54th Annual Symposium / 54e Symposium Annuel

November 30th – December 2nd, 2022

International Ballroom, Delta Hotel - Ottawa

ENVIRONMENTAL AND LIFESTYLE EXPOSURE TO ENDOCRINE DISRUPTING CHEMICALS: FROM CELLS TO SOCIETY

EXPOSITION PAR L'ENVIRONNEMENT ET LE MODE DE VIE AUX PERTURBATEURS ENDOCRINIENS : DES CELLULES À LA SOCIÉTÉ

Organized by / Organisé par

SOCIETY OF TOXICOLOGY OF CANADA
LA SOCIÉTÉ DE TOXICOLOGIE DU CANADA

Programme Committee / Comité du Programme

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Board of Directors

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Land Acknowledgement

We recognize the Indigenous, First Nations, Inuit, and Métis peoples of Canada, on whose traditional land and territories the members of the Society of Toxicology of Canada professionally contribute to the field of toxicology. We gratefully acknowledge them as the past, present, and future stewards of this land.

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President's Welcome Message

Dear Colleagues,

Welcome to the 54th Annual Symposium of the Society of Toxicology of Canada (STC).

We are meeting during an extraordinary time, after over two years of a global pandemic, ongoing political unrest in different parts of the world, and the effects of climate change. We have worked hard navigating through these times constructively and efficiently, making significant scientific advances in the field of toxicology.

Our cutting-edge basic to translational research has led to understanding the adverse nature of persistent and emerging chemicals that affect human and environmental health. We also have made significant efforts to recognize vulnerable populations at risk from chemical exposures, and to include research and regulatory approaches focused on them. This year's theme — *Environmental and Lifestyle Exposure to Endocrine Disrupting Chemicals: From Cells to Society* — is thus a timely and overarching topic of discussion in our scientific programme. The 2022 Programme Committee, chaired by Dr. Anne Marie Gannon (*Health Canada*) has functioned tirelessly to bring forth an excellent series of lectures and sessions. It is the first time that STC is dedicating an entire session to the topic of Indigenous People's Health. The programme has many interesting features in the form of Flash Talks, Short Oral Presentations, and Posters. Our plenary session lecturers, facilitators, and *Plaa* and *Henderson* awardees are leaders in the field of toxicology and are internationally recognized. This year we have strong participation from government sector scientists who will provide lectures and focussed discussions that will spark the interests of attendees, especially our trainees.

Being the first in-person gathering after two years of virtual meetings, this 2022 symposium would not be possible without the leadership of our Past President, Dr. Géraldine Delbès (*INRS*), and the exceptional work of our Board of Directors (past and present). As much as we are excited to have the opportunity to convene in person, STC is pleased to continue providing virtual access to our proceedings through a hybrid model.

We gather annually as a national society to share our fascination with science, debate on new concepts and data, rekindle our friendships, and form new collaborations. I wish to thank each member, delegate, speaker, sponsor, exhibitor, and volunteer for participating in this 54th Annual Symposium.

Ottawa, our capital city, and its surroundings, is vibrant, multicultural, and alive with sights and sounds to please our delegates. We hope you find time to enjoy the attractions, museums, shopping, art, and culinary places available in the Ottawa-Gatineau region.

I wish you a warm welcome and hope you find the Annual Symposium informative, productive and stimulating.

Enjoy!

Jayadev Raju

Jayadev Raju, PhD (*Health Canada*)

STC President

Message from Chair – ICT2028 Vancouver Steering Committee

Dear Colleagues,

Congratulations to the 2022 Programme Committee and the STC Board of Directors for organizing what promises to be a successful in person/virtual meeting.

On behalf of the Steering Committee of the ICT2028 Vancouver, I am delighted to announce that STC was awarded the International Union of Toxicology's flagship conference, the triannual International Congress of Toxicology. The ICT XVIII will be held at the Vancouver Convention Centre, in Spring-2028.

ICT2028 Vancouver Theme: **TOXICOLOGY IN A CHANGING WORLD**

This will be the third time that STC has hosted the ICT: ICT I in 1977 in Toronto, and the very successful ICT XI in 2007 in Montreal.

I am looking forward to the Steering Committee meeting on November 30th, 2022 to begin planning for the ICT in 2028. We are seeking active working group participants to assist with: developing the scientific program; communication, partnerships and outreach; sponsorship and finance; organizing the local events.

To be part of planning this exciting event please connect with any of the following:

Scientific Programme Committee: Elaine Leslie, eleslie@ualberta.ca

Secretary: David Josephy, djosephy@uoguelph.ca

Finance/Sponsorship: Chris Nicol, nicolc@queensu.ca

Vancouver Local Events: Aaron Shapiro, aaron.shapiro1@phsa.ca

Partnerships/Outreach: Jayadev Raju, jayadev.raju@hc-sc.gc.ca

Chair: Angela Hofstra, angela.hofstra@syngenta.com

On behalf of the ICT XVIII Steering Committee, I wish you a warm welcome to Ottawa, and a scientifically rewarding experience at STC's 54th Annual Symposium.

Angela Hofstra

Angela Hofstra, PhD (*Syngenta Canada Inc.*)

Chair – ICT2028 Vancouver Steering Committee

Meeting information for virtual attendees

This year, our meeting is a hybrid event. We will be using a secured platform to host this virtual session. Platform presentations, Plenary, Plaa and Hendersen awards will be recorded and made available to attendees via a password-protected link after the meeting. For those attendees who will be joining us via Zoom.

Zoom Link

https://pft-ca.zoom.us/j/91704887698?pwd=Y25ieXhPampzTkNyemtwQ0F6anVQZz09

Passcode

484787

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Symposium Programme

DAY 1 – November 30

STC Board of Directors Meeting (*Richelieu Meeting Room*)
2:00-3:30 pm Chair: Jayadev Raju, STC President
ICT-2028 Vancouver 1st Planning Meeting (*Richelieu Meeting Room*)
4:00-5:30 pm Chair: Angela Hofstra, ICT-2028 Steering Committee

Meet & Greet @ Featured Ottawa Restaurant
5:30 pm onwards @ Queen Street Fare www.queenstfare.ca
Reservations made for STC guests for dinner (*pay as you dine*)

DAY 2 – December 1

(All sessions take place in the *International Ballroom* unless otherwise stated below)

Welcome and Opening Remarks
8:45-9:00 Jayadev Raju, President STC

Session I - Impacts of Endocrine Disrupting Chemicals on Indigenous Health
9:00-9:05 *Chair* – Anne Marie Gannon (Health Canada) *Co-chair* – Mike Wade (Health Canada)
9:05-9:25 Michelle Murphy, University of Toronto
9:25-10:05 Beze Gray and Vanessa Gray, Aamjiwnaang First Nation
10:05-10:15 Coffee/Tea Break (Sponsored by Syngenta Crop Protection)
10:15-10:35 Élyse Caron-Beaudoin, University of Toronto and Amira Aker, Université de Laval
10:35-10:55 Laurie Chan, University of Ottawa

Flash talks
10:55-11:15 Poster award finalists

VE Henderson Award Lecture
11:15-12:00 Marc-André Verner, Université de Montréal

Break
12:00-1:00 Lunch and Poster viewing and judging (Lunch sponsored by Charles River)

Session II - Endocrine Disruption: Considerations for Health & Consumer Product Safety
1:00-1:05 *Chair* – Albert Licollari (Nucro-Technics) *Co-chair* – David Lefebvre (Health Canada)
1:05-1:25 Tara Barton-Maclaren, Health Canada
1:25-1:45 Barbara Hales, McGill University
1:45-2:05 Ella Atlas, Health Canada
2:05-2:15 Coffee/Tea Break (Sponsored by Intertek)
2:15-2:35 Annabelle White, Dragonfly Ventures
2:35-2:55 David Møbjerg Kristensen, University of Copenhagen

Plenary Lecture - *Endocrine Disruptors and the Developmental Origins of Breast Cancer*
3:00-4:00 Ana Soto, Tufts University

Trainee-Focussed Session - *Science/Education/Training/Governance & the Next Generation*

4:15-6:15 *Chair:* David Lefebvre, Health Canada
Speaker: Yad Bhuller, Health Canada

Concurrent STC Annual Business Meeting (*Joliet Meeting Room*)

4:15-6:15 All STC Members

President's Reception & Awards (*Lift Lounge*, Delta Hotel Ottawa)

6:30 pm All attendees are welcome
(*Finger foods & refreshments provided and cash bar*)

DAY 3 – December 2

(All sessions take place in the *International Ballroom* unless otherwise stated below)

Session III – Endocrine Disrupting Chemicals During Development

8:30-8:35 *Chair* – Géraldine Delbès (INRS) *Co-chair* – Alison Holloway (McMaster University)
8:35-8:55 Earl Gray, EPA
8:55-9:15 Deborah Sloboda, McMaster University
9:15-9:25 Hugh Taylor, Yale University
9:25-9:35 Coffee/Tea Break (Sponsored by Aniara Diagnostica)
9:35-9:55 Vicki Sutherland, NTP
9:55-10:15 Hamid Habibi, University of Calgary

Gabriel L. Plaa Award Lecture

10:15-11:00 Lauren Foster, McMaster University

Short Oral Presentations

11:05-11:45 Select abstracts

Break

11:45-12:15 Chair Yoga (optional guided practice)
12:00-1:00 Lunch and Poster viewing (Lunch sponsored by Glencore)

Session IV – The future is now – Using NAMs to elucidate the effects of EDCs

1:00-1:05 Chair – Angela Hofstra (Syngenta) *Co-chair* – Marc Beal (Health Canada)
1:05-1:25 PJ Devine, Bristol Myers Squibb
1:25-1:45 Sandeep Raha, McMaster University
1:45-2:05 Steve Wiseman, University of Lethbridge
2:05-2:15 Coffee/Tea Break (Sponsored by Charles River and Glencore)
2:15-2:35 Natacha Hogan, University of Saskatchewan
2:35-2:55 Vladimir Elias, Eurofins

Current Topic Lecture - *COVID-19: the regulatory role and the science – reflections*

3:00-3:30 Supriya Sharma, Health Canada

Closing Remarks

3:30-3:45 Jayadev Raju, STC President

Plenary Lecture: December 1, 3:00 to 4:00 PM

Endocrine Disruptors and the Developmental Origins of Breast Cancer

Ana Soto

Department of Immunology, Tufts University School of Medicine & École Normale Supérieure, Paris

Dr. Ana M. Soto is a theoretical and experimental biologist. She is a professor at Tufts University School of Medicine, Boston, and a Fellow at the Centre Cavaillès, Ecole Normale Supérieure, Paris (ENS). She was the Blaise Pascal Chair in Biology 2013-15 at the ENS. Her research interests include the control of cell proliferation, the developmental origins of cancer, endocrine disruptors and theoretical and epistemological topics pertaining to biological organization. In this regard, in partnership with Professor Carlos Sonnenschein, she co-authored a book entitled *The Society of Cells* (Bios-Springer-Verlag, 1999, published also in French in 2006, in Spanish in 2019 and it is now being translated to Italian). They posited that the default state of cells in all organisms is proliferation, and proposed the Tissue Organization Field Theory of Carcinogenesis, in which cancer is viewed as development gone awry. As the Blaise Pascal Chair she coordinated a multidisciplinary working group devoted to the elaboration of a theory of organisms (Soto, AM, Longo, G Noble, D, editors: From the century of the genome to the century of the organism: New theoretical approaches. Prog. Biophys. Mol. Biol, 122:1, 2016).

Dr. Soto is the recipient of several awards, including the 2012 Gabbay Biotechnology & Medicine Award of Brandeis University, presented to her, Dr. Sonnenschein and Dr. Hunt as a result of their contributions to public health. She has been elected a member of the prestigious Collegium Ramazzini, Carpi, Italy in 2011, and awarded the Blaise Pascal Chair of Biology 2013-15 at the Ecole Normale Supérieure, Paris. She was recently referenced in the article titled "The Top 50 Women in STEM" by TheBestSchools.org (https://thebestschools.org/features/50-top-women-in-stem/). In 2019, she was also awarded the Grand Vermeil Medal, the highest distinction from the City of Paris for her pioneering role in the discovery of endocrine disruptors. Due to her unique profile spanning theoretical and experimental biology as well as public health issues, she is frequently called on to serve as a member of government-sponsored advisory panels including the US-National Academy of Sciences, the Swiss National Science Foundation, US-EPA, and EU Environmental Agency. She has also been invited to testify before multiple legislative bodies (US Congress, French Assemblée Nationale, etc). Her research has been funded by the US National Science Foundation, the US-National Cancer Institute, the US EPA, the Susan G. Komen Foundation, the US-National Institute of Environmental Health Sciences, the Avon Foundation, the UK Medical Research Council, and EU research programs.

Abstract: Fetal exposure to endocrine disruptors such as diethylstilbestrol and the pesticide dichloro diphenyl trichloroethane has been linked to an increased risk of breast cancer. Based on the principles of ecological developmental biology and the tissue organization field theory of carcinogenesis, we examine the hypothesis that developmental exposure to xenoestrogens increases the propensity to develop breast cancer by altering mammary gland organogenesis. In mice, perinatal exposure to environmentally relevant levels of the ubiquitous xenoestrogen bisphenol-A (BPA) induced alterations in mammary gland architecture that were manifested during fetal morphogenesis and throughout life, well beyond the exposure period. In rats, perinatal exposure to BPA increased the incidence of pre-neoplastic and neoplastic lesions in the mammary gland. Like many other effects of hormones and endocrine disruptors, the effects of BPA show a non-monotonic dose-response curve. Although this phenomenon is undisputed in endocrinology, regulatory agencies still question the validity of these curves. We addressed this issue in a subproject of the FDA-CLARITY study by developing a combined morphometric and statistical approach to assess nonmonotonicity of BPA effects in the mammary gland. Consistent with our findings, in the core study, BPA increased the incidence of mammary neoplasms at the lowest dose tested. Our study shows that when adequate methodology is used, non-monotonic effects can be unambiguously detected. Regulatory agencies should be adopting the appropriate tools to assess these effects instead of a priori negating their existence.

Current Topic Lecture: December 2, 3:00 to 4:00 PM

COVID-19: the regulatory role and the science – reflections

Supriya Sharma

Health Canada

Dr. Supriya Sharma became Health Canada's Chief Medical Advisor in August 2015. She added these responsibilities to those in the role of Senior Medical Advisor in the Health Products and Food Branch, a role she has had since March 2013. The Health Products and Food Branch has the responsibility to regulate pharmaceuticals, medical devices, biologics, vaccines, natural health products, veterinary medicines and food. Prior to that, Dr. Sharma has held a number of positions in Health Canada over the past decade in both the pre-market and post-market health product regulatory areas including most recently Director General of the Therapeutic Products Directorate, which had the regulatory responsibility for pharmaceuticals (prescription and non-prescription) and medical devices. She has also worked as a Senior Policy Advisor as part of the National Pharmaceuticals Strategy in Health Canada. Recently, she has returned to Health Canada following a leave of absence to work in an academic research group focusing on health innovation adoption in the Canadian Health system.

Trained as a pediatrician in both Canada and Australia, Dr. Sharma was a research fellow in hematology focused on clinical research relating to thalassemia and sickle cell disease and has worked on a number of large multi-center clinical studies, including research in collaboration with Oxford University on a project in Sri Lanka. She then went on to complete a Masters of Public Health at the Harvard School of Public Health with a concentration in International Health and an interest in Health Policy.

Trainee-Focused Session: December 1, 4:15 -6:15 PM

Science/Education/Training/Governance & the Next Generation

Speaker - Yadvinder Bhuller

Since joining Health Canada, in 2002, Yad continues to lead several national and international, science-policy and regulatory initiatives. He is a strong believer in continuous education, training, and collaborative approaches to governance. As an Executive Advisor, Yad is currently pursuing an independent research opportunity to build awareness and understanding on the identification, assessment, and management of health (and environment) risks, and how this relates with next generation decision-making at Health Canada. You can follow Yad and his leadership journey through his LinkedIn profile:
https://www.linkedin.com/in/yad-vick-bhuller/

Facilitator – David Lefebvre

Dr. David Lefebvre, PhD has a research background in food immunology, allergy, and nanotoxicology at Health Canada (HC). He is presently chief of the Regulatory Toxicology Research Division (Bureau of Chemical Safety, in the Food Directorate, HC). The team completes innovative research to determine the threshold level of potential health hazards of chemical contaminants. The division also engages in initiatives federally and internationally, and provides scientific advice to support Canadian federal policies, guidelines, standards and regulations, to ensure the chemical safety of the Canadian food supply.

STC Award Lectures

Gabriel Plaa Lecture: Lauren Foster, *McMaster University*

Dr. Foster is Professor Emeritus in the Department of Obstetrics & Gynecology, at McMaster University, and a Fellow of the Canadian Academy of Health Sciences. She is also an Adjunct Professor in the Department of Cellular Biology and Pharmacology at Florida International University and a member of the Department of Reproductive Medicine at the University of California, San Diego. Following undergraduate training and a Master's degree from the University of Guelph, Dr. Foster obtained a doctorate in medical sciences from McMaster University and subsequently joined the staff at Health Canada where she served as the Head of the Reproductive Toxicology Section transferring positions to the Director of Research and Associate Director of Women's Health at Cedars-Sinai Medical Center in Los Angeles in 1999. Dr. Foster later joined the faculty at McMaster University in the Department of Obstetrics & Gynaecology in 2001. Professor Foster is an expert in reproductive biology and toxicology with more than 200 scientific papers and book chapters. She has received several awards including an Ontario Women's Health Council Career award and the Canadian Fertility and Andrology Society Award of Excellence in Reproductive Medicine. She has served on numerous international and national expert advisory panels, editorial boards, as well as grant review committees. Dr. Foster is an associate editor for the Journal of Applied Toxicology, Journal of Ovarian Research, and a past President of the Canadian Fertility and Andrology Society. She holds several patents and recently co-founded AIMA Laboratories Inc. to commercialize patents developed over the course of her academic career.

VE Henderson Lecture: Marc-André Verner, *Université de Montréal*

Marc-André Verner received his PhD from the Université du Québec à Montréal where he worked on physiologically-based pharmacokinetic (PBPK) modeling under the supervision of Sami Haddad. He pursued his studies at the postdoctoral level at the Karolinska Institutet under the supervision of Gunnar Johanson, and subsequently at the Harvard Medical School under the supervision of Susan Korrick. His unique background in both toxicology and epidemiology led him to develop novel approaches to assess the health effects of chemicals in humans, namely through the use of PBPK models in longitudinal birth cohorts. As an Associate Professor at the Université de Montréal, he focuses on gestational and developmental exposures to environmental chemicals. He has several ongoing projects that touch on many aspects of developmental toxicology, namely environmental and biological monitoring of gestational exposure to contaminants, *in vitro – in vivo* extrapolation in the context of human health risk assessment, and environmental epidemiology.

In the past few years, he has been heavily involved in exposure assessment and determination of guidelines with regards to human exposure to per- and polyfluoroalkyl substances (PFAS). His expertise has been solicited by multiple agencies, including Health Canada, the World Health Organization (WHO), the Agency for Toxic Substances and Disease Registry (ATSDR), the Center for Disease Control and Prevention (CDC), and Minnesota Department of Health (MDH). He was the only non-US member serving on the National Academies of Sciences, Engineering and Medicine committee on Guidance on PFAS Testing and Health Outcomes, which released its report in the summer of 2022. Marc-André has been an active member of STC since 2007: to date, he and his students have given 4 talks and presented 14 posters at annual meetings.

Speaker Bios and Abstracts

SESSION 1: Impacts of Endocrine Disrupting Chemicals on Indigenous Health

M Murphy
University of Toronto

Dr. Murphy is a Tier 1 Canada Research Chair in Science and Technology Studies and Environmental Data Justice at the University of Toronto. They are Co-Director of the Technoscience Research Unit that hosts an Indigenous-led, Indigenous-majority research lab focusing on the relations between Pollution, Colonialism, and Data. Murphy's current research concerns rethinking how to understand chemicals, pollutants and exposures in the specificity of the lower Great Lakes and Indigenous knowledges, collaborating with community researchers and chemists. Murphy is the author of three books and is a Fellow of the Royal Society of Canada. They are Métis from Winnipeg from a French settler and Métis family.

Title: Endocrine Disrupting Chemicals, Responsibilities, and Colonialism

Abstract: Indigenous scholars and land defenders have shown how pollution in colonialism, disrupting both land and body sovereignties intergenerationally. Starting with the Indigenous feminist framework that understands "violence on the land is violence on our bodies," this talk discusses the relationships between colonialism, Endocrine Disrupting Chemicals, and responsibilities, particularly through Anishinaabe, Métis, and Haudenosaunee teachings from the Great Lakes region. This talk shares insights from Indigenous researchers, both from academia and communities, in the Indigenous-led Environmental Data Justice Lab at the University of Toronto. It will discuss how to reframe EDCs as more than just a question of the inherent toxicity of particular substances that might be regulated at a substance-by-substance level, and instead as larger structures of colonialism with deeper histories that need to be addressed broadly. It shares ways of understanding health and reproductive effects as land/body relations. Building on the argument that pollution is colonialism, the talk will address the limits of current frameworks for regulating and studying EDCs, and offers multiple ways that EDCs can be reconsidered as a form of colonial environmental violence that requires different kinds of collaborations between toxicologists, other disciplines, and Indigenous knowledges. It also offers a desire-based approach to EDCs that seeks to build Indigenous futures rather than enumerate Indigenous deficits, thereby challenging some of the boundaries and norms of toxicology, chemical management, and even chemistry.

Vanessa Gray
Aamjiwnaang First Nation

Vanessa Gray is a queer Anishinaabe Kwe from the Aamjiwnaang First Nation. She is a water protector, environmental researcher, and community organizer for the Great Lakes region. Vanessa is a respected land defender emphasizing Indigenous peoples' inherent and legal rights and sovereignty within climate justice. She continues to take part in a diversity of strategies, including calls on Concordia University to divest from fossil fuels, co-hosting Toxic Tours, and direct actions in solidarity with land defenders on Wet'suwet'en territory who continue to oppose the Coastal Gas Pipeline. As a researcher, Vanessa is well known for her environmental justice work on pollution in Ontario's Chemical Valley – a petrochemical hub on her territory and surrounding her community of Aamjiwnaang First Nation. She is the co-founder of Aamjiwnaang and Sarnia Against Pipelines (ASAP), Porcupine Warriors, and co-lead of the Environmental Data Justice (EDJ) Lab, which produces tools to visualize the relationship between colonialism, data, and pollution such as the Pollution Reporter App. Aamjiwnaang community member's constant exposure to harmful emissions results in some of the highest mortality rates for cancers and respiratory diseases in Ontario. Vanessa has dedicated her life to challenging colonial violence and its impacts on environmental health.

Beze Gray
Aamjiwnaang First Nation

Beze Gray (They/Them) is a two-spirit Anishinaabe, Delaware, and Oneida from Aamjiwnaang First Nation, treaty #29 territory. Beze is currently working with the Environmental Data Justice Lab in the Technoscience Research Lab of the University of Toronto as a Community Researcher, as well as a Youth Coordinator of the Niizh Manidook Hide Camp, and Producer of a grassroots documentary from the Kiijig Collective. Beze is a part of the Jiibwaabiigamowag Young Peoples Council (Aamjiwnaang Youth Council), and Co-founder of Aamjiwnaang and Sarnia Against Pipelines. Beze is a youth organizer of grassroots events based on culture and environment including Toxic Tour, Niizh Manidook Hide Camp, and Aamjiwnaang Water Gathering. They focus on telling their experience of living in Canada's Chemical Valley, as well as Indigenous culture/language resurgence. Beze practices Anishnaabemowin, sugar bushing, hide tanning, seed saving, and structure making.

Title: Environmental Racism in Canada's Chemical Valley

Abstract: Vanessa (She/Her) and Beze (They/Them) Gray are Anishinaabe siblings from the Aamjiwnaang First Nation Reserve located in Canada's Chemical Valley. They are co-founders of Aamjiwnaang & Sarina Against Pipelines and continue they're community engagement with the Environmental Data Justice lab as part of the Technoscience Research Unit at the University of Toronto. These grassroots organizers and researchers continue to address Canada's colonial history of how Chemical Valley impacts their community's health and environment. Their extensive advocacy experience with surrounding companies and local politicians have helped identify the lack of information about the chemicals Aamjiwnaang community members are exposed to. While working with Aamjiwnaang's youth council and environmental committee, the sibling duo is committed to working with the community to build their own database of the spills and releases from the surrounding industry. Our traditions, culture, and ceremony are still practiced, and hold a deep connection to land. Our people have related the health of our land affects the health of our peoples thus affecting future generations. We hold our kinship and connection to land that when we have a healthy land, or environment we are living a good life.

Élyse Caron-Beaudoin
University of Toronto, Scarborough

Dr. Élyse Caron-Beaudoin is an Assistant Professor in environmental health at the University of Toronto – Scarborough. Her research focuses on the development of transdisciplinary community-based research projects to assess the impacts of anthropogenic pressures on health by combining information across multiple levels of biological organization. Élyse holds a PhD in biology with a specialization in toxicology from the INRS – Armand-Frappier Institute in Laval, Quebec. From 2018 to 2020, she was a CIHR-funded postdoctoral fellow at the Université de Montreal. During her fellowship, Élyse investigated the associations between density and proximity to oil and gas wells and birth outcomes in Northeastern British Columbia. She instigated in partnership with First Nations from the region, the first biomonitoring studies on exposure to environmental contaminants associated with unconventional natural gas exploitation in Canada. She is a collaborator and co-investigator on several other research projects on environmental and Indigenous health, including in the Arctic.

Amira Aker
Centre de recherche du CHU de Québec and Université Laval

Dr. Amira Aker, Ph.D. is an environmental epidemiology postdoctoral fellow at the Centre de recherche du CHU de Québec and Université Laval. Her research focusses on interdisciplinary and community-based participatory research that aims to protect systematically and structurally excluded populations from contaminants of emerging concern. She is currently studying the exposure sources and health impacts of perfluoroalkyl substances in Nunavik. Amira completed her PhD at the University of Michigan, Ann Arbor in Environmental Health Sciences and her MPH in Environmental Health & Policy at George Washington University. She also completed a postdoctoral fellowship at the University of Toronto Scarborough on chronic disease and maternal health

Title: Persistent and non-persistent chemicals in Indigenous populations: exposure and endocrine disrupting effects

Abstract: Perfluoroalkyl acids (PFAAs) are compounds with multiple industrial usages that are resistant to degradation, making them extremely persistent in the environment, mobile and bioaccumulative. Non-persistent chemicals such as phenols, parabens and phthalates are commonly found in consumer products and food packaging. Inuit populations are faced with increasing concentrations of both these contaminant groups via different exposure routes. Largely unregulated long-chain PFAAs continue to accumulate in the northern environment and food web due to long-range transport, contaminating country (traditional) foods hunted/harvested from the land. Conversely, the increased consumption of market food items and products containing non-persistent chemicals in Indigenous communities may augment their exposure to these chemicals. Among the various linked health outcomes, elevated PFAAs exposure has been linked with thyroid hormone disruption, and phenols, parabens and phthalates have been associated with both reproductive and thyroid hormone disruption. This presentation will provide an overview of the levels of exposure to these contaminants in the *Qanuilirpitaa?* Nunavik Inuit Health Survey 2017; the Nunavik Pregnancy Wellness with Country Foods (NQN) study and the *Jeunes, Environnement et Santé*/Youth, Environment and Health project (JES!-YEH!) and compare them to concentrations in the general Canadian population. The endocrine-disrupting properties of these compounds will be highlighted through a review of the existing literature. Special attention on the associations between exposure to PFAAs and thyroid function in Indigenous youth will be presented.

Laurie Chan
University of Ottawa

Dr. Laurie Chan is a Professor and Canada Research Chair in Toxicology and Environmental Health at the University of Ottawa. He obtained a B.Sc. and M.Phil. at the University of Hong Kong and a Ph.D. in Toxicology at the University of London. Dr. Chan's research focuses on the exposure of chemical contaminants and their effects found in the diet and environment, particularly among Indigenous Peoples.

Dr. Chan has published over 300 papers and supervised over 100 HQPs. He served as an advisor for international and national governments and organizations and numerous Indigenous communities on environmental health issues. He is currently the Canada co-chair of the Health Professionals Advisory Board of the International Joint Commission. He has been awarded many prestigious fellowships, including Leopold Fellow, Japan Society of Promotion of Science Fellow, Fulbright Scholar and Fellow of the Canadian Academy of Health Sciences.

Title: Impacts of Persistent Organic Pollutants on Indigenous Health and Wellbeing in Canada

Abstract: Persistent Organic Pollutants (POPs) are toxic substances composed of organic chemical compounds and mixtures such as industrial chemicals like PCBs and pesticides like DDT. Global pollution and long-range transport have caused the accumulation of POPs in the environment, particularly in northern Canada. Higher levels of POPs are commonly found in fish and marine mammals due to biomagnification along the food chain in aquatic ecosystems. Indigenous Peoples in Canada are at higher risk of exposure to POPs because these foods are important components of their traditional diets. Many studies have shown that Indigenous Peoples in Canada have high exposure and body burden of POPs. There are increasing concerns about the endocrine disruption effects of POPs as increasing evidence shows that exposure to POPs is a risk factor in the etiology of metabolic diseases such as type 2 diabetes mellitus (T2D). This poses a higher risk to Indigenous Peoples as they already have a disproportionally higher rate of T2D compared to the Canadian general population. In this talk, I will present the results from laboratory and epidemiological studies conducted by our team on the relationship between POPs exposure and T2D and discuss the impacts of POPs on the health of Indigenous Peoples in Canada including issues related to food security, well-being and inequalities.

SESSION II: Endocrine Disruption: Considerations for Health & Consumer Product Safety

Tara Barton-Maclaren
Health Canada

Dr. Tara Barton-Maclaren is the Research Manager of the Emerging Approaches Unit of Health Canada's Existing Substances Risk Assessment Bureau. She has been contributing to human health risk assessments and methods development under Canada's Chemicals Management Plan since 2007 following the completion of her BSc Honours from the University of Guelph in 2000 and her PhD in Reproductive Toxicology from McGill University in 2007. She is a leader in translational research bridging innovations in modern toxicology research and human health risk assessment and serves as the focal point for the development of new approach methods and strategies for the assessment of chemicals existing in the Canadian marketplace. To promote alignment for the use of modern toxicology and emerging technologies in regulatory applications, she contributes to international initiatives such as the Organisation for Economic Co-operation and Development (OECD) and the Accelerating the Pace of Chemical Risk Assessment (APCRA) and collaborates with leaders nationally and internationally in the fields of computational toxicology and integrated testing and assessment strategies.

Title: Sorting the Signal from the Noise: Using Automation to Enhance the Screening of Large Inventories of Chemicals for Endocrine Disruption Potential

Abstract: Canada's Chemicals Management Plan (CMP) recognizes the importance of continuing to expand the consideration of endocrine disrupting properties and endocrine-related effects for chemical prioritization and risk assessment. Yet the rapidly changing chemical landscape and limited availability of hazard data to characterize the mechanisms of endocrine disruption present challenges for chemicals regulation. To work toward addressing these challenges, research and regulatory efforts are focused on leveraging emerging science from New Approach Methods (NAMs) to progressively modernize practices to identify, prioritize and assess the potential risk from chemical exposures using more efficient and mechanistically based methods and tools. The endocrine activity screening module within Health Canada's Automated Workflow for Prioritization (HAWPr) was designed to keep pace with the evolving science and technology pertaining to EDC prioritization and assessment. The module implements a high throughput rules-based screening approach using computational tools to collect and integrate available evidence across in vivo, in vitro and in silico based mechanistic information to identify priority chemicals for further action under the CMP. Future work to enhance the collection of academic data pertaining to identifying EDCs using machine learning will also be shown. To demonstrate the current state of the screening module and to provide a perspective on a vision for the use of NAM data in tiered testing and assessment, elements of an OECD Integrated Approach to Testing and Assessment (IATA) case study on bisphenols will be presented.

Barbara F. Hales
McGill University

Barbara Hales received her M.Sc. in Pharmacognosy from the Philadelphia College of Pharmacy and Science and Ph.D. in Pharmacology from McGill University. She then joined the faculty in the Department of Pharmacology and Therapeutics at McGill University where she is currently a James McGill Professor. Research in her lab focusses on teratogen-induced signaling pathways in limbs; the effects of house dust mixtures of flame retardants on reproduction and development; the impact of exposure to phthalates and "green" plasticizers on progeny outcome; and approaches towards the responsible replacement of endocrine disrupting chemicals. She has extensive experience with *in vivo* (rodent), *ex vivo* (limb and embryo cultures) and *in vitro* (cell culture) approaches to assess the developmental and reproductive toxicity of drugs and environmental chemicals and has published over 170 research articles and 45 book chapters in toxicology, birth defects research and reproduction. In addition, she has served as Co-Chair of the Chemicals Management Plan Science Committee of Canada (2013-2016) and was a member of the US National Academies Committee on Endocrine-Related Low Dose Toxicity (2015-2017). She served as President of the Society of Toxicology of Canada and is the recipient of their Award of Distinction. She also served as President of the Teratology Society, from which she received both the Edward W. Carney Distinguished Service Award (2018) and the Agnish Fellowship Award (2019). She served as Secretary General of the Executive Committee of International Union of Toxicologists (IUTOX, 2016-2019) and is currently a Scientific Advisor for the Health and Environmental Sciences Institute (HESI) DART Committee.

Title: Strategies towards the Responsible Replacement of Endocrine Disrupting Chemicals

Abstract: Bisphenols, plasticizers, and flame retardants are added to consumer products such as food packaging, cosmetics, toys and electronic devices. Among these, there is evidence that bisphenol A (BPA), di(2-ethylhexyl) phthalate (DEHP), and polybrominated diphenyl ethers (e.g. BDE-47), may act as endocrine disrupting chemicals (EDCs). This has led to their regulation and public pressure to find replacements, yet little is known about many of the alternatives. Our goal is to develop a screening strategy to assess the potential EDC activities/health effects of replacements using established cell lines (C18-4 spermatogonial cells, TM4 Sertoli cells, MA-10 Leydig tumor cells, and KGN granulosa) and *ex vivo* developing organ cultures to capture key endocrine functions. High-content live single-cell images were analyzed to determine effects on cell survival and phenotypic endpoints, including lipid droplets, mitochondria, lysosomes and oxidative stress. Benchmark concentration estimations were determined to compare "legacy" chemicals with their alternatives. Both cell-line and chemical-specific effects were found after exposure to bisphenols, plasticizers and flame retardants. Using in vitro to in vivo extrapolation (IVIVE), we estimated human administered equivalent doses (AEDs) to identify chemicals of concern. With some notable exceptions, a number of the alternatives/replacements in each family of chemicals had a profile indicative of greater toxicity than the legacy chemical. To capture effects during development, we investigated endochondral ossification and the transcriptome in limb bud cultures. Chemical-specific effects on bone formation and alterations in gene expression were observed in limbs exposed to some bisphenols and organophosphate esters. Thus, single-cell high-content imaging, in combination with organ cultures, may be used to rapidly and reliably compare the effects of chemicals on targets related to reproductive and developmental toxicity. Further, the toxicity of some of the alternative chemicals in commerce today may be similar to, or greater than, that of the legacy compounds that they are replacing.

(**Supported by a CIHR IPPH Team Grant (FRN # IP3-150711) and McGill University. Co-authors: Bernard Robaire)**

Ella Atlas
Health Canada

The research conducted in Dr. Atlas' laboratory focuses on the development of *in vitro* models to investigate the effects of chemicals on adipogenesis, and to investigate the effects of these chemicals on the phenotype of the mature fat cells and on liver toxicity. Dr. Atlas' research also investigates the effects of chemicals on breast cancer progression or initiation in *in vitro* models. In addition, the Atlas lab uses toxicogenomics to inform potential modes of action and potency ranking of chemicals for risk assessment.

Title: Effects of PFAS on the Liver – Harnessing 3D in vitro models

Abstract: Per- and polyfluoroalkyl substances (PFAS) are man-made chemicals considered "forever" chemicals based on their bio-accumulative and persistent properties. As a consequence, human exposure to PFAS is ubiquitous. Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) are two well studied PFAS which are now on the Stockholm convention and removed from commerce. However, there are thousands of replacement PFAS that are now in consumer products and for which there isn't any or very little toxicity data. Regulatory agencies are facing with true challenges to regulate these chemicals due to the sheer number of new PFAS found in humans and the environment. Thus, using and adopting new approach methodologies (NAMs) is crucial for obtaining toxicity data and to regulate these compounds. We used human primary liver cell spheroids to investigate the effects of PFAS on human cells in the 3D model, alone and in mixtures. We were able to derive transcriptomics point of departure, rank potency and delineate some molecular targets and mode of action of these chemicals.

Annabelle White
Dragonfly Ventures

For the past fifteen years, Annabelle White has engaged in a deep dive into the world of finance with a profound internal drive to approach her investments and philanthropy differently. Allowing her philanthropic mission, vision and values to inform her for-profit investments, she has worked with a steadfast determination to invest in climate resilience, freshwater conservation, elimination of toxics, and land and soil health. Through building her vision to achieve this, she is now tuning her compass to supporting as many Women, Womxn and BIPoC led organizations as possible. Her hobbies include horseback riding, all things outdoors, creative cooking and an annual binge watch of Star Wars.

Title: A Role For Private Wealth in Toxics

Abstract: At 19 years of age, Annabelle White unexpectedly became a wealth inheritor and beneficiary of a sizeable trust shared equally with her two siblings. She knew she would eventually have to either learn how to manage her wealth or how to hire the right people to manage it for her. Fast-forwarding through a decade and a half of emotional baggage, life lessons, global adventures and unfettered privilege, she slowly began to develop her financial education.

Dragonfly Ventures was born as a deep inquiry into Annabelle's life experiences. In working with a business and money coach, she identified her areas of interest to be deeply rooted in her connection with the earth itself. Starting with clean energy, freshwater conservation and land and soil health, Annabelle realized that toxic chemicals were underpinning the need to invest in cleaning up our environment and preventing disease. She began to create an investment and philanthropic mission/vision/values that embodied a long-term vision of healthy people living in a toxic-free world in synergy with each other and every living creature. Anchoring this path was her compelling need to turn the powerlessness and grief of the loss of her non-immunocompromised brother to CNS Lymphoma into something amazing.

Today, with prevention a key factor in our decision-making process, Dragonfly is building a 'toxic elimination' vision designed to limit, reduce and eventually eliminate the pervasiveness of harmful human-contrived chemicals. Though we are a small organization, we are deeply committed to supporting individuals, communities, organizations, and businesses that share this vision. Despite knowing this will not happen in our lifetime, our perfect future world is in recovering our pristine planet where pollution and toxic chemicals no longer exist and have been replaced with safe alternatives and closed-loop organic systems.

David Møbjerg Kristensen
University of Copenhagen, Denmark and Institut National de la Santé et de la Recherche Médicale (Inserm), France

Dr. Kristensen's research focusses on understanding how the environment impacts human development and adult homeostasis. He is doing this by using clinical studies in combination with animal models, cellular assays, and modelling. The central aims of this work have been in a translational manner to understand disease mechanisms and create better treatments for patients by: (i) identifying new drug targets; (ii) understanding off target effects of drugs already in the clinic; and (iii) understanding how ubiquitous xenobiotics can drive recent increases in prevalence of adverse health outcomes within reproduction, metabolism, and neurobiology. This has led to work at Massachusetts General Hospital (Boston, USA), Mont Sinai Hospital (NYC, USA), and Inserm (Rennes, France). Dr. Kristensen holds positions as Clinical Pharmacology Specialist at Novo Nordisk A/S and Group Leader at Righospitalet, while also being affiliated as Senior Scientist to Inserm.

Title: Acetaminophen/paracetamol and pregnancy – should we be concerned?

Abstract: Paracetamol/acetaminophen (N-acetyl-p-aminophenol (APAP) is the active ingredient in more than 600 medications used to relieve mild to moderate pain and reduce fever. APAP is widely used by pregnant women as governmental agencies, including the FDA and EMA, have long considered APAP appropriate for use during pregnancy when used as directed. Increasing experimental and epidemiological research now suggests that prenatal exposure to APAP might alter fetal development, which could increase the risks of some neurodevelopmental, reproductive and urogenital disorders. Our data suggests that there is likely several mechanisms behind these effects, including inhibition of androgens, prostaglandins and activation of cellular receptors as CB1 and TRP channels, and that the timing and dose of exposure play critical roles. APAP is at the same time an important medication and alternatives for treatment of high fever and severe pain among pregnant women are limited.

SESSION III: Endocrine Disrupting Chemicals During Development

L Earl Gray, Jr
US Environmental Protection Agency

Dr. L. Earl Gray, Jr is a reproductive toxicologist in the Reproductive and Developmental Toxicology Branch at the U.S. Environmental Protection Agency (US EPA), ORD, CPHEA. He received his Ph.D. in Zoology from North Carolina State University in 1976. Dr. Gray is also an Adjunct Professor at the North Carolina State University Department of Toxicology. His research is focused on how individual toxicants and mixtures induce alterations of mammalian reproductive development. Dr. Gray's research team is investigating mechanisms by which chemical exposure alter steroid hormone action during critical developmental periods that result in altered reproductive morphology and function, Mechanisms under investigation include, AR, ER, AhR and hormone synthesis inhibition mediated alterations in the reproductive system. The overall objectives are to compare 1) effects of low doses of toxicants with 2) *in vivo* tissue levels of the active metabolite(s), 3) determine how mixtures of chemicals with similar and different modes of action interact and to 4) identify *in vivo* and *in vitro* mechanisms of action. In their studies, pregnant animals are exposed during developmental stages and the reproductive system of the male and female offspring assessed throughout lactation, puberty, mating and, on occasion, old age. Chemicals of interest include antiandrogenic fungicides, phthalates, xenoestrogens and PFAS. Currently, they are very interested in how chemicals with divergent mechanisms of action interact during sexual differentiation to determine how often synergistic effects are seen and how different PFAS chemical mixtures affect development. Dr. Gray has been an AAAS Fellow since 1999. He was the recipient of the Lifetime Achievement Award from the Society of Toxicology Reproductive and Developmental Toxicology Specialty Section in 2012.

Title: 30 Years After Wingspread: Development of Quantitative Adverse Outcome Pathways for Endocrine Disrupting Chemicals that Alter Reproductive Development In Utero

Abstract: Since the origin of the term "Endocrine Disruptors" at the 1991 Wingspread Meeting, led by Dr. Theo Colborn, the field has evolved from description of the *in vitro* and *in vivo* effects of EDCs to the utilization of mechanisms of toxicity and key events in Adverse Outcome Pathways (AOP) to predict the latent, life-long adverse effects of *in utero* exposure to EDCs on reproductive development. Our research team has developed an AOP Network (AOP-N) of the androgen signaling pathway that includes multiple AOPs with diverse mechanisms of toxicity. These AOPs converge on common key events in the AOP-N resulting in the development of common adverse outcomes in male offspring.

Two examples of how this AOP-N can be utilized to predict the effects of individual chemicals and mixtures that disrupt androgen signaling *in utero* will be presented. The first example demonstrates how the effects of mixtures of chemicals with diverse mechanisms of toxicity can be predicted using dose addition models based upon the individual dose response data in rats for each of the components. The mixtures studies include simple binary mixtures up to complex mixtures including 15 to 18 chemicals. These chemicals include those that act as androgen receptor (AR) antagonists, AR degraders and chemicals that inhibit fetal hormone function. There are several key observations from these studies. First, dose addition models should be the default approach to predict mixture effects because they consistently provide more accurate quantitative predictions of the adverse effects on androgen-dependent tissues than do response addition (RA) or integrated addition (IA) models. RA and IA mixture models may grossly underpredict the toxicity of the mixture. Secondly, mixtures of chemicals can produce adverse reproductive effects well below the individual reproductive NOAELs and LOAELs of each chemical.

Using the data from a nine phthalate mixture study, the second example in this presentation will describe several different approaches to predict the effects of phthalates or mixtures of phthalates. In one approach, postnatal dose response data on each chemical accurately predicts the *in utero* effects of this mixture on male rat offspring. However, this approach requires the availability of dose response data from a one generation study of each phthalate. Other approaches that provide accurate predictions include using statistical models of the effects of the individual phthalates or the mixture of phthalates on key events in the AOP-N to predict the adverse effects of the nine phthalate mixture. Using alterations of key events in the phthalate AOP to predict the adverse effects of the nine phthalate mixture requires fewer resources and uses fewer animals than the approach using one-generation dose response data on each of the nine phthalates.

(**This is an abstract of a proposed presentation and does not necessarily reflect EPA policy.)**

Deborah Sloboda
McMaster University

Dr. Sloboda is a Professor and the Associate Chair of Research in the Dept of Biochemistry and Biomedical Sciences at McMaster University, Canada. She completed her PhD training at the University of Toronto in Physiology in 2001 following which she was a Postdoctoral Research Fellow at the University of Western Australia. In 2006 she was recruited to the Liggins Institute at the University of Auckland in New Zealand and where from 2008-2011, she was the Deputy Director of the National Research Centre for Growth and Development. In 2012, she left Auckland to take up a faculty position at McMaster University and held a Tier 2 Canada Research Chair in Perinatal Programming for 10 years. Dr. Sloboda's laboratory investigates early life impacts on maternal, fetal and placental development and the risk of non-communicable disease later in life. Her experimental studies investigate parental nutrient manipulation on pregnancy adaptations, including the microbiome, placental inflammation and offspring reproductive and metabolic function. In community-based health studies, Dr. Sloboda engages with expectant mothers and services that support pregnant women, developing community-based knowledge transfer and work programs to promote and advocate for health behaviours before and after conception. She has investigated the impacts of COVID on adolescent health and well-being and developed resources that target the need of adolescents during the pandemic and is currently the lead on The Art of Creation Project: an arts-based knowledge translation program, with the Art Gallery of Hamilton. In 2015, Dr. Sloboda was awarded the International Society of Developmental Origins of Health and Disease Nick Hales Award for outstanding research contribution to the field of early life programming, and in 2017 won the Hamilton YWCA Woman of Distinction Award in Science Trade, and Technology. In 2019, she was awarded the FHS McMaster University Graduate supervision award for her outstanding student mentoring and in 2022 received the McMaster University Faculty Association Outstanding Service Award. Dr. Sloboda is one of the founding co-Presidents of the Developmental Origins of Health and Disease Society of Canada, and has been the Secretary and member of the Executive of the International Society for the Developmental Origins of Health and Disease since 2013. She has published over 125 papers in leading scientific journals and book chapters on the early life origins of health and disease.

Title: Looking at both sides of the coin: Maternal and Paternal influences on offspring health disease risk

Abstract: There is now considerable epidemiological and experimental evidence indicating that early life environmental signals, including nutrition, affect subsequent development and long-term metabolic function. These signals induce highly integrated responses in endocrine-related homeostasis, resulting in persistent changes to the developmental trajectory producing an altered adult phenotype. This phenomenon has been termed developmental programming, whereby early life events trigger processes that prepare the individual for particular circumstances that are anticipated in the postnatal environment. Whereas many studies, including our own, have shown that maternal dietary challenges can lead to postnatal disease risk; paternal impacts on offspring phenotype are largely understudied. Paternal diet has been shown to impact offspring metabolic function. This should not be surprising, since it has long been known that the sperm (epi)genome directly modifies embryonic/fetal development. But whether paternal factors can induce changes in the intrauterine milieu in other ways, including placentation, has been largely overlooked. We have shown in preclinical models that paternal diet-induced metabolic compromise is associated with placental hypoxia and altered placental angiogenic markers, with the most pronounced effects in female placentae. These placental impairments may fuel changes in fetal hepatic development, in a manner that leads to postnatal metabolic dysfunction. Studies investigating both maternal and paternal impacts on offspring health and disease risk highlight the need to consider the periconceptional window – to include paternal intervention strategies to improve health instead of placing the onus just on pregnant individuals.

Hugh Taylor
Yale University

Hugh S. Taylor, M.D., is the Anita O'Keeffe Young Professor of Women's Health and chair of the Department of Obstetrics, Gynecology and Reproductive Science, at the Yale School of Medicine in New Haven, Connecticut. He is also Professor of Molecular, Cellular and Developmental Biology at Yale University. He is a board-certified specialist in Obstetrics/Gynecology and in Reproductive Endocrinology. Dr. Taylor received his undergraduate training at Yale University and received his medical degree from the University of Connecticut School of Medicine. He completed his residency in Obstetrics and Gynecology at Yale. His postdoctoral training included a fellowship in Reproductive Endocrinology and Infertility as well as a fellowship in Molecular Biology, both at Yale. Dr. Taylor has been Principal Investigator on 15 National Institutes of Health grants, and site PI or Co-Investigator on numerous additional NIH funded projects. His clinical research centers on implantation, endometriosis and menopause. His basic science research focuses on uterine development, the regulation of developmental gene expression by sex steroids, endocrine disruption and on stem cells. Dr. Taylor has published more than 400 articles in leading medical journals. He is an author of Speroff's *Clinical Gynecologic Endocrinology and Infertility*. He serves on several editorial boards and as a reviewer for numerous scientific journals and is frequently invited as a speaker at national and international medical meetings. Dr. Taylor has received numerous awards including the IVI Foundation International Award for the Best Research in Reproductive Medicine and the Society for Gynecologic Investigation Distinguished Scientist Award. He has also served as the academic mentor of numerous trainees and has twelve times been awarded the Society of Gynecologic Investigation President Presenter's Award for this training. Dr. Taylor is past president of the Society for Reproductive Investigation and immediate past president of the American Society for Reproductive Medicine. He was elected to the National Academy of Medicine in 2016.

Title: Endocrine disruptors interfere with E3 mediated epigenetic fetal programming

Abstract: Estrogens are steroid hormones essential for development of female sex characteristics and reproduction. There are three common mammalian estrogens: estrone (E1), estradiol (E2), estriol (E3). E2 is the primary circulating and most potent estrogen produced by the ovaries in premenopausal women. E3 is present at negligible levels in non-pregnant women and is considered a much less potent estrogen than E2 or E1. E3 likely contributes little to the overall estrogenic activity in non-pregnant, premenopausal women. However, during pregnancy E3 is produced in prodigious quantities by a unique and complex pathway that involves three organs of the feto-placental unit: the adrenals, liver, and placenta. In humans, E3 accounts for more than 90% of total estrogens circulating in pregnancy. While it has been known for decades that in humans and several other primates, E3 is produced in much greater quantities than other estrogens by this pregnancy-specific pathway, its physiological role, if any, remained unknown. Estrogen exposure during gestation can have profound effects on organs both within the reproductive system and outside the reproductive system including the brain, breast, and cardiovascular system. We found that many so-called "weak estrogens" can have actions that would not be predicted based on their binding affinity to ER or their effect on the vagina and uterus. Of note, several compounds with weaker binding affinity for ERs than E3 have an important effect on developing reproductive organs and brain during pregnancy. This has led us to suspect that E3 might have a functional role. Rodents do not normally produce E3 during pregnancy. Thus, we treated rodents with E3 mimicking E3 production during human pregnancy. E3 exposure subsequently shapes adult offspring reproduction and behavior by epigenetically programming the fetus. E3 alters the expression levels and DNA methylation patterns of many genes in the uterus and brain of exposed animals. Mechanistically, E3 affects complexing of ERs with several DNA/histone modifiers, and the binding of these complexes to target genes. Rather than a weak estrogen as defined by its function as a canonical transcriptional activator, E3 is a potent epigenetic modulator and influences developmental programming of the fetus. E3 functions by driving epigenetic change, mediated through epigenetic modifier interactions with estrogen receptors rather than through canonical nuclear transcriptional activation. We identify an unexpected functional role for E3 and a novel mechanism of estrogen

action. Endocrine disruptors are a synthetic or natural chemical that either mimics or blocks hormones and disrupts normal development or function. Many such compounds are present in the environment or used in drugs and food. A classic example is diethylstilbestrol (DES), a drug formerly used in pregnancy to prevent miscarriage. Instead DES distorted the development of the female reproductive tract; exposure to DES led to an increased risk of miscarriage and cancer in women who were exposed as a fetus. We have identified a common mechanism by which several endocrine disruptors cause these defects. Like E3, many endocrine disruptors are considered "weak" estrogens, however we find that many endocrine disruptors function by blocking E3 rather than canonical E2 action. Understanding the mechanism of action of these agents may lead to better means of testing new compound for adverse effects, and perhaps prevention of excess exposure.

(**Zhou Y, Gu B, Brichant G, Singh JP, Yang H, Chang H, Zhao Y, Cheng C, Liu ZW, Alderman MH 3rd, Lu L, Yang X, Gao XB, Taylor HS. The steroid hormone estriol (E3) regulates epigenetic programming of fetal mouse brain and reproductive tract. BMC Biol. 2022;20(1):93.)**

Vicki Sutherland
National Institutes of Environmental Health Sciences, National Toxicology Program

Vicki Sutherland, Ph.D., is a toxicologist working for the Division of the National Toxicology Program (DNTP) at the National Institute of Environmental Health Sciences. She serves as a study scientist for chemicals and agents selected for developmental and reproductive, neurotoxicity, and carcinogenicity evaluations by the DNTP. Currently, she is the lead on studies evaluating environmental agents and select therapeutic combinations found in consumer products and therapeutics. These studies include standard *in vivo* toxicity evaluations as well as *in vitro* and *in silico* assessments.

Title: Assessing endocrine disrupting chemicals

Abstract: Assessing endocrine disruptors, chemicals capable of altering hormonal homeostasis, is vital to understanding the risk of adverse effects on health and well-being. While exposures can occur during any life stage, impacts during embryonic development appears to be of most concern. The bisphenol class of chemicals includes over 20 analogues that have different structural, chemical, and biological activities. The primary analogue in this class is Bisphenol A (BPA), a chemical widely utilized in plastics, epoxy resins, and other products. While BPA has been extensively studied, evaluations and comparisons of other analogues is of interest due to the similarities in structure, the activity at the estrogen receptor (ER), and overall concerns about this class. Therefore, BPA, bisphenol AF (BPAF), and bisphenol S (BPS) were assessed and then compared across various studies with similar results across perinatal endpoints (decreases in body weight, reduction in pup survival noted for all three chemicals). However, differences were observed in some endocrine sensitive endpoints: dystocia, balano-preputial separation, and vaginal opening. While there were similarities in decreased body weights (dams and pups) at high doses for all three chemicals, the differences in endocrine sensitive findings were considered puzzling given the similarities in ER activities in in vitro transcriptional assays. Although there are slight differences in disposition of BPA, BPAF, and BPS, this variance likely does not explain the disparity in these endpoints. These data suggest that at high doses, BPA, BPAF, and BPS have effects on body weights and pup survival; however, endocrine sensitive findings associated appear to differ.

Hamid R Habibi
University of Calgary

Dr. Habibi received his BSc and Ph.D. degrees from Birmingham, United Kingdom, followed by postdoctoral training at St. Francis Xavier University and the University of Alberta, Canada. He joined the University of Calgary as an Assistant Professor and NSERC Scholar in 1988 and went through the ranks as an academic member. He is currently a full Professor at the Department of Biological Sciences, Faculty of Science, and an Adjunct Professor of Physiology and Pharmacology at the Cumming School of Medicine. Dr. Habibi has significantly contributed to basic research in comparative endocrinology and environmental toxicology. His research led to technologies relevant to pharmaceutical, environmental health monitoring, agri-food, and aquaculture industries. He received several international awards, including the Grace Pickford Medal by the International Federation of Comparative Endocrinological Societies and a Professorship/Lectureship in Science and Sustainable Development by UNESCO and the World Academy of Science. He was also recognized with the Award of Excellence in Community Outreach for promoting public awareness of environmental issues from the University of Calgary and an Order of Good Servant from the University of Calgary Faculty Association. He has published over 198 peer-reviewed full papers and trained over 47 graduate students and postdoctoral fellows. He is a founding co-co-principal investigator of the Advances in Canadian Wastewater Asset (ACWA) and investigates health impact assessment of environmental contaminants. He is serving the scientific community as an associate editor and member of the editorial boards of several prestigious scientific journals.

Title: Metabolic and developmental impact of environmental contaminants detected in the Southern Alberta Rivers on fish

Abstract: Contaminants of emerging concern (CECs) pose a health risk to animals and humans. However, insufficient information is available about the mechanisms by which these compounds cause adverse physiological, metabolic and pathological effects. We have previously observed a significant increase in the female-to-male ratio in wild populations of longnose dace caught downstream of municipalities along the Oldman River in Southern Alberta, Canada. We performed controlled laboratory experiments in which adult and embryonic fish were exposed to low, environmentally relevant concentrations of a selected number of chemicals detected in the river system, individually and as mixtures. Physiological, morphometric, transcriptomics and metabolomics approaches were used to investigate the mechanisms by which CECs disrupt reproduction and development in fish. Metabolomics studies demonstrate significant dysregulation of amino acid, lipid, energy, carbohydrate, nucleotide and cofactor/vitamin metabolism. Exposure of fish to a mixture of chemicals resulted in a relatively unique pattern of metabolism distinct from individual contaminants in the gonad, liver and brain. Exposure of fathead minnows to the same environmental contaminants also resulted in significant changes in transcriptome profiles. We were able to identify candidate low-dose biomarkers of chemical exposure in fish. Combined with the metabolomics data, the results provide critical information on cellular response following exposure to CECs. In other studies, exposure of developing zebrafish embryos to contaminants resulted in precocious neurogenesis via an androgen receptor and Aromatase-B mediated mechanism, linking contaminants with altered behaviour as a consequence of changes in the timing of neuronal birth. The results of our studies can be used to assess risk through a mechanism-based understanding of cell and tissue response. The overall results support the hypothesis that different chemicals identified in the Oldman River disrupt fish health by altering the gene expression and metabolism in the liver, ovary, testis, and brain. The use of the "Omics" approach led to the identification of new pathways and biological endpoints, and the findings are relevant to reveal mechanisms underlying adverse health impacts of environmental in fish and other vertebrate species.

(**This study was funded by grants from NSERC of Canada.)**

SESSION IV: The future is now – Using NAMs to elucidate the effects of EDCs

Patrick J Devine
Bristol Myers Squibb

PJ Devine obtained his Bachelors degree in Biology/Chemistry at the University of Delaware, then studied toxicology at the University of Maryland, Baltimore for a PhD involving early embryonic developmental toxicology. He went on to study reproductive toxicology as a post-doctoral fellow at the University of Arizona and as a professor at the INRS (2003-2010, Laval, QC). Major projects included evaluating mechanism(s) of chemotherapy-dependent ovarian toxicity, fertility biomarkers, and effects of pollution on frog development. PJ worked in Preclinical Safety at Novartis from 2010-2022 initially focusing on investigating endocrine and reproductive toxicity, and has expanded his focus over the years. He recently joined Discovery Toxicology at Bristol Myers Squibb (March, 2022). PJ advises drug discovery teams in multiple disease areas (cardiovascular, liver, GI, with a current focus on oncology) on safety and is focusing on investigative toxicology and safety biomarkers. Research has involved using both simple and complex *in vitro* models, as well *in vivo* models, examining mechanisms of toxicity that have been seen in preclinical or clinical studies. PJ is also involved in cross-industry consortia involving biomarkers (Preclinical Safety Testing Consortium) and evaluating microphysiological systems (Innovation and Quality consortium, IQ MPS). In his leisure time, he enjoys playing sports (soccer, volleyball, and Australian rules football), reading fiction, bird watching and traveling.

Title: Complex in vitro reproductive biology models and their possible roles in the pharmaceutical industry

Abstract: Reproductive and developmental toxicity of drugs can be important adverse effects which may lead to project termination or difficult decisions for doctors and patients for life-saving treatments. Often, reproductive toxicity is not identified until late in drug development. Effects on male or female hypothalamic-pituitary gonadal axes may be observed in early *in vivo* toxicology studies if effects are rapid and cause morphological changes in reproductive organs. More subtle impacts on fertility and reproduction are usually not evaluated until clinical trials have been initiated. *In vivo* reproductive toxicity studies are typically expensive, long and low throughput. *In vitro* assays could provide higher throughput and identify reproductive toxicity earlier in drug discovery/development, but modeling reproductive organs has proven difficult. Ovarian follicles, ovaries and testicular cells or pieces can be cultured *ex vivo* to evaluate certain questions. Isolated fallopian, uterine, epididymal and prostate cells have been cultured in 2- or 3-dimensions or developed into organoids. More complex *in vitro* models have had good success in recapitulating female hormonal and tissue cycles with human and mouse tissues. For male models, spermatogenesis has been recapitulated as far as round or elongated spermatid stages in testicular organoids or reconstituted seminiferous tubules in bicameral chambers, respectively. These models have predominantly been used for investigative toxicology or disease-related questions and have not yet found key roles in drug discovery. Further characterizations, biomarker development and adaptations of current models may aid in identifying impactful roles for these models and eventually help reduce animal use in research.

Sandeep Raha
McMaster University

Dr. Raha completed his PhD in the Department of Biochemistry at the University of Toronto and carried out post-doctoral training at the Hospital for Sick Children in the area of metabolic diagnostics. Since 2007, Dr. Raha has been a principal investigator in the department of Pediatrics, at McMaster University, and the Director of the McMaster Children and Youth University; a multidisciplinary, STEAM (science, technology, engineering, arts and math)-based outreach effort to engage children and their families in interactive education activities across the Greater Hamilton Area. His research focuses on understanding how dietary, pharmaceutical and environemental stressors impact placental function and potentially alter the post-natal health of the baby. Recently, his work is aimed at elucidating the role of the endocannabinoid system (ECS) in female reproduction; specifically its functions in the placenta and mammary gland with a view to uncovering the mechanistic underpinings of how the bioactive componnents of cannabis may disrupt the ECS.

He also applies his previous experience in the biotech sector to developing advanced *in vitro* models for toxicological testing in human tissues. His current efforts are directed at developing a functional construct of the maternal fetal-interface, in collaboration with D. B. Zhang (McMaster University).

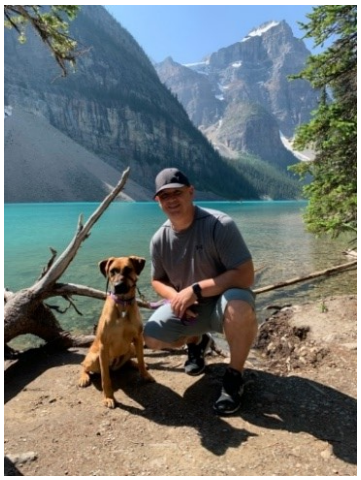
Title: A journey to developing a microphysiological model of the human maternal-fetal interface: Past lessons and future challenges

Abstract: Assessing safety in reproductive biology can be challenging. Animal models do not accurate emulate the functions of the human placenta. Simple *in vitro* 2D-cell culture models do not reflect the complexity of the human uterus. To address this issue, we along with others, have focussed on the development of microphysiological models of the human placenta. Human trophoblasts demonstrate several distinct functional characteristics that are important for the processes of placentation (i) invasion (ii) syncytialization and (iii) regulation of the transport of wastes and nutrients. Our team has attempted to address this complexity through the use to two distinct models.

We utilized extravillous trophoblast (EVT) spheroids embedded in a 3D matrix to model early placentation and trophoblast invasion of maternal tissues. We demonstrate that the spheroid architecture significantly alters the gene expression pattern of the EVT trophoblasts. Furthermore, this model can be utilized to assess trophoblast invasion in response exogenous drugs such as delta-9-tetrahydrocannbinol.

To assess trophoblast syncytialization and transplacental transport we utilized commercially available BeWo cells derived from a choriocarcinoma, as well as a placental stem cell line derived from human blastocysts. We describe the development of two different microphysiological models for the assessing the function of the maternal-fetal syncytium. The first was produced by culturing BeWo and human umbilical vein endothelial cells (HUVEC) on contralateral sides of an extracellular matrix coated transwell insert. A more advanced model consists of the incorporation of blastocyst derived trophoblast stem cells in a 3D-matrix with HUVEC derived vasculature. This structure was incorporated in an IFlowPlate™, for high throughput evaluation of placental barrier function. This model more closely emulates the architecture of the human maternal fetal interface.

(**Co-authors: Michael Wong, Sonya Kouthoridis, Boyang Zhang)**



Steve Wiseman
University of Lethbridge

Steve Wiseman is an Associate Professor and Canada Research Chair (Tier 2) of Aquatic and Mechanistic Toxicology, in the Department of Biological Sciences at the University of Lethbridge. He received his BSc from Mount Allison University, and his MSc and PhD from the University of Waterloo. His PhD research focused on the effects of dioxin-like compounds on physiological stress in fishes. Following completion of his PhD, he moved to the University of Saskatchewan where he completed a post-doc under the supervision of Prof. John Giesy. Today, his research focusses on identification and characterization of mechanisms by which chemical stressors cause adverse effects in fishes and use of this information to develop predictive tools in ecotoxicology. Currently his lab is exploring: 1) endocrine disrupting effects of environmental contaminants and development of novel approaches to predictive impairment of reproductive performance, 2) toxicity of dioxin-like polycyclic aromatic hydrocarbons (PAHs) and other emerging contaminants to early life-stages of fishes, and development of quantitative adverse outcome pathways to predict embryotoxicity across phylogenetically diverse fishes.

Title: Inhibition of oocyte maturation as a mechanism of endocrine disruption in fishes: toward development of novel approaches to predict impaired reproductive performance

Abstract: There is concern regarding potential impairment of fish reproduction associated with exposure to chemical stressors. To date, studies of mechanisms of reproductive impairment have focused primarily on decreased fecundity due to dysregulation in steroidogenesis which regulates synthesis of vitellogenin that is required for oocyte growth during oogenesis. An understudied mechanism by which anthropogenic chemicals could impair reproduction in fish is inhibition of oocyte maturation, which is a critical step in oogenesis during which the oocyte becomes fertilizable. Maturation is regulated by maturation-inducing hormone (MIH) which acts upon membrane progestin receptors (mPRs) on the oocyte and signals formation of maturation-promoting factor (MPF), which promotes oocyte maturation. Studies have demonstrated inhibition of MIH stimulated oocyte maturation by anthropogenic chemicals, *in vitro,* using immature stage IV oocytes from the zebrafish (*Danio rerio*). However, how inhibition of oocyte maturation by chemicals could cause ecologically-relevant effects on reproductive performance requires further investigation, including in disparate species that might differ in sensitivity. Therefore, using the zebrafish assay as a starting point, research in my lab is interested in 1) adapting the *in vitro* oocyte maturation assay to assessments of disparate fishes to facilitate studies of potential species differences in sensitivity to chemical induced inhibition of MIH-stimulated oocyte maturation, and 2) determining whether this assay can be used as a tool to predict decreased fecundity. We have adapted the zebrafish *in vitro* assay to assess inhibition of MIH stimulated oocyte maturation using Japanese medaka (*Oryzias latipes*), and studies with fathead minnows (*Pimephales promelas*) are underway. Using these *in vitro* assays in tandem with reproductive toxicity tests, our studies to date suggest that there is potential for *in vitro* oocyte maturation inhibition assays to predict impacts on reproductive performance and that inhibition of oocyte maturation warrants greater consideration as a potential mechanism of reproductive impairment in fishes.

(Steve Wiseman[1], Darren Van Essen[1], Justin Miller[1], Yamin Raza[1], Chloe Devoy[1], Dani Jakovljevic[1], Jon Doering[1,2]
[1]Department of Biological Sciences, University of Lethbridge, Lethbridge, Alberta, Canada
[2]Department of Environmental Sciences, Louisiana State University, Baton Rouge, Louisiana, United States)

Natacha Hogan
University of Saskatchewan

Dr. Natacha Hogan received her PhD in Chemical and Environmental Toxicology from the University of Ottawa in 2007 followed by a post-doctoral fellowship with the Canadian Rivers Institute. She held a term position as a faculty member at the University of Prince Edward Island then moved to the University of Saskatchewan in 2011 where she is currently an Associate Professor, cross-appointed to the Department of Animal Science and the Toxicology Centre. Her research group uses in vitro approaches, embryo bioassays and other new approach methods (NAMs) as screening tools to prioritise chemicals for more extensive adverse effect characterization. In this context, previous and current research in her lab have elucidated mechanisms of action and effects of pesticides, pharmaceuticals, antimicrobial compounds, and other emerging contaminants as well as complex environmental samples such as contaminated groundwater, municipal wastewater effluent, and oil sands process-affected waters.

Title: Using Embryo Bioassays in Toxicity Assessment of Emerging Contaminants

Abstract: Current hazard assessment approaches for emerging contaminants, including endocrine disruptors, rely heavily on live animal testing and are therefore expensive, time-consuming, prone to uncertainty, and of significant ethical concern. Regulatory bodies have recognized these concerns, triggering a paradigm shift toward the development of alternative approaches rooted in mechanistic toxicology. Examples of emerging approaches under this paradigm shift are the utilization of embryos as surrogate models for adults and the use of toxicogenomics' technologies to elucidate mechanisms of toxicity with the aim to predict apical outcomes of regulatory relevance. This talk will explore the advantages and limitations with generating and using data from embryonic exposures to reliably link mechanistic information to adverse outcomes. I will also describe the development and application of a novel standardized reduced transcriptome assay (the EcoToxChip system, www.ecotoxchip.ca), which uses short-term embryonic exposures elucidate molecular response patterns across model species representing three vertebrate taxa (amphibian, bird, fish).

Vladimir Elias
Eurofins

Vladimir O. Elias is R&D and Best Practices Director of Eurofins Latin America, holding a master's and doctorate in organic chemistry. Dr. Elias joined Oregon State University in 1995 as Faculty Research Assistant and has almost 30 years of experience in analytical chemistry applied to various business segments such as natural products for medicinal and pharmaceutical application, chemical compounds used as chemical weapons and analysis of environmental and food matrices for a variety of companies.

Title: Advanced Methodologies for the Determination of Endocrine Disrupting Compounds in Biological and Environmental Samples

Abstract: In recent years, the potential impact of endocrine disruptor compounds (EDCs) has increased on a global scale. Never has exposure to EDCs and other compounds like persistent organic pollutants (POPs) and emerging pollutants, among others, been so high.

EDC analysis is important across a number of different matrices, including food and feed, biological samples, plants, air, industrial products, residues, sewage and water. EDCs are characterized by their ubiquitous presence at trace-level concentrations and their wide diversity. Since the discovery of the adverse effects of these pollutants on wildlife and human health, highly sophisticated techniques and advanced instruments have been used for their qualitative and quantitative determination.

Endocrine disruptor 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), for example, has been demonstrated to disrupt hormone signalling, reduce fertility, interfere with embryo development and cause spontaneous miscarriage in humans. Dioxins and furans are one of the most difficult analyses to perform, requiring detection of very low levels of substances (one part in 1,000bn). Furthermore, the distinction of each substance among the very similar dioxins and PCB molecules necessitates the use of highly sophisticated techniques and advanced instruments. More recently, another class of compounds - per - and polyfluoroalkyl substances – known as PFAS - have attracted a lot of attention because of their widespread use and their persistence in the environment. Low levels of PFAs are found in the blood of humans and animals all over the world, as well as in a variety of food products and the environment. Scientific studies have shown that exposure to some PFAs may be linked to harmful health effects.

This work focuses on the use of advanced analytical techniques of important EDCs of different chemical classes in complex environmental and biological matrices. Moreover, the use of automation for preparation and analysis of a large number of samples is also discussed.

Abstracts List

Posters are to be set up in the International Ballroom on December 1 between 7 and 8:30 AM and removed during the afternoon coffee break on December 2. Full abstracts are available in the digital booklet emailed to all attendees.

Poster Number	Title and Authors
1	**Characterizing the role of Peroxisome Proliferator-Activated Receptor γ (PPARγ) in Ductal Carcinoma *in situ* (DCIS) and Invasive Ductal Carcinoma (IDC) Cell Lines** **Madeleine Carew**, Natasha Iaboni, Rachel R. Rubino and Christopher JB Nicol
2	**Assessing the epigenetic toxicity of the flame retardant triphenyl phosphate in an aquatic *in vitro* model** **Logan Germain**, Dr. Sidra Shafique, Sydney Wolpert, Dr. Louise Winn
3	**Effect of seleno-L-methionine on hepatic glucose and lipid homeostasis: Potential role of peripheral serotonin** **Zaineb Hamoodi**, Laiba Jamshed, Jessica Moreira, Abithiny Selvarajah, Janelle M Baker, Philippe J. Thomas, Alison C. Holloway
4	**Characterizing the Cytotoxic Effects of Environmentally Relevant Pesticides Using the RTGill-w1 Cell Assay** **Sophie Emberley-Korkmaz**, Jessica Head, Stephane Bayen, Niladri Basu
5	**Translation of health-based guidance values for perfluorooctanoic acid (PFOA) into biomonitoring equivalents** **Ernest Tewfik**, Nolwenn Noisel, Annie St-Amand, Marc-André Verner
6	**Acute Toxicity and Antidiabetic Screening of Roots Extract of *Sansevieria liberica* Gerome & Labroy (*Dracaenaceae*) Using Streptozotocin-Induced Diabetic Model** **Amao Omowunmi S.**, Arikawe Adesina, Ikumawoyi Victor, Oke Folashayo
7	**Toxicity induced by exposure to trace elements associated with unconventional natural gas exploitation (UNG) on rat fetal testis** **G. Balbaaki**; VC. Lim; MA Verner; C. Vaillancourt; E. Caron-Beaudoin; G. Delbès
8	**Impact of Oxidative DNA Damage on Gene Expression Pathways in the Mechanism of Developmental Disorders** **Ashley Cheng**, Peter G Wells
9	**Phase-specific density and proximity metrics for oil and gas wells: Exposure estimates in the EXPERIVA study** **Coreen N. Daley**, Élyse Caron-Beaudoin
10	**Assessing levels of oxidative stress biomarkers in pregnant women living in the vicinity of oil and gas sites in Northeastern BC** **Matthew W. Day**, Yifan Wu, Élyse Caron-Beaudoin
11	**Using metabolomics to improve the prognostic information of human Colorectal Cancer samples** **Natasha Iaboni**, David Hurlbut, Martin Kaufmann, Kevin Yi Mi Ren, Amoon Jamzad, Vanessa Wiseman, Parvin Mousavi, Gabor Fichtinger, John F. Rudan, Antonio Caycedo-Marulanda and Christopher JB Nicol
12	**Naphthenic acid fraction components alter lipid homeostasis in 2D and 3D cultured hepatocytes via PPARa activation** **Laiba Jamshed**, Richard A. Frank, L. Mark Hewitt, Philippe J. Thomas, and Alison C. Holloway
13	**Exposure to brominated flame retardants in utero and through lactation impacts the development of breast cancer and the presence of metastasis in the lungs** **Melany Juarez**, Alec Mcdermott, Mike Wade, Isabelle Plante
14	**Benchmark Concentration Modeling and ToxPi Analyses for Potency Ranking of the Effects of Organophosphate Esters on Human Adreno-carcinoma (H295R) Cells** **Zixuan Li**, Bernard Robaire, Barbara F. Hales

15 **Associations between estimated occupational exposure to endocrine disruptors and colorectal cancer risk in the Alberta's Tomorrow Project**
Laura Pelland-St-Pierre, Marc-André Verner, Vikki Ho

16 **Examining the impact of dioxin and dioxin-like chemicals on human pancreatic beta cell function via use of human stem cell-derived beta-like cells**
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17 **The effects of phenanthrene and chlorinated phenanthrene on steroid production in rat ovarian granulosa cells**
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18 **Characterizing the relationship between arsenic exposure and breast cancer risk in Canada**
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19 **Chronic dietary arsenic exposure induces neurotoxicity, impairs reproductive performance, and induces developmental effects in zebrafish (*Danio rerio*)**
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20 **Breath, Blood and the Brain: Modeling how changes in stress hormones following air pollution exposure affect the brain's immune cells**
Mercedes Rose, Jessica Hursti, Errol Thomson

21 **Potency analyses of organophosphate esters on KGN human granulosa cells using high-content imaging and transcriptomics**
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22 **Effects of six environmentally relevant organophosphate esters on HepG2 human liver cells**
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23 **Multi-element Biomonitoring of Welding Fume Exposure in Apprentices**
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24 **Contaminated Sites and Indigenous Communities in Canada and the United States: A Scoping Review**
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25 **Effect Polystyrene Nanoplastics on The Testis and Epididymis of the Mouse**
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26 **Mapping of endocrine disrupting chemicals in urban air**
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27 **How do maternal serum per- and polyfluoroalkyl (PFAS) concentrations vary over the course of lactation?**
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29 **The Impact of Cannabidiol on Cellular Stress and Differentiation of Trophoblasts**
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30 **Glyphosate and glyphosate-based herbicide (Roundup©) alter inflammatory pathways in human trophoblasts**
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31 **Effects of brominated flame retardants exposure during gestation and lactation on Sprague Dawley rats' mammary glands**
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32 **Transformation of Cd-containing quantum dots during simulated human digestion increased adverse subcellular effects on intestinal cells**
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35 **New Neurons on-a-chip Platform Enables Big Data Generation Through a Top-Down Screening Approach for In-Depth Chemotherapy Induced Neuropathy Screenings**
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36 **Halogenated polycyclic aromatic hydrocarbons induce NLRP3 inflammasome and prostaglandin biosynthetic pathways in extravillous trophoblast cells**
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37 **Determination of blood:air, urine:air and plasma:air partition coefficients of selected microbial volatile organic compounds**
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44 **Gestational benzene exposure perturbates the expression of DNA repair genes in murine placenta**
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47 **Transformation of Cd-containing quantum dots during simulated human digestion increased adverse subcellular effects on intestinal cells**
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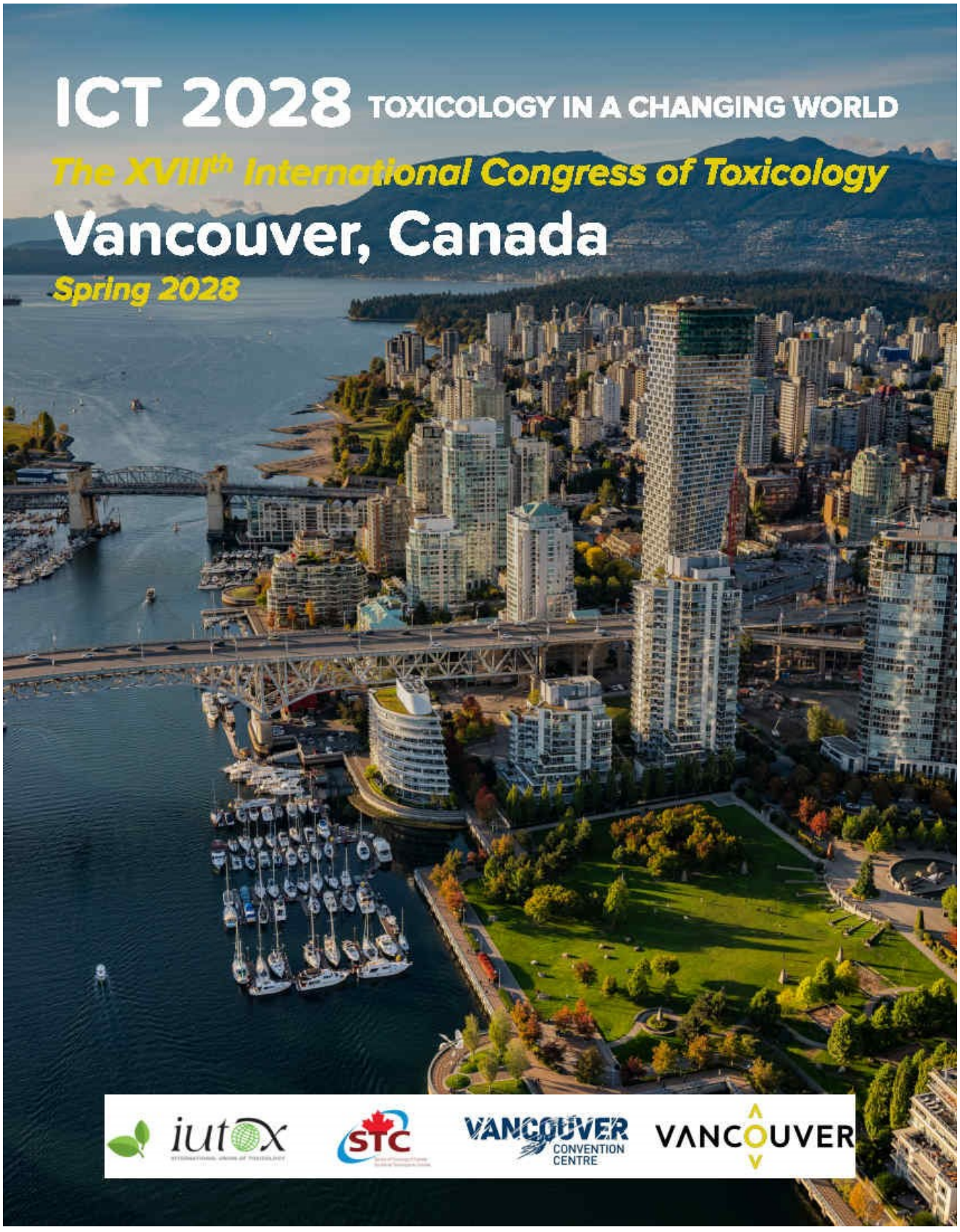
Symposium Social Events

Meet & Greet @ Featured Ottawa Restaurant
5:30 pm onwards @ Queen Street Fare www.queenstfare.ca
Reservations made for STC guests for dinner (*pay as you dine*)

President's Reception & Awards (*Lift Lounge*, Delta Hotel Ottawa)
6:30 pm All attendees are welcome
(F*inger foods & refreshments provided and cash bar*)

11:45-12:15 Chair Yoga (optional guided practice)

55th Annual Symposium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