

Providing SOLUTIONS



UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURAL,
LIFE & ENVIRONMENTAL SCIENCES

From the Dean



At the Faculty of Agricultural, Life & Environmental Sciences, what we offer the world is as unique as our name.

We conduct research that looks for solutions to some of the most pressing issues the world faces today. Those include global food security and food safety, the environment, natural resource development, individual and community health, and socio-economic issues surrounding an ageing population.

We are an applied science faculty in the enviable position of being able to draw on the social sciences, business and the arts and humanities to find what many of our students call real-life solutions. This approach is something we teach our students, providing them with real-world skills as they enter the labour market.

In the pages that follow, you'll see countless examples of the impact our faculty members and students have had with their discoveries. We are relentless in our commitment to excellence so that our programs provide an even greater impact on the world as we move forward.

We welcome your feedback on opportunities for partnership in our quest to be solution providers. Please send me an email or contact any of our development team members to learn more about the work we do in our faculty and the solutions we are providing.

John J. Kennelly, Dean
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Helping Feed the WORLD



Quantity and quality. Faculty researchers and students are focused on both issues.

As the world population increases, the quantity of food produced will need to rise dramatically to meet the new demand. According to UN agencies devoted to agricultural development and food security, food production will need to rise by at least 70 per cent by 2050 to meet world demand.

At the same time, consumers are demanding higher-quality foods, better products and that production animals be treated with the utmost care.

Through genetics, the rice yield in areas of drought can be doubled, potentially alleviating poverty for millions of people



Jérôme Bernier's discovery could make a dramatic difference for subsistence farmers who grow upland rice in mountainous regions that are susceptible to drought.

Providing a hand-up

While earning his PhD, **Jérôme Bernier** identified a group of genes that enables rice farmers to double their yield in drought conditions.

Rice is the number one crop consumed by humans annually. About half the rice fields in the world are in non-flooded, dry fields, which are vulnerable to drought. "If drought hits, the crop can drop to almost nothing," explains Bernier.

He started with 126 genetic markers and narrowed his search to a group of genes that had the desired impact. In very severe conditions, rice strains with the new genes produced twice as much as those that didn't have the new genes.

The discovery could provide relief to millions of people living in some of the poorest and most distressed areas in the world. Since graduating, Bernier has taken a job with a major food producer and is looking for genes that provide similar results with corn.

Genetics is also revealing how to produce healthier livestock resulting in better meat and milk products for people

Healthier animals, better products

ALES researcher **Graham Plastow** leads a group of scientists who have identified more than 125 genetic markers in cattle that are responsible for variations of a number of economically important traits such as efficiency, fatness, yield, tenderness and cow longevity.

Twelve of these genetic markers have been validated and commercialized while many others are currently in the technology transfer pipeline.

Producers can use the information to breed healthier cattle that produce more milk and better meat.

“Consumers will benefit from cost-effective and healthier products on store shelves,” says Plastow. “Understanding what genes contribute to specific cattle traits will also have spinoff applications related to other fields like human health.”

Recently, Plastow and his team expanded their research to include all livestock.



Livestock producers can use the genetic information Graham Plastow and his team are uncovering to breed healthier, more efficient animals.



The faculty has built world-class expertise in crop protection, particularly canola, in ensuring food safety, in agricultural and consumer economics as well as agricultural policy.



Ensuring a Healthy ENVIRONMENT



The facts are undeniable. Air and water temperature, sea levels and humidity are all rising while snow cover, sea ice and glaciers are all diminishing. Concern about the environment and the effects of climate change are mounting.

In Alberta, there is particular concern about the environmental impact of the oil sands, forestry and agriculture.

Our faculty researchers have the unique ability to examine environmental issues from a very broad perspective that encompasses science, economics, sociology, politics and cultural issues.

The science of reclamation is enabling us to do in 30 years what it takes nature 1,000 years to do



Anne Naeth's research discoveries compelled the provincial government to change its regulations about reclaiming land in the oil sands.

Reclaiming the oil sands

ALES researcher **Anne Naeth** and her team found that spreading forest floor materials on overburden in a mined area can lead to the boreal forest regenerating itself.

The finding compelled the provincial government to change regulations recently and require oil sands companies to adopt the practice in their reclamation efforts. The technique is more effective than planting trees and other plants into the traditional peat mix oil sands companies had been using.

Naeth is also working on reclaiming tailings ponds and the dikes that surround them.

To date, researchers haven't been able to reclaim these ponds, full of slurry, sandy material, but Naeth and her colleagues have been experimenting with about 50 different plants. Preliminary findings indicate that many will survive and reproduce in tailings ponds.

After studying water quality in the headwaters, ALES researchers are looking at ways to increase water production

Examining our water's future

Forest hydrologist **Uldis Silins** and his team have been studying the changes brought about by the Lost Creek Fire in 2003 that burned 21 square kilometers in the Oldman River Basin in the Rocky Mountains.

They found that the fire produced a large amount of sediments in the water, increased phosphorous and nitrogen and caused a small increase in heavy metals including the level of mercury.

The level of nitrogen returned to normal levels within three or four years but the level of phosphorous has remained high.

Accordingly, plant life productivity in the headwa-

ters, which typically have few nutrients to support much plant life, has increased significantly as has the biodiversity of stream insect populations.

While mercury levels rose, the increase didn't warrant a consumption warning.

Silins and his group are also working with water treatment engineers, looking at the implications of their findings for downstream communities.

They have also started the next phase of research, looking at the impact of forest management techniques to increase the water quantity and develop a framework, in cooperation with many stakeholders, for source water protection.



John Spence, centre, has found that, contrary to what had been considered conventional wisdom until very recently, undisturbed patches in harvested areas need to be at least two to three hectares for the forest to conserve its ecosystem and biodiversity.



The faculty has built world-class expertise in forestry, soil science, adaptation to climate change and valuing environmental goods and services.



Fostering a New INDUSTRY

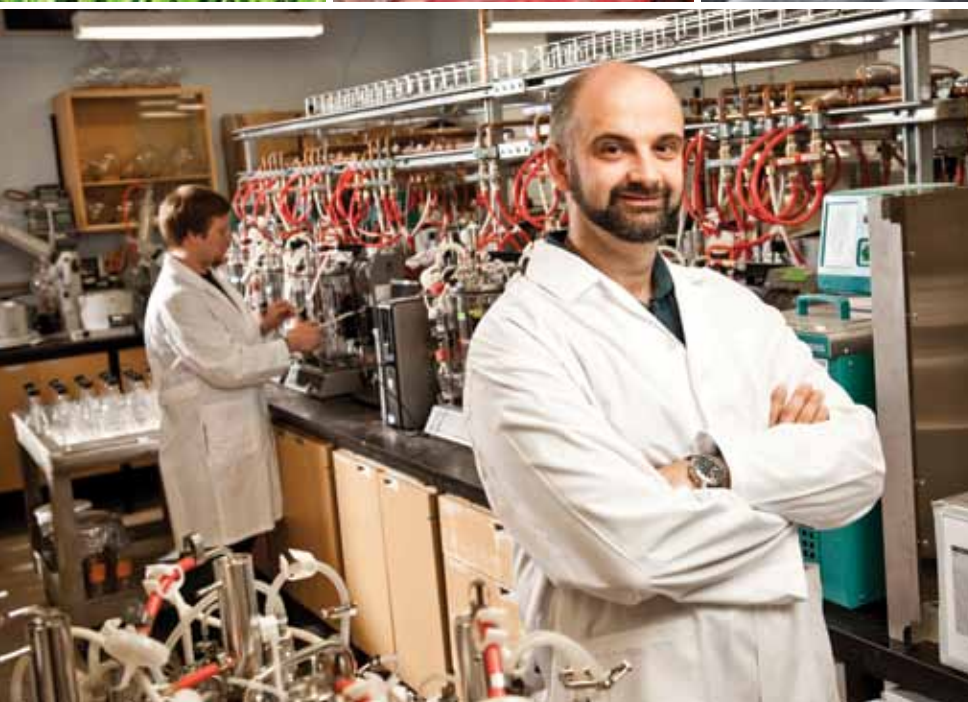


Converting biomass, such as animal fat or crop seed oil, into high value products is creating extraordinary new economic opportunities, which Alberta is well-positioned to seize.

The province has an abundance of biomass, a strong infrastructure, a highly educated workforce and researchers that are at the forefront of these emerging technologies.

While products created from biomass have traditionally been different types of fuel, they also include myriad other products that can be used to make car parts, packaging materials, foams and other consumer products.

ALES researchers were the first to convert cost-effectively animal fat and crop seed oil into high value products



Research being conducted by David Bressler and his colleagues is revealing how to cost-effectively convert agricultural and forestry waste into fuels as well as an increasing number of high-value chemicals used to make an ever-growing number of consumer products.

Converting a problem into a profit

Using high-temperature chemistry has enabled ALES researcher **David Bressler** to convert animal fat and crop seed oil into lubricating oil, jet fuel, diesel, gasoline and natural gas.

Bressler, an expert in biorefining conversions and fermentation technology, is the first scientist to be able to do this in a cost-effective way.

In addition, his research is providing value to the livestock rendering industry. The BSE crisis resulted in the loss of half the value of cattle as its rendering – which converts animal parts not used for human consumption into animal feed, fertilizer and other commercial products – suddenly became a cost. Bressler and his group are currently optimizing processes to convert the rendering materials into high value-added products such as foam and packaging materials.

Turning waste and low value feedstocks into high value products is creating a potentially massive new industry

Taking value up a notch

Jonathan Curtis and his research group have discovered a two-step process that converts canola oil into organic polyol, or bio-polyol, used to produce polyurethanes and adhesives.

“Polyols are used to manufacture polymers like polyesters, polyamides and polyurethanes,” explains Curtis. “Polyurethanes, in particular, have large commercial applications and right now, it’s the petro-chemical industry that produces the overwhelming majority of polyurethane.”

Polyurethane produced from Curtis’ bio-polyol can

easily be used as a substitute for petrol-based polyol. The group is currently working with a major car parts manufacturer to develop rigid foam products to make parts such as dashboards and headliners.

In a separate project, Curtis and his team are collaborating with a local company to optimize the manufacture of rigid foam insulation panels to be used in the manufacture of modular buildings, providing structural integrity and greener thermal insulation.

Curtis and his group continue to research other possibilities to develop cost-effective synthetic routes to high value chemicals from plant oil feedstocks.



Jonathan Curtis has found a way to manufacture polyurethanes from canola oil rather than from hydrocarbons. Polyurethanes are used extensively to make flexible and rigid foam products, seals, gaskets, adhesives and much more.



The faculty is home to the Biorefining Conversion Network, bringing together the research skills sets to help develop the emerging bio-economy.



Strengthening Personal and COMMUNITY WELL-BEING



From the personal to the community, programs and policies developed by organizations and governments have an impact on our lives and how we relate to each other and our communities.

ALES researchers have made substantial contributions to improving lives by examining programs and policies that affect us at the personal, family and community levels.

Research resulted in legislation being enacted to eliminate the inequity in programs for veterans and their spouses



Norah Keating's research into veterans and elders has led to changes in government policy.

Helping veterans' families

Research conducted by ALES researcher **Norah Keating** led to a fundamental shift in the federal government's policy towards spouses of veterans.

She discovered the programs helped the veterans a great deal but not necessarily their spouses.

Programs that included assistance with home care, housekeeping and general outside maintenance of their properties proved to be of great help for veterans with health issues. However, if the veteran had to be placed in a nursing home or passed away, all assistance vanished for the spouse, sometimes leading to their inability to stay in their home. Keating noted the inequity of this situation given that spouses often had provided care to the veteran for many years. Legislation was enacted and implemented ensuring spouses of veterans receive the same levels of services until they no longer require them.

Research reveals substance abuse is about being lonely and feeling disconnected, not having too much money

Substance abuse exacerbated in boom towns

Conventional wisdom dictates substance abuse in boom towns is due to workers having too much money and too little to do. Not so, says ALES researcher **John Parkins** and his master's student **Angela C. Angell**. Underlying pressures including loneliness, a lack of healthy social connections and a need to “keep up with the Joneses” are more likely to blame.

Parkins and Angell conducted research in Hinton and found that social problems in resource-based communities have existed for many years and are exacerbated by boom town conditions.

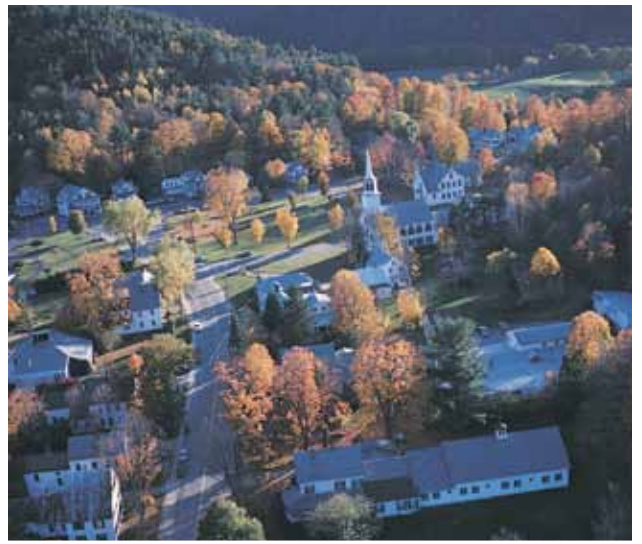
“Communities such as Hinton have been battling these issues long before oil and gas booms, and the inter-generational transfer of these behaviours and attitudes have led to widespread family and community dysfunction,” noted Angell.

The study recommends that industry and major employers need to promote healthy lifestyles and, though desperate for workers, not turn a blind eye to substance-abuse issues among their employees.

Since many resource-based communities in Alberta and North America have similar social and economic structures, the study's findings may provide insights into the social challenges of boom towns everywhere.



John Parkins' findings about substance abuse in boom towns may provide insights into the social challenges of boom towns everywhere.



The faculty has built world-class expertise in ageing, material culture, textile and apparel science, children, youth and family studies, and rural communities.



Improving Health through FOOD



Increasingly, studies reveal consumers are demanding higher quality food products that are “good for them” and taste good.

ALES researchers are at the forefront of the field examining the impact of food on our health and how we can use food to not only prevent but also treat diseases, especially diabetes, obesity, cancer and heart disease.

Research suggests fish oil reduces cancer tumours and helps patients maintain muscle mass and live longer



Vera Mazurak's research could lead to a much better quality of life for cancer and chronic disease patients.

Fish oil fights cancer

ALES researcher **Vera**

Mazurak led a study that examined the various effects of fish oil, specifically its two fatty acids, on lung cancer patients.

She found that patients who take fish oil on a daily basis are more likely to see a reduction in the size of their cancerous tumour and survive beyond a year.

Mazurak and her team also found that 69 per cent of patients taking fish oil maintained or gained muscle mass compared to 29 per cent from a group who didn't receive the fish oil. According to the National Cancer Institute, 20 to 40 per cent of cancer patients die from malnutrition as opposed to tumours.

Dr. Mazurak added that fish oil may be beneficial to patients with other forms of cancer and other chronic diseases associated with malnutrition, as well as to elderly individuals who are at risk for muscle loss.

ALES researchers are discovering there's more to cardiovascular disease than bad cholesterol

Unlocking the mysteries of cholesterol

Researchers couldn't explain why as many as half the people diagnosed with cardiovascular disease do not have high levels of "bad" cholesterol.

ALES researcher Spencer Proctor found that chylomicrons – particles of fat and cholesterol that form in the small intestine following a meal and are rapidly

processed throughout the body – are cholesterol carriers that are just as dangerous if not even more so than "bad" cholesterol.

He also found that a diet with enriched levels of trans vaccenic acid, a natural trans fat found in dairy and beef products, reduces the production of chylomicrons and can lower cholesterol and reduce risk factors associated with heart disease, diabetes and obesity.



Spencer Proctor has found that particles of fat and cholesterol that form following a meal are cholesterol carriers that are just as dangerous as "bad" cholesterol.



The faculty has built expertise in children's nutrition and the impact of food on pregnant women, their developing fetuses and toddlers.



Experiential Learning – Learning by DOING



The faculty is convinced that students enter the labour market with a competitive advantage when they have had the opportunity to apply the knowledge they've acquired during their undergraduate studies in the real world.

That's why the faculty is committed to ensure that each and every student has at least one experiential learning opportunity during their undergraduate degree, and that 25 per cent of those students have that experiential learning opportunity in an international setting.



Students have several opportunities to gain experience through internships and practicum before they graduate.

Providing real-world experience

Every student in Human Ecology completes a practicum. For example, students have been placed in fashion houses in New York City, they've performed community work in Ghana and they've worked with industrial clothing manufacturers here in Alberta.

Every nutrition student who wishes to graduate as a registered dietitian must complete a year-long dietetic internship, one part of which is conducted in a rural setting.

We are so convinced of the wide-ranging benefits of the opportunities for our students to experience that sense of discovery, of applying what they've learned in a real-world setting, that we've allocated resources in a time of financial constraints to renew our Faculty Internship program.

In only its first year of renewed operation, about a dozen students did a work placement with an employer who operates in their field of study.

While all human ecology students complete a practicum and nutrition students complete a year-long dietetic internship, the faculty offers many other opportunities for students to perform some type of experiential learning.

Field schools provide students with the opportunity to apply their knowledge and see first-hand the practical application of what they've learned in any number of work settings.

In addition to the required six-day introductory forestry field school and the three-week advanced field school for forestry and environmental and conservation sciences students, an international field school took place last year where more than a dozen students went to Mexico and studied the Mexican forestry system. This year, the field school took place in Germany and plans are in place to go to the Czech Republic and Romania in the next two years in addition to returning to Mexico.

Two summers ago, a group of environmental and conservation sciences students went to Tanzania and South Africa for a three-week field trip. The following summer, another group went to Botswana.

In the last two years, two groups of agriculture students went to Cuba to examine their agricultural systems, which are very different from ours.

The faculty offers **scholarships** and **awards** to enable students to study abroad for a semester or two. Nutrition student Michelle Dotto, pictured here, spent a year at the University of Wollongong in Australia while food science student William Lau studied at the Chinese University of Hong Kong and Kaitlyn Scaber, an environmental sciences student, studied at the University of

Leeds for a year.

The **Community Service-Learning program** links course work with community-based experiences, enabling students to work in not-for-profit organizations to explore concepts learned in the classroom within a real-world context.

This year, the faculty offered several opportunities for students to participate in the program through a course entitled Plate, Planet and Society. Plans call for expanding the opportunities for students next year through a multi-class/multi-partner initiative.





Capstone courses challenge students to draw upon all they have learned in their undergraduate studies to solve a typical problem they may face in their post-graduation jobs.

Capstone courses

Capstone courses are a unique feature of our faculty, offering senior students a course that challenges them to draw on the knowledge and experience they have gained during their undergraduate studies in their field of study and complete term projects.

For example, students in the capstone course in land reclamation are given a problem for which they must find solutions that are realistic and within budget. They're encouraged to consult with industry and government as they develop solutions.

Food science and technology students are tasked with creating a new food product. In environmental economics, students must develop a solution to an issue using the same tools as agricultural, forestry and environmental economists and business specialists.

The capstone courses provide students with a taste of what it will be like to work in their field after graduation.

The Devonian Botanic GARDEN



A jewel in the crown of the Faculty of Agricultural, Life & Environmental Sciences is the Devonian Botanic Garden.

It is a unique facility in central Alberta that offers extensive community programming, education programs and research resources for national and international plant experts.



In addition to offering the spectacular gardens, the Devonian Botanic Garden hosts many popular events during the season that attracts thousands of people.

Connected to the community

The DBG – which boasts breathtaking gardens, including the Native People’s Garden, the Kurimoto Japanese Garden and soon, an Islamic Garden – welcomed more than 50,000 people this past year. It’s projected more than 250,000 people will visit the garden annually by 2015.

The DBG features 80 acres of display gardens and 110 additional acres of natural areas and ecological preserves. Indoor displays include a variety of greenhouses for arid, tropical and sub-tropical plants.

Community programming

The DBG offers a wide variety of community programming including courses in design and landscape, gardening, crafts and photography, painting and programs designed specifically for children and their families.

It also offers a popular master gardener program where students learn practical and theoretical information providing them with a truly comprehensive base of gardening knowledge.

Getting in touch with nature

Imagine a student sitting under a tree in a garden listening to birdsong, feeling the warmth of the sun, and smelling the earth and grass. Imagine that today this student will be holding a frog maybe for the first time, planting a seed to take home or searching for wood bugs under a log.

Then imagine this is your classroom for the week.

The Green School immerses children in the natural world for five consecutive school days. The essence of the program is about giving children time and opportunity to observe, hear, smell and touch the natural world, to reflect on their experiences and make personal connections to nature. Through observation, hands-on inquiry and guided exploration, children are given unique opportunities to become engaged with their natural environment. The Green School builds on a child's invaluable sense of wonder. Many first-time students are 'nature-starved' and have never been in close contact with the natural world.

For a week each child can feel a part of nature rather than apart from it. The benefits are significant and lasting as the students develop an appreciation of the natural world and their relationship to it, leading to an understanding of the importance of conservation and biodiversity.

The Green School is the most extensive of a series of 10 programs that offers kindergarten to grade 12 students the opportunity to connect with nature through full-day programs for a variety of science courses that examine insects, wetlands, plants, forest ecology and biodiversity.





The Devonian Botanic Garden is home to many research resources used by scholars from around the world.

Research

Researchers from across Canada and around the world routinely use the unique research resources provided by the Devonian Botanic Garden.

The DBG houses the internationally-renowned Microfungus Collection and Herbarium. Medical researchers involved in pathology, toxicology and allergens often access the collection to examine fungal controls of insects and plant pests, land remediation practices as well as overall environmental health.

The Peatland Resource Centre provides research opportunities related to naturally occurring carbon sinks while the Prairie & Northern Plant Diversity Centre focuses on facilitating the sustainable management of plant diversity.

As Alberta continues to develop its natural resources, seed bank materials kept in the Seed Preservation Laboratory will play an increasingly vital role in the re-vegetation of disturbed areas through land reclamation.

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