

AI Bio's Impact Innovation 2013 Speaker Series

For the third year, Alberta Innovates Bio Solutions (AI Bio) brought stories about research and innovation to the public with Impact Innovation 2013. Held May 15 in Edmonton, the future-focused speaker series featured Alberta researchers speaking about the exciting projects that AI Bio is investing in to bring innovation to the sectors that it supports.

The morning program opened with breakfast before Dr. Stan Blade, chief executive officer of AI Bio, welcomed the participants, who came from the province's four Alberta Innovates corporations, government departments, funding agencies, private industry, universities and the general public. Dr. Blade introduced the audience to AI Bio, which supports three sectors—agriculture, forest and food—that represent \$25 billion of economic activity every year. He explained how the organization starts with thousands of innovative ideas from industry, AI Bio's Board and extensive networks, and current science, and uses scientific rigour to decide where to invest.

Jay Ingram, well-known host of the Discovery Channel's Daily Planet, was master of ceremonies for the second year. He pointed out that although oil and gas receives a lot of attention, the three industries leading the economic push in the future will be tourism, agriculture and forestry. Ingram also said that economic benefits are not the only benefits of supporting research and innovation. The development and support of incredibly passionate, smart, and creative people like the day's presenters is also positive for the province.

Mr. Art Froehlich

Currently a strategic advisor and board member of AdFarm, one of North America's largest agriculture and food marketing and communications companies, Art Froehlich is also active in his farming operations in Saskatchewan. Over the last 30 years, he has held senior executive positions with Hoechst Canada Inc., Alberta Pool, and Westcan Malting.

Today, Mr. Froelich continues to work with Canadian food and agriculture companies to develop international markets for their products. He is also chair of the board of directors of AVAC and a member of the Science Alberta Foundation. In 2005, he was awarded the Distinguished Agrologist Award by the Institute of Agrologists, and the Alberta Centennial Medal by the Province of Alberta.

- Mr. Froelich spoke about the top metre of soil, which provides us with everything we need and have come to love in the province. He said we need to step back and look at what we're doing more holistically because when soil quality disappears, when water quality disappears, nothing else matters.
- We have a tremendous opportunity to create wealth in the province. Mr. Froelich pointed out the strengths in the various sectors, such as the engineering, production and manufacturing talent in the energy industry, and the visionary people in our agricultural sector. As we work to develop

novel food products, generate chemicals in a sustainable way, and make more efficient use of water while dealing with challenges like climate change, it is important to work together.

- A recent guest of the Clinton Foundation, Mr. Froelich told of a day spent in New York City with Bill Clinton, his daughter Chelsey, and 70 guests from around the world. After Mr. Froelich told Mr. Clinton about feeling out of place among the movie stars and five-star generals attending the event, Mr. Clinton told him that the world needs farmers to take it where it has to go. "Every successful democracy in the world has been built on the basis of a strong resource where we've preserved the soil... farmers represent what's good in the world," said the former president.

Dr. Catherine Field

A professor in the Department of Agricultural, Food and Nutritional Sciences in the Faculty of Agricultural, Life and Environmental Sciences at the University of Alberta, Dr. Field holds an adjunct position in the Department of Medicine and is a registered dietitian. Her research centres on the effect of nutrition on the immune system and the role of nutrients in the treatment of cancer. Current research studies include identifying the importance of feeding specific plants-derived omega-3 fatty acids to enhance the effectiveness of chemotherapy treatment of breast cancer.

- Dr. Field discussed her work in the area of oil, diet and cancer. One in nine Canadian women will be diagnosed with breast cancer over their lifetime. In 2012, 22,700 Canadian women were diagnosed and 5,100 died, indicating a compelling need for further advances in science to improve treatment.
- Studies are showing that high intakes of fatty fish are associated with a lower risk of breast cancer. In animals, fish oil has reduced tumours. Dr. Field's work is showing that fatty acids can decrease the growth of human breast cancer cells and that they are decreasing tumour growth both through apoptosis (cell suicide) and by controlling growth receptors to decrease replication.
- In her current research, Dr. Field is exploring a plant source of fatty acids from canola, which is being used on an animal model implanted with a human tumour. She is also looking at stearidonic acid (SDA). SDA and SDA oil decrease the growth of two human breast cancers, and feeding the SDA oil to mice implanted with a human tumour decreases tumour growth after just two weeks of treatment. Next, Dr. Field and her team are studying the effect of feeding plant-derived sources of different types of fatty acid to animal models to determine tumour efficacy and identify mechanisms by which the fatty acids work.

- Mr. Ingram asked if there is proof that a fat-rich diet can prevent the development of the type of cancer Dr. Field is working with. Dr. Field said that the question is a difficult one to answer but that there is very strong evidence in animal studies that it prevents tumour growth, and human populations that consume more of these fats are lower risk. Unfortunately, she explained, scientists don't have good biomarkers or knowledge about when the disease starts.

Dr. Tim McAllister

A principal research scientist with Agriculture and Agri-Food Canada based at the Research Centre in Lethbridge, Dr. McAllister focuses on microbiology, nutrition and beef production, and on food and environmental safety issues related to livestock production, including prion inactivation within the environment, antimicrobial resistance in bacteria in feedlots, and strategies for mitigation of *Escherichia coli* 0157:H7.

Dr. McAllister's research examines complex interactions among rumen microorganisms, grain kernel structure, and the method of grain processing in understanding the rate and extent of ruminal digestion of cereal starch. He also has extensive research experience in GHG emissions from manure and the impact of manure handling procedures, such as composting, on emissions.

- In his entertaining presentation, *Food Safety: The Risk is Never Zero*, Dr. McAllister explained that microbes are part of the natural world. They are in humans, animals and our food, and most are harmless. But under certain conditions—antibiotic-resistant bacteria, compromised human systems— infections result, like the notorious *E. coli* 0157:H7 outbreak.
- In food safety, Dr. McAllister says, scientists are trying to decrease the odds that these microbial populations can survive. That requires an integrated approach involving beef producers, slaughter plants, retailers and consumers.
- Dr. McAllister pointed out that microbes are masters of adaptation, which is why continued work in the area is necessary. He talked about DNA fingerprinting of E-coli 0157 strains inoculated into cattle and how there are emerging pathogenic E. coli serotypes. With the number of variables, it is critical to be vigilant across the chain—when the cattle are on the pasture, in the feedlot and at slaughter, and when meat is in the store and the consumer's hands.

Dr. Dan Farr

Dr. Dan Farr is director of the Application Centre at the Alberta Biodiversity Monitoring Institute, where he supports the ABMI by initiating collaborative

projects to demonstrate the value of environmental monitoring. Passionate about environmental monitoring and biodiversity, he has spent more than 20 years as a biologist, computer modeller, and project manager, collaborating with like-minded people in academia, industry and government.

Dr. Farr's current projects include climate change adaptation, the assessment of ecosystem services and the challenges of monitoring rare species of plants and animals.

- Dr. Farr discussed the benefits we receive from nature—ecosystem services—and how it is difficult to determine the value of benefits such as carbon sequestration, water filtration and flow regulation. Setting up a system in which development rights can be purchased from organizations like Ducks Unlimited, which collects money from urban developers that drain wetlands and uses those funds to restore wetlands elsewhere, is one way we can protect ecosystem services. While there are many buyers and sellers in Alberta who could use such a system, there is a missing link—a lack of clarity about what is being bought and sold.
- The example of pollination was used to illustrate why we need a credible and transparent method of estimating the value of ecosystem services. Pollination is an ecosystem service that increases economic returns for farmers and the value can therefore be determined. By predicting bee abundance on a farmer's land using a mathematical model and determining how much bees contribute to canola yield, Dr. Farr determined that the value of bee pollination to canola producers is \$505 million/quarter section.
- Dr. Farr posed interesting questions that might be asked if a land manager adjacent to a farmer growing canola had bees flying into the canola field and boosting the profits of the canola farmer. Would the land manager want to be paid for adding that value? Would the canola farmer be willing to pay? How much should the farmer pay? How much should the land manager expect? This is why it is important to be able to value pollination. Pricing can be done by considering nature's benefits as services and integrating biophysical and economic data to estimate their value.

Dr. Stephanie Czub

A doctor of Veterinary Medicine with a specialty in neuropathology and prion diseases, Stefanie Czub heads the prion, pathology, virology and wildlife disease units at the Canadian Food Inspection Agency lab in Lethbridge, which has Canadian National Reference Laboratory status and World Organization for Animal Health Reference Laboratory (IEO) status for *bovine spongiform encephalopathy*. She is a member of the TSE Expert Advisory Group, the Canadian Association of Veterinary Pathologists, the College of Veterinarians of Ontario and adjunct professor in the faculty of Veterinary Medicine at the University of Calgary.

- Do we still need to be concerned about BSE? Dr. Czub noted that there were no new cases of BSE in Canada in 2012 and only 18 new cases worldwide in that year. But scientists have found atypical BSE: L-type BSE (lower) and H-type BSE (higher). This raises several questions. What is the significance of this finding? Is atypical BSE transmissible to cattle? How long will it take to develop the disease? What is the clinical presentation of atypical BSE? Which tissues will have the infectious prion?
- Dr. Czub's team infected cattle with classical BSE and the two types of atypical BSE and monitored their reaction to touch, light and sound. They found differences in symptoms and that disease progression with all three types was slow and continuous. In tests with the human brain, they found that classical BSE primarily affects brain stem areas but atypical BSE affects the core, mainly the hippocampus, which is responsible for emotions. They have also found that atypical BSE transmits easily and rapidly to cattle and to non-human primates.
- This knowledge about atypical BSE leads to the most important question that research must answer—is it possible to contract atypical BSE through food? Without an answer, a precautionary approach must be taken to protect human and animal health.
- Mr. Ingram asked where atypical BSE comes from, whether it is happening spontaneously or if its origin is unknown. Dr. Czub replied that the origin is unknown, but that scientists think it may be spontaneous. There is currently no way to test this. She says that a major question is why it is not occurring in countries with large cattle populations.
- During the Q&A period, Dr. Czub was asked for the next steps regarding overall strategy from government and producers regarding atypical BSE. She said that IEO is not making a distinction between classical and atypical BSE, nor have governments. There is a need to remain vigilant to prove to trading partners that Canada has a declining level of BSE. We need to be testing at high levels and testing levels have been dangerously low for the last two years.
- Another audience member asked Dr. Czub why some animals exposed to the BSE prion do not develop the disease and, if some animals have an immune response, whether it was possible to get a vaccine to stimulate that response. Dr. Czub said that, in all other animal prion diseases, genetics play an important role in whether animals are susceptible or the rate at which they develop the disease, but there is no evidence that that is the case for BSE. All breeds of cattle are susceptible but scientists do not understand why some cattle are less susceptible. As for a vaccine, Dr. Czub said that prion protein is

a normal component of functioning and well-being so there is no immune response to it.

Dr. Jack Saddler

Dr. Saddler is the endowed professor of Forest Products Biotechnology (originally an NSERC Industry Chair) and also former dean of the Faculty of Forestry at the University of British Columbia. His commitment to advancing the development and application of innovative biorefining technology for production of biofuels and chemicals from biomass feedstocks has positioned him as an international leader of scientists, advisor to governments, and facilitator to industry.

For more than 30 years, Dr. Saddler has been involved in various national and international organizations that have advanced the global understanding of how woody biomass can be converted to useful fuels and chemicals. He is a Fellow of the Royal Society of Canada, and serves on a number of review panels/boards including the International Energy Agency, the United Nations Food and Agricultural Organization and the U.S. Department of Energy.

- Dr. Saddler's presentation focused on how we can evolve from a hydrocarbon-based economy to a carbohydrate-based society. Forests have incredible value for recreation purposes as well as for structural material, and there is a lot of forest material we currently don't use. Society has moved from coal to oil to natural gas and will eventually move into renewables as hydrocarbons become more difficult and more expensive to access.
- Dr. Saddler talked about the evolving needs of society and how energy consumption is increasing, as well as the impacts of climate change and the mountain pine beetle. He pointed out that most of the Canadian pellet production of 2.4 million tonnes is exported and used for combustion/cogeneration, not as a sugar feedstock. He also stated that of all the products made from crude oil, "other products" bring the most returns to industry.
- There is an opportunity for deriving higher value from biomass. A pulp and paper biorefinery could provide power for heat, electricity and other products; biofuel/bioconversion for fuels; and fibre, through pulping, for traditional uses like paper and tissue and for new cellulose products and green chemicals.
- Dr. Saddler discussed his research focuses on power (electricity), biofuel and bioconversion, including the difficulties of getting access to the inside of cellulose. Moving forward, he said, it is important to think in terms of generations, not just the next quarter century.

- During the Q&A period, Dr. Saddler was asked whether breaking cellulose down to the nanoscale could speed up progress in accessing the inside of the cellulose. The problem, he responded, is cost. Nature is designed to not be broken down. Another audience member asked if there were opportunities for oil and gas and forestry to work together to share the resource. Dr. Saddler said there is and that the oil and gas sector is already involved, providing the example of one company that has made a \$500-million investment in the biorefinery sector.

To view photos and PowerPoint presentations from both sessions, visit www.albertainnovates.bio/media/events/impact-innovation.

Are you an innovation champion looking to make an impact? Attend the Impact Innovation 2014 Speaker Series. For more information, contact Marie Cusack, Communications Director, Alberta Innovates Bio Solutions, 780-638-4060, marie.cusack@albertainnovates.ca.