was among the organizers and presenters at a unique symposium at Laurentian University: Thinking Extinction brought together experts in conservation biology, philosophy and other disciplines to discuss species at risk, and to explore the many questions about human intervention to slow, or even reverse extinction. Along with her colleagues Albrecht Schulte-Hostedde, Brett Buchanan and Gillian Crozier, Litzgus' work in organizing Thinking Extinction has raised the profile of Laurentian University and brought fresh attention to the important subject of vanishing species.


NATHAN BASILIKO

Extracting BIO-ENERGY from the Boreal Forest

How wood chips and soil microbes might change our footprint

By Tyrone Newhook

Traditionally, when forestry companies harvested trees, they took out the trunks but left branches and other bits of trees behind to rot on the forest floor. In recent decades, the industry has found ways to turn that wood "waste" into fuel. There are environmental implications to this change, and this subject is just one of the research interests of Dr. Nathan Basiliko, Canada Research Chair in Environmental Microbiology at Laurentian University.

As Dr. Basiliko explains, the science of bio-mass gave forestry companies a way to find profit in the discarded scraps of trees, while also improving the industry's environmental footprint. Along with the trunks, companies began hauling out tree parts that couldn't be turned into paper or wood products, and had them chipped up and combusted to produce electricity, heat, and steam.

"People don't tend to realize that there's a pretty green aspect to forestry," Basiliko says, adding that pulp and paper mills are among the largest producers of bioenergy worldwide.

However, the practice of harvesting trees in their entirety may not be as environmentally sound as it seems. The tree scraps – or "biomass" – are rich in the nutrients needed to feed the next generation of plants. With forestry companies wanting to harvest more and more biomass, there's a risk they could ultimately remove too much.

"It's relatively inexpensive to take more of that biomass out and turn it into green energy," Basiliko says. "But you're potentially going to hit some point at which you've done more harm to the system than good."

How much biomass removal is too much? That's a question Basiliko and his research team, in collaboration with government and industry partners, are trying to answer through one of two major research projects he has underway.

His overarching research interest is the impact of human activity on ecosystems, and in turn, the study of how these ecosystems affect the broader environment.

Basiliko's work takes him to the root of an ecosystem: his focus is the role soil microbes play in forest and wetland ecosystems.

"These tiny organisms are difficult to study and to categorize," says the soil scientist. The plants are the easy half of the ecosystem to see. There's another half of the ecosystem that's hidden below ground that's just as important, and also the one we know the least about."

He says those microorganisms that are hidden below ground make up the bulk of biodiversity in most ecosystems. Just one handful of soil contains hundreds of millions of microbes, and there could be hundreds of thousands of different types of species among these organisms, according to new genetic techniques.

"It really is still a breakthrough area and that makes it quite exciting," Basiliko says.

Pulling out nutrient-rich biomass changes the functioning and the structure of the microbe communities, he explains, resulting in the depletion of other aspects of biodiversity or less forest productivity in the future.

"And that's what both we and the (forest) industry want to avoid," Basiliko says, referring to his forestry study that started last year in Northern Ontario.

Long-term field trials are underway in boreal forests near Chapleau, Ontario and northwest of Thunder Bay and at northern temperate forest sites spanning from Sault Ste. Marie to Petawawa.

In total over 30 sites are being studied to find out how companies can get more bioenergy from forests without causing negative effects. They're also looking for ways to improve forest management practices in general.

Soil microorganisms play a vital role in the other major research project Basiliko is working on: a study of future climate change.

As atmospheric greenhouse gasses increase, Basiliko and his research team are looking into how microbes living in Northern Ontario's wetlands – more specifically, the area's peatlands – are responding.

Peatlands are unique ecosystems that naturally remove carbon dioxide from the atmosphere and store it in the soil. Microbes play a pivotal role here. They can either remove greenhouse gases from the atmosphere or release them. Since peatlands act as vast storage areas for carbon dioxide, Basiliko says there are concerns about the impact environmental changes will have on them down the road.

"That's really the big worry with future climate change," Basiliko says. "We can hit some tipping point, and carbon that's stored in soils could end up in the atmosphere. It borders on a magnitude worse than the carbon we pump into the atmosphere from burning fossil fuels."

Along with studying forest and wetland ecosystems, Basiliko plans on taking his research in a new direction: investigating the role soil microbes might play in mitigating the impact of mining and smelting. That aspect fits nicely with his recent move to mining-rich Sudbury.

Basiliko comes to Laurentian University from a position as associate professor in the Geography Department at the University of Toronto at Mississauga, where he began working in 2006.

To maintain continuity with his students and research work, Basiliko will keep an adjunct appointment at the University of Toronto; however two or three of the students on his research team are transferring to Laurentian University to continue working directly with him.

Over the next few months, however, Basiliko may be focusing less of his attention on research and more of it on an organism far more complex than the mighty soil microbe. He and his wife, Dana Wilson, who is joining Laurentian's faculty in the School of Rural and Northern Health, welcomed a baby in the summer of 2013.

Patented Medicine

Laurentian's licensed diagnostic tool is changing cancer treatment

By Cara Chartrand

AMADEO PARISSENTI

Breast cancer is the most frequently diagnosed cancer in women; every year, over 1 million women are diagnosed with this disease worldwide. Imagine an instrument that can significantly improve the quality of life of women with breast cancer while also saving monetary and human resources.

Dr. Amadeo Parissenti has developed a game changing cancer treatment management tool that will be able to do just that.

Dr. Parissenti is a professor in the Department of Chemistry and Biochemistry at Laurentian University and an Affiliate Scientist with the Advanced Medical Research Institute of Canada (AMRIC). One of his principal research foci is drug resistance, particularly in breast cancer patients. His interest in this area stems from what he describes as the shockingly low patient survival benefit in breast cancer chemotherapy. "In breast cancer the number of patients that do get a survival benefit is around 15%, that's all; 85% failure rate," Dr. Parissenti explains. Patients who are not getting the survival benefit from chemotherapy are receiving all the toxicity associated with the treatment such as hair loss, cardio-toxicity, nerve-toxicity, and poor quality of life. "To get no benefit from that experience is really quite startling," says Dr. Parissenti.

Researching this phenomenon is allowing Dr. Parissenti to understand why tumour cells are developing resistance to chemotherapy as well as identify this resistance in the early stages of treatment.

Beyond his work at Laurentian as well as the research institute, Dr. Parissenti is the Chief Scientific Officer at Rna Diagnostics Inc. – a molecular diagnostics company developing tools to manage cancer chemotherapy. He oversees research and development involving new studies and clinical trials. Within Rna Diagnostics, the management team, clinical advisory board, and business advisory board work together to provide oncologists with diagnostic tools to improve the lives of women undergoing chemotherapy for breast cancer.

In February 2010, Laurentian University licensed a new diagnostic tool in cancer treatment with Dr. Parissenti at its forefront. The product, Rna Disruption Assay™ (RDA™), measures how well cancer patients are responding to chemotherapy. "The potential benefit is huge," Dr. Parissenti explains, "we believe that RDA is going to be highly accurate – and our initial studies are certainly proving that – at identifying non-responders to chemotherapy." Oncologists will be able to conduct the test in the early stages of chemotherapy, and if it is determined that some patients are not responding to the drugs, they can move on to a different form of treatment. Alternative treatment options that are available to non-responders are surgery to remove the cancerous tumor, radiation therapy, or other drugs. Ideally, with RDA, non-responders will be identified during to the first chemotherapy cycle and can directly move on to an alternative treatment.

This presents important savings in terms of the human resources, the costs to the healthcare system, the time to complete the treatment cycles and the toxic side effects for the patients.

Dr. Parissenti says RDA was discovered unexpectedly in a clinical trial with patients, so its capability was proven instantly. Currently, RDA is being used in patients in a research perspective, not in a patient management perspective. It is being used as a research investigative tool in order to further validate its effectiveness. "We essentially have three studies underway – soon to be four – if all of those are positive then there's a really good chance this would be used widely," he says.

RDA™ technology is not only being sampled at Health Sciences North but in hospitals all over the world.

Rna Diagnostics is in close collaboration with a hospital in Cremona, Italy, outside of Milan. Biopsies from Cremona are being sent to Sudbury for assessment. The researchers are also accepting data and samples from San Francisco, Toronto, and Montreal, and are in discussions with a group of German clinical researchers.

The research Dr. Parissenti and his team are performing is groundbreaking; their product has the potential to better the lives of cancer patients worldwide. This is an immense achievement for medical research in Sudbury as well as the entire cancer community.

ABOUT THE PATENT:

Rna Diagnostics holds the first commercial license ever granted by Laurentian from which the University received its very first royalty payment for intellectual property. Laurentian earned royalties following the licence signing and will continue to see returns with each product sale. Additionally, royalties were awarded to the University when the company reached its objective in raising private sector financing. Rna Diagnostics has twice reached its milestones in private sector fundraising, triggering payments to Laurentian. The revenues were divided between covering the costs that had been incurred in filing the patents and presenting the University and inventors with a portion.

Giving VOICE

How one researcher explores children's health issues by listening

By Erica Sawula


NANCY YOUNG

The voices of children who live in rural and northern regions are rarely heard when it comes to their health. Dr. Nancy Young, Canada Research Chair in Rural and Northern Children's Health, is helping to give these children a voice.

Dr. Young is a clinical epidemiologist and physiotherapist with more than fifteen years of research experience focusing on children's health. She joined the Faculty of Professional Schools at Laurentian University in September of 2005 and is a Professor in the School of Rural and Northern Health, as well as holding a Canada Research Chair in Rural and Northern Children's Health. She is also the leader of the ECHO research centre (Evaluating Children's Health Outcomes) based at Laurentian University.

Dr. Young has always had a passion for helping children of vulnerable populations, including those with disabilities, and more recently, Aboriginal children. She was one of the early adopters to a "child-centric" research approach. She has been using this technique since the early 1990s.

Clinicians and other health care providers often discredit children's stories and opinions about their health. Dr. Young's research methods involve children directly, allowing them to self-report through carefully crafted surveys. "Numbers have an appeal to clinicians," stated Young. Therefore, Dr. Young's research is helping to give value and credibility to children's perspectives on their health and well-being.

Dr. Young declares that "research isn't just a job; it's a way of life." For someone who shows such strong enthusiasm for investigation, it may come as a surprise that as an undergraduate student, Dr. Young did not look forward to doing research. It wasn't until Dr. Young began working with an orthopedic surgeon in the late 1980s that she realized generating evidence and providing logical explanations to health-related situations was of great importance to her.

Her attraction to a "child-centered" research approach surfaced when she later worked in a research position at SickKids® in Toronto, Ontario. While collaborating with another orthopedic surgeon who performed limb-lengthening surgeries on children, Dr. Young realized that children should have a say in their own health outcomes. The rest is history.

It is evident that Dr. Young's life revolves around children; this includes her own. When she isn't busy collecting data, she enjoys paddling, biking, and skiing with her family. She also enjoys travelling to international destinations with them. She is sure to have her family accompany her on research-related trips whenever possible, even if this means that they get to sight-see while she is in meetings and conferences.

Dr. Young's students and research team are also of great importance to her. She enjoys nothing more than seeing the development of them in their own research efforts. Even after her collaborators move on to different endeavours, Dr. Young takes great pride in their accomplishments and growth.

The most satisfying part of Dr. Young's research is when she gets to collaborate and communicate with children in the rural and northern regions, and see positive things happen for them. Dr. Young is trying to improve the health of these children, who face unique challenges due to geography, disability or limited health-care resources. Her research could contribute to decrease spending on health interventions and programs that aren't effective. Limited resources can then be focused on initiatives that have the greatest health benefits to these children. Dr. Young knows her research is making an impact, especially when the children ask, "Can we do this again next year?".

POVERTY HOMELESSNESS AND MIGRATION

Unique project maps migration, measures homelessness across the North

By Vito Cupoli

Valuable research grants fund laboratories of all kinds. But there are no white coats in the lab of Laurentian University's Dr. Carol Kauppi. "Our laboratory is on James Bay. It's in Timmins, Cochrane, Hearst, North Bay, Sudbury; all of these communities. We're on the streets."

Dr. Kauppi and her team of researchers are halfway through a five-year, one million dollar grant for their study, "Poverty, Homelessness and Migration in Northern Ontario" (PHM).

This award from The Social Science and Humanities Research Council of Canada was the first Community-University Research Alliance (CURA) grant ever made to Laurentian University. The long-term funding allows the LU investigators to connect with individual communities and help them develop tailored solutions to poverty and the lack of affordable housing.

Contrary to the stereotype that substance abuse is at the root of most homelessness, Dr. Kauppi's work so far indicates that people leave their communities in the North to search for work.

In this era of government cutbacks Dr. Kauppi says migrant workers are coming to the region from every direction. "Some come from the James Bay coast but we have also found that migrants are coming from Southern Ontario and even internationally. They think there are jobs here in the resource industry but many of them don't find work and they end up with nowhere to go."

Providing shelter and services for an influx of people seeking work creates many challenges for municipalities. The PHM interdisciplinary team is trying to help in both the short and long-term.

A technique used by the LU researchers asks those in need to share their experiences and their ideas in a workshop known as a Design Charette. While they visualize and describe their ideal housing solutions, architects and designers draft versions of these ideas in real time.

Encouraging people to talk about their own stories supports another aspect of the research: fostering a wider understanding of the circumstances which lead to poverty, homelessness and migration. So with the help of team members, participants tell their life stories in short digital presentations using pictures, audio and video. Some of the storytellers want to use their own names when describing their experiences. One man's determination to have his story known resulted in a short documentary called "Will to Live: George Stephen On and Off the Street". It won the Best Short Documentary award at the 2012 Winnipeg Aboriginal Film Festival.

To keep the conversation going over the study period and across such a vast area of Northern Ontario, the PHM Project relies heavily on social media. That allows more people to participate in the research.

For instance, those who can't afford phones are using free broadband services in libraries or other institutions to stay in touch with the LU team.

Supporters are responding to the project's momentum. Successful social science peer review has kept the grant money flowing Dr. Kauppi and her team have now raised enough from other sources to keep their scattered laboratory open for a sixth year of study into Poverty, Homelessness and Migration.

See the Short Digital Stories produced by the research team on Facebook at: facebook.com/pages/Poverty-Homelessness-andMigration/141172799312286

The Sweet Science

Giving athletes a competitive edge through cultural psychology

By Jonathan Migneault

ROBERT SCHINKE

Robert Schinke had to re-evaluate everything he thought he knew about sports psychology when he first started working with Canada's national boxing team in the mid-1990s.

"When I was working with these people, and I came in with the sorts of skills I was taught in graduate school, none of them worked," said Schinke, the Canada Research Chair in Multicultural Sport and Physical Activity, and a professor at Laurentian University's School of Human Kinetics. "I had to revisit my language."

Combative sports like boxing tend to attract athletes from the inner cities with limited education. Immigrants with cultural backgrounds very different from those of western countries, and Aboriginal athletes, are also more likely to participate in the sport.

To adequately help the athletes achieve their full potential, Schinke had to develop a culturally inclusive approach to sports psychology – something that had not yet been done in Canada.

Coaches and sports psychologists often use imagery to empower athletes. A boxer born and raised in a middle-class Toronto suburb, for instance, could be asked to picture himself on top of the Olympic podium as a motivator to succeed. But that same imagery might not work as well for an athlete who immigrated to Canada from a more collectivist society.

"Those athletes actually see their success in relation to their community," Schinke said. "It's a community success and not an individualistic success."

More than a decade after his first introduction to the team, he has been a leading force in the field of cultural sports psychology, a term he branded in 2006 with a colleague from Australia.

Almost 20 per cent of Canada's Olympic team is made up of immigrant athletes, but for the most part Schinke said their cultural, religious, socio-economic, racial and educational differences have not been taken into account when it comes to their training.

"The practice of sports psychology in Canada does not include a cultural competence component," Schinke said. But he has worked to change that with his research and work with immigrant and Aboriginal athletes.

He recently edited a special issue of Psychology of Sport and Exercise – the leading academic journal in the field – on cultural sports psychology.

In 2010, Schinke led a Social Sciences and Humanities Research Council (SSHRC) grant-funded project to explore the barriers that prevented youth from the Wikwemikong First Nation on Manitoulin Island from participating in sport.

"Sport is a really good diversion when you're dealing with challenges of pregnancy, high rates of substance abuse and high rates of incarceration," Schinke said.

But after speaking with the community, Schinke and his team discovered that off-reserve racism, when local youths competed in nearby towns or cities, caused many of them to give up on organized sport.

In another research project one of Schinke's PhD students interviewed some 20 Aboriginal athletes who competed off-reserve. Using pictorials and other techniques the athletes shared their journey of acculturation.

Schinke says a number of high-performance Aboriginal athletes only last about a year competing off-reserve because of the problems of acculturation. He says the work he and his colleagues have done in cultural sports psychology will help ensure future Canadian athletes do not feel alienated in the same way.

"What I'm allowed to do out of Laurentian is very cutting edge," Schinke said. "They give me a lot of latitude to do these sorts of things."

STUDENT MELISSA PECMAN WORKING IN THE FIELD TAKING MEASUREMENTS ON DRILL CORE.

X-RAY VISION

A Laurentian professor's patented technology can help geologists "see" through rock

By Vito Cupoli

RICHARD SMITH

IN THE MINING INDUSTRY'S CONTINUAL SEARCH FOR NEW DEPOSITS, DR. RICHARD SMITH OF LAURENTIAN UNIVERSITY HAS PATENTED A NEW TECHNIQUE TO HELP SEE THROUGH THE SURFACE OF THE EARTH AND INTO THE BEDROCK.

Dr. Smith's innovation promises to add another layer of perspective and dimension to the electromagnetic readings miners use when looking for the specific minerals which are so vital to Canada's prosperity.

An exploration and research geophysicist with Laurentian's Department of Earth Sciences and Industrial Research Chair in Exploration Geophysics, Smith says his process hasn't been turned into an electromagnetic instrument yet. But if it gets to that stage it will provide a much more textured portrait of the rocks and geologic formations being investigated for mineral wealth.

"Most geophysical instruments have one transmitter, normally it's a vertical transmitter but this particular patent relates to a system that has three transmitters, one vertical and two horizontal. By using this particular transmitter at multiple locations then you can potentially see deeper and see things in more detail."

The patented idea is currently being assessed for usefulness by CGG, a company that does geophysical surveys. If CGG decides to build and deploy a prototype the instrument would be huge, spanning approximately 15 metres, and attached to the underside of a plane as it surveys an area.

Professor Smith's work also has the potential to produce a more detailed understanding of the seabed where many expect to find large new deposits of hydrocarbons. If the instrument is marketed, Professor Smith and the University will share the royalties. But he sees the patent in a larger context:

"There's a possibility that what you do may have an impact on the country or economy. If you help to find a deposit, there is a ripple-through effect so that in the end what you do is a benefit to communities, provinces and the country. One of the things that society needs is resources. For instance, everybody's got a cell phone and there are certain minerals and metals in that cell phone and they need that in order to live."

Professor Smith got the idea for his patent after joining Laurentian University in 2009. For the previous sixteen years he interpreted geophysical data at Geoterrex-Dingham, an exploratory contractor. Today at Laurentian, his focus is on training students to conduct exploratory research for Canada's mining industry.

Though born and partially educated in another resource-rich country, Australia, Smith was drawn to Canada for the rocks. "Though the rocks are similar in Canada, the rocks here are glaciated so there is only a very thin veneer of soil and clays over the top of the rocks. This makes it very easy to look through using electromagnetic methods."

His method for detecting electromagnetism was registered at the United States Patent office in 2010.

The patent was then published by the World Intellectual Property Organization in March which will help speed the process of extending patent protection to other countries.

Professor Smith expects to know by 2015 whether his idea will move from plan to prototype.

Following the footprints of Mineral Wealth

Laurentian leads national geo-science research that could change exploration

By Sherry Drysdale

Imagine an enemy submarine, lying submerged beneath the waves, on a foggy moonless night, somewhere off the rocky coastline.

How far from land is it? At what depth?
What are its dimensions, its weight and properties?
And how can we get this information from a distance?

These questions give us a sense of the challenge geoscientists are taking on in one of the most significant research projects in the field today.

The research is national in scope, global in its potential impact. It will bring together geoscience researchers from 24 universities across Canada, and will also leverage the skills and expertise of 27 partners in the mining and mineral-exploration industries.

The project is being led by Dr. C. Michael Lesher, Professor in Economic Geology and Research Chair in Mineral Exploration at Laurentian University, in conjunction with co-leader Dr. Mark Hannington, Goldcorp Chair in Economic Geology at the University of Ottawa.

Dr. Lesher says the submarine analogy is apt in describing mineral exploration." In fact, some of the methods that Inco used to find the Thompson Nickel Belt in the late 1940s were based on military technologies developed to detect submarines during the Second World War," he says. "Submarines and ore deposits are both difficult to find even when on the surface, accounting for the continued discovery of near-surface deposits like Voisey's Bay."

Geoscientists have long relied on an array of techniques and instrumentation to read the signals given off by valuable ore deposits lying beneath the surface; subtle chemical and physical signs may indicate mineral riches.

"Just as a motionless submarine may physically disturb only a very thin layer of water around its hull but may thermally disturb a thicker layer, ore deposits physically, chemically, and thermally disturb the rocks around them to varying degrees as they form and are modified by later geological processes, with each modification having a different sized footprint," Dr. Lesher explains.

What's new and exciting about the Footprints project is its objective of integrating these distinct signals to produce a much more useful 'map' for mineral exploration – a closer read of what lies beneath the surface.

"The major goal is to combine the barely detectable signatures of all of the available geophysical and geochemical techniques in ways that maximize the combined signal," says Dr. Lesher. "The various attributes of ore deposits are often layered but rarely combined and integrated, so this project focuses on integrating the signals. To do this, we have assembled a pan-Canadian research team with expertise in each of the methods – geological, mineralogical, geochemical, petrophysical, and geophysical – that tell us something about the ore deposits. We've designed the project to maximize researcher interactions and to give us more of a 'high-definition' picture," he says.

An unprecedented aspect of the research is the degree of collaboration among partners in the mining and mineral exploration industries, who clearly see the potential value in the science.

Dr. Francois Robert is VP and Chief Geologist, Global Exploration with Barrick Gold and, along with the research team one of the chief architects of the project. "It has come about through extraordinary collaboration and a shared strategic vision," says Dr. Robert. "This really sets a new standard for our industry."

Mining and mineral exploration companies and service providers across the country will be contributing to the multi-year Footprints project through the Canada Mining Innovation Council (CMIC). The industry sponsors, through CMIC, will contribute nearly $3M in cash to propel the research and $3.9M in cash-equivalent in-kind support.

Also new and exciting in the Footprints project is the unprecedented size of the matching research grant awarded by the Natural Sciences and Engineering Research Council: $5.1M, the largest grant ever awarded under the NSERC's Collaborative Research and Development Program.

As the official NSERC grant-holder, Dr. Lesher will be working with more than two dozen academics who've signed on to be part of the history-making Footprints research project. It will be a lot of work, and it will be spread over the next several years. Ultimately, the results of the research could change the way that mineral exploration is conducted across Canada, and around the world.

BUILDING A BETTER BUGGY

Laurentian's Mechanical Engineering students show 'the right stuff'

By Sherry Drysdale

SOMETIMES RESEARCH DOESN'T HAPPEN IN A LAB. SOMETIMES, IT STARTS IN A WORKSHOP, WHERE UPPER-YEAR MECHANICAL ENGINEERING STUDENTS ARE TINKERING WITH THE DESIGN OF A DUNE BUGGY BUILT VIRTUALLY FROM SCRATCH.

A Laurentian University team made a successful first foray into the Baja SAE Competition in 2013, outranking some bigger and better-known schools of engineering in the prestigious international design contest.

While it isn't 'research' per se, the competition provides a valuable hands-on experiential learning exercise that can lead to real-world practical and applied results in the automotive industry.

Over the past 37 years, the Baja Competition, run by the Society of Automotive Engineers (SAE), has become a premier design competition for undergraduate and graduate engineering students from around the world. The object: to design and build a safe, sturdy but nimble off-road vehicle that performs well on an unforgiving four-hour test course.

"The judges were impressed with our design and very impressed we didn't have any major issues," says Assistant Professor and faculty advisor Krishna Challagulla. "There were a few things they really liked. The rear suspension design was much stronger than what they usually see, so our buggy was more robust than others."

Safety is a paramount concern in the Baja SAE events. All competitors' vehicles have to pass a rigourous technical inspection before they're allowed to compete. "They don't want them flipping or breaking, and ours was pretty strong," says Challagulla.

It's the field test, of course, that tells the tale. About 1 in 5 of the buggies will break down – or break apart – during the road test. "We had to run it through a punishing endurance test, with steep hills and obstacles like logs and water, all muddy, and really a tough course. Our buggy was still intact and running after 4 hours, and that in itself is a big achievement."

Dr. Challagulla says his students spent 10 to 15 hours a week, sweating over design problems, modifying and adjusting frame, axle length and camber on their "Voyageur Racing" buggy, and many more hours as the competition date approached. Hard work, he says, but great fun, and a "great feeling of accomplishments for these guys, in a tough international competition."

The *Whispers* of the Universe

THE SEARCH FOR DARK MATTER IN SUDBURY'S SNOLAB

By Ben Williamson

NIGEL SMITH

It turns out that the best place to learn about the stars above us is deep underground. Way down an active mine shaft, at the end of a long tunnel, is SNOLAB, the sprawling physics complex. Laurentian is one of five Canadian universities involved in the science there.

Dr. Nigel Smith is the one in charge of the facility. His background is in extreme underground physics – he's been building detectors and leading teams in the search for dark matter since 1999. He came to Sudbury in 2009 because of the advantages SNOLAB has for detecting neutrinos and, hopefully, dark matter.

"The combination of the great depth and the cleanliness is what I believe attracts many of the people that work here. My view is SNOLAB is the best place to do this research."

A lot of tiny particles from outer space hit our planet. Some smack right into it. That's the easy stuff to detect and study. But there are particles such as neutrinos that barely interact with us or our detectors. It's hard to hear these whispers from the universe among the noisier particles. The solution is to go deep underground, where only the weakly interacting particles can penetrate.

The original SNO experiment was a gigantic sphere forty feet across, filled with heavy water. As millions of neutrinos from the sun sped through it, a few would interact with the water and produce a flash of light. Nearly 10,000 sensors lining the inside of the sphere watched for those flashes. It's been upgraded to SNO+. The heavy water has been swapped for another liquid that is even better at getting those rare neutrino interactions.

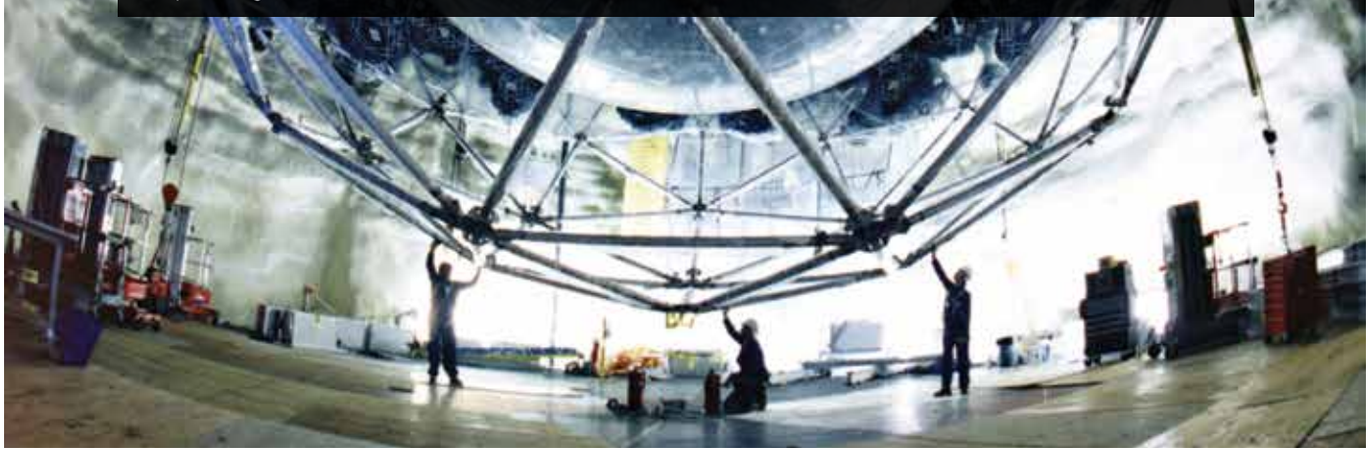
There's another neutrino project called HALO, which is waiting for a supernova: an exploding star. When that happens, a neutrino burst will get to Earth even before the light. That isn't because neutrinos go faster than light, says Dr. Smith, but because the light ricochets around in the star's plasma for a while before it escapes. The neutrinos just pass right through.

The other main focus at SNOLAB is the search for dark matter. Dr. Smith explains that "this is the search for the missing mass of the universe. We know if you look at the structure of the universe, there has to be more out there than we see. And because it's non-luminous, it's known as dark matter."

"We think it is a subatomic particle called a Weakly Interacting Massive Particle. The idea is to build experiments underground, so as the earth moves through this halo of dark matter in our galaxy, we'll occasionally detect one of those particles hitting our detectors."

Even though overseeing the facility keeps him busy, Dr. Smith makes time to bring physics out into the public. Recently, he gave a public talk at Science North about the discovery of the Higgs Boson.

"People are generally fascinated by the universe around them. As somebody trying to understand the universe, I think it's my duty to get out there and explain what we think is happening, how the universe works."



LaurentianUniversity
UniversitéLaurentienne

LAURENTIAN UNIVERSITY

Strategic RESEARCH Plan

2012 - 2017

Laurentian University is the principal research and graduate training centre in Northeastern Ontario. In just 50 years, it has grown from a small undergraduate university to a mid-size comprehensive institution with increasing research intensity serving the entire Northeastern Ontario region and Simcoe County. It has thrived and developed in a resource-based region of Ontario that produces most of Ontario's metal exports (90%). As well, the region is home to the highest concentration of Francophone and 40% of the province's Aboriginal population. The region is now facing massive impacts from climate change and large scale development pressure induced by the global resource boom. All these elements are fundamental to Laurentian University's research endeavours. Within this context, the Strategic Research Plan (SRP) aligns itself to the University's 2012-2017 Strategic Plan and embraces its purpose statement, value, aspirations and associated results.

Research Values

- **Intellectual impact:** the pursuit of excellence in all forms of research based on the highest standards of the peer-reviewed process
- **Engagement:** the involvement of faculty, students, Federated University partners, and the community at all levels as an integral part of the research enterprise
- **Mnaddendmiwin (Respect) and Inclusivity:** the importance of valuing Indigenous knowledge and the importance of supporting outstanding research in all fields
- **Interdisciplinarity:** the ability to create synergies between disciplines to foster innovative research
- **Research integrity:** the commitment to creating an environment that promotes responsible conduct by embracing standards of excellence, trustworthiness, and ethical practices
- **Dissemination and knowledge translation:** the exchange and synthesis of knowledge to address the gap between the large volume of research data and its systematic review and implementation in the academic and non-academic outlets

Strategic Research Themes

All faculty research is valued and important to the overall mission of Laurentian. We aspire to be known nationally for our world-class expertise in stressed watershed systems; genomics and bioinformatics; applied evolutionary ecology; rural and northern children's health; multicultural sport and physical activity; environment, culture and values; mining innovation and exploration; nanotechnology and particle astrophysics. To facilitate and encourage initiatives and new collaborations within these areas of research excellence, Laurentian University has identified five strategic research themes:

1. Environment and Conservation, 2. Health and Wellness, 3. Social and Cultural Research and Creativity, 4. Engineering, Mineral and Material Sciences, 5. Subatomic Physics – SNOLAB.

Research at Laurentian is integrative and often spans several themes.

1. Environment and Conservation

Since its creation, Laurentian University has been recognized worldwide for its environmental research especially in the areas related to the restoration of industrially damaged aquatic and terrestrial ecosystems. The recent construction of the 'Vale Living with Lakes Centre' (VLWLC), a state-of-the-art facility is also a testament of the importance of this research field and the need to expand this work. The involvement of Laurentian in environmental research is ensured by several undergraduate and graduate programs. In addition the University has established three Canada Research Chairs (Stressed Aquatic Systems, Genomics and Bioinformatics and Applied Evolutionary Ecology) whose domains intersect.

We aspire to be known nationally for our world-class expertise in freshwater ecology/ environmental restoration. To achieve this aspiration by 2017, we will focus on the following:

- Establishing a new NSERC Canada Research Chair Tier II in Environmental Microbiology
- Establishing a Canada Excellence Research Chair in Northern Watershed Processes and Policies
- Focusing on aquatic sciences including addressing a diversity of aquatic organisms from fish and amphibians through to invertebrates, microbes and plants through the development of the Vale Living with Lakes Centre
- Attracting an increasing number of international researchers and graduate students to the new Vale Living with Lakes Centre through scholar-in-residence initiatives and conferences
- Fostering environmental science in support of First Nations land use planning activities in northern communities

2. Health and Wellness

Research in health and wellness at Laurentian University has been expressed in a variety of scientific endeavours, from basic science projects that investigate the bio-molecular basis of disease to participatory action research focused on promoting wellness. Other foci within this theme have included: work in bioethics and critical disability studies, exploration of determinants of health, understanding the intricacies of health services and health policy, and generating evidence to guide practices that will improve health outcomes. Some of the research centres that contribute to this theme: Centre for Rural and Northern Health Research (CRaNHR), Centre for Research in Human Development (CRHD), Centre for Research in Occupational Health and Safety (CROSH), and the recently established Centre for Evaluating Children's Health Outcomes (ECHO). The Canada Research Chair's Program (CRC) currently funds a chair in Rural and Northern Children's Health. Several MSc and two PhD programs (Rural and Northern Health and Bio-molecular Science) are devoted to the growth of interdisciplinary health research at Laurentian.

We aspire to be recognized internationally for our expertise in rural and northern health and human kinetics. To achieve this aspiration by 2017, we will focus on the following:

- Creating the Sudbury Coalition for Health Research (SCHeR), a coalition between Laurentian University, the Northern Ontario School of Medicine (NOSM), the new Advanced Medical Research Institute of Canada, Cambrian College, Collège Boréal and other organizations in Sudbury involved in heath research
- Creating a research Chair in Occupational Health and Safety (OHS) in collaboration with CROSH
- Pursuing actively the creation of a new chair under this theme
- Establishing the Heart and Stroke Foundation Chair in Aboriginal and Rural Health in collaboration with NOSM
- Providing the needed space, infrastructure, and administration to support CROSH and ECHO
- Expanding the animal research facility to meet expected demand
- Reinforcing cross cultural research with a focus on Francophone and Aboriginal health

3. Social and Cultural Research and Creativity

Social and Cultural Research and Creativity at Laurentian University is sustained by nine interdisciplinary research centres, three scientific journals (Nouvelles Perspectives en Sciences Sociales, Revue du Nouvel-Ontario, Reflets), one monograph series (Human Sciences Monograph Series), the English Arts Society's publication Sulphur, several masters programs spanning four Faculties, and one PhD program focusing on Interdisciplinary, Culture, and Society. Laurentian University is also home to two CRCs: one in Multicultural Sport and Physical Activity, the other in Environment, Culture and Values. The University has a particularly strong record in studies relating to education and Franco-Ontarian Studies and a commitment to developing Indigenous Studies and research in the social science and humanities. A strong cadre of faculty in various departments already focuses its research on the evolution and development of various aspects of Northern Ontario. Spanning faculties and departments, research activities in this area involve the study of art, culture, heritage, and applied and practitioner based work.

Building on these assets, Laurentian University will encourage research and research collaborations, especially those that contribute directly or indirectly to regional linguistic, cultural, social, educational and economic development.

To achieve this aspiration by 2017, we will focus on the following:

- Reviewing the strengths of the research centres associated with this theme
- Support graduate programs specializing in social research, especially those with a regional component
- Funding three research chairs: a Research Chair in Sustainable Northern Economic Development, a Research Chair in Franco-Ontarian History/Studies and a Research Chair in Indigenous Relations and Governance
- Increasing the number of research grants in social sciences and humanities and the amount received by at least 25%

4. Engineering, Mineral and Materials Sciences

Laurentian University is located in the Sudbury Basin, a globally significant Ni-(Cu-PGE) mining centre near other significant mining centres (Au, Zn-Pb-Cu, U). During the past two decades Laurentian University has taken advantage of its location to develop internationally-recognized educational programs in Earth Sciences and Engineering that focus on mineral exploration and aspects of mine-related engineering. A doctoral program in materials science was launched in 2010 and the University has established a Canada Research Chair Tier II in Polymer Nanomaterials. Laurentian is well poised to develop new knowledge in the earth and material sciences needed to make the transition to a more sustainable use of planetary resources. With the steady development of the graduate programs in Engineering (MSc and PhD in Natural Resources Engineering) and its three Research Chairs, the Bharti School of Engineering has reached a high level of competence and research expertise in the fields of (a) Mining Engineering, (b)Robotics, Automation and Advanced Technologies, and (c) Process Engineering.

Building on these assets, Laurentian University will encourage research and research collaborations, especially those that bridge the traditional disciplines in Earth Sciences and Engineering with other programs (economics, health, environment, Aboriginal, law).To achieve this aspiration by 2017, we will focus on the following:

- Establishing a new NSERC Canada Research Chair Tier II in Geochemistry
- The Mineral Exploration Research Centre will secure funding for the flagship exploration research project of the Canadian Mining Innovation Council's on 'Multidisciplinarity Integrated Footprints of Magnetic, Hydrothermal, and Basinal Ore Deposits'

5. Subatomic Physics - SNOLAB

Canada's contribution to Underground Science infrastructure is SNOLAB, the superlative-defying 2km deep underground facility situated at the Vale Creighton mine, near Sudbury. Since the early days of the formation of the SNO Collaboration, Laurentian University has been a growing force in the scientific output of the laboratory. A founding member of both SNO and SNOLAB, Laurentian's commitment to subatomic physics research has gone from one faculty member to presently five faculty- including a CRC Tier II, five adjunct faculty (SNOLAB Research Scientists), and five postdoctoral fellows. Assisted by students and approximately $1M per year from NSERC, these 15 Laurentian scientists currently play key or leading roles in five experiments that span the full range of Underground Science.

Having grown together for 25 years Laurentian University and SNOLAB will continue to support each other and prosper from this close relationship. To achieve this aspiration by 2017, we will focus on the following:

- Continuing to be a sought-after partner in future international collaborations, able to provide expertise in all aspects of the experiments from on-site operations and management, through data collection and interpretation.
- Continuing to attract high-profile research and researchers to Sudbury, thereby providing a stimulating academic environment, both in terms of collaborative opportunities and unparalleled supporting infrastructure.

In summary, our high profile in these broad areas of research is evidenced by an excellent record of scholarly publications, substantial research funding and collaborations with the private sector and government agencies.

Strategy

Led by the Vice-President, Francophone Affairs, Research and Graduate Studies and (VPFARGS), Laurentian has embarked on an ambitious process to increase research capacity and develop new strategic research avenues. Working in conjunction with all Faculties, Laurentian's Federated partners as well as the Provost, the Office of the VPFARGS is committed to raise the total annual research income to $30 M by 2017 and to showcase nationally our exceptional research. In order to meet those goals the Office of the VPFARGS will:

- Support emerging and experienced research scholars through offering legal advice, mentoring, grant writing assistance and by extending a well organized system of review of ethical and animal research protocols
- Create new internal funding envelopes to support emerging scholars, create new research chairs and promote multidisciplinarity and partnership
- Seek framework agreements with federated partners to facilitate their full participation in graduate research and funded research
- Locate and assist in obtaining funds from diverse sources including that of the Tri- Council agencies
- Increase research capacity in Simcoe County
- Enhance travel supports to faculty and graduate students giving peer-reviewed papers at international and national conferences
- Implement scholars-in-residence programs
- Establish a policy for Research Centres and Institutes to enable the leveraging of new opportunities and external funding in response to changing circumstances
- Develop a University Analytical Services Unit to centralize acquired equipment
- As an indication of its commitment to targeted research areas, the University will endeavour to create endowments for research chairs, and post-doctoral and graduate fellowships
- Encourage coordinated action by teaching centres and committees in the Laurentian federation to support student learning through undergraduate research