Making Waves

A Landscape of Discovery, Creativity and Innovation

University of Saskatchewan

100 Years Engage · Enlighten · Explore

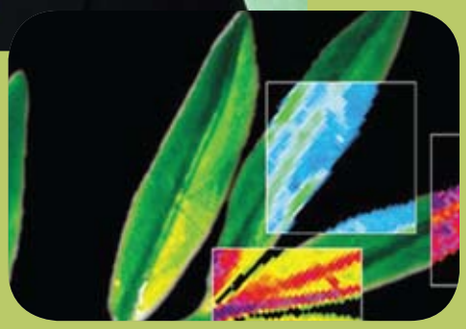
Making Waves in Environment, Resources and Sustainability

Probing Heavy Metals with Light

Ingrid Pickering and Graham George use synchrotron-based X-ray absorption spectroscopy (XAS) to explore the molecular form and function of metals in the environment and in the body, and to find strategies to reduce or eliminate toxic effects.

Heavy metals such as mercury and arsenic are known to be toxic, yet many organisms have mechanisms to cope with these toxins, and some plants actively accumulate them. Ingrid Pickering, Canada Research Chair (CRC) in Molecular Environmental Science, uses XAS to study hyperaccumulators—plants that take up and store high amounts of metals from the environment.

Ingrid Pickering



One such plant is a purple-flowered milk-vetch, or locoweed, which is common on the Great Plains. The plant accumulates toxic levels of selenium in its tissues. This affects the nervous systems of cattle that eat it, causing symptoms described as the "blind staggers."

Understanding how locoweed handles such high levels of selenium could provide a strategy whereby plants are used to clean up contaminated water or soil.

Transforming Toxins

Biological properties of a heavy element—such as whether it is toxic, benign or even beneficial—are largely controlled by the molecule that contains the metal.

Graham George, CRC in X-ray Absorption Spectroscopy, studies biochemical transformations of toxic elements in living tissues. He is currently working with molecules that include arsenic, selenium, mercury, and sulphur.

Such knowledge will aid the design of new, highly specific molecules that bind to the metal and carry it out of the body. This work has important applications in drug therapy, water treatment, and the remediation of contaminated industrial sites.

Finding the Antidote to Mass Poisoning

For nearly 70 years, it has been known that a lethal dose of arsenic cancels an equal, and otherwise lethal, dose of selenium.

Graham George

George and Pickering have used synchrotron XAS to reveal the reason for this toxicological curiosity—why a detoxification molecule containing one selenium and one arsenic atom is formed in blood and excreted. Their research could have profound implications.

The contamination of well water by natural arsenic has resulted in the mass poisoning of nearly 100 million people in Bangladesh and the surrounding Ganges River delta.

Soil selenium levels in the area are also very low, and the scarce selenium that is ingested is leached from the body in the arsenic-selenium molecule. Unlike arsenic, selenium is essential to human health, and symptoms of selenium deficiency can closely resemble those of arsenic poisoning.

George, Pickering and co-workers hypothesize that rather than arsenic poisoning, the Bangladeshi are actually suffering from selenium deficiency. The U of S team is now part of an international collaboration conducting a clinical trial of selenium supplementation in Bangladesh.

Maintaining Healthy Rivers

Toxicologist and CRC in Aquatic Ecosystem Health Diagnosis, Monique Dubé is working to ensure our rivers supply safe water for future generations.

She is a member of the Aquatic Toxicology Research Centre at the U of S, a $7-million initiative unique in Canada.

As water is the lifeblood of all organisms, rivers are the arteries of the earth. Dubé monitors and studies the effects of stressors such as sewage, industrial effluents, farm chemical runoff, and mining and pulp mill waste on our river systems and food webs. Her work will help policy makers address two basic questions: How much is too much? And what must we do about it?

Dubé's research group has developed artificial stream systems to assess the toxic effects of waste mixtures on fish and river life. One project involves identifying contaminants from pulp and paper mills that cause reproductive problems in fish. Dubé is also working to transform lab studies to scales applicable in real ecosystems.

With support from the Saskatchewan government, she developed The Healthy River Ecosystem Assessment System (THREATS), software that identifies "hotspots" when changes have occurred in the quality of water in rivers and in the health of the plants and animals that live in them.

Under UNESCO, Dubé chairs an international group on the use of ecology and hydrology to resolve water-related issues in developing countries.

Ajay Dalai

Engineering Environmentally Friendly Energy

Ajay Dalai, Canada Research Chair in Bio-Energy and Environmentally Friendly Chemical Processing, is developing more economical, renewable sources of energy and "greener" chemical processing methods.

The quest for clean energy has become the holy grail of environmental research.

Dalai's group has successfully produced biodiesel from oilseeds and waste vegetable oils, with properties very similar to diesel fuel. While the replacement of petro-diesel is a long-term goal, in the immediate future biodiesel is an important fuel additive. Since it contains no sulphur or nitrogen, biofuel lowers emissions. The addition of one per cent of biodiesel also improves fuel lubricity—or slipperiness—up to 65 per cent, thereby greatly reducing engine wear.

Hydrogen has the potential to be the ultimate clean energy source—when burned, water is the only by-product. Dalai is developing methods of producing pure hydrogen from waste biomass, such as municipal solid wastes and wood chips. He and his U of S colleagues are converting glycerol, a by-product of biodiesel, to hydrogen. They are also developing catalysts to convert methanol and crude ethanol to hydrogen.

Dalai is also working to develop cleaner methods of processing heavy oil and gas, and value-added products from fuel oil by-products. He has been successful in oxidizing toxic sulphur compounds in natural gas, sewage and jet fuels, and capturing mercury from coal-fired power plant flue gases. Dalai is working with several industry and government partners to test and eventually commercialize this research.

Reclaiming the Oil Sands

A team of U of S scientists, led by U of S civil engineer Lee Barbour, is helping to transform more than 20,000 hectares of land disturbed by oil sands mining into sustainable ecosystems.

Lee Barbour

In partnership with Syncrude, and with funding from NSERC, the team has been researching how to store sufficient moisture for vegetation while minimizing the salts that are released when mountains of clay shale—or overburden—are removed to expose the oil sands.

Barbour and geological sciences professor Jim Hendry are working on research to reclaim other types of waste materials, such as sulphur and coke, from oil sands mining and refining. Composed almost entirely of carbon, coke is a fine-grained black sand that is the by-product of extracting crude oil from tar sand.

The team's research results will help ensure sustainable boreal forest ecosystems are re-established following oil sands development.

Monique Dubé

Dubé's research group has developed artificial stream systems to assess the toxic effects of waste mixtures on fish and river life.

Making Waves in Culture and Society

Harnessing the Spirit of Co-operation

The U of S Centre for the Study of Co-operatives is a world-leading research and teaching institute devoted to studying the contribution and potential of co-operatives in Canada and around the world.

Just as the spirit of co-operation is woven into Prairie culture, co-operative organizations have been integral to the development of Saskatchewan's society and economy.

With 7,000 organizations and 10 million members across Canada, co-operatives are collectively one of the most important means by which people address the economic issues facing their communities.

The Centre for the Study of Co-operatives is a broadly interdisciplinary group whose mandate includes teaching and research in co-operative theory, principles, structures, and development. The Social Sciences and Humanities Research Council (SSHRC) is a major supporter of this U of S research.

Engagement with the community is essential to the Centre's activities, which draw upon and influence the practical work of numerous partner organizations in the co-operative sector in Saskatchewan and Canada. With its reliance on strong university–community relationships, Centre research affirms the University of Saskatchewan's commitment to a "sense of place."

The Centre's current major research focus is the social economy. A project titled "Linking, Learning, Leveraging: Social Enterprises, Knowledgeable Economies, and Sustainable Communities" bridges urban, rural and remote communities and involves 25 academics in 10 disciplines from 13 universities, along with 53 community partners in Canada, the United States, Colombia, and Belgium.

Benefiting Society– at Home and Abroad

Spearheaded by U of S history professor Brett Fairbairn, a recently completed project—the largest on co-operatives ever undertaken in Canada—investigated how voluntary membership in co-ops has changed Canadian communities and

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contributed to social and economic development.

Among other projects:

- Centre director Lou Hammond Ketilson, associate professor in management and marketing, is working in partnership with the First Nations Agricultural Council to develop Aboriginal co-operatives in the province.
- Agricultural economist Murray Fulton is studying the roles of boards and management in co-operative organizations, and the challenges of governance in times of change.
- Sociologist Michael Gertler is examining the role of co-operatives in local food distribution and retail systems.

Centre staff members ensure ongoing liaison with partner organizations and the co-op community, and maintain the most comprehensive resource library on co-operatives and related topics in anglophone Canada.

Internationally, U of S faculty involved with the Centre have developed training programs for emerging farming associations in China, as part of an initiative by the Canadian International Development Agency. Other international partnerships include academic, governmental and community-based organizations in Brazil, Sri Lanka and Mongolia.

From left to right: Karen Neufeldt, Patty Scheidl, Nora Russell, Michael Gertler, Roger Herman, Lou Hammond Ketilson (director), Murray Fulton, Lorraine Salt. Missing: Brett Fairbairn

Dramatizing the Human Condition

From ancient to post-modern times, art in society has examined, questioned, critiqued, and celebrated the human condition.

For U of S drama professor Jim Guedo, the theatre is the ultimate art form, encompassing music, sound, voice, movement, visual art and design, and technology.

For the past 25 years, Guedo has been engaging audiences across the country, as artistic director, actor, director, designer, and teacher. He has worked with most of the country's major regional theatres, including the Stratford Festival, the National Arts Centre, the Manitoba Theatre Centre, the Citadel Theatre, Persephone Theatre, and Twenty Fifth Street Theatre.

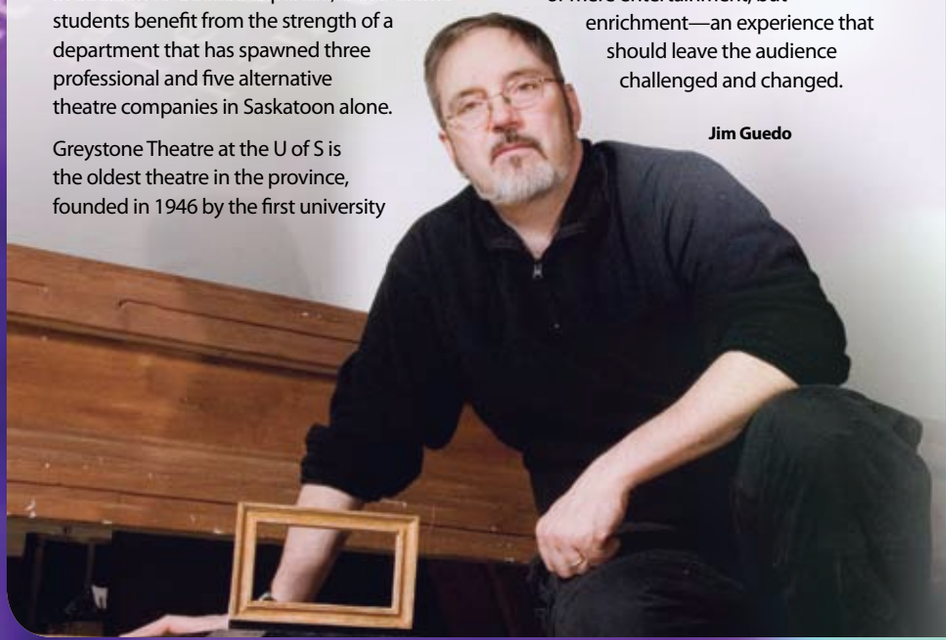
In addition to Guedo's expertise, U of S drama students benefit from the strength of a department that has spawned three professional and five alternative theatre companies in Saskatoon alone.

Greystone Theatre at the U of S is the oldest theatre in the province, founded in 1946 by the first university drama department in Canada and the Commonwealth. Every year, Guedo stages a large-cast mainstage production at Greystone, one of four presented by the U of S drama department each season.

Guedo's artistic research also includes several professional productions each year. His company, Wild Side Productions, explores contemporary, provoking work by theatre's more maverick playwrights.

For Guedo, theatre is not about propaganda, or mere entertainment, but enrichment—an experience that should leave the audience challenged and changed.

Jim Guedo



Breaking Down Racial Barriers

As the population ages and birth rates decline, Canada has increasingly relied upon immigration as the main source of growth in population and labour force.

New immigrants bring human resources, economic investment and cultural enrichment. Yet all too often, they face social and cultural barriers to integration.

U of S sociologist Peter Li's influential studies of Chinese Canadians have provided a new perspective and critical framework for understanding institutional racism. More recently, he has expanded his studies to include Asian investment in Canada, Chinese business immigration and entrepreneurship.

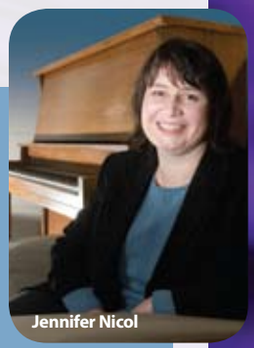
In his current research, Li addresses two main questions: Are recent immigrants able to improve their economic status over time? And, why do some immigrants manage to surpass the earnings of native-born Canadians and others do not?

Peter Li

Studies have shown that recent immigrants have lower incomes compared to native-born Canadians than immigrants who came to Canada 30 years ago. Yet immigrants today are more highly educated. His work will provide policy-makers with new insights into how best to integrate newcomers to Canadian society.

Li's contributions to understanding racial and ethnic inequality, immigration and multiculturalism are recognized by scholars and senior policy-makers around the world. He was recently appointed by the Governor General of Canada as a director of the International Centre for Human Rights and Democratic Development. In 2002, he received the "Outstanding Contribution Award" from the Canadian Sociology and Anthropology Association.

Healing with Music



Jennifer Nicol

For most of us, music has the power to change our mood. For Jennifer Nicol, music has the power to heal.

An assistant professor in educational psychology and special education and associate member of the music department, Nicol is exploring the therapeutic benefits of music. As a psychologist, musician and music therapist, she has experienced the healing and transforming power of music from a multitude of perspectives.

Nicol believes that listening to music while alone is not a solitary experience. Solitary listening evokes relational processes that include feeling connected with others. In fact, people with chronic illnesses derive benefits similar to those associated with other social support systems.

By researching the social and psychological effects of music listening, Nicol hopes to improve quality of life for, among others, the elderly and the 65 per cent of Canadian women who suffer from chronic health conditions.

Making Waves in Human and Animal Health

Developing Vaccines for Newborns

U of S scientist Volker Gerdts and his team at VIDO are working to improve vaccines for newborns.

Newborns of all species are the most vulnerable to infections, yet because their immune systems are still developing, they are the least likely to be protected by vaccines.

Volker Gerdts

Volker Gerdts heads the Neonatal Immunization Program at the U of S Vaccine and Infectious Disease Organization (VIDO), a world-leading centre for research and development of vaccine and immunotherapies for livestock and humans.

By 2010, a $110.3-million International Vaccine Centre will be built next to VIDO, significantly enhancing Canada's capacity to develop and test new vaccines for both humans and animals. Diseases to be studied include tuberculosis, hepatitis C, SARS, HIV, and avian influenza.

Preventing Whooping Cough

Each year, 300,000 children die from whooping cough. Although vaccines are available, they require multiple immunizations and therefore are challenging to use in developing countries.

Gerdts and colleagues recently showed that vaccinating pregnant sows may protect newborn piglets from disease. As a result of vaccination, the sows developed antibodies against whooping cough bacteria *B. pertussis*. These antibodies were passed to the piglets through the sows' milk. The technique is now at a stage where it can be studied in humans.

Protecting Global Health

The VIDO team, spearheaded by Lorne Babiuk, is working to develop single-shot vaccines for newborns, a complementary strategy to maternal vaccines which only protect infants in the first few weeks to months of life.

Gerdts, scientific manager of the project, says the goal is to create vaccines that protect newborns while eliminating both booster immunizations and needles.

With U.S. $5.6 million over five years from the Bill & Melinda Gates Foundation through its Grand Challenges in Global Health initiative, and $3 million over three years from the Krembil Foundation, the VIDO team is helping to turn the tide against infant mortality from respiratory infections such as whooping cough. Eventually, this technology will be applicable to vaccines for both infants and children.

Gerdts and colleagues are also working on new ways to control disease by stimulating the body's innate immune system. This system can be activated by delivering a vaccine through the mouth or nose, where it is deposited directly to the mucosal surfaces of the respiratory tract. The vaccine stimulates a strong response at these surfaces, which is where most disease-causing organisms enter the body.

Unravelling Chronic Wasting Disease

Veterinary pathologist Trent Bollinger is leading a major project to unravel the mystery of chronic wasting disease (CWD) in wild deer.

Prions are infectious proteins that trigger similar, naturally occurring proteins in the body to mis-fold, causing diseases such as CWD in deer and elk, bovine spongiform encephalopathy (BSE) or mad cow disease in cattle, and Creutzfeld-Jakob disease (CJD) in humans.

A variant of CJD in people has been linked to eating products from cattle infected with mad cow disease.

With funding from PrioNet Canada, Bollinger and his research team are using population genetics and radio tracking to determine where deer congregate and how they move within their habitat.

This research will help predict the spread of CWD in the wild and identify risk factors such as population density, social structure and land-use patterns, which potentially could be altered in order to manage the disease.


Dr. Alan Rosenberg

Tracking the Origins of Disease

According to Dr. Alan Rosenberg, the vast majority of adult health problems—from obesity and diabetes to osteoporosis and high blood pressure—have their roots in childhood, or even earlier in the womb.

As director of the U of S Paediatric Rheumatic Disease Laboratory, Dr. Rosenberg is recognized across Canada for his research and clinical treatment of childhood arthritis and related rheumatic diseases.

Rosenberg believes that good health is a result of both nature and nurture. Early causes of disease not only involve genetic factors, but also social and economic influences, nutrition, stress, and exposure to pollution. These factors can set children down a path to poor health long before they are capable of making their own lifestyle decisions.

With funding from the Canadian Institutes of Health Research, the Canadian Arthritis Network, the Arthritis Society, and the Saskatchewan Health Research Foundation, Dr. Rosenberg leads a national team of researchers in a $1.1-million study on how the interaction of genes, environment and lifestyle affects long-term health.

Rosenberg and his research team are specifically studying how the interplay of genes, lifestyle and environment can help predict Juvenile Idiopathic Arthritis (JIA), a painful form of inflammatory joint disease that is one of the most common chronic and disabling conditions of childhood.

Understanding these interactions will help to ensure early diagnosis, improve treatment, and provide more effective prevention of JIA and other chronic diseases.

Dr. Rosenberg leads a national team of researchers studying how the interaction of genes, environment and lifestyle affects long-term health.

Advancing Treatment for Anxiety and Depression

Lisa Kalynchuk combines psychology and neuroscience to further the understanding and treatment of mood disorders such as anxiety and depression.

She and her U of S research team are working to understand what triggers symptoms of anxiety and depression in adults, and how the brain controls the development of these disorders.

Kalynchuk is studying both behavioural symptoms and neurobiological changes in animal models to help provide more effective and holistic treatment.


Lisa Kalynchuk

She is especially interested in the role that stress plays in depression. Her work shows that stress can cause memory problems, helpless behaviour and lack of motivation in animals, symptoms similar to those observed in people with depression. However, not all people who experience stress suffer from depression. Kalynchuk is studying how stressful events in early childhood and the quality of maternal care affect susceptibility to anxiety and depression in adulthood.

Her research with rat pups shows that interventions such as enriched environments—including treats, toys and running wheels—can counteract changes in the brain that seem to increase susceptibility to depression in later life. This could indicate that activities such as exercise and relaxation are as important as medication in treating depression.

A key part of Kalynchuk's research is translating the knowledge gained by her work in the lab to help mental health professionals provide more effective treatment.

History and Social Justice | Health | Administration and Business | Education

Making Waves for Indigenous Peoples

Transforming Education—and Lives

Marie Battiste knows the challenges Aboriginal people face in education. A Mi'kmaq from Nova Scotia, the U of S education professor is internationally renowned for her efforts to improve education for Indigenous Peoples.

The University of Saskatchewan offered its first course in Aboriginal Education in 1961. Since then, the College of Education has gained an international reputation for teacher training and research that supports and improves education among Aboriginal learners.

Marie Battiste

While positive strides have been made, 70 per cent of Aboriginal high school students in Canada do not complete their programs. Those who do go on to university are less likely to enrol in graduate programs, and the number of Aboriginal students in science and mathematics is far lower than their non-Aboriginal peers.

Marie Battiste, director of the U of S Aboriginal Education Research Centre (AERC), is committed to fostering excellence in Aboriginal education. Battiste's work has influenced policy nationally and internationally.

She is currently on the executive committee of the Canadian Commission for UNESCO, a member of the Circle of Experts for the Aboriginal Task Force for Heritage Canada, a board member of the International Research Institute for Maori and Indigenous Education, and a United Nations expert on the protection of Indigenous knowledge.

Valuing Traditional Knowledge

In the next three decades, the Aboriginal population is projected to increase dramatically in Saskatchewan. Battiste notes that prospective teachers must be aware of the implications of changing demographics to contemporary schooling, and the issues of cultural and racial prejudice that affect student attitudes and achievement.

Cultural practices inspire pride, motivation, and a sense of self-worth. AERC researchers are working to instil an understanding of diversity and a respect for Indigenous knowledge into the philosophy of teaching.

Essential to Battiste's research—and the mandate of AERC—is developing programs in partnership with communities, organizations and elders that acknowledge Aboriginal culture, history and language.

Since AERC was established in 2005, researchers have created several key partnerships and initiatives. Among them:

- A partnership with the National Science Foundation explores the relationship between contemporary knowledge and Aboriginal heritage.
- A project explores a Virtual Aboriginal Health Training Centre of Excellence with First Nations and Métis people and the provincial and federal governments.
- An initiative aims to improve the participation of Aboriginal students in math and science.

Recently, Battiste was selected to co-direct the Aboriginal Learning Knowledge Centre, a national network of more than 50 members from the Prairie provinces, the Northwest Territories and Nunavut. The centre will enable sharing of existing research, identify gaps, and provide the knowledge required to improve learning opportunities and outcomes for Aboriginal peoples.

Understanding the Role of Culture in Health

Canada Research Chair Sylvia Abonyi is studying the relationship of culture in the health of Aboriginal populations.

As an anthropologist and health researcher, Abonyi believes we need to understand cultural values and beliefs in order to improve the well-being of Aboriginal communities.

Sylvia Abonyi

Key questions she is trying to answer are:

- How does the support of cultural practices contribute to the health of a community, such as longer life expectancies and lower incidences of diabetes and obesity?
- In communities where incomes are low and food prices high, how can traditional foods fill the gaps?
- How can homes be designed to accommodate distinct family and social arrangements?

Aboriginal art work: "Our Ancestors are Teachers" 2004 by Kevin Pee-Ace


Caroline Tait and her team

Reducing Health Disparities in Indigenous Communities

U of S researcher Caroline Tait is working to reduce disparities and improve the health of Indigenous and marginalized women.

A Métis from MacDowall, Saskatchewan, Tait is trained in medical anthropology and is an expert in Indigenous health.

In a Canadian Institutes of Health Research (CIHR)-funded project, Tait is working with First Nations communities to reduce the incidence of fetal alcohol syndrome (FAS) in northern Saskatchewan. FAS is a leading cause of preventable birth defects in Canada. Her research aims to provide policy and programming direction that reflects First Nations values and needs, and helps prevent FAS by improving the health of women most at risk.


Caroline Tait

Tait and an interdisciplinary research team are also examining the migration experiences of Indigenous and immigrant women settling in Saskatoon. They are working with community-based organizations, policy makers and health practitioners to address economic and social barriers that affect the mental health of disadvantaged and marginalized women.

Indigenous Peoples' Health Research Centre

Tait is a member of the Indigenous Peoples' Health Research Centre (IPHRC), a collaboration among the First Nations University of Canada, the University of Regina, and the University of Saskatchewan.

The IPHRC works to promote and increase research in areas of Indigenous health such as chronic diseases, delivery of health services, and prevention measures. The IPHRC is also working to expand the role Indigenous people play in finding solutions to their own health needs.

Reclaiming the "Words" in Broken Promises

Historian Keith Thor Carlson's research examines the Stó:lō First Nation oral history with the aim of redressing historical injustice. His work is also aiding ongoing treaty negotiations in British Columbia.

According to Stó:lō oral tradition, the Crown promised the Stó:lō people one-quarter of all revenue from the sale or exploitation of their land and resources. The Stó:lō cite the fact that no payment has ever been made as proof that the government has broken its promise.

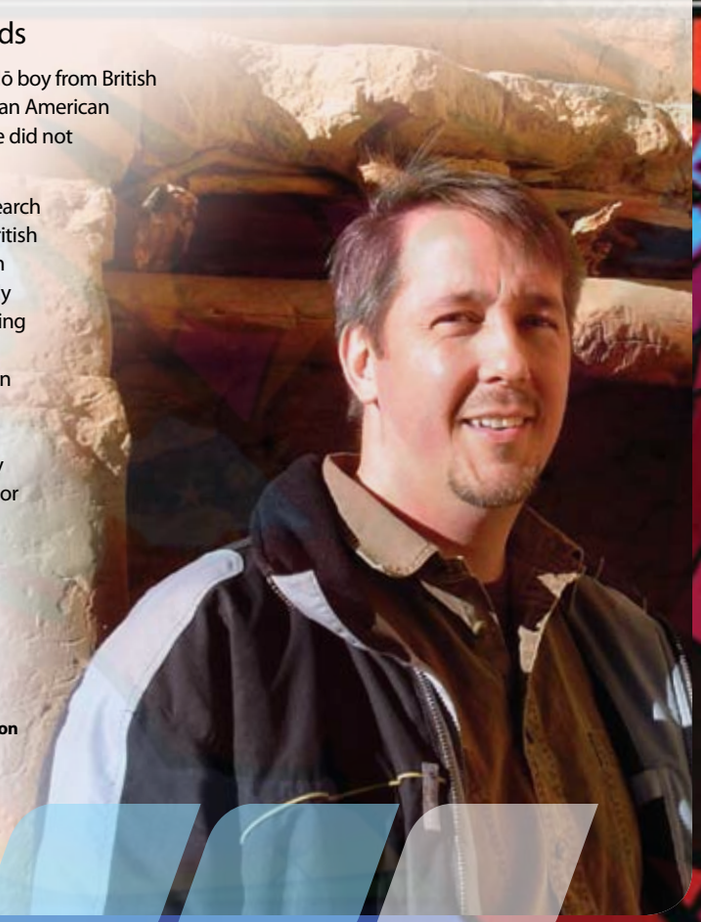
Their claim is significant because B.C.'s Coast Salish people currently assert title over Vancouver – Canada's third largest city – as well as the lower Fraser River—home to the world's largest salmon runs.

Carlson's research underscores the need to harmonize Native-newcomer relations as well as historical perceptions. He has been examining Stó:lō history to determine the effects of their transition from an oral tradition to literacy in the late 19th and early 20th century. His research aims to bridge the chasms between academic literature, government records pertaining to Crown–Native relations, and Stó:lō oral history.

Healing Old Wounds

In 1884, a 14-year-old Stó:lō boy from British Columbia was hanged by an American lynch mob for a murder he did not commit.

As a result of Carlson's research into the event, both the British Columbia and Washington governments have recently resolved "to promote healing among the Stó:lō people and reconciliation between Natives and non-Natives on the Pacific Coast…to ensure that such a tragedy will neither be forgotten nor repeated."


Keith Thor Carlson

Making Waves at the Frontiers of Science and Technology

Producing Designer Feeds from Biofuel By-products

The burgeoning biofuels industry is poised to make a major contribution to greenhouse gas emission reductions—if scientists can come up with a way to add value to the by-products.

Agriculture and bioresources professor Bernard Laarveld is working to boost the economic return of biofuels by developing designer feeds.

Laarveld leads the U of S Feed Technology Research Facility, a $12.6-million initiative to explore the challenges and opportunities in bioresources, such as making high-value animal feed from low-value crops or biofuel by-products. With support from the Canada Foundation for Innovation and Saskatchewan Agriculture and Food, the facility will catalyze collaboration and enhance the international profile of U of S research in bioresources.

Bernard Laarveld

The amount of by-product from one billion litres of ethanol – well within the capacity of Saskatchewan alone – is 850,000 tonnes of distillers' dried grains and solubles. Increased canola crushing capacity for biodiesel will generate more than one million tonnes of high protein canola meal for animal feed use per year.

The Canadian livestock feed industry is worth more than $5 billion a year. Pet food sales are worth another $5 billion. By developing animal feed from by-products, Laarveld and colleagues are helping to increase the feasibility and profitability of biodiesel and ethanol industries—and creating new market opportunities in the process.

Improving Feed Safety, Animal Health and the Environment

Feed safety and wholesome nutrition for livestock and pets are increasingly important to livestock producers, consumers and pet owners. Laarveld and colleagues are working to improve feed safety and to minimize the risks from infectious diseases, feed toxicity, and diseases transmitted from animals to humans.

Laarveld studies how food products can be better metabolized, and is working to develop feeds with optimum nutritional value as well as nutraceutical benefits, which strengthen animals' immune systems and benefit human health.

Nutraceuticals in food products include omega 3 in eggs and milk, and conjugated linoleic acid (CLA)—a known cancer fighter—in dairy products and beef.

Breeding Crops to Benefit the Environment

U of S researchers are also breeding new varieties of crops with improved feed qualities, such as higher starch content and low phytate levels in grains to reduce the environmental impact of phosphorous excretion in livestock manure. Since the addition of flax or canola oils can reduce methane production (animal flatulence) in ruminants, feed research can also help to reduce greenhouse gas emissions.

Laarveld, his colleagues and students are motivated by the incredible potential of feed technology research—and by the prospect of improving the health of animals, humans and our environment.

Qiaoqin Yang

A Nano-Coating of Protection

Qiaoqin Yang is developing nanostructure carbon coatings to dramatically improve wear resistance of surgical implants such as artificial joints.

Each year, more than 50,000 joint replacement surgeries are performed in Canada, and with an aging population, the number is on the rise. Increasing wear resistance is key to improving the durability and performance of artificial joints.

Canada Research Chair (CRC) in Nanoengineering Coating Technologies, Yang is one of several U of S scientists working at the forefront of nanotechnology. She is working with Akira Hirose, CRC in Plasma Science, and other colleagues at the U of S and the Canadian Light Source synchrotron to structure new carbon-based composites on materials surfaces at a molecular level.

These new nano-structured surfaces are extremely hard and durable, and promise superior wear resistance. For patients, this means fewer surgeries, improved quality of life, and reduced exposure to the toxic effects of wear.

X-Ray Visionaries

Biophysicist Dean Chapman is using synchrotron light to develop X-ray technology that will provide unprecedented image quality and lead to better diagnosis and treatment of diseases such as cancer and arthritis.

Images in conventional X-rays are produced when dense tissues such as bone absorb radiation as it passes through the body. Soft tissues such as lungs and cartilage are more difficult to image because they do not absorb radiation as readily. Instead, the X-rays are diffracted, or scattered.

This scattering is exactly what Chapman, Canada Research Chair in X-ray Imaging, is harnessing with diffraction-enhanced imaging (DEI). Chapman worked with Bill Thomlinson, now executive director of the Canadian Light Source (CLS), and colleagues in the U.S. and Europe to develop DEI.

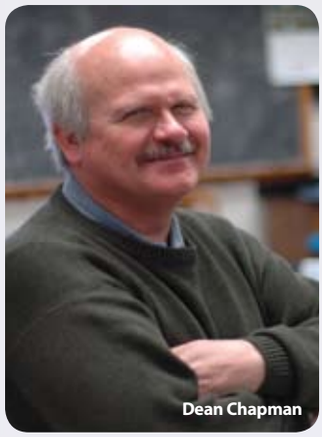
Sharper Image Brings Tiny Tumours to Light

With DEI, scientists measure how synchrotron-generated X-rays diffract when they pass through various tissues, creating high-resolution images of muscles and organs that clearly reveal details such as the extent of cancer tumours in breast tissue.

DEI can provide 33 times greater image contrast and dramatically less radiation exposure than regular X-rays. The technique promises better cancer detection, particularly in mammography.

Chapman is the project leader of the $17-million BioMedical Imaging and Therapy (BMIT) beamline at the CLS. Once complete, BMIT will be unique in North America, one of only three such facilities in the world, and the only biomedical imaging beamline located on a university campus.

BMIT research will involve U of S researchers in human medicine, veterinary medicine and pharmaceuticals, and more than 60 of their colleagues across Canada.



Dean Chapman

Revealing the Properties of Complex Materials

Understanding the electronic structure of matter and molecular systems is fundamental to the design of new materials for a wide range of applications—from biosensor devices and improved nano-electric circuits to longer-lasting coatings for human implants.

As Canada Research Chair in Materials Science with Synchrotron Radiation, physicist Alexander Moewes uses synchrotron light to illuminate the properties of new and exotic materials.

His goal: design materials with novel electronic, optical, magnetic, photochemical, and catalytic properties.

Moewes and his "beam team" use an array of techniques to reveal intriguing properties of materials. For example, they have shown that gamma silicon nitride, an exotic material that rivals diamonds in hardness, is a semiconductor. Though difficult to manufacture, the material could someday be used in ultra-durable electronics.

The beam team collaborates with scientists in Japan, Russia and the U.S., combining information on electronic structure, chemical states and advanced synthesis methods to custom-design materials with specific properties.

With Canada Foundation for Innovation funding, Moewes is supervising construction of an endstation at the new REIXS beamline at the Canadian Light Source.

When complete, this state-of-the-art facility will offer scientists around the world another powerful tool for probing the properties of matter.

The beam team from left to right: David Muir, Adrian Hunt, Mikhail Yablonskikh, Regan Wilks, Alexander Moewes, Mark Boots

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100 YEARS *Engage · Enlighten · Explore*

For more information about U of S research themes and the cross-campus consultative process led by Associate Vice-President Research Karen Chad that produced them, please visit:

http://www.usask.ca/vpresearch/strategic/preeminence.php

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