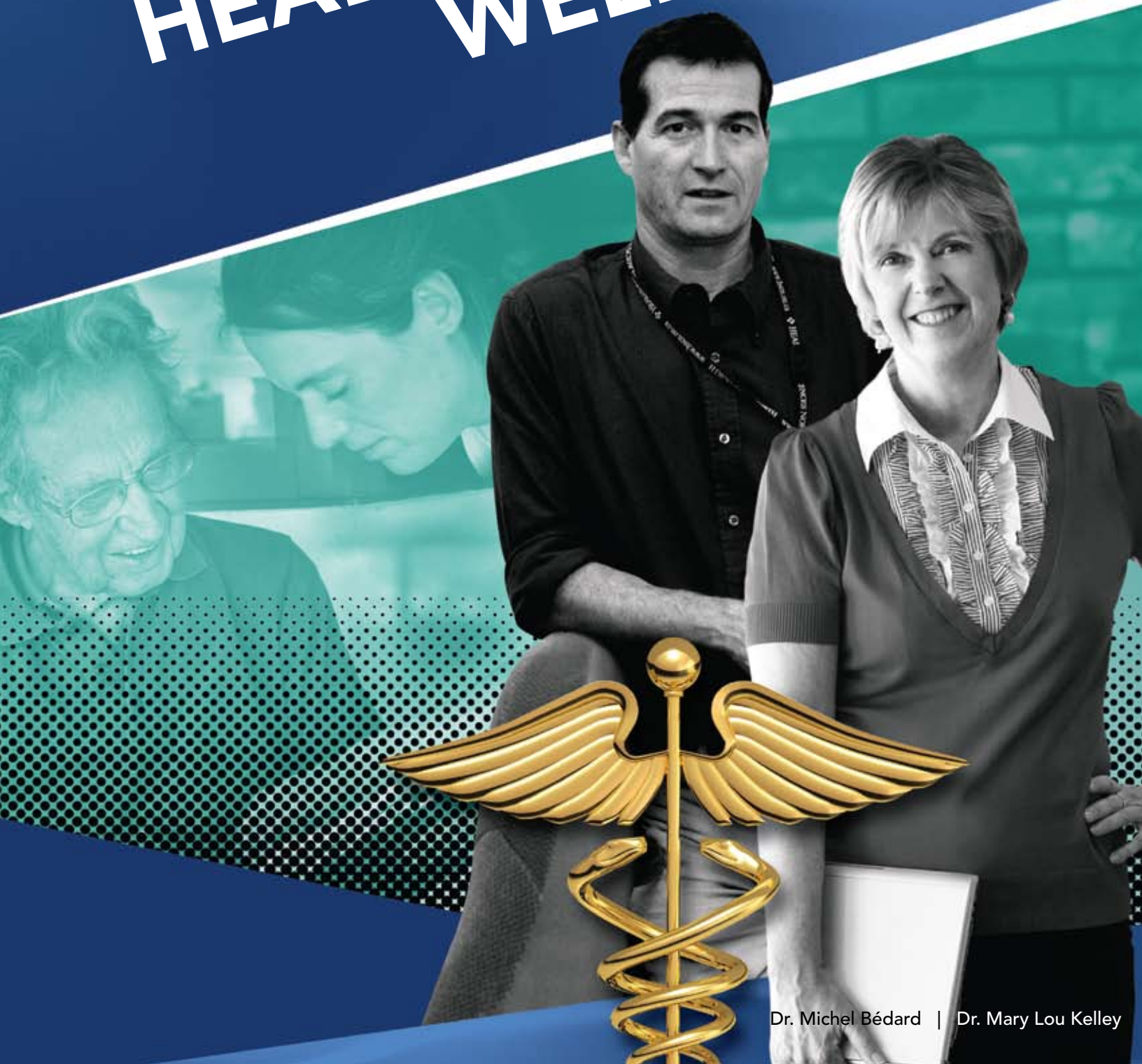
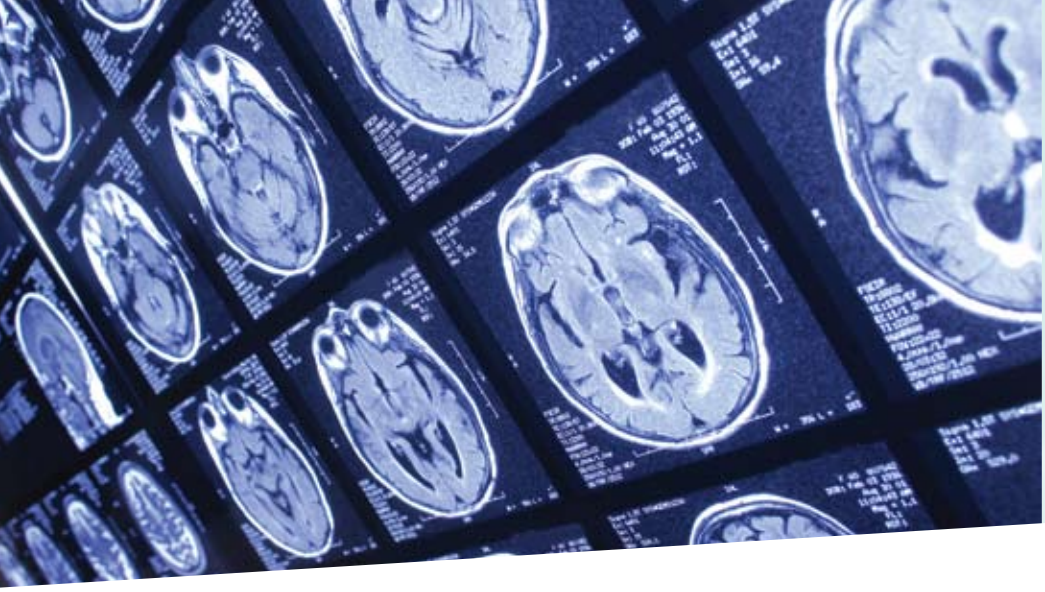
Lakehead
UNIVERSITY

RESEARCH & INNOVATION

HEALTH AND WELLNESS



Dr. Michel Bédard | Dr. Mary Lou Kelley



Lakehead University leads the way in innovative health research with a focus on rural, remote, Aboriginal, and northern issues.

CREATING THE FUTURE NOW

Lakehead University is at the forefront of innovative health and medical research. With its broad spectrum of world-class investigators, modern research facilities, and now home to the new Northern Ontario School of Medicine, Lakehead is supporting health research that makes a difference.

With special emphasis on rural, remote, Aboriginal, and northern health issues, Lakehead's research teams are delving into mysteries of body and mind. From injury prevention, end-of-life care, and safe driving, to the worlds of gasotransmitters, antioxidants, and solid-state imaging physics, Lakehead is pioneering many aspects of health and medical research.

Novel discoveries on the health effects of endogenous hydrogen sulphide by Lakehead's Dr. Rui Wang have led to a whole new branch of biomedical research in the world. Dr. Michel Bédard's research into safe driving is contributing directly to a reduction of traffic-related crashes. And the Northern Ontario School of Medicine is now a global leader in the rapidly developing world of community-based medical education.

Lakehead University houses thirteen health research laboratories, is home to five research centres, and supports nine health-related graduate programs with nearly 200 students involved. Lakehead's health researchers have authored hundreds of peer-reviewed papers over the past few years, produced seven invention disclosures, and filed three health-related patents.

CARE FOR **the dying**

Eventually, everyone dies. Some people die young or unexpectedly, others die after a long life, or from a chronic or terminal disease. As Canada's population ages, communities are seeking better ways to support the end-of-life choices of their friends, family members, and neighbours.

Developing hospice palliative care services is the focus of Dr. Mary Lou Kelley, Professor of Social Work at Lakehead University. She and her research team work in many care settings to better understand the complex issues surrounding care for the dying, as well as for their families. Of particular interest to Dr. Kelley are the issues related to rural communities.

Rural communities face unique challenges. Health care professionals are in short supply, and are usually generalists. Access to palliative care experts is limited. But rural communities also have distinct advantages. Community care providers already work together and know their patients well. Friends and volunteers gather to help provide a good death.

Dr. Kelley leads a community-based project to help sixteen rural areas develop palliative care programs. Her research model builds on each community's unique features and strengths and has generated a theory of change that can be applied nationally.

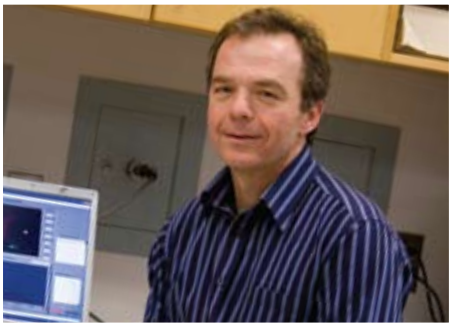
This research is supported by the Canadian Institute of Health Research.

Dr. Mary Lou Kelley
School of Social Work

THROUGH HARD WORK, SUPPORT, AND IMAGINATION, LAKEHEAD UNIVERSITY'S RESEARCHERS ARE CREATING A NEW WORLD OF HEALTH INNOVATION. **— LAKEHEAD IS LEADING THE WAY**

REDUCING sport injuries

The good old hockey game may be the best game one can name, but the good old hockey game extracts a heavy toll when it comes to spinal cord and brain injuries. Each year, in addition to spinal injuries, thousands of hockey players suffer concussions, which range from mild to severe. Research at Lakehead University is helping to bring down these numbers.



Dr. William Montelpare is a Professor of Kinesiology and a researcher focused on injury prevention in sport. One of his main areas of research looks at brain and spinal cord injury in minor hockey.

As part of this work Dr. Montelpare leads a team of national and international researchers in the assessment and development of *Play it Cool* (www.playitcoolhockey.com). This science-based skills enhancement program is helping to reduce the number of concussions and spinal cord injuries in minor hockey.

Lakehead's team is involved in the assessment as well as the ongoing enhancement of this national program. Through this and other work, Lakehead's researchers are helping to improve general injury rates in Canada and around the world.

Dr. Montelpare's research is supported by Ontario Neurotrauma Foundation and the Canadian Spinal Research Organization.

Dr. William Montelpare
Department of Kinesiology

UNDERSTANDING vascular diseases

Hydrogen sulphide (H_2S) is a toxic gas best known to cause that "rotten egg" smell. But recent discoveries have found that our bodies also produce small amounts of the toxic molecule, and that H_2S is linked to certain vascular ailments such as high blood pressure and heart disease.

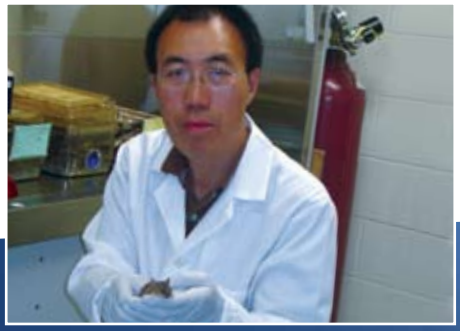
Dr. Guangdong Yang, a researcher at Lakehead's School of Kinesiology, is examining how H_2S is created and regulated at the genetic levels. Dr. Yang is looking at how one particular enzyme, known as cystathionine gamma-lyase (CSE) is produced, and how it regulates levels of H_2S in cells.

Hydrogen sulphide is one of a group of gases known as gasotransmitters. Much like neurotransmitters, these gases carry messages around the body, regulating tasks such as cell growth and constriction. Gasotransmitters were first characterized by Lakehead University researcher Dr. Rui Wang.

Dr. Yang and his team are specifically looking at CSE expression and H_2S production at both a cellular and molecular level. Using multiple techniques such as gene cloning, RNA silencing, and gene mutation, Dr. Yang's work will enhance the understanding of how vascular diseases develop. Ultimately this could lead to new and improved treatments.

This research is supported by the Canadian Institutes of Health Research and the Heart and Stroke Foundation of Canada.

Dr. Guangdong Yang
Department of Kinesiology



ENHANCING diagnostic imaging

Medical imaging has come a long way from that first X-ray taken in 1895. Vast improvements in technology and a proliferation of new tools means earlier detection of diseases like cancer, and better outcomes for patients in general.

Research at Lakehead University is now leading to the next generation of diagnostic imaging devices. Led by Dr. Alla Reznik, Canada Research Chair in the Physics of Molecular Imaging, scientists at Lakehead and Thunder Bay Regional Research Institute (TBRRI) are using advances in solid-state technology to create better diagnostic tools.

One aspect of Dr. Reznik's research focuses on amorphous selenium (a-Se), a known photoconductor that is currently used in medical imaging. By applying extremely high electric fields to a-Se, Dr. Reznik can increase the material's photosensitivity by many magnitudes using an internal magnification process called avalanche multiplication.

Avalanche multiplication has been proven at an experimental level. Dr. Reznik's team is now focused on performing the research and development needed to implement this phenomenon in practical radiation medical imaging detectors.

This technique could greatly enhance diagnostic tools such as X-ray and Positron Emission Tomography (PET) systems. As early detection of cancer leads to higher cure rates, this research could lead to substantial public health benefits. The work is supported by the Ontario Ministry of Research and Innovation and industrial partners Philips Healthcare and Weinberg Medical Physics.

Dr. Alla Reznik
Department of Physics / Thunder Bay Regional Research Institute

HEALTHY **hearts**

The body's cells produce free radicals as they metabolize oxygen. Although free radicals can destroy cells, antioxidants work to defend against this kind of destruction, and limit oxidative stress.

Dr. Neelam Khaper is studying the role of oxidants and antioxidants in heart health. Specifically, her laboratory is focusing on the role of inflammation and oxidative stress associated with diabetes and iron overload on the cardiovascular system. She is also examining the role of exercise on various markers of inflammation that regulate how the heart changes in these conditions.

Both these studies will lead to a deeper understanding of the underlying conditions that contribute to some cardiac problems. This in turn will form the foundation for future therapeutic studies.

In collaboration with Dr. Aicheng Chen, Canada Research Chair in Lakehead University's Department of Chemistry, Dr. Khaper's laboratory is also studying the effects of nanoparticles in cardiac cells. Together they are investigating whether these nanoparticles can cause an imbalance between free radicals and antioxidants, and whether this can then induce cell damage and cardiac dysfunction.

Dr. Khaper's research is funded by the Northern Ontario School of Medicine.

Dr. Neelam Khaper
Northern Ontario School of Medicine

MENTAL **health**

Seeking help for a mental health problem is difficult for most people, but when cultural differences and dissimilar cultural perspectives are thrown into the mix, the challenges can be vast. Such is the case with Aboriginal populations of Northern Ontario. Here the burden of mental health is great, while the lack of services and the number of culturally competent practitioners is small.

A team from Lakehead University's Centre for Rural and Northern Health Research, led by Dr. Bruce Minore, is working to document some of these gaps in mental health care. To do this they analyzed services available to Ontario's First Nations, Métis, and Inuit peoples in a variety of settings: urban, off-reserve rural, and First Nations sites. The Centre's research indicates that effective care is available for a person in crisis, but that not enough practitioners are available for prevention and follow-up.

One approach to improving services is to increase the cultural awareness of all practitioners. Another approach is to increase the number of Aboriginal practitioners. Minore's team helped pinpoint the successes and challenges in both approaches.

The study's findings and recommendations are now being incorporated into Ontario's new mental health strategy, which is being developed by the Ministry of Health and Long-Term Care.

This research is funded by the Ontario Mental Health Foundation.

Dr. Bruce Minore
Department of Sociology
Centre for Rural & Northern Health Research

MEASURING public health

Demographics, incidence of disease, and economic indicators are one way to measure the health of a community, but raw numbers only tell a partial tale. New research led by Dr. Elaine Wiersma, Assistant Professor with Lakehead University's Master of Public Health program, uses the power of story and image to document the human elements of public health.

Dr. Wiersma's research focuses broadly on issues around aging, particularly in rural and remote communities. One project involves a small town in Northwestern Ontario that is strengthening its economy by attracting retirees. Dr. Wiersma and her team are examining the social and economic factors affecting people's experiences in this particular community.

Another innovative project puts cameras into the hands of people seldom heard from: those with early-stage Alzheimer's and other forms of dementia. Using a methodology known as photovoice, participants document their lives. Through this approach researchers are uncovering important recurring themes that challenge stereotypes about those living with dementia. These findings will help health care practitioners recognize the strengths and abilities of people with dementia.

The Social Science and Humanities Research Council of Canada, the Alzheimer's Society of Canada, and Lakehead University support Dr. Wiersma's research.

Dr. Elaine Wiersma
Master of Public Health Program

SEASONAL affective disorder

Everyone appreciates a sunny day after three days of rain. But, just as a case of "the blues" is not clinical depression, a wish for sunlight is not Seasonal Affective Disorder (SAD).

Research shows that the prevalence of SAD increases the further north one goes. Causes of the disorder are linked to the interplay between natural body rhythms and external time cues, typically sunrise and sunset.

Dr. Josephine Tan, a clinical psychologist with Lakehead's Department of Psychology, is investigating the contributions of environmental, psychosocial, cultural and biological factors to seasonal changes in mental health and suicide in youth and adults from First Nations and non-Aboriginal communities in Ontario. This program of research is being conducted at Lakehead's site for the Centre of Biological Timing and Cognition (CBTC). It is one of five research programs developed within an omnibus team project which examines how disordered sleep and biological rhythms in Northern communities relate to physical and mental health problems.

Along with other CBTC researchers from the University of Toronto, Trent University, and with First Nations and non-Aboriginal community research partners, the findings from the omnibus project will offer a multi-disciplinary understanding of the impact that disorganization in the body's rhythms has on health and daily functioning. Understanding the nature of these relationships is important to the development of appropriate assessment and intervention strategies for different populations.

This work is supported by the Canada Foundation for Innovation, Ontario Innovation Trust, and Ministry of Economic Development and Trade.

Dr. Josephine Tan
Department of Psychology

OLDER ADULTS and driving

For young people, driving brings independence. The loss of this privilege as one grows old can mean a reversal of this freedom, and can trigger serious depression. As a result, older people may continue to drive without the necessary skills to remain safe on the roads. Yet, with help, many of these people could learn strategies to allow safe driving to continue.

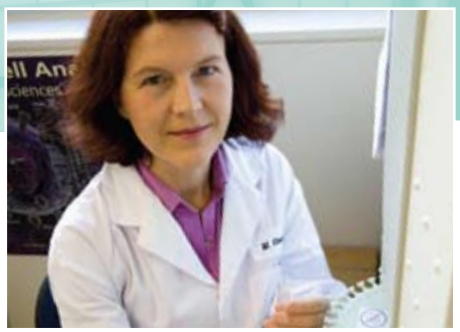
Age-related issues around driving is just one theme being investigated by Dr. Michel Bédard and his team at Lakehead University's Centre for Research on Safe Driving. The Centre studies the complex and interrelated factors that contribute to safe driving at all ages.

One area of research involves the use of driving simulators as part of a multi-tier assessment for determining a driver's safety. Through this work, researchers are developing predictive tools to safely and quickly assess the driving skills of individuals.

Dr. Bédard's team is also a key member of the national Candrive research study. This five-year, seven-sites research project is an interdisciplinary research program dedicated to improving the safety of older drivers. The Lakehead team will follow Thunder Bay drivers, aged 70 and older, to document the effect of health changes on driving safety. Ultimately one of the goals is to develop a screening tool to allow physicians to more easily and objectively assess a patient's driving ability.

The Centre's research is supported by the Canadian Institutes of Health Research, AUTO21-Network of Centres of Excellence, Ontario Neurotrauma Foundation, Canada Research Chairs Program, and the Natural Sciences and Engineering Research Council.

Dr. Michel Bédard
Master of Public Health Program
Centre for Research on Safe Driving



IMPROVING immunization

Vaccinations help prevent many life-threatening illnesses, including some forms of pneumonia and blood stream infection. But vaccines only protect patients against specific microorganisms, and in general, the body's immune response to virulent and persistent pathogens is still not fully understood.

Research in immuno-epidemiology at Lakehead University is delving into this mystery by looking at immune system responses in specific groups of people. Dr. Marina Ulanova, Associate Professor of Immunology, and a researcher with the Northern Ontario School of Medicine, is leading this work. She is examining the questions from both an experimental, as well as a clinical perspective.

The experimental research examines the interplay between a specific pathogen and the immune system of patients with cystic fibrosis. The findings indicate that although their immune systems combat the pathogen, patients still develop chronic infection. Dr. Ulanova is examining the impact of early stimulation of the immune response to see whether this may eliminate the pathogen entirely, and thereby improve a patient's overall health.

Dr. Ulanova is also looking at the rate of bacterial pneumonia in various parts of Northwestern Ontario. It appears the number of patients with diseases caused by bacterial strains, which are not included into common pediatric vaccines, is increasing. This is especially true among Aboriginal children, and people with chronic illnesses. In these patients, both new vaccines and repeated vaccinations can help, but many questions still remain unanswered. Dr. Ulanova and her team are analyzing patient data to document actual immunization rates and determine immunization effectiveness.

The Northern Ontario School of Medicine, the Ontario Lung Association, and the Natural Sciences and Engineering Research Council support this research.

Dr. Marina Ulanova
Northern Ontario School of Medicine

UNDERSTANDING **trauma**

Following a traumatic event, most people work through the after-effects within months, and return to their normal resilience. But for some, the hurt goes too deep. They experience debilitating anxiety, intrusive flashbacks, and sleep problems – a condition now called Post Traumatic Stress Disorder (PTSD).

A team of graduate students, led by Dr. Ron Davis of Lakehead University's Psychology Department, is studying the psychological and biological effects of trauma to better understand PTSD. By measuring various bodily reactions such as heart rate, skin conductance, and hormones, Dr. Davis is exploring whether those who are more affected by a trauma share a unique profile.

The research builds on a study conducted by Oxford researchers where participants play videogames after witnessing a traumatic video involving a motor vehicle accident. The game seems to interfere with the way the brain deposits traumatic memories. Ultimately this work could lead to a way of identifying people who are more likely to experience PTSD.

In related work, Dr. Davis' research on eating disorders has led to the production and distribution of educational video material that helps young women develop healthy living choices. The *Turning Points Program* (www.turningpointsprogram.com) promotes healthy eating and body image.

This research has received support from the Canada Foundation for Innovation, and the Ontario Ministry of Health and Long-Term Care.

Dr. Ron Davis
Department of Psychology

PROGRAMMING **interprofessional health care**

Health care professionals are good at collecting information about a patient, but sharing that data in a meaningful way amongst a wide variety of experts is difficult. A collaboration among physicians, software engineers, and medical researchers at Lakehead University is now seeking to create a new system that will improve interprofessional care and education.

The research is led by Dr. Rachid Benlamri and Dr. Richard Khoury from Lakehead University's Software Engineering Department, working in collaboration with Dr. Arnold Kim from the Thunder Bay Regional Health Sciences Centre. The project known as Northern Lights uses existing collaborative technologies to standardize patient information among medical disciplines such as social work, physiotherapy, medicine, and nursing.

Through the development of a text-based computer language, Northern Lights extends this collaboration by enabling the computer system itself to analyze and act on the input. For example, the system may analyze the diverse data coming in from the health care team, and automatically alerts a physician to a specific change in patient status. Eventually, the information will form the basis of case studies to help train new medical students.

In a related project, Luke Docksteader and Kristopher Scott, graduate students under the supervision of Dr. Benlamri, have developed a prototype system that allows patients to be monitored far from the hospital. Sensors send patient data, such as heart rate, to a server through the standard cell phone network. The server then evaluates and acts on the data.

Lakehead University, the Northern Ontario School of Medicine and the Thunder Bay Regional Health Sciences Centre support these projects.

Dr. Rachid Benlamri
Department of Software Engineering

Dr. Richard Khoury
Department of Software Engineering

BREATHING signs of asthma

For centuries, healers have known that disease can change the odour of a patient's breath. Sweet or fruity breath can indicate diabetes, while an ammonia-like odour suggests possible kidney problems.

Dr. Brian Ross at the Northern Ontario School of Medicine is now bringing a new trick to this old diagnostic technique. Using a new measuring device of his own creation, Dr. Ross is able to quickly and easily quantify some of the changes certain diseases cause in human breath.

Known as the Selected Ion Flow Tube Mass Spectrometer, or SIFT-MS, Dr. Ross can identify gases in very small quantities that are by-products of disease. The SIFT-MS is particularly well suited to examining trace amounts of gas in human breath due to its ease of use, and its ability to work with humid air samples.

In collaboration with Dr. Rui Wang of Lakehead University's Biology Department, Dr. Ross is using the SIFT-MS to help determine the role hydrogen sulphide plays in asthma. It is known that asthma patients have unusually low levels of hydrogen sulphide in their lungs, but the exact role of hydrogen sulphide in asthma is poorly understood.

Dr. Ross's work will help researchers develop fast, non-invasive ways to screen for asthma and monitor the progression of the disease. Through early detection, patients can manage their disease more effectively.

This project is sponsored by the American Asthma Foundation.

Dr. Brian Ross
Northern Ontario School of Medicine

LAKEHEAD UNIVERSITY'S centres of excellence

Lakehead University Centre for Health Care Ethics (CHCE)

Ethics is the heart of health care, but it is also a rational activity requiring views based on a reasoned argument, and on facts. Through collaborative interdisciplinary research in selected areas of bioethics, educational programs, and direct consultations, the CHCE works to enhance the ethical quality of health care.

Centre for Rural & Northern Health Research (CRaNHR)

The Centre for Rural and Northern Health Research coordinates and supports science around issues affecting health care in rural and northern communities. Investigators from various faculties at Lakehead University and the health care community study the organization, delivery, and effectiveness of rural and northern health services, as well as various health workforce issues.

The Centre for Education & Research on Aging & Health (CERAH)

Through collaboration between professionals, educators, researchers, students, caregivers, and older adults, CERAH is working to better understand the process of aging. Through CERAH, Lakehead's researchers focus on issues such as palliative care in First Nations communities, the role of hospice volunteers, and rural women's perspectives on aging. Ultimately, CERAH's mission is to advance health and social care for an aging population and to promote the health and well being of older people.

Centre for Research on Safe Driving (CRSD)

A collaborative and interdisciplinary team of researchers work to understand the fundamental processes that result in safe driving. Through the CRSD, Lakehead University supports the development of new practices and methods to optimize driving for people of all ages and all health backgrounds.

Northern Ontario School of Medicine (NOSM)

The Northern Ontario School of Medicine is a pioneering Faculty of Medicine. A medical school for the whole of Northern Ontario, the School is a joint initiative of Lakehead University and Laurentian University with main campuses in Thunder Bay and Sudbury, and multiple teaching and research sites distributed across Northern Ontario. By educating skilled physicians and undertaking health research suited to community needs, NOSM will become a cornerstone of community health care and contribute to improving the health of people in Northern Ontario.

Research & Innovation | Lakehead UNIVERSITY

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