

RCIS Science Gala Dinner 2016: Table Topics and Hosts

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TABLE 1

Border Security and Facilitating Trade: Risk vs. Opportunity

Laurie Tannous, CEO Institute for Border Logistics & Security, Adjunct Professor, Windsor School of Law

Trade facilitation and border security are both essential and interdependent; the two should not be interchangeable at any cost. Increased trade is acknowledged as a significant instrument contributing to Canada's economy, but the unimpeded flow of trade through the border should not compromise border security. A better understanding of the border and how to manage its nuances requires a balance of ensuring security while facilitating trade. There is no trade-off between securing regulatory compliance and facilitating legitimate trade. **Maximum Compliance = Maximum Facilitation.**

TABLE 2

Antibiotics and Antibiotic Resistance in Nature and in Medicine

Justin Nodwell, Chair, Biochemistry Department, University of Toronto

Most antibiotics are "natural products." They are produced by environmental microorganisms that live all over the earth, primarily in the soil but also in other ecosystems. It is not well-understood why bacteria produce these molecules and, furthermore, the full diversity of structure and activity of them is also unknown. A growing body of evidence suggests that resistance to antibiotics may also have its origin in nature. To be able to grow and survive, the antibiotic-producing bacteria must encode antibiotic resistance genes. The implication of this is a very important question for the future of medicine.

TABLE 3

Cholesterol and Heart Disease: Cause and Current Treatments

Aubie Angel, Professor Emeritus, University of Manitoba, President, Friend of Canadian Institutes of Health Research

1.3 million Canadians live with heart disease and approximately 1 person dies of it every 7 minutes in this country. The link between cholesterol and heart disease has been long established. What is the mechanism behind this connection and what current treatments are available to help reduce the risk?

TABLE 4

Infusing Ecology and Evolution into Aquaculture to Produce Sustainable Seafood

Trevor Pitcher, Associate Professor, Biological Sciences & Great Lakes Institute of Environmental Research, University of Windsor

Traditional capture fisheries cannot meet the increasing demand for seafood. As aquaculture, or "fish farming", grows, it must balance production with environmental impacts. Though challenging, there are opportunities to increase aquaculture productivity and sustainability by learning from ecology and evolution. For example, we have evaluated sustainable organic salmon farming with a native salmon species in British Columbia and the value of incorporating natural mating into traditional hatchery-based breeding. We will discuss the challenges and misconceptions of aquaculture and the merits of more sustainable practices that involve an understanding of the ecology and evolution of wild salmon populations.

TABLE 5

Music and the Brain

Jessica Grahn, Associate Professor in the Brain and Mind Institute and the Department of Psychology at Western University

Moving to music is an instinctive, often involuntary activity, experienced by those in all cultures. We will discuss why humans move to music, and whether other species share this special ability. We will also talk about how the brain's movement centres light up in response to music and rhythm, even when we aren't moving a muscle, and potentially speculate about why music evolved in the first place. Lastly, we will cover the exciting potential held by some musical therapies for helping those with degenerative neurological diseases such as Parkinson's disease.

TABLE 6

Should Exercise be a Vital Sign?

Lora Giangregorio, Associate Professor, Department of Kinesiology, University of Waterloo

Replacing only one hour of sitting time with exercise or even non-exercise physical activity, like housework or gardening, can reduce one's risk of death. However, monitoring or prescribing of physical activity is not routine in health care, and inactivity is highly prevalent, contributing to an epidemic of obesity, diabetes and chronic disease. Should we consider exercise as something life-sustaining, like heart rate or blood pressure, a metric that is monitored as part of our health care, and interventions are initiated when one is "at risk" of perpetual inactivity?

TABLE 7

Is Dirt Good for Quantum Computers?

Rachel Wortis, Professor, Department of Physics, Trent University

Why do you feel safe entering your credit card number on a website? Would a quantum computer change that? We will discuss quantum computers and the role that new materials might play in making them. We have long known that materials are made from electrons and nuclei which interact. And yet fascinating mysteries continue to bubble up from this familiar stew. A lot of materials research focuses on synthesizing and characterizing the cleanest possible materials. However, impurities aren't always just an inconvenient distraction. A new phase of matter, dubbed the many-body localized phase, has recently been identified in disordered interacting systems. Might it help address a key challenge in the construction of quantum computers?

TABLE 8

Team Science, Genomics, Big Data and Open-Source: The Tools of Modern BioScience

Tom Mikkelsen, President and Scientific Director of the Ontario Brain Institute

The old image of a scientist working alone in the lab is persistent in popular culture. But that image could not be more wrong in this era of collaborative research. It is not uncommon to a paper to include more than 100 authors. The reason is that teams of scientists can uncover more, at a faster rate, by sharing their data and collaborating on methodologies. We will explore how this works and why this is the future of bioscience.

TABLE 9

The Visualizing Spirit: Current trends in data visualization

Isabel Meirelles, Professor Faculty of Design, and researcher, Visual Analytics Lab, OCADU

The second half of the eighteenth century saw most disciplines in the sciences and the humanities share a "quantifying spirit" characterized by the systematization of knowledge as well as a preoccupation with measuring all types of phenomena. This is not much different from our current obsession with collecting, quantifying and analyzing all types of data. I would argue that a "visualizing spirit", however, better describes the present passion and widespread use of visual-spatial techniques in the already quantified sciences, humanities and the arts. I will discuss the significance of our present "visualizing spirit" with a focus on recent visualization trends, their roles, affordances and limitations in helping us explore, extract and interpret information.

TABLE 10

Atmospheric Remote Sounding Satellites

Charles Thomas McElroy, NSERC Industrial Research Chair, Dept. of Earth and Space Science and Engineering, Lassonde School of Engineering, York University

Space exploration has extended greatly our knowledge about our own planet. Satellites, in particular, have revolutionized how we track and monitor what is happening on Earth. We will discuss what satellites can contribute in measuring the composition of the atmosphere, supporting weather forecasts, contributing to national security and supporting disaster management.

TABLE 11

Why Your DNA Isn't Your Destiny: the Promise of Epigenetics*

Art Petronis, Senior Scientist in the Neuroscience Research Department & Head of the Krembil Family Epigenetics Laboratory, CAMH.

The prefix "epi-" indicates small chemical marks that sit on the top of DNA and control genes. Several major findings have placed epigenetics at the frontier of biomedical research. First, epigenetic factors may be inherited from the parents. That means that heritability may not be an exclusive function of DNA. Second, epigenetics signals are malleable and can be influenced by what we eat, drink, breath, how long we sleep and what kind of stresses we experience. Finally, epigenetic misregulation of genes may be directly involved in the origin of common diseases such as cancer, diabetes, and schizophrenia. Several large epigenetics programs have been launched to uncover the most fundamental questions. We will explore the latest research and its implications.

*The discussion title is borrowed from an article on epigenetics published in the *Time* magazine (John Cloud, *Time*, Jan 6, 2010).

TABLE 12

Stem Cells and Neural Repair: The last frontier in regenerative medicine

Cindi Morshead, Professor, Department of Surgery, University of Toronto School of Medicine

The promise of using stem cells and their progeny to treat a variety of currently untreatable human diseases has received worldwide attention. In particular, work in animal models has shown that stem cells could potentially be used to treat patients suffering from disorders of the nervous system, such as stroke and spinal cord injury, conditions which are devastating to the patients, their families, and society as a whole. If stem cells hold out the promise of becoming a biological tool kit, then it's important we use the right tools for the job. An understanding of the fundamental biology as it relates to stem cells is needed so that we can apply this knowledge to repair the injured nervous system – the last frontier in regenerative medicine.

TABLE 13

Change the Numbers: Ensuring Diversity in STEM is essential for Canada's Economic Future

Imogen Coe, Dean, Faculty of Science, Ryerson University

Only 3% of Nobel Prizes in physics, physiology/medicine and chemistry have been awarded to women. In 1987, women were 20% of the Science Technology Engineering and Math (STEM) workforce; in 2015 it was 22%. At the same time, there is substantial evidence for equal interest and engagement in STEM in both boys and girls from an early age. Data from diverse studies are peeling back the barriers to inclusion and the nature of exclusion. Cultural conditioning, implicit bias, stereotype threat and media influence actively and persistently exclude girls and women from making significant contributions to society in STEM. Full inclusion and engagement of girls and women in STEM are moral and economic imperatives for Canada because diversity leads to creativity and innovation which will both be needed as we tackle the complex global problems of the 21st century. To quote Malala Yousafzai, "We cannot all succeed when half of us are held back" and as Myra Sadker said, "If the cure for cancer is in the mind of a girl, we might never find it."

TABLE 14

Mathematics and Architecture

Ian Hambleton, Director, Fields Institute & Dr. F. Ronald Britton Professor Mathematics, McMaster University

From earliest times, mathematics has been closely linked to architecture. The underlying structural integrity of any building is based on geometrical analysis of stress and strain, from the invention of the arch, the flying buttresses of Gothic cathedrals, to the earth-quake resistant skyscrapers of the modern world. Beyond function, architecture expresses the beauty of proportions and symmetry through harmonious ratios. Leading architects now experiment with new materials, aperiodic order and curved structures. To create practical designs, new mathematical methods are under active development.

TABLE 15

Can Advances in Medical Image Analysis and Computing Replace the Physician?

April Khademi, Assistant Professor, Department of Biomedical Engineering, University of Guelph

IBM's supercomputer, Watson, is currently training to become a radiologist's assistant by learning how to read both images and medical records. *Is this the future?* When a patient visits their physician, a plethora of tests can be ordered producing radiology and pathology images, genomic data, blood work, biomedical signals, cognitive tests and more. These data are generated quickly and in large volumes, and are classified as *medical bigdata*. Recent technological advances ensure medical bigdata are captured in a digital format and can be stored in central repositories, creating new opportunities to leverage computing power to analyze it. The result is an integrative approach that is *personalized* and *prescriptive*, with models that describe disease on a much deeper level than is usually done today. Focusing on neurological and breast cancer disease, we will explore how algorithms can be used to automatically analyze and diagnose medical images, and how this knowledge may be integrated with other pieces of the medical bigdata pipeline for computer-aided prognosis.

TABLE 16

Global and Local Threats to the Production and Distribution of Essential Omega-3 Fatty Acids

Michael Arts, Professor and Graduate Program Director for Molecular Science, Department of Chemistry and Biology, Ryerson University

Our world is warming rapidly yet we do not fully understand the ramifications of this far-reaching process. Monitoring and modeling changes in temperature, rainfall patterns and extreme weather patterns, on both local and global scales, has still not produced a complete picture of how increased temperatures will affect the biochemical processes essential to the health of plants and animals. For example, plants and animals respond to increasing water temperature by adjusting the chemical composition of their cell membranes. This involves increasing the amount of saturated fatty acids at the expense of polyunsaturated fatty acids (PUFA). The potential for systemic wide-scale losses of omega-3 long-chain PUFA as our world heats up has enormous implications for all life.

TABLE 17

Pharmaceutical Patents and Innovation

Scott Beeser, Lawyer and patent agent at Aitken Klee LLP

It is often said that a strong patent system is required in order to promote innovation, particularly in the pharmaceutical sector. But what types of pharmaceutical innovation should the patent system be promoting? Are all pharmaceutical patents necessarily desirable? If not, how should patents take into account the competing interests of pharmaceutical patentees and generic drug manufacturers be balanced? What role does the public have in this establishing and maintaining this balance?

TABLE 18

Are we using the best tools to protect our environment?

Jim McGeer Professor, Biology & Director, Laurier Institute for Water Science, Wilfrid Laurier University

The environmental impact of contaminants is a rapidly developing field where leading edge technologies can help us understand and solve real problems. The development of “omic” technologies: genomics, proteomics and metabolomics, and other molecular tools, has made exciting new areas of research possible. These have potentially broad-reaching uses, including in regulatory decision making. In spite of these and other developments, the basis for environmental regulations and guidelines has not changed in the past 30+ years. The traditional measurements of survival/death, growth inhibition and reproductive impairment remain as the main (or only) data used for establishing environmental thresholds and criteria. The reasons for and implications of this situation provides insight into how we approach the protection of our environment.

TABLE 19

Convergence of Science and Engineering to Solve Globally Challenging Problems

Shushanta Mitra Associate Vice-President Research and Kaneff Professor in Micro & Nanotechnology for Social Innovation at the Lassonde School of Engineering, York University

Traditionally, researchers in natural sciences and engineering have worked in silos. However, some of the globally challenging problems in water, food security, energy, and health would require teams with complementary skills working across the traditional discipline boundaries. Also, it is increasingly becoming important to understand the uptake of technological solutions by communities and broader stakeholders, which often is driven by researcher questions in social science.

TABLE 20

Robotics as a Next Generation Technology for Neurological Assessment

Stephen Scott, GSK-CIHR Chair in Neuroscience, Centre for Neuroscience Studies, Queen's University

Clinical assessment plays a crucial role in all facets of patient care, from diagnosing the specific disease or injury, to management and monitoring of rehabilitation strategies to ameliorate dysfunction. However, assessment of sensorimotor function is largely subjective in nature (e.g. observe touching finger to nose) with relatively coarse rating systems (0, 1 or 2). It is difficult for even experienced observers to discriminate consistently small changes in performance. I am exploring the potential of robotic technologies for neurological assessment and have developed a robotic device called KINARM to measure and modify how the arms are used to move and interact in the environment. These devices are now being used at Queen's and elsewhere around the world to quantify neurological impairments in many disorders/injuries including stroke, ALS, Parkinson's disease, traumatic brain injury and concussion.

TABLE 21

Your Heart and Blood Vessels Need a Good Night's Sleep

John Floras, Canada Research Chair in Integrative Cardiovascular Biology, University of Toronto

Healthy sleep relaxes the heart and circulation and quiets the nerves that control their function. The cardiovascular system may not enjoy fully the restorative effects of sleep when this pacific state is interrupted. A common and concerning cause of such interruption is obstructive sleep apnea, which has been linked to high blood pressure, heart failure, stroke and serious heart rhythm disorders. Remarkably, patients with heart disease and sleep apnea tend not to be sleepy, and the majority are not aware that they have this condition. Dr. Floras and his colleagues have devoted over 2 decades to understanding the causes and cardiovascular consequences of sleep apneas and how these risks can be mitigated.

TABLE 22

Cognitive Ageing

Julia Spaniol, Associate Professor, Psychology, Ryerson University

Why does cognitive function change as we age? What is “normal” cognitive aging? Are there cognitive skills that improve with age? Can new technologies help mitigate age-related cognitive decline? Is brain training effective? Our discussion will focus on scientific evidence on these and other questions, as well as the societal significance of cognitive-ageing research in the 21st century.

TABLE 23**Penrose Tilings and Quasicrystals**

Latham Boyle, Faculty, Perimeter Institute

In the 1970's, a renowned mathematical physicist named Roger Penrose, and an unknown (but ingenious) recreational mathematician named Robert Ammann, independently discovered a new type intuition-defying pattern now called "Penrose tiling". Among its many remarkable properties, the pattern never repeats itself and can even seem random, although it is, in fact, just as rigidly ordered as the tiles on, say, your bathroom floor. Mathematicians were immediately entranced, but it wasn't for 10 years that scientists discovered Penrose tiling was the blueprint for a new class of materials called "quasicrystals." Remarkable analogues of Penrose tiling exist in two, three and four dimensions. These are clearly special objects which stand at the crossroads between many different topics in physics and mathematics, where they beautifully illuminate the unity of physics and mathematics, suggest intriguing new connections, and point the way to future discoveries.

TABLE 24**Electric mobility and transportation: "Charging" ahead and looking at what's in "store" for the future**

Sheldon Williamson, NSERC Canada Research Chair in Electric Energy Storage Systems for Transportation Electrification, UOIT-Automotive Center of Excellence (UOIT-ACE)

Electric transportation has the potential to offer a practical and sustainable mobility solution in the face of dwindling oil reserves and growing environmental concerns. Major transportation electrification R&D efforts have accelerated and commercialization plans laid out in the last decade. However, major barriers and issues linger: costly battery energy storage and management systems, few alternate energy storage options, limited driving range, lack of charging infrastructure and fast charging stations, and expensive electric machines and drives for e-propulsion. From e-bikes, scooters, industry-grade electric vehicles and e-golf-carts-to urban mass transit and infrastructure electrification, we will discuss a wide range of applications of e-transport and explore new ideas for Canadian innovation, R&D, and manufacturing for low-carbon economic development within the automotive and transportation sectors.