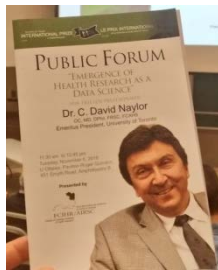


Before CSPC — Highlights from David Naylor's Friezen Prize lecture, Nov 6 2018 at the University of Ottawa



Other nations are moving much faster than Canada for bridging data science and health, to drive personalized medicine.

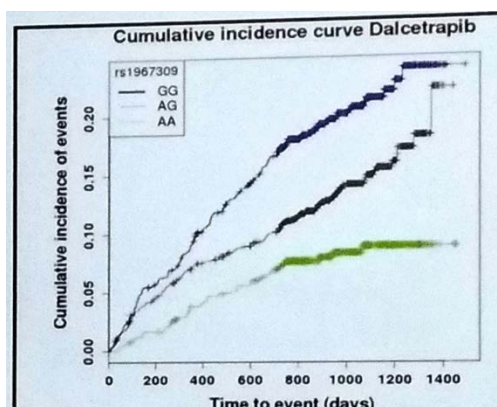
These slides acknowledge past advances in health research, and they are filled with old white men — we have to realize this, and things must change.

On evidence— interpretations vary widely including in healthcare delivery, leading to many "Grey zones" of clinical medicine and the establishment of "halfway technologies" that do not offer definitive results.

Evidence-based medicine and randomized clinical trials as we know them today, and by and large the field of clinical epidemiology, stemmed from a breakthrough report by Archie Cochrane.

- Even with formal reviews of recent evidence, and after discussions among leading experts to promote consensus, physicians often disagree on what should be done when faced with the same clinical scenarios...

- INTERPRETATIONS of EVIDENCE VARY by nation, by specialty, and by subspecialty...



How much better would treatment be if we can better account for a broader range of determinants? Looking only at minor gene variants can identify subsets of patients that respond, others not. Data is a must for personalized medicine. Without it, predictions are just guesses.

Precision medicine emerged as a priority for healthcare in Canada in the 2015 report. Naylor argues there is still no serious plan to drive evidence based medicine in Canada. Shotgun therapy still prevails. Actions are being made, but we are still behind internationally



Chapter 7. CHANNELING THE DATA DELUGE, MAPPING THE KNOWLEDGE FRONTIER

- 7.1 Through the Healthcare Innovation Fund and new Agency, develop and initiate a national Strategy for Implementation of Precision Medicine, in concert with provinces, territories, healthcare and health research agencies, and a range of relevant stakeholders and experts.
- This field is characterized by a blurring of the lines between applied research, innovation, and implementation at scale. The Strategy should seek to leverage Canada's diverse populations and single-payer healthcare systems as a competitive advantage.
 - The Strategy should include development of a roadmap of steps needed to ensure that Canada's health information and communications technology can support data-intensive models of care and the rapid cycle innovations that characterize this field.

REPORT OF THE ADVISORY PANEL ON HEALTHCARE INNOVATION



The UK leads in this field. Just last month they approved funding the sequencing of a cohort of 5 million people. The US has the All Of Us project, where they are matching sequencing data to clinical data for millions.

Budget 2018 had serious wording about big data, which helps, it is a meaningful sum, but it doesn't replace a formal strategy. We have an opportunity to deliver precision medicine in Canada.

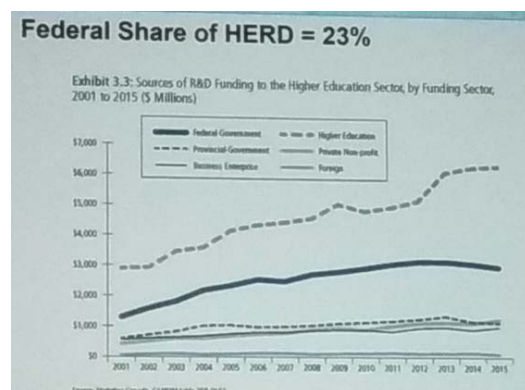
Budget 2018 *Harnessing Big Data*

Big data has become an essential tool for progress in science, underpinning world-class research across all disciplines. Improved technologies, such as cloud computing and faster networking, allow for new opportunities to address scientific challenges. For example, medical researchers in genomics can use advanced research computing to analyze genetic sequences to look for DNA-related changes that might cause cancer or dementia. Eventually, researchers may be able to develop personal medical treatment plans for patients based on genetics, age and behavioural data, improving health outcomes. Improved access to essential digital research tools and services will strengthen Canada's reputation as a global leader in science, research and innovation. **The Government proposes to provide \$572.5 million over five years, with \$52 million per year ongoing, to implement a Digital Research Infrastructure Strategy....**

The new generation of early career researchers is more diverse, has a healthy disrespect for the old ways, is more interdisciplinary, and is more innovative. We need to support them, and that includes early career faculty and trainees at all levels. An important down-payment was made in Budget 2018 for Canadian Science and for our young talent. We now have to provide solid support for graduate students and post-docs moving forward.

Federal-Provincial panel, David Naylor Keynote

CSPC opens with a keynote from David Naylor and a panel on better federal-provincial collaboration. Naylor open with a quip — “We really put the FUN in dysfunctional! Canada is a relatively small country on a population standpoint, but we are ever smaller if we are divided across provinces”



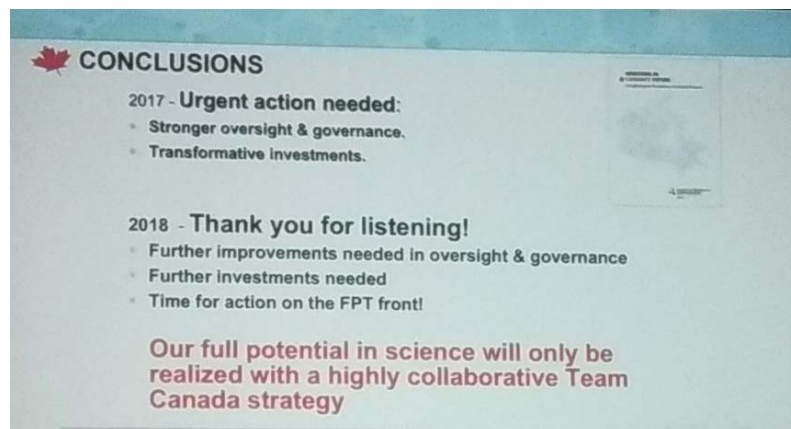
He follows by saying that the majority of dollars in HERD come from universities, not the federal government. To note, provinces don't contribute much either, though Québec has been a model to follow.

Canada doesn't collaborate well across provincial borders, they work much more with international partners. We have a chance to knit Canadian research closer together and make our science more national, we have a chance to realign. The full potential of Canadian research will only be

unleashed with national support, and urgent actions needed for [#Budget2019](#) and beyond to do so.

He also mentions notably that NCEs can be reimagined to link research-driven collaborations across the country, rather than just partnership-driven collaborations.

Trainees are the most likely to cross international and provincial boundaries, they will drive the future of Canadian research, and they need support!



Mona Nemer thanks Naylor and Gilles Patry for helping to bring about her position as Chief Science Advisor. She wants us to think about 3 areas.

1. How do we develop national action plans? Dr. Naylor talked about a plan for precision medicine in his Friesen lecture on November 6, 2018, for example.
2. Training & talent development. We have more students now in colleges and universities; we need more space, more professors, and more federal support for the tri-council into those areas.

3. Big science & big data infrastructure. There are strategic & practical considerations to fostering these.

Nemer adds that more provincial chief science advisors would be a big help, in addition to more departmental science advisors at the federal level.



Michael Strong, the new President of CIHR, says the roadmaps built so far – including the new impact center report out of the University of Toronto — are useful but often redundant. There should be better whole of government approaches moving forward, better logistics.

CIHR-funded trainees know they are not heading to academic careers, yet we still train them for those 8% who "make it" in academia. We need to shift and broaden training to be inclusive of broader careers. But, how do we train the next generation of researchers if they don't know yet if they will be researchers? The pipeline is not as relevant as it once was. The Health System Impact Fellowships are one way, but keep an eye out for June 7, 2020. This is the 20th anniversary of CIHR, a 10-year strategy released by then.

Janet Rossant, President of the Gairdner Foundation, notes the importance of fundamental research, that getting answers requires money, patience, and thick-skinned researchers. The latest Nobel Prize winners for medicine were studying T-cells and didn't expect their work to lead to immunotherapy.

Marc LePage says 70M\$ of Genome Canada's funding is federal, 50M\$ provincial, and 50M\$ is from industry. There are 6 regional offices across the country, that each have their own priorities. More federal-provincial cohesion and dialogue benefits all.

As the only provincial representative on the panel, Krista Connell says it isn't just about money. She agrees that federal/provincial strategies are too often disjointed and ad-hoc.



Provincial research agencies have come a long way and should be at the table — they bring value. Federal government, agencies, and universities have ignored the voice and place at the table of provincial agencies. Yet, provincial agencies hold peer reviewed competitions, support discovery research, fund trainees.

A representative of Yukon College (soon, University) asks what considerations there are in the federal-provincial research infrastructure for northern communities and scientists. Naylor says lots of work remains ahead but the "All Boats Rise" theme of Fundamental Science Review stays true for them and for indigenous people as well.

Mona Nemer Luncheon

Mona Nemer congratulates Mehrdad Hariri and his team for the 10th anniversary of CSPC, and on the success of Science Meets Parliament for facilitating great dialogue for science policy and Canadian science in Parliament. She also thanks the community for being there and answering the call when they were needed, including groups like Let's Talk Science that foster a culture of science in Canada.



Building the OCSA was a challenge similar to Early Career Researchers just starting up a lab, and she believes she has built an excellent team. Some of her top files include:

- Drafting science integrity policy, a very important code of conduct for scientists and employers defining scientific freedom and ability to communicate freely;
- Aquaculture policy;
- Setting up departmental science advisor network like UK, Australia, and elsewhere. A DSA network has started to develop via NRCan, NRC, CSA, and DFO.

She has been honoured to take part in the CRCC and be invited to participate in science based departments to work more collaboratively and ensure no gaps (scientific, policy, or economic) are left behind. This is a step towards a whole of government strategy. She mentions that with her office Canadian science has taken place at the table, including at international meetings and with the G7. She gives a particular shout out to the mandate letter on oceans and plastics, which is a grand challenge and a priority.

On the federal budget, Dr. Nemer reiterates that continued support for science is important, and that the 2018 budget was a solid down payment. The championing of science by Minister Duncan and PM Trudeau are very welcome by the community.

Questions (from Mehrdad Hariri, unless otherwise specified):

1. **How will the DSA network improve evidence informed policy in ways existing science officers cannot?** There is a strong need for extra hands to help ADMs thru this role, to create bridges.
2. **How is Canada faring compared to other countries on science advice in government?** Dr. Nemer points to some of the great work from Paul Dufour outlining this in his previous reports.
3. **If the public asks, why do we need a Chief Science Advisor, what do you answer?** The public does value this office (they have said so!), and the presence of an objective advisor who can

challenge policy where more evidence is required, and who can give trustworthy advice, is valued

4. **How should we promote talent development and HQP?** Strong research generates great ideas and great talent; this is something that must stay at the forefront of our minds. Broader HQP questions should go towards the Prime Minister Trudeau and Ministers Bains and Morneau.
5. **Dr. Kirkwood from NRCan asks, how can we support young researchers looking to contribute to science policy?** Mona Nemer gives a glowing recommendation to Science & Policy Exchange and agrees we need to support these career paths.
6. **Anthony Morgan, CEO of Science Everywhere, asks about funding for science literacy and science communication towards the adult public (not just K-12). What kind of federal support is there for this?** Mona Nemer says that the government is serious on science and evidence-based decision-making, and this is a gap we need to address.
7. **Someone from Global Affairs Canada working on S&T asks, how can IP created in universities be leveraged to attract international projects and to compete internationally?** Mona Nemer clarifies that we can't look at IP monolithically. Drugs take longer to develop than software. This is important among many priorities

The many ways in which the next generation can be involved in the governance of research



Jean-Christophe Belisle-Pipon is a post-doc at Harvard University, a long-standing member of Rémi Quirion's *Comité Intersectoriel Étudiant*, and a board member of FRQS. He introduces the very first panel organized by CIÉ. Panelists:

- Blake Freier (Waterloo, alumni of Science Outside the Lab North)
- Tina Gruosso (Forbius, co-President of Science & Policy Exchange)
- Madison Rilling (Laval, Vice-President of CIÉ, board member of FRQNT)
- Donna Kirkwood (Chief Scientist, NRCan)
- Paul Dufour (President of PaucityWorks, Professor at uOttawa and ISSP)

Paul Dufour mentions that CSPC received support from the FRQ, and Dr. Quirion is now co-chair of INGSA. In Tokyo, they announced that 2-5 Nov 2020 will be a joint INGSA-CSPC conference.



A new interesting report, called NISR, National Inuit Strategy for Research, was highlighted as something to read. One recommendation touches Mona Nemer's comment on integrating science advice from different sources — a deputy science advisor from territories.

There has been a tipping point in science policy, where students and post-docs have started paying attention. This panel comes with recommendations.

About the speakers:



Blake Freier is an alumni of SOTLnorth and PhD of Philosophy from Waterloo studying the use of evidence in decision-making. SOTLnorth is a science policy bootcamp in Canada that brings knowledge and connections. Applications are open for the next cohort.

Tina Gruosso is a new Co-President at Science & Policy Exchange, a non-profit that creates platforms for science policy dialogue and is a springboard for trainees to get into the field. They also represent trainees in policy at both the federal and provincial levels. As a French postdoc, she saw a friend in the lab working nights and weekend at SPE, then got hooked herself. She says these trainees are brave, and they learn by doing. They bring their own chairs to the table.





Madison Rilling is a member of the *Comité Intersectoriel Étudiant*, which works under the FRQ and the chief scientist Rémi Quirion. His global role is to bring advice to the ministry, and in 2014 he built up the CIÉ to get advice of his own, from the next generation of scientists. The CIÉ exists in a lasting way within the governance structure of the FRQ; every agency board has a student member as well. Rilling sits at FRQNT and Belisle-Pipon at FRQS.

Donna Kirkwood works at NRCan as Chief Scientist.

From a geology PhD, she stumbled upwards into this position. This is a shop at NRCan on integrating science better into policy where half the department is composed of scientists and 70% of the budget is dedicated to science and research. Young folks out of university wanting policy experience can join NRCan via a dedicated 3-year program. They hire 40-60 analysts per year. They also hire student scientists, who can be exposed to the policy side. They also host Mitacs Science Policy Fellows.



Expanding on the work done at Science & Policy Exchange, Gruosso mentions a few key events:

- Public forums, held in Montreal, have been largely funded by CIHR. 2017 forums focused on genomics (gene editing and genetic sequencing), while 2018 forums were on the policies regulating cannabis and opioids.
- They wrote a white paper on STEM education in 2016, which highlights the metrics used to evaluate researchers as a major barrier to opening career opportunities for trainees.
- They collected support from 300,000 trainees across Canada for an open letter supporting the Naylor report, which was submitted to the Budget 2018 consultation.
- They are running a survey on scholarships and fellowships for Budget 2019, with over 850 respondents so far.
- They plan to bring together the trainee community in science policy via a “science policy network”, and are now starting to engage with other groups to develop this platform.

Kirkwood highlights the major impact students and trainees can have, now and in their up and coming careers, and that a network would be a good way to share resources, skills, network, successes, and failures. Trainees can bring fresh ideas, and they are most affected by the policies regulating science.

Representatives from SSHRC and NSERC in the audience ask to find out more about trainee-led initiatives like these, and Liz Boston notes that diverse careers do need more support. The question is, **how can professors be convinced?** Gruosso says metrics drive what careers are supported. Broader definitions of excellence would be a game-changer. Rilling agrees and cites that many other papers do so as well, including work by the CIÉ.

On building capacity for trainees in science policy, Belisle-Pipon notes that the patience of Dr. Quirion in letting the CIÉ grow and mature was vital. Gruosso says having a champion and mentor is one way, another is the SPE model of bringing your own chair to the table and building capacity at grassroots

level. Rilling adds that, once that seat at the table exists for a student, make it sustainable so that other trainees can take that space when turnovers happen.

A student asks, how can someone get involved without resources? Gruosso says this is the point of having a network that can provide support and accessibility. Alana Westwood (Mitacs Science Policy Fellow at NRCan) adds that Evidence for Democracy has served as a network and training incubator as well.

Westwood asks, given that not many trainees get through selective programs like Mitacs', how do we democratize opportunities? Freier says he found out about SOTLnorth via his thesis supervisor, and sensitizing academia in general may be a way to ensure more have access to opportunities

Enabling interdisciplinarity for the next generation of problem solvers

Panelists

- Steven Cooke (Carleton)
- Shohini Ghose (Laurier U)
- Vivian Nguyen (Mitacs Science Policy Fellow, now NRCan)
- Andrea Jane Reid (UBC and Carleton).

Ghose leads the Women in Science Centre at Laurier University and works in physics and computer science including quantum. There is no

choice to cross disciplines in her research, which also bridges into the social sciences. She mentions “Her Space Time” as a cross-disciplinary event that merges art and sciences to promote women’s research.

She also gives the example of the Heisenberg uncertainty principle to outline that uncertainty is a superpower. There's no way to know every property of an electron; similarly, security, encryption, and teleportation all depend on embracing uncertainty. If disciplines are the norm, interdisciplinary is the superpower.

Nguyen now works at NRCan and was always multidisciplinary. She had a social science thesis despite studying biology. This led her to the Mitacs Science Policy Fellowship program, a real shift from academia, to drive impact.

Reid is an indigenous scientist working on salmon ecosystems from multiple perspectives. The impact of changes in those ecosystems is far-reaching especially for indigenous communities, and the combined lenses from each discipline are necessary to understanding this system.

What are the barriers and enablers of interdisciplinarity? Reid says funding, publishing, and university programs are generally monolithic. Finding multidisciplinary grants (she points to a new one at National Geographic) and broad interest impactful journals is not easy.



Science and the next generation: Partnerships and collaborative infrastructure as enablers



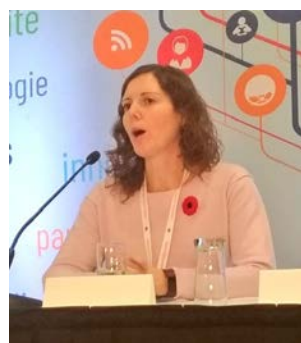
Panelists

- Mona Nemer (Chief Science Advisor)
- Martha Crago (VP Research at McGill University)
- Stacey Robinson (Research Scientist at ECCC)
- Dan Wicklum (Oil Sands Innovation Alliance)
- David Castle (VP Research at University of Victoria)



Mona Nemer notes the reinvestments of 2.8B\$ in Budget 2018 to create more collaborative infrastructure in government labs and beyond. This is a once in a lifetime opportunity to get things right and elevate Canada in science leadership. All major equipment in federal labs will be part of a CFI registry and be accessible to everyone, thus democratizing the infrastructure of Canadian science.

David Castle replaces Kate Moran on the panel. He is VPRI of the University of Victoria and vice-chair of the board for TRIUMF. He mentions the Strategic Infrastructure Fund which helped build space for new labs at Victoria, supporting many collaborations.



Stacey Robinson is a research scientist at Environment and Climate Change Canada, who collaborates internally and externally including at Carleton. Engaging with students and giving them experience of in government labs is an important part of her work.

Dan Wicklum works at Oil Sands Innovation Alliance and collaborates with companies, helping them develop and share IP, leveraging funding and infrastructure to drive innovation.

Martha Crago asks, why should there be a border btw intramural and extramural science? If one lab needs machines and resources, and they are gathering dust elsewhere, why not share them? Infrastructure is key to all research. When the U15 university VP Research group noticed that CFI funding could be matched with other



funds, and not be stacking, this was a game-changer! Now that the Royal Victoria hospital is being repurposed by McGill, the plan is to be a more communal and collaborative space where resources aren't constrained to the walls around them. Building capacity to drive joint ventures, like the Marine Commercialization Centre which eventually led to funding the COVE project, is possible and should be done! COVE gives companies and labs waterfront space to ask and answer critical questions.

Caste adds that physics and astronomy communities depend on large infrastructures and have decade-long plans for systematic capacity building, including new shared facilities. We can't say this for biology, oceanography, or many other fields. What are the pain points for access to infrastructure? It has to fundamentally start with the nature of the work researchers want to do, and to align common interest as joint funding asks to build inclusive capacity and infrastructure.

Mona Nemer asks, how do biologists get our act together? Robinson responds that important questions must be asked — who is responsible when an important machine breaks? Having space to test things out is also key (COVE is a good example).

This outlines two key points for Nemer:

1. Maintenance of infrastructure requires more structure;
2. Defining what infrastructure is. It's not just machines and labs, it's also land and space and engagement for researchers to get their hands dirty outside those walls.

Wicklum adds that a major tool to break down barriers and bridge gaps is the collective need from diverse groups. This includes startups — for them, large prizes like a 20M\$ Carbon X-Prize to turn CO₂ streams into a usable product are a great innovation driver.

On trainee and talent support, Castle says we need to look internationally for good models of infrastructure management. And, we need to foster those research scientists that drive science forward as middle authors, not just the principal investigators and trainees. For example, a CFI-funded platform At Victoria University for scanning electron microscopy is hiring a facility manager and research scientists that can support the physical infrastructure. This will greatly benefit trainees and labs across the university.

Mona Nemer asks, how is the graduate student experience in government labs different from those in academic labs? Robinson says the pathways for permission are larger on government side, but there are often broader perspectives available to students for diverse career development than in academia.

A representative of CANARIE asks about security and privacy in a more open research infrastructure. Crago says there are challenges but now that we are facing the internationalization of research we can't stay closed.

How do you see the private sector contribute to research more effectively? Nemer clarifies via calling out to Liz Boston from NSERC, that industry letters aren't required (though suggested) for discovery grants. Nemer adds that we need to strengthen research infrastructure broadly, and that includes many partners. To that end, she announces an open invitation to the community, to send her their

definition of infrastructure for research, so that the definition used fits the community's needs broadly. Castle specifies that infrastructure and space are not necessarily the same.

With big data and advanced computing (both counting as infrastructure), more researchers are becoming trans-disciplinary. If we support more collaborative infrastructure, would researchers bury back into their silos or stay collaborative? Robinson says she wouldn't change back. There is much to learn from collaborations, and being in your own little world limits your perspective and your impact. Crago mentions that she did basic research as a language expert that included teaching northern communities and learning from them. This engagement was of immense value. This value parallels in crossing borders btw academia/industry, fundamental/applied, science/policy. That being said, collaboration is a skill that can be developed, but it shouldn't be forced. There are a lot moving parts especially across academia and industry, where you can go faster alone but further together.



Monica Granados, a current Mitacs Science Policy Fellow, asks about open data, and where this fits in the infrastructure discussion if industry collaborators may have other priorities (like IP)? Wicklum says that specific open datasets are being built, and its importance is recognized in the oil sands sector.

Crago adds that there are good examples in Montreal. The Montreal Neurological Institute is 100% open access. Open data is less clear with the AI supercluster and the fact that new IP is being developed through collaborations with industrial giants like Facebook. Whose data is this? These are good questions that should drive further developments. Nemer reiterates the commitment to open science and open data in her office and across the government; this is something championed by Minister Duncan as well.

Anne Webb from NSERC asks, how can developing new infrastructure promote equity, diversity, and inclusion? Castle says that Victoria University are building capacity to get NRC researchers to join shared facilities, and that democratizing data and improving access will help as well. Nemer says this is increased facility access is an opportunity for early Career Researchers that don't have the capacity in their young labs yet.



Shawn McGuirk, Mitacs Science Policy Fellow at NSERC, asks the speakers to describe from their interactions with industry — what is the appetite for bringing in trainees, especially given this can broaden their skills and vision of careers accessible to them? Nemer responds that throughout her career she has seen PhDs reach so many diverse careers; the options and the need are there already. Crago is surprised by the question given that there is a good uptake of the NSERC CREATE program among others, and that McGill University has been doing a lot of work to promote co-op placements. However, Germany has CEOs with PhDs, we don't. Wicklum adds that talent development is embedded in their initiatives.

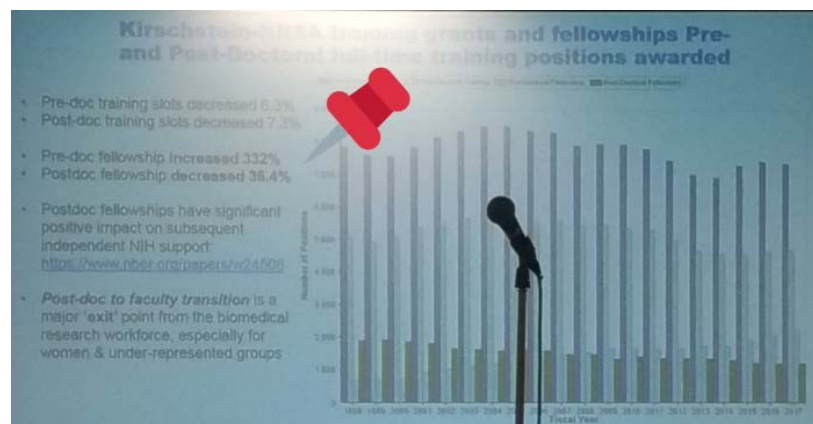
Policy and funding models for graduate students and postdoctoral fellows

The panel starts with a poll from the audience on the best model for support for trainees — the top pick is direct support via scholarship and fellowships at 48% rather than through institutions (39%) or via grants (13%). When asked to pick between supporting more awards or a higher value of individual awards, the crowd was split; 52% preferred a higher value, and 48% wanted more awards. These are also among the questions posed in the ongoing Science & Policy Exchange survey on scholarships and fellowships (sp-exchange.ca/events/survey/).

Dr. Kay Lund continues the panel by presenting some of the programs held by the National Institutes of Health (NIH) in the USA.



Importantly, there seems to be a 30% decrease in the number of postdoc fellowships awarded, despite an increase in support for graduate students of over 300% in the same period.



She goes on to present the NRSA awards, some recommendations for enhancements to the program, and the ways in which the NIH evaluates programs of this scale.

NRSA: current and ongoing recommendations for enhancements

- Stipend increases & increased funds for benefits 2016–2019 ✓
- Consider increased numbers & enhancements to postdoctoral fellowships
 - Continued stipend and benefit increases
 - Improve opportunities to transition to independence
 - Extend current 3 year postdoctoral limit to 4 years for clinicians
- Promote, enhance internships/externships to facilitate career development
 - Other laboratories, institutions or agencies, policy, communication, industry
 - Current NSTC–Lab2 Market committee assessing current federal programs for entrepreneurial training
- Strategic Plan for Data Science (ongoing)
 - Data science, computational science, rigor & reproducibility to be incorporated into all NIH training and fellowship programs

NIH National Institutes of Health
Office of Extramural Research

How to evaluate programs

Metrics:

- Number of applicants and awardees
- Number who continue in research and specific programs
- Demographics of applicants & awardees proceeding to 'next stage'
- Representation ratio (NIH funded versus relevant labor market)

Evaluation of Program Impact:

- Regression Discontinuity analyses compare applicants with similar 'scores' & 'characteristics' who were **funded** or received an excellent score but just missed an award (**unfunded**) to more directly assess the impact of the award itself
- Percentage of those who go on to next award or 'independence' (R01 equivalent)
- Periods of differing NIH budget allocations (doubling 1998-2003; post-doubling 2004-2016)

NIH National Institutes of Health
Office of Extramural Research

Before moving on to a panel discussion, she poses important questions, including on how to assess the value of different funding models. One important consideration is for maternity leave — the NIH only provides 8 weeks, which may soon be increased to 12 weeks. In Canada, the current duration of leave is 8 months. One new policy to palliate the impact on mothers would be to extend the eligibility of research for Early Career Researcher status; periods of leave will be excluded.

Discussion points 1

Benefits of institutional training awards versus individual fellowships

- Fellowships may promote independence
- Institutional awards provide a network for trainees
- Institutional awards may benefit graduate students more than postdocs (would awards combining pre- and postdocs better promote networks for retention?)

How to evaluate/compare outcomes of students and postdocs supported on 'Research Grants' rather than training awards/fellowships?

Novel models 'Institutional Research & Career Development Awards (IRACDA)'

- Partners research intensive and less resourced/minority serving institutions; Postdocs do research & teaching and encourage students to do research
- Majority of postdocs go on to faculty positions at research intensive or less resourced institutions

<https://www.nih.gov/news-events/reports-and-statements/iracda-outcomes-report.pdf>
Postdoctoral Training Aligned with the Academic Professionals, BioScience 2011 61 699-705

Discussion points 2

Career Development (K) awards

- Clear benefit to career advancement & retention in research as well as diversity
- Similarities/differences between NIH and Canadian models?

Physicians in biomedical research

- Residency and medical school debt can be exit points from research careers
- New Institutional 'Research in Residency' R38 Program [NOT-HL-18-639](#)
 - Followed by individual K38 award designed to promote retention in research [NOT-HL-17-533](#)
- LRP program: <https://www.lrp.nih.gov/>

Canadian models?

Panelists:

- Alejandro Adem (CEO, Mitacs)
- Martha Crago (VP Research and Innovation, McGill University)
- Bonnie Le (Banting fellowship recipient, Rotman School of Management, University of Toronto)
- Kay Lund (Director of a new Division of Biomedical Research Workforce in the Office of Extramural Research, NIH)



Adem lists the programs available for trainees at Mitacs and clarifies that these are not a "distraction" from graduates' thesis. Internship opportunities and fellowships in industry or government are useful and very relevant for future of work in Canada and in science.

Crago highlights three main points:

- The tri-council agencies should do follow the lead of the FRQ tri-agency to help PhD students reach their career goals — applications require 2 proposals, one from the student applicant and one from the supervisor, to make sure that expectations line up and that trainees are supported.
- Trainees should avoid becoming isolated by going abroad and make sure they foster a "science family" in their lab; Crago considers this more important for career development.
- 50-60% of research grants in Canada go to trainee support, not reagents. This isn't appreciated enough.

Le says her Banting award gave her financial stability as an international student, and that grant and award application writing doubled as a great opportunity to develop the narrative of her research, esp to reflect on its impacts

On taking leave, Crago notes on maternal leave that Switzerland supports trainees not just with leave but also with benefits. Stipend awards increase with the number of children mothers have to support. Lund mentions a paper showing that providing teaching experience to trainees for 2 months had zero negative effects on productivity, it actually increased employability! The NIH is now looking into better ways to integrate trainees policy as well. Adem mentions how Mitacs programs enable trainees to develop skills that complement their PhD training and to transition into these kinds of careers. On teaching — if professors are meant to teach, aspiring professors (post-docs) should be able to get experience doing this.

Building skills and capacity at the science policy interface (Mitacs)

Alejandro Adem introduces the Mitacs Science Policy Fellowship program. It is in its 3rd year at both the federal level in Ottawa and provincial in British Columbia.



Panelists:

- Gail Bowkett, Director of Innovation Policy at Mitacs
- David Castle, VP Research at University of Victoria
- Katie Gibbs, Executive Director of Evidence for Democracy
- Scott Findlay, Professor at University of Ottawa, co-Founder of Evidence for Democracy, and part of the Office of the Chief Science Advisor.

David Castle is the champion for the Science Policy Fellowship program in British Columbia, given its importance for capacity building of science policy across levels of government (federal and provincial).

To start the panel, Bowkett presents the 8 clusters that make up the framework for better evidence-informed policies. This comprehensive skillset is useful for both sides of science and policy, and it fosters the growth layer between the two.

Scott Findlay discusses the set of attitudes and beliefs in policy that are barriers to evidence-based decisions. One is a lack of understanding of science, another is the assumption science is value-free. It isn't — evidence is about burden of proof.

Donna Kirkwood had highlighted this well earlier, as science into policy is about using the best evidence we have, at a given time.



He adds that policymakers and politicians often believe that evidence is only important if it's important to the public. This isn't sustainable. Several competencies are lacking in their perspective:

- the ability to distinguish normative vs factual claims
- knowing how to request and appropriate an evidence summary
- being able to understand the science

Gibbs mentions that it is difficult for scientists to outreach to policymakers, or to reach policy careers. Most don't know how either process works. She calls for a culture change across post-secondary education, to add communications skills to programs. This includes training establish scientists as well as adding requirements to undergraduate, masters, and PhD curricula. Key competencies missing from the science side include

- communications skills
- knowing when and how to reach across silos
- bridging STEM and the social sciences / humanities
- the ability to develop concise evidence summaries for policy.

On writing summaries, Findlay specifies that policymakers can't properly use a data dump, they need a clear picture. On the other hand, the policy side needs to learn how to ask for this in a way scientists understand. Bowkett notes that this takes time — the fellowship program is about culture clash, and it took nearly one year for a past fellow to learn how to provide the evidence policymakers need.

Bowkett adds that culture change takes time! #CSPF program @MitacsCanada is all about clashing these cultures. After a year w/ the fellowship, a prev fellow who is a professor learned how to properly and quickly provide the evidence policymakers needed. Importantly, this boosts the impact of her research. When the evidence is formatted in a clear, concise, understandable, and digestible way it is more likely to move forward. There is a need to build incentives to gain these competencies.

Castle adds that while some decisions can be made without evidence, most desperately need it. It is important that researchers and policymakers know where and when evidence needs to be provided.

How do we build partnerships and engagement in science policy, especially since this takes a lot of time and effort? Bowkett says it goes back to institutions and culture change; this isn't currently valued in the metrics for academic careers or success. We need to show this has value.

Do you see the landscape change for those organizations at the intersection of science and policy?

This is a hard landscape to bridge for non-profits with low budget. Gibbs says NGOs can indeed play a strong support role, and this has been challenging. Allowing NGOs to play a full partnership role in grants would be a great step forward. She mentions this is not currently an option in the NSERC research partnerships program, but consultations are still open and this can still change. **Note, it was mentioned later by Marc Fortin that charities will be eligible in a further iteration of the plan.**

A full list of fellows is available at <https://www.mitacs.ca/en/newsroom/news-release/laboratory-legislature-fellowship-deploys-23-researchers-government>.

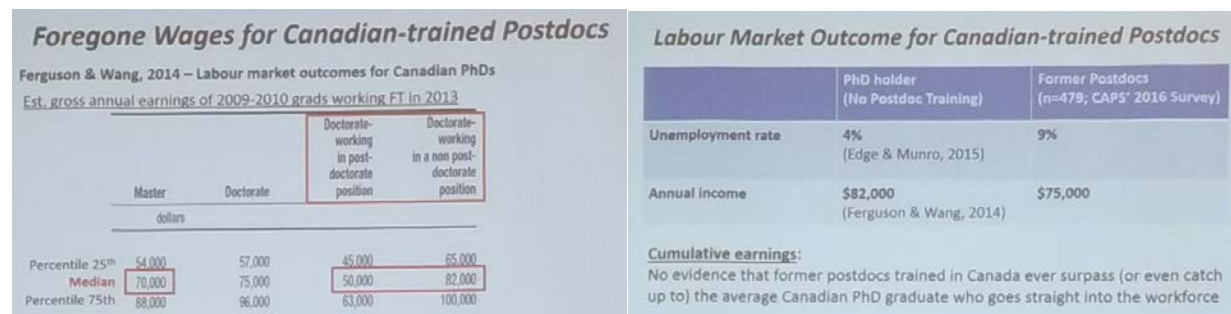
Where the rubber meets the road: The real life impact of policy on Canadian postdocs



Panelists:

- Joe Sparling (Chair of CAPS)
- Krishnamoorthy Hegde (Postdoctoral fellow at INRS and CAPS member)
- Rachel Fernandez (Associate Dean of Graduate and Postdoctoral Studies, UBC)
- Jenna Haverfield (International Postdoctoral fellow at McGill University and Vice-Chair of CAPS)
- Dominique Bérubé (VP Research Programs, SSHRC)

Sparling notes that, on average, postdocs lose money for every year they train as a postdoc. PhDs that go straight to the workforce are often more financially stable. Post-docs lose retirement income and forego wages despite bring high talented and paying full tax. Fernandez adds that graduate students should be better aware of career opportunities; a postdoctoral fellowship should only be one option of many for their next steps.



Due to unionization and internal funding, there are now more post-docs with employee status. This palliates some of those issues, but externally funded and government post-docs are still behind — they are not considered employees and receive no benefits despite taxation. Hegde further adds that post-docs are either considered trainees OR employees, rather than a step at the intersection of the two. As result, “trainee” post-docs lose on benefits, “employee” post-docs lose on training. How do we reconcile this?



Employment Status of Postdocs in Canada

The 'Average' Postdoc

- 2016 Survey data: ~30% of postdocs estimated to be employees
- 2018 Update: 'Average' postdoc in Canada now an employee?
 - Unionization → internally-funded postdocs now employees at most universities
 - Majority of postdocs in Canada are "internally-funded" (range 50-85%)

Externally-funded postdocs (fellowship-holders)

- Largely denied employee status
- Few exceptions – employer expenses often deducted from postdoc \$

Government Labs also continue to deny postdocs employee status

- Government labs hire postdocs ('visiting fellows') to conduct research
- 2012 – CRA ruled a visiting fellow with federal funding was an employee
- Not yet implemented by all government labs

Postdoc Salaries / Stipends

The Impact of Taxation

- All postdocs pay full federal income tax
- Most postdocs pay full provincial income tax (except externally-funded/international postdocs in QC)
- Most postdoc take home after tax is <\$45,000/year. Sometimes less than a graduate student with Vanier scholarship (\$35,000, tax-free)

Lack of Recognition of Years of Training/Experience

- Failure to acknowledge the value of the training and experience
- No set minimum pay in grant funds
- No guidelines for increasing pay with years of training
- Such schemes are supported by agencies in other countries (e.g., NIH)

Wage disparity is rampant in the Canadian Postdoc Training System

- Gross annual income for full time postdocs in Canada varies by >50%
- Minimum income standards <\$40,000/year are common
- Maximum income standards generally lacking – (some exceptional external awards)
- Pay of two postdocs who largely do the same work in the same lab may vary by >50%
- Fellowship holders are commonly forced to take a cut in pay once their fellowship expires

This can lead to an unfortunate choice when applying for external funding awards. Postdocs are enticed to apply, and these come with merit, but accepting external awards can be followed by a change status – losing employee status leads to loss of benefits, which is an even more difficult choice for those with families. Though parental leave also depends on status, thankfully the tri-council agencies have taken positive steps to ensure this is accessible to award holders as well.

External Award Holders vs. The Average Postdoc *What's wrong with this picture?*

Average Canadian Postdoc	External Award Holders
<ul style="list-style-type: none"> • Internally-funded • Full federal & provincial income tax • Employee status <ul style="list-style-type: none"> • Access to EI benefits & CPP • Union member <ul style="list-style-type: none"> • Access to health/dental • Access to other employee-style benefits & pensions • Bargaining rights 	<ul style="list-style-type: none"> • Award from funding agencies • Full federal & provincial income tax (except in QC) • Trainee status <ul style="list-style-type: none"> • No access to EI/ CPP • Maternity / parental leave – only if provided by funding body • Excluded from unions <ul style="list-style-type: none"> • Mostly, no such 'employee' benefits • No bargaining rights

Maternity & Parental Leave

Access to paid parental leave depends on source of funding

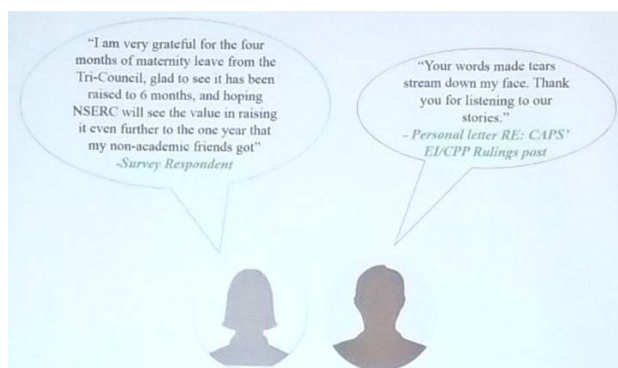
- Internally funded postdocs
 - Employee – Yes (covered by EI)
 - Trainee – Up to institution / supervisor / funding
 - Only recourse = EI/ CPP Ruling from the CRA
- Externally funded postdocs
 - Trainees only – typically no, unless provided by funding body
 - No recourse – EI/ CPP Ruling precedence not in favour

Why coverage provided by institutions/funding agencies in lieu of EI is not ideal

- Postdoc contract ends just before birth of child – unlikely to get a renewed contract so no paid leave
- 6 months at full pay – people need longer to adjust and get comfortable with their child

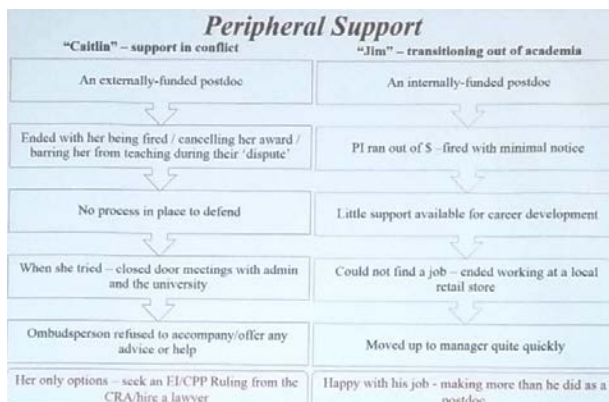
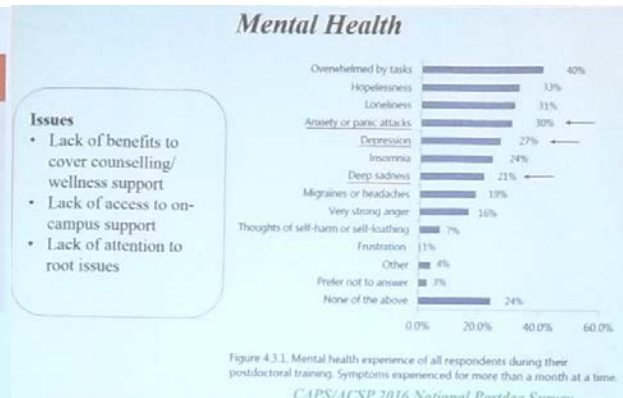
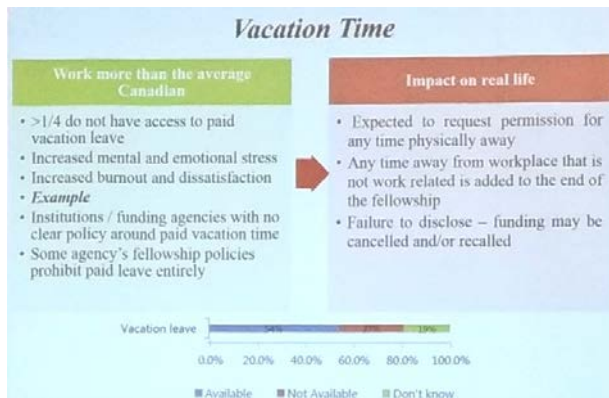
Family Planning

- Very difficult for someone on a short-term contract
- Postdocs who want children forced to take other jobs to ensure paid leave



Since extended parental leave to 6 month was announced, many postdocs with young families have reaped benefit.

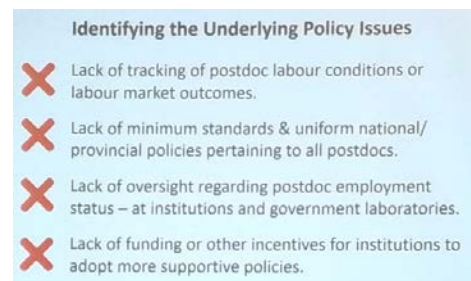
Still, many post-docs suffer from overwork; many take no vacation time, which can significantly impact mental health. There are few outlets for counseling.



Only 20% of post-docs make it in academia, and through the @CAPSACSP survey they heard many stories from those who had to make difficult transitions

Haverfield is from Australia, where the average postdoc salary is \$73,000. In Canada, the average salary is closer to 40-45K. This is equivalent to an entry level salary for a job that requires little specialized training. Postdocs are experts with 10+ years of experience. The key issues beyond this:

- no tracking of labour conditions or career outcomes
- no oversight for employment status
- lack of standards, institutions make up their own rules
- lack of funding



Fernandez notes the support of the U15, as Sparling announces that CAPS has launched a postdoc registry that will be updated on a rolling basis. This is in response to the lack of tracking for career outcomes, and they are in discussions with Statistics Canada and other organizations and agencies to maximize the impact of this.

Bérubé represents SSHRC on the panel, and notes that representatives from both CIHR and NSERC are in attendance. She adds that getting good data still has barriers, but work is being done to collate data among the agencies to improve tracking and to make evidence-informed policy decisions. However, it is important to note that the role of federal agencies get complicated when unions are involved. We should be able to harmonize postdoc status as employees, although this will require work across the tri-council. Sparling notes that the UK has a good model for harmonizing post-doc status.

Haverfield notes that international postdocs do not know what salary to expect at all. Plus, a lack of transparency and information can introduce inequalities in the pay that different postdocs in same lab get. As Sparling suggests that a basic minimum income for postdocs be instated, Bérubé asks the audience: **should the basic minimum be based on annual pay or hourly wage?** An audience member replies that \$45,000 is definitely not enough for Canadian postdocs planning to work abroad.

Bérubé notes that perhaps the Made-in-Canada AthenaSWAN consultation could be the place for this policy discussion. It should also be made clearer that fellowships are a contribution to salary, and that universities and supervisors should supplement to a minimum amount.

Social implications of emerging technologies

This panel is organized based on four key questions, with more interaction with the audience:

1. In a time of rapidly developing technology, what social implications should we be concerned about?
2. Why do the social implications of technology matter? Who is affected?
3. Are we devoting sufficient attention to social implications? What are the challenges?
4. What can we do to better address the social implications of emerging technologies?

Panelists

- Peter Severinson (Policy analyst at the Federation for the Humanities and Social Sciences)
- Jaigris Hodson (Assistant Professor at Royal Roads and Mitacs Science Policy Fellow at ECCC)
- Eric Meslin (Council of Canadian Academies)
- Dominic Martin (Professor at UQAM)

Meslin notes that some of these questions are easy to answer, others are more important and harder to answer. Hodson adds that the social implications of new technology, especially if algorithms can exponentially increase biases and misinformation, are the latter. Most people are not literate in digital media, and so many engineers and entrepreneurs that design digital tools have little expertise in social implications. Better understanding from designers and users is necessary.

On the skills gap and digital literacy — historically most people don't know how to fix a car, how to blacksmith... why is the current skills gap different, why is it more important? Martin says there are inequalities in who controls the technology; Hodson says it's an issue of scale. The data industrial complex is huge, just look at the impact of social media on voting. When Zuckerberg goes to Congress and says they will build an algorithm to deal with “Fake News”, they need to be able to challenge and question this.

Sandra Lapointe from McMaster University chimes in from the audience, noting we must distinguish the goals of (1) looking to definitively answer ethical questions and (2) take a decision on ethics for these technologies. Meslin says both are important and we need to be comfortable with uncertainty. Closure isn't certainty, it is the sufficient threshold to call a question solved, for the time being. Agreeing on what that threshold is, is a complex question to itself.

Who is socially affected by new technology? Martin says lower socio-economic classes and those playing lower functions in society will be more vulnerable to automation (though machine learning can take over high level tasks as well).

Ethics vary across cultures, and even within cultures. The range starts at Ayn Rand, through to Silicon Valley thinking, to extremists/terrorists. How do we ask ethical questions if ethics vary so widely?

Meslin attempts an answer, that there's only so much one can do. There are risks and benefits to all approaches, and the history of governance getting involved has generally been associated to mediatized

events. When one person died during a gene therapy study, for example, regulations were added that set back the field by years.

Sarah Miller from Mitacs follows up on the morality question — particularly for the most vulnerable, who is responsible for making decisions? Hodson says this is a systemic question, to a systemic problem. Not everyone can make the choice to cut off from social media even over ethics. We need room for decision-making but this is just a piece, not the whole puzzle. Over-regulation is also an issue in several parts of the world. Martin adds that it is difficult to regulate technology that develops and changes so rapidly. Broad expertise is needed in the regulatory arm.

With the increasingly rapid development of technology and its implication on training, schools and universities aren't able to adapt quickly enough. How do we deal with this? Meslin says it's challenging but many professors are adopting technology and introducing ethics from a grassroots level. One of his own grade 12 teachers challenged their class about the science and ethics of in vitro fertilization; this case study shaped Eric's career.

Jean-Christophe Belisle-Pipon from Harvard University and the FRQ mentions the concept of ethics by design. How do we make sure the algorithms are good before they are deployed? Some designers say they do, but it's only to avoid breaking laws. How do we make sure they test for bias and social considerations? Martin says there's a lot to unpack, especially when bad algorithms build on each other in a cycle of garbage in, garbage out, garbage back in again. Meslin adds that much can be learned from going elsewhere, from other cultures. Economic development does not mean ethical superiority or superior ways of knowing. Hodson says training silos are not up to the task, interdisciplinary and transcultural exchange is necessary.

A student comments that those who don't have a seat at the higher table often need to mirror or follow the ethics of those higher up, to get that seat. It's tough for the next generation to have an impact when their success depends on fitting the mold. Meslin says the next generation are future leaders, and the old guard will step down soon. In fact, it's probably overdue. Bringing different ways of knowing and diverse perspectives needs to happen.

What can we do better to address social implications of emerging technology? Martin says we're trending towards openness in algorithms and how technology is built, but we do not understand all social implications yet. Hodson adds this is not just a policy problem, this affects everyone. Meslin ends by saying the impediment is not just a lack of understanding, or lack of communication about new technology — there is a need to build capacity to critically assess technology and to engage the public directly about the ethics and its impacts.

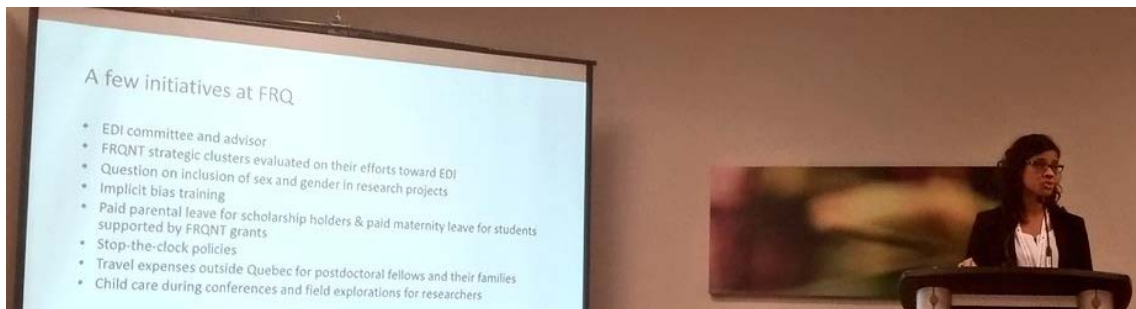
Shaping science policy to improve equity, diversity and inclusion



Panelists:

- Fanny Eugène (Organizer, Fonds de Recherche du Québec, Nature et Technologies)
- Maryse Lassonde (Moderator and President, Conseil Supérieur de l'Éducation du Québec)
- Mary-Rose Bradley-Gill (PhD Student at McGill University and co-President of Science & Policy Exchange)
- Shirley Malcom (Director, Education and Human Resources Programs, AAAS)
- Denise O'Neil Green (VP Equity and Community Inclusion, Ryerson University)
- Anne Webb (Senior Policy Advisor, NSERC)

Eugène from FRQNT organized this panel and presents some of the projects at the FRQ, including the [SAGA-UNESCO](#) (STEM and Gender Advancement) model. The first workshop was held in February 2017, the second in May 2018. In that time 160 organizations were contacted, 77 responded, and 97 measures were identified to support gender equality in STEM.



Malcom is on the board of SAGA and presents the US model of S EA Change, which is itself based on AthenaSWAN. Importantly, this model embraces intersectionality — it's about fixing the system, not the people.



What Can SEA Change Do?

- Promote systemic, institutional changes
- Fix the system, not the participants
- Exploration and understanding of context for each institution
- Other key elements:
 - Voluntary participation
 - Declaration of commitment
 - Disaggregation within each analyses

Webb presents the tri-council vision on EDI, and the initiative of a Made-in-Canada AthenaSWAN. She notes that, in most disciplines, most fields have not seen much change in diversity in 20 years. We can't de-marginalize groups field by field; it needs to be an all-inclusive strategy. She also presents the factors and steps that are taken into account for the EDI policy and for its action plan. This isn't an add-on, this plan is being designed for lasting impact.

BARRIERS EMBEDDED IN RESEARCH CULTURE AND SYSTEMS

Multiple factors contribute to low % of women, people with disabilities, visible minorities, Indigenous peoples and LGBTQ2+ people in various fields of research, including:

- Unintentional and intentional biases
- Microaggressions
- Hostile work environments, stereotype threats
- Biased indicators of excellence
- Few role models
- Assumed linearity norm of research career paths
- Under-valued service and outreach contributions

SHARED PRIORITIES

- Collect, analyze and report data on underrepresented group participation in funding competitions and selection committees
- Implement and monitor measures to increase equity and diversity within pool of applicants and recipients
- Build awareness, understanding and integration of EDI analysis and practices throughout our stakeholder communities and institutions, and in how we work as granting agencies
- Embedded EDI considerations and analysis recognized as among factors indicative of research and research team excellence

SHARED PRIORITIES

- Develop and provide EDI resources, including bias awareness training, tailored to our communities
- Take steps to eliminate impact of periods of leave taken and research pace on assessments of researcher accomplishments, competencies, contributions and expertise
- Review 'use of funds' regulations to clarify that research costs related to increasing EDI are eligible
- Consultation with expert EDI advisors

KEY CURRENT AGENCY INITIATIVES

- Tools and systems developed to collect and monitor data on underrepresented group participation in funding programs, peer review and committees
- Reviewers, panels, agency staff to complete bias awareness training; staff to complete gender and diversity-based analysis training
- Specific funding programs now include EDI-related requirements in relation to personnel and research
- Guidance and resources relating to EDI consideration and analysis in research, research teams and institutions being added to agency websites
- Agencies are integrating GBA+ into program evaluation and policy reviews

Green presents the Ryerson University model for EDI, "proudly diverse, intentionally inclusive". Even then, to bring equity professionals to the conversation, she had to both create a space for herself and bring her own chair to the table.



Bradley-Gill was the lead on a Science & Policy Exchange consultation on breaking gender barriers in STEM (http://sp-exchange.ca/news/Breaking_Gender_Barriers_in_STEM/). As the new co-President, she presents the non-profit's mandate of and some of their work in representing students in science policy.



She lists the issues and recommendations from the gender report by Science & Policy Exchange:

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Family planning <ul style="list-style-type: none"> ➤ Standardize and encourage parental leaves, creative policies 2. Criteria for excellence/merit <ul style="list-style-type: none"> ➤ Revise criteria to take into account unconscious bias over a lifetime 3. Hiring practices <ul style="list-style-type: none"> ➤ Radical transparency 4. Discrimination outside hiring (harassment to more unconscious) <ul style="list-style-type: none"> ➤ Sustainable positions for monitoring inclusion and diversity | <ol style="list-style-type: none"> 5. Role models and mentorship <ul style="list-style-type: none"> ➤ Formalize mentorship programs, give credit 6. Lack of men in the conversation <ul style="list-style-type: none"> ➤ Leadership from the top, more equity and diversity training 7. Societal pressures and unconscious bias we all hold <ul style="list-style-type: none"> ➤ Financially and socially support conversations and dialogue |
|---|---|

Claire Trottier (Trottier Foundation, McGill University) asks about accountability. What can we do to make sure institutions are held accountable? Green says our government has influence as a higher body to request and enforce strategies from universities, and the reputation hit is a strong force as well. Malcom says external forces are useful, particularly what affects reputation. Trustees and funders are paying attention. But, scientists often care more what their discipline thinks about them, than their institution — so AAA now revokes fellow status where necessary.

Bystander training is also important, so that those not part of visible minorities are not being viewed as part of the problem but part of the solution. Can we expect to move the needle if we are fighting against a sea of toxic masculinity? Malcom gives an example of a minority student whose PI becomes a problem due to toxic masculinity. There can be uncontrolled abuse of power. If we can disrupt this and provide options, then yes we are moving the needle systematically and significantly. Green adds that it's about power toxicity, not just toxic masculinity. Women can be abusive too. This is about being inclusive and preventing abuse in the broad sense.

A Canada Research Chair from Western University asks, is there a plan in the Canadian AthenaSWAN and in SEA Change to enforce having EDI measures through withholding funding? Malcom specifies that SEA Change is from AAAs, not the US government. There are limits to that power but they can affect the behaviour of private funders. By using the competitiveness of institutions to obtain accreditation, they can still have strong impact. Webb says the tri-council is not currently looking to tie EDI requirements to funding for the initial 5-year pilot. They are still consulting though, and it's a work in progress.

When talking about data science, the HQP pool is small and not diverse at all. How do we promote diversity at that level? Lassonde says other countries have HQP that may help bring diversity. Malcom adds that if grads are not diverse enough, reach out to undergrads. In general, the lower you go, the more diverse the population. Pulling them up as a cohort can drive diversity quickly. Do not only bring up token minorities, bring a cohort of diverse young talent. Bradley-Gill adds that providing more opportunities for graduate students from other faculties to join data science courses can help bridge the gap, and this would address a need for those students who want to hone data science skills for their careers and research projects.

A representative of the Canadian Space Agency mentions that they would be willing to set aside funds to drive diversity goals. What are the gaps, where can they help? Malcom says money is needed everywhere! One obvious choice is to fund and promote post-docs and students that show excellence, especially if they wouldn't be recognized by existing awards and programs.

International science and Canada, global agenda for 2030



Gordon McBean provides a background on international consortia and meetings on this important topic, highlighting a need to bring stakeholders together for a global program.

Panelists:

- Wendy Watson-Wright (Ocean Frontier Institute)
- Alan Bernstein (CIFAR)
- Amy Luers (FutureEarth)
- David Grimes (World Meteorological Organization)
- Ted Hewitt (SSHRC)
- Maria Uhle (NSF and Belmont Forum)



1. **Wendy Watson-Wright – CEO, Ocean Frontier Institute (IOC-UNESCO)**
 - Partnerships Matter – International Transdisciplinary Approach to Ocean Research
2. **Alan Bernstein – President, CIFAR**
 - Lessons learned supporting research across disciplines and borders to address questions of importance for the world
3. **Amy Luers – Executive Director, Future Earth**
 - Research, innovation, Sustainability – global program and Canada's role
4. **David Grimes – President, WMO and ADM, MSC-ECCC**
 - Role of national meteorological-hydrological services
5. **Ted Hewitt – President, SSHRC**
 - Advancing knowledge for Canada's Future – Enabling Excellence, Building Partnerships, Connecting Research to Canadians.
6. **Maria Uhle – Co-Chair, Belmont Forum, US NSF**
 - International Transdisciplinary Research Funding through the Belmont Forum



Watson-Wright stresses that there is only one ocean, where distinct bodies are connected. If we treat them separately and let borders define policy, we limit the impact our policies can have. This is not just about climate change, this one ocean is critical to life on the planet. It sustains life, provides food, and is a source of social and economic wealth.

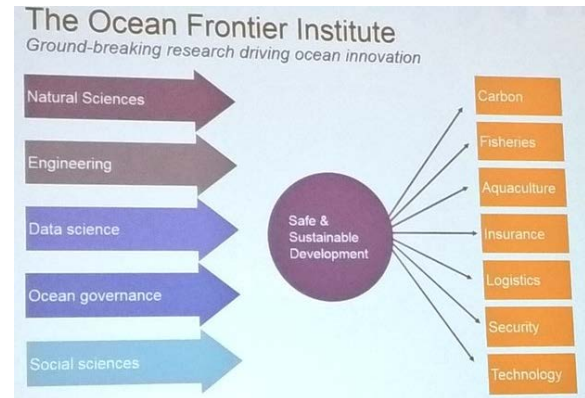
The Ocean - a source of social and economic wealth

- Sustains life on earth
- 71% of Earth's surface
- 97% of Earth's waters
- 96% of living space
- Half the oxygen we breathe

- Main source of thermal inertia
- Cultural heritage
- 2.5% global GDP

OCEA
FRONTIER INSTITUTE



One of the biggest challenges across partners of the Ocean Frontier Institute internationally, is working collaboratively to maximize impact. Their metrics go beyond policy, papers, and HQP produced; they have to work across disciplines and silos to bring impact to global priorities.

Bernstein says science is intrinsically global, and so are most of the issues we are facing today. Canada has the opportunity to be an honest broker and to lead in being collaborative in addressing these challenges. We shouldn't just try to excite students and young people about science; we should mobilize them to think about grand challenges. Science is required to address / solve them all.

On CIFAR — they are not a research funder, they are a convener of science. They are not bound by borders and invite Canadian scientists to come together to lead on a world stage. For Canada to act boldly, the country



needs an integrated strategy, a science action plan that we can build on to create partnerships that tackle grand challenges & excite young people to choose science and to work on solutions.

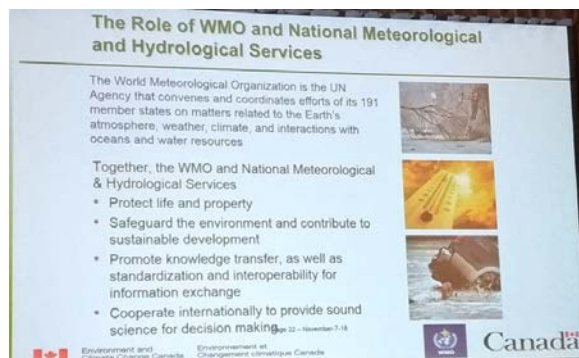
Luers presents the levers of transformative change and how to co-design new methods and policies across silos to drive impact. This includes support for young scientists & early career researchers. Building sustainability into earth targets and into the digital age is also critical for Future Earth. At all levels, they strive for co-development of knowledge and tools, while training the next generation to build capacity to address those issues.



Grimes presents the role of the World Meteorological Organization within UN — it is one of the oldest scientific institutions. They convene international interests to promote sustainable development, knowledge translation, and evidence-informed decision-making. Their vision for 2030 for climate has implications across fields of science and society in general:



By 2030, we see a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic consequences of extreme weather, climate, water and other environmental events; and underpin their sustainable development through the best possible services, whether over land, at sea or in the air.



Hewitt presents the role of SSHRC, and science at large, in these future goals, including for AI. The 'I' is most important, and it depends on the human element. That is what we are going to trust, when our kids board a driverless bus to take them to school.

He also covers the Canada Research Coordinating Committee and its role in driving cross-sectional, high impact, collaborative, fast breaking research. The first competitions will be on 3 areas. These were discussed more at length at the European Research Day on Nov 5, 2018, at the University of Ottawa:

1. Support for new higher risk programming across fields, led by individuals or small teams (1M\$ over 2-3 yrs)
2. Larger team based projects that are transformative (20M\$ over 5+ years)
3. Support international research directly (joint with Canadian researcher), including joint calls with other agencies abroad.

The first calls will be coming in the next few weeks. The definition of "High risk" is open to interpretation; it can be compelling ideas, new teams and young / unproven scientists, complex implications of research results, or other contextual reasons. "Impact" means benefits to society, advancing science and the body of knowledge. Some of the goal of multiple streams is to fund high risk projects, including for immediate needs. The stepwise stream means conceptual projects can apply to stream 1 and graduate to stream 2, if successful in building capacity.

Our role

Federal agency mandated to:

- promote and support postsecondary-based research and training in the social sciences and humanities
- advise the minister of Science

Through grants, fellowships and scholarships SSHRC:

- Trains the next generation of talented, creative thinkers and doers
- Builds knowledge and understanding about people, cultures and societies
- Drives the innovations that address the challenges of today and tomorrow



Canada Research Coordinating Committee Consultation

New committee mandated to improve the coordination efforts of Canada's research funding agencies

- New **tri-agency fund** for international, interdisciplinary, fast-breaking, high-risk research is one of five CRCC priorities
- The fund will:
 - reduce barriers to cooperation;
 - increase the flexibility of researchers to adapt to new circumstances; and
 - explore different approaches to the development of new knowledge.



Uhle presents the Belmont Forum and its 25 member organizations spread over 50 countries. Rather than being pay to play, it's more of a potluck where each member brings their strengths to the table. You don't have to be a member if you want to contribute. The slides below show current and upcoming opportunities.

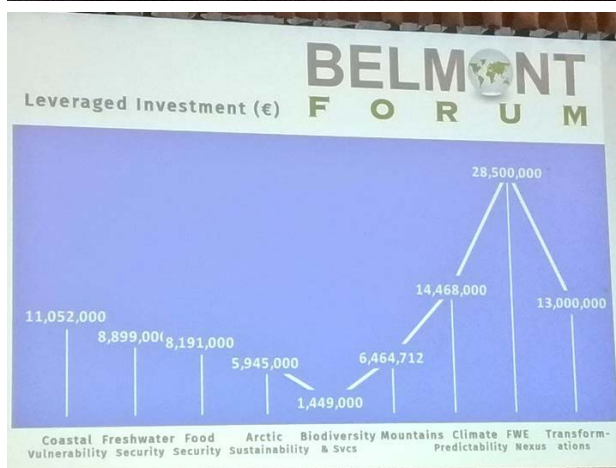
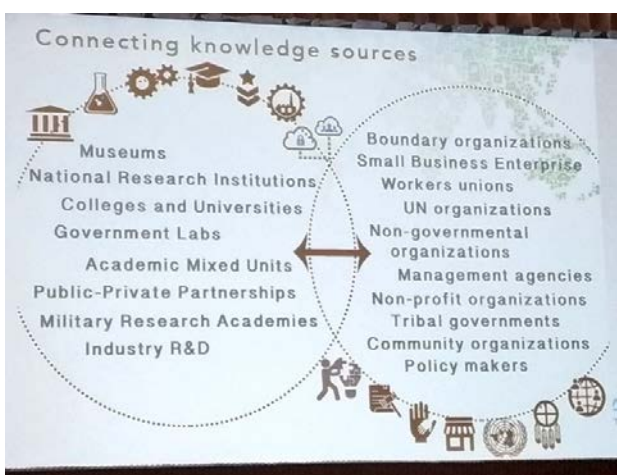
BELMONT FORUM

Over 25 member organizations representing more than 50 countries on 6 continents



and 7 partner organizations collaborating on regional to global frameworks

Partner organizations: GEO iap, ICSU, International Institute for Applied Systems Analysis, ISSC, START



Developing opportunities for partnership

Recently awarded:

- Biodiversity and Ecosystem Services II – 20 awards – 35M Euros

In – review:

- Science Driven e-Infrastructure Innovation (SEI)

Open call:

- Ocean Sustainability

On the horizon to be released:

- Disaster Risk, Reduction and Resilience (DR³)
- Arctic II

Under development:

- Science for Sustainable Development Goals
- Food Security and Safety
- Climate, Environment and Health



Of particular note, the NIH and Wellcome Trust, as well as other large bodies, are involved in the Climate, Environment, and Health opportunity. This is an exciting project that bridges two massive global priorities in climate and health. The Belmont Forum has opportunities for students as well, including the Global Sustainability Scholars and links to the Association of Polar Early Career Scientists (APECS). In Canada, Students On Ice is a great program for engaging young people on climate change and international challenges.

Announcement : NSERC is now a member of the Belmont Forum, and hopes to serve as a convener for Canadian researchers to participate in these opportunities.

New directions for science advice in federal government



Panelists:

- Toby Fyfe (Moderator and President, Institute on Governance)
- Sarah Gallagher (Science Advisor, Canadian Space Agency)
- Donna Kirkwood (Chief Scientist, Natural Resources Canada)
- Dan Wayner (Chief Science Advisor, National Research Council)

What are the key challenges ahead? Kirkwood says the issue moving forward is not to make sure science is valued in government (seems like it is), but to ensure evidence is used and valued for policy. Since policy is inherently quicker than science, this can be challenging. Gallagher says building relationships between scientists and policymakers is key, and that more science communication skills would help.

Wayner agrees and adds that the speed of new data and technology is another key challenge, particularly since departments and sectors are still siloed. They need to work together as we face digitization and AI, which can and will affect government and policy writ large. The problems we have to solve today are too complex for any one person or organization; we need governance structure that allows cross cultural collaboration to take place — across government, industry, academia, institutions, and third party groups.

How do you make science for the public good effective? How does it interface with policy? Kirkwood doubles down on Gallagher's point of fostering science-policy relationships, both within and across departments, and that these must be maintained and fostered. Though Gallagher is still new to her role, she has seen a need for data and knowledge that crosses divisions and departments. If we keep reinventing the wheel, we'll end up with a lot of shoddy wheels. Let's work together — we all want good wheels!

Wayner notes the chief scientist's role to speak truth to power when faced with evidence, but warns that you can't reason someone out of a position that they didn't reason themselves into. Processes can't replace relationships; trust and respect are built and maintained through effort. Kirkwood brings back the "honest broker" role of the position — provide advice, the best possible, without interference from personal opinions. Be that trustworthy source, so they keep coming back for advice.

Gallagher says this reflects back on the need for interdisciplinary input into policy. There are two main ways to promote this:

- Make a clear point about the expertise needed from the other department or agency.
- Bring people together, get them to hang out. This creates a platform for finding common ground without forcing a relationship.

What role can the science policy community play to drive evidence-informed decision making and interdisciplinarity in that process? Kirkwood realized that the youngest people in the department were often those with talents across disciplines. To build capacity, bring in the right people and support training.

Where are social science and humanities in all this? All current departmental science advisors are in STEM. Wayner says it didn't happen by chance that social scientists got involved in emerging technology! It is absolutely critical to engage them early if we want disruptive innovation. Kirkwood agrees and adds that multiple ways of knowing should be considered. There's so much to learn from social scientists! That the tri-council is working closer together is a great stride forward. If you don't think you rely on the social science and humanities, you're thinking of academic disciplines. If you're doing communications, developing strategy, or building relationships, you're using expertise from humanities and social sciences.

When speed is an issue, so is confidentiality. Scientists share data, while governments may like to retain it until they are ready. Governments like control, scientists like independence. How do we close these gaps? Kirkwood says step 1 is admitting there is a gap. No doubt, there is. Relationships, again, are key to understanding the needs of each actor and what they are bringing to the table. Wayner says being a diplomat of sorts allows you to find points of overlap, which can bridge that gap. Gallagher adds that scientists often need to keep quiet about their research until it's ready as well — we don't want to have years of work scooped! The “two cultures” narrative might be overhyped.

Preston Manning notes that many politicians (especially if they have a legal background) think there are multiples bodies of evidence that can support either side of an argument, rather than a single and more fluid body of evidence. Evidence needs to be weighed together, not separately. Can we have a common understanding of what evidence is? Wayner says that scientists can also be too rigid, which muddies the water. Facts given by scientists are still opinions and conclusions made using data. Kirkwood clarifies that we need to communicate that science is a never-ending quest, that we are presenting evidence as best we know it, at that given time.



Mireille Ghoussoub, a PhD student at the University of Toronto, asks about climate change, about the carbon tax, and the balance between evidence, agenda, and communication. She asks, what are your thoughts of how your department is taking on this file? Kirkwood is satisfied with the work at NRCan. There is a lot of work being done to address climate change and the Pan-Canadian Framework, including relevant government research. Weaver explains how policy communications work, noting that although there is a lack

of cross-department effort to work towards solutions, each department is working hard. Gallagher cannot comment due to her new position, but she is impressed with how quickly she was integrated into decision-making boards. The appetite for science advice is present.

What advice would you give to scientists and the science policy community? Wayner says to make sure you have no agenda when giving advice. Arms-length advice (honest brokering) and advocacy are very different. Gallagher says to make sure communications are clear and jargon-free to have as much impact and reach as possible, and to prevent misunderstanding of evidence. Kirkwood asks everyone to support open science and science literacy.

Granting agencies and participatory science in Canada



Panelists:

- Véronique Morin (Moderator and Science Journalist)
- Marc Fortin (VP Research and Partnerships, NSERC)
- Ted Hewitt (President, SSHRC)
- Michael J. Strong (President, CIHR)
- Serge Marchand (Scientific Director, FRQS)
- Louise Poissant (Scientific Director, FRQSC)

Fortin says citizen and participative science are incredibly important. This isn't only about including public in research; it's engaging communities who have knowledge, including traditional knowledge. There is an interesting ongoing project with a northern community that wants to better document the status of their natural resources (air quality, water). They want to analyze the impact of climate change and other human endeavours on these resources. There is added value to including these communities.

On the NSERC Research Partnerships program, the current document on the website is not very relevant anymore. A 2.0 version is upcoming. We are also looking further into open access and open science, and how we can support these broadly.

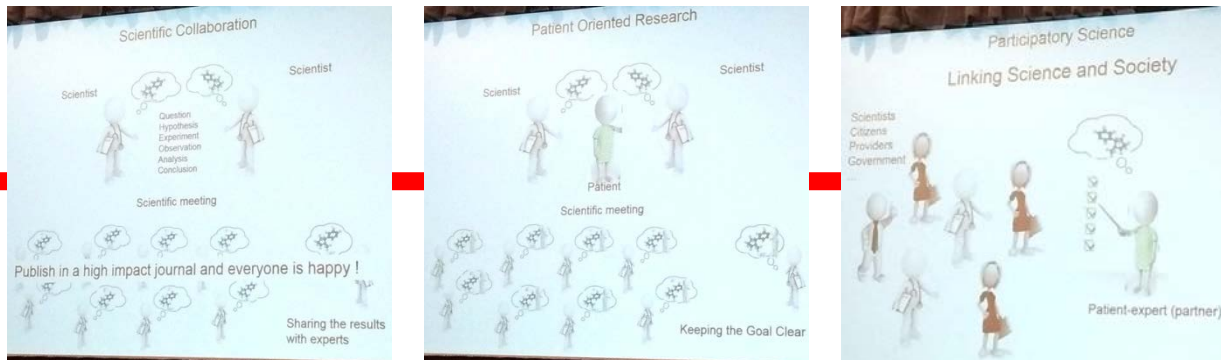
Hewitt notes SSHRC's support of collaborations with key stakeholders to inform decisions about their programs. They consistently engage stakeholders and community members. He mentions the social innovation fund and community partnerships program, and that SSHRC strives to get diverse perspectives into peer review. They've broadened grant eligibility to community groups and third party can contribute to the Canadian research enterprise. Indigenous knowledge and research has been increasingly included across their programming. The tri-council is engaging and consulting still, to develop better strategies for reconciliation and to allow indigenous non-profits with a research focus to retain their eligibility for support.



Marchand says participatory science is particularly exciting for health research. He presents the FRQ structure and thanks their Chief Scientist Rémi Quirion for taking care of Québec's science and the three councils like a caring mother.

He describes the shift from classical research to patient oriented research — rather than just talking in silos, speak to the patients! Don't exclude them in

later stages of the research project either. Even better, empower them as a partner.



Projects can also come from a need — this patient perspective can introduce new avenues. Projects have started at the FRQS that were pitched by engaged citizens, which are now funded and ongoing. One relevant example is on ethical foie gras!

Poissant describes programs for students and the role that citizens play in research process at FRQSC, from co-design to joining the assessment team. She also notes the engagement of indigenous communities and individuals who want to be included as a partner, rather than as a subject of research.

The FRQSC soon plans to:

- revise metrics to include participative research
- revise partner status
- adapt assessment measures
- sensitize committees to broader sources of research and knowledge
- extend the duration of some grants



When Michael Strong was working with patients with Lou Gehrig's disease, he engaged patients and families, and was allowed to do autopsies after the fact. They found links to dementia, previously known to patients but not researchers. He also mentions diabetes, which is affecting so many young people around the world. Via the SPOR program, they were able to drive a 12% decrease in diabetes rates in indigenous community — they empowered teenagers and gave them the tools to teach children about how to prevent diabetes.

"We are doing our job because it's funded by taxpayers. Scientists have a duty to explain, and to make research accessible." — Michael Strong

Fortin brings up the GMO debate that came up while he was a plant researcher — he acknowledges the failure of scientists to engage and foster the trust relationship with the public. That trust was lost. Maintaining that trust is critical. Hewitt adds that it's not critical for everyone to make the link between

research aims and a tangible output; fundamental research doesn't work this way. If your research is fundamental, communicate your passion and excitement for your research, and why it is important.

Fortin adds that op-eds can be very powerful tools to engage the public, and mentions the Promoscience program as a good tool for reaching out to public (especially youth); the upcoming research partnerships program will also bring groups together.

On indigenous inclusion, Hewitt says we have to realize that many don't respond well to the word "research" due to a long-standing exclusion from it. Start with engaging, ask what they want to know, their thoughts, what they want the capacity to do.

Will inclusive and participatory science lead to more co-applicants on grants? Co-authors on papers?

Strong, Hewitt, and Fortin all mention the tri-council effort to increase eligibility for support. Hewitt adds that peer review needs an overhaul as well. Do we really only want to fund and promote those who publish in Nature, at the expense of those who engage communities and drive impactful initiatives? Absolutely not — culture change is required. Poissant reminds that not everyone in the public feels comfortable reaching out to scientists. Making dialogue and relationships more accessible by increasing science literacy, promoting science culture and communication will increase that capacity for participatory science.

A comment from the crowd mentions US initiatives like Federal agency STEM group across US federal agencies and the YES program at the NCI as great to drive public engagement. Strong highlights Let's Talk Science, and Fortin notes the both Promoscience and Science Literacy Week, as valuable programs. Bonnie Schmidt from Let's Talk Science mentions that engaging the public goes beyond top-down, there is a lot that should go top up.

How do we bring about the changes discussed? Poissant says culture change is hard, but changing evaluation and assessment metrics is a critical step, for both tenure promotion and peer review. Strong says we made the problem. New profs need so many high impact (by journal metrics) papers within 5 years for promotion and to achieve "success". This is a brutal process. We did this; we have to fix it. Fortin says a conversation should be had on the CCV as well, if we hope to drive a culture change.



Arthi Ramachandran, a PhD student at Concordia University and Treasurer of Science & Policy Exchange, adds that there are few funds available for scientists to engage communities after the research is complete, to communicate the results. Engaging only at the beginning is part of the problem. Hewitt says this should be funded, absolutely.

CIHR grant budgets allow engaging patients, but not other audiences whether they are niche or a broader public. Can this change? Strong says these conversations must be had, and he hopes he can answer that question crisply in 2020 once a strategy for CIHR is in place.

A dean from the University of Saskatchewan says they have already changed metrics to value community engagement, and that this can definitely be done.

Rachel Ward-Maxwell, a staff astronomer at the Ontario Science Centre, tells the panel about the role museums are playing to engage the public and create those participatory links. They are happy about the SSHRC partnership grants, but want to know if there is / will be portion of grants dedicated to engagement and communication. Marchand says there is space for outreach in the FRQS grants.

A member of AGE-WELL says that citizens can feel token when they are engaged, especially if no member of the public is included on the panels developing policies about participatory science. Strong mentions SPOR as a model to follow. Support for non-academic groups who do research, from research councils, is clarified by Hewitt as important. Fortin confirms that nonprofits and non-academic groups can be partners in research and should be supported.

Final thoughts? Marchand says AI is not emerging, it's emerged. Hewitt says there will be evolution of the CCV in the revamp of their programming, Fortin adds that culture change is collaborative and requires collective effort.