



Canada and the world: research collaboration is more important than ever

Moderator:

Roseann O'Reilly Runte, President and CEO, Canada Foundation for Innovation

Panellists:

Mitch Davies, President, National Research Council Canada

Dr. Mona Nemer, Chief Science Advisor (Canada)

Dr. Fred Wrona, Special Science Advisor, Laboratories Canada

Moderator: Welcome to the International Conference on Research Infrastructures (ICRI) and the first panel on federal research. It's a conversation with three extraordinary guests: Dr. Mona Nemer, who is Chief Science Advisor to Canada's Prime Minister and also Honorary Chair of this conference. Previously, she was Professor, Vice-President of Research and Director of the Molecular Genetics and Cardiac Regeneration Lab at the University of Ottawa.

She has a PhD in Chemistry and postdoctoral training in molecular biology, the Institut de recherches cliniques de Montréal (IRCM) and Columbia University. She has, among other significant accomplishments, discovered several genes essential for normal heart development and function.

She was awarded the Arthur Wynne Gold Medal by the Canadian Society for Molecular Biosciences (CSMB), the Order of Canada Fellowship and the Royal Society, and is a Knight in the Ordre national du Québec and the Ordre national du Mérite de la France.

Mitch Davies is President of the National Research Council of Canada, Canada's largest federal research and development organization. It does basic and applied science in a number of fields, including photonics and aerospace, and through the NRC Industrial Research Assistance Program, provides advice, connections and funding to help Canadians small and medium-sized businesses increase their innovation capacity and take ideas to market.

Mr. Davies previously served as Senior Assistant Deputy Minister, Industry Section, at Innovation, Science and Economic Development (ISED). He has held senior executive roles across government, including the Privy Council Office and has served as Senior Assistant Deputy Minister and founding executive of Innovation Canada. A graduate of the University of Manitoba and Queen's University, he holds degrees and Master's in Business Administration and a Bachelor of Commerce degree.



Dr. Fred Wrona is a Professor and Svare Research Chair in Integrated Watershed Processes at the University of Calgary, and is also an external Special Science Advisor to the Laboratories Canada Program with the Department of Public Services and Procurement Canada.

Previously, he was the inaugural Chief Scientist for Alberta Environment and Parks Department; the Assistant Deputy Minister for Environmental Monitoring and Science Division; and Vice-President and Chief Scientist at the Alberta Environmental Monitoring and Reporting Agency.

Prior to working for the Government of Alberta, he was Research Scientist and Manager with the Environment and Climate Change Canada for over 20 years and served as Canadian Head Delegate to the Arctic Council, Arctic Monitoring and Assessment Programme (AMAP) and the UNESCO International Hydrology Program.

He's been the recipient of numerous national and international distinctions and awards for his scientific leadership and contributions.

And I'm Roseann O'Reilly Runte, President and CEO of the Canada Foundation for Innovation. And it's my great privilege to join this conversation with our distinguished guests.

The first thing I'd like to ask them, is could they perhaps share with us a few points of pride, some of the reasons we are so proud of research and the research infrastructure that we have in Canada.

Mona, would you care to commence?

Dr. Mona Nemer: Well thank you very much, Roseann. What a pleasure to be here with you and my colleagues. But first, let me welcome everyone virtually, to Ottawa. I'm just so sorry that we're unable to meet in-person and really hope that we'll be able to do so in the near future.

I'm super proud of Canadian science and research. It's, I think, demonstrated during this pandemic how it can come together in the national interest, both in terms of providing the answers that we need for the advancement of science, whether it's about the virus, about the immunity generated following infection, but also practically helping the government as we needed to scale-up diagnostic testing, to create reagents that we need. So many different labs have really put efforts into this and, of course, the National Microbiology Lab that has the unique level 4 lab in Canada that was instrumental in developing



many diagnostic tests in helping basically detect the virus very rapidly and also limit the spread of the disease.

As a researcher myself, of course I know the importance and the richness of the ecosystem in Canada when it comes to research facilities. Whether they are in one place, like we mentioned the National Microbiology Lab, many of the NRC labs that we'll hear about from Mitch, but also distributed infrastructure like, for example, the funding that the government provided to Genome Canada and that we are using as we speak right now, to determine which variants of the virus are circulating in Canada and what we can do about it. So there are just so many reasons to be extremely proud and enthusiastic about research and science in Canada.

Moderator: Mitch, I think you're ready to jump in.

Mitch Davies: Thank you. Merci. Merci, Roseann [00:06:45 French language]. It's great to be with you and everyone at the conference and welcome you to Ottawa and Canada for this important conversation. And it's a great honour to represent the National Research Council and to work with such a great organization that's been part of Canada's science and technology history, dating back to 1916.

And so as a steward of very significant research facilities across the country, in 14 research centres, and we've recently actually completed a large scale facility review of all of our facilities to assess them for strategic merit and the count was somewhere around 126 facilities under our care, which if you had to replace them would be close to \$2 billion of infrastructure that is supported through the National Research Council. So it's a little difficult to pick among the 126 to give you just a few, because I'm proud of all the men and women that take care of these facilities and that are integral to their being available to Canada and the world at all times. But I'll just give a few examples just to highlight the kinds of things we do at the Council.

It was spoken out that we're involved in photonics and actually if you think about the history of science and the use of light and lasers and all the aspects of science this includes it's something that's been an important part of the NRC's legacy in scientific terms, and it now is very much embodied in our photonics fabrication centre which has been in existence for over 17 years, which is the only pure-play compound semiconductor foundry in North America at this time and has had an impressive track record of delivering impactful photonics device fabrication services to research and to the industry over many years. An important niche we occupy is in compound



semiconductors for photonics and microelectronics and this is a centre of a dynamic industry critical to growth in several sectors, including telecommunications, health care, defence and security, environment and automotive, and we've just actually recently received support through the most recent federal budget to renew the facility entirely and we're very excited with that opportunity. So it's something we're proud to be able to see grow and continue to be available to the research and industrial ecosystem in Canada.

Just to switch, perhaps in terms of areas of research that the NRC's involved with, is going back to our founding, we were responsible for our role in international astronomy and maintaining Canada and international astronomical observatories for research and we do this now through the Hertzberg Astronomy and Astrophysics Research Centre, or HAA, which has an outstanding international reputation for being able to build, design these large instruments that we use to peer into the sky, to unlock new scientific discoveries. And we do this in large measure as well, in partnership with university researchers who are leading in this field and one example is a UBC project called CHIME, which is involved in discovery of fast radio bursts from the universe. And we're poised here in this area to make major breakthroughs in terms of the study of pulsars and mysterious dark energy that dominates our universe and in particular, we take it as a point of pride to be able to design and fabricate these types of instruments using our expertise, but also to provide the space to maintain them and make them available to researchers on an ongoing basis, which we do in this case in the Okanagan Valley of Canada in partnership with the Okanagan Nation Alliance, who are really the stewards of the land and we work in respect with them in terms of how we maintain this infrastructure. So it's a long tradition, a long history through the NRC in our role in facilities, and we're very proud of it and of the place we take on the land and across our country to maintain these facilities for science and for industry.

Thank you.

Moderator: Thank you so much.

Fred, in a way, the whole country, our environment, is your lab, the Arctic, the whole from coast to coast to coast. However, you are also a special advisor on Laboratories Canada, so you see the issue from both sides and we'd love to hear from you about where you think we are and where we might be going.



Dr. Fred Wrona: Great Roseann and thank you very much for the kind introduction. And again, it's a wonderful and great pleasure to be with both Mona and Mitch to discuss this important topic.

I'm actually in a very interesting role in providing science advice to the department, to Public Service and Procurement Canada and the Laboratories Canada Program, and there's some interesting statistics just quickly to maybe put the context in there. Federal science and infrastructure portfolio in Canada, and this is actually known as a research asset class, encompasses approximately 2,400 buildings and a total floor area of 2.5 million square metres. It represents 11 per cent of the overall government portfolio invested in science infrastructure, and I think that illustrates the importance of science technology, infrastructure in enabling the type of work that we need to conduct both in Canada and also in terms of our partnerships in the international scene.

As you've mentioned, one really good example, in addition to the examples that both Mitch and Mona have provided, is the support and infrastructure for Northern Arctic science in Canada. As you can imagine, the geographic scale of Canada, it's land and ocean masses north of 60 degrees and related diversity of scientific cultural landscape, biodiversity types of issues, atmosphere, climate change, all of these areas are requiring infrastructure supports and facilities to actually enable our science community both from a federal point of view with our partners, collaborators to actually work in these often extreme environments. Some very good examples of some of the areas that we have of course, is our showcase Canadian High Arctic Research Station, the CHARS research station that is actually managed by Crown-Indigenous Relations in Northern Affairs Canada, this station located in Cambridge Bay is really a world-class facility. It's a multi-purpose federal building. It's been put in place to help advance Canada's knowledge on Arctic science in general in the broadest sense and strengthen Canadian leadership as it relates to polar science. It operates a campus type of approach that brings in Indigenous communities and knowledge holders, inter-and transdisciplinary researchers from around Canada and also is the home to the Polar Knowledge Network. So it really plays an important role in facilitating and coordinating science in the Arctic. Other examples include the facilities that are run by Environment Canada and others in Alert and Eureka which are dealing with atmospheric type of measurements. And of course, I have to mention that not everything is sitting in buildings on land, but we have ships like the CCGS Amundsen that is a port often in Laval and moved to the Canadian Arctic and this is a mobile laboratory platform that's used by



oceanographers and others in terms of doing Arctic work. So we have a diversity of infrastructure that we work within the Arctic and the federal government certainly supports a lot of these activities.

Moderator: Thank you so much for that.

As we think about the infrastructure and the people, we're getting through this pandemic and as we do, we note that scientists in Canada have participated in international projects and I'm wondering, Mona, if you might talk a little bit about the Milan project and Art MacDonald and say what researchers in the U.S. and Italy and Canada did together, researchers who weren't even engineers, who were people who were studying physics to do something that really served the countries around the world and people in this pandemic. And in a way, this leads to the question of open science and sharing so maybe you could talk about that a bit.

Dr. Mona Nemer: Well like I said, this pandemic has really showed us how researchers are ready to not quite pivot the research, but really bring all their expertise to bear, to help out the country. And the example you mentioned, Roseann, is spectacular because here's our physics novel laureate whose studying dark matter with his collaborators around the world deep down underneath the earth and they just basically drop all this to develop ventilators to support our hospitals, to support our health care system and actually they managed to do it very successfully and produce several of those. I think this is a great example of how I guess, adaptive, imaginative and useful science can be when we need it and, of course, these are past investments but they're also dependent on large infrastructure. And just to go back and tie what my colleagues here, Fred and Mitch mentioned, one can easily get overwhelmed with all these great infrastructure and knowing what's where when you need it. So I just want to acknowledge the great work that the Canada Foundation for Innovation (CFI) that you head, Roseann, is doing with the navigator instrument to basically make it easier to find the specialized infrastructure that we need here in Canada, whether it is in a government lab in Ottawa, or at the other end of the country, or up in the Arctic. And I think this is also a great instrument of collaboration internationally with our international colleagues. I very profoundly believe that these large infrastructures are the perfect platform for collaboration across countries but also across sectors and between the private, the public and the university sector, to make sure that our research goes from discovery all the way to communities. So this is another great thing that we can be excited about and we can imagine that we can pivot to any emergency and any complex question that we may be faced with.



Moderator: Mitch, are there limits to where we go with open science and global sharing, or is it just what should happen in the world?

Mitch Davies: Thank you, Roseann. And I just want to credit you again, as Mona has, in terms of the navigator, as we are participating fully in that as well so that all of our facilities are fully visible and integrated into what Canada has to offer. And I think that's a great example of how we share in the science world with the government, but also sharing with our partners in the university sector to ensure our facilities are known.

Open science, when I think of the history, if you think of the NRC, we are the keeper of Canada's National Science Library. So at the time when NRC was created, there really was a place where you had to retain the books and knowledge about science and our job was to do that for our whole country. Now of course, the way that's done now has been transformed many times over and will continue to be, but we're very much a very significant player in open science and working particularly with Mona across the federal system to take our work to the next level and progress our goals. And I think in our unique case, obviously we have areas of research, for example, astronomy which I spoke of, is such an international community. The data sharing, it's very, very open and obviously, it's a global common, right? The information, we pull from all these very important instruments that's made available to the researchers around the globe. And it has to be because obviously there's only scarce time that you spend to look through these very significant instruments and you have to make sure that information is available in a form that people can use it. There's also work that we would do, for example, in the National Research Council on particular missions, like for defence or security applications, for example, another government, the Department of National Defence where they would be essentially a client of ours. And obviously in that case, there's a different set of requirements that's supplied in terms of how we work. But really, we as an institution have to embrace this whole spectrum of how you want to apply as open science principles and ensure that we're really favouring making sure we have this maximum accessibility and that we're making data and governing data and making it a true resource that we manage as an institution and that we make available as broadly and widely as possible. So I think we can embrace this and move with this. And again, under Dr. Nemer's leadership, we've been certainly doing that as a federal community with the Government of Canada for some time now and have more work to do.



Dr. Mona Nemer: Maybe I'll just mention, Roseann, if I may, on the open data front? I think that this is creating, of course, great opportunities and it's proven to us during this pandemic, the importance of accessibility to the data, to the research. However, I think it's going to come with its own challenges of interoperable data, of the systems and we need to think, of course, of data as the next frontier in terms of research infrastructure. We can't see it, but that's eminently present everywhere with us.

Moderator: Fred, you are a specialist in water and then there's the air, too. And the water and the air know no boundaries and they know no frontiers, and so you're probably the first and best person to talk about the importance of meeting global challenges globally. How do you see scientists working together to face some of the important issues that the whole world faces?

Dr. Fred Wrona: Well, I think based on what has been said already, I think COVID has given us a very clear example that applies really to the scientific [00:22:54] as a whole. No single organization in the system can do it alone any longer. I think we're getting into the realm that the advancements that we need to make in terms of the various science disciplines, also now we're moving towards trans-and interdisciplinary science in a major way that we haven't done before, including I might add, recognition of multiple knowledge systems that involves also recognition and working side by side with Indigenous knowledge holders and others. This requires a new way of doing things for us and some of our class with training that we've had in terms of our discipline [00:23:37] silos or whatever, those institutions and those approaches are beginning to be broken down. And I think what we have is an ability. Part of that is actually going to be through things like open science and open information management and IT platforms, but actually through networking and being able to develop approaches where we can actually work as a community, as an integrated community to address problems not only that Canada faces, but of course, the global community as a whole. And I think it's an exciting era, but as Mona's mentioned, there will be challenges associated with this. And I think that the more that we learn from each other's experiences, the more that we develop the networks and including one of the things that I know about the Laboratories Canada Program is trying to do is address barriers. What kind of institutional barriers do we still have in terms of collaboration and partnerships? Those also have to be addressed directly for us to move forward. But it's an exciting time and like you said, I think COVID has really taught us that we cannot work alone. We have to work as an integrated body.



Moderator: Mitch, thinking about global challenges and working together not just on the ground but in the air, there's aerospace and working together on space missions and even the telescopes like the Super DARN, which is working with 30 different countries around the world to look at the radio bursts that affect the earth's climate and environment. Would you like to just say a few words about the global challenges and the global possibilities?

Mitch Davies: Thanks very much. And I just would pick up what Fred has said, is that we just, a few months ago, as part of an international organization among research and technology organizations which counts among its members, 16 international institutions, similar to the National Research Council of Canada but with different mandates. We joined together and released an international statement on collaboration at this time, just to draw an emphasis how important it is that we work close to together and we've done things through the Eureka Network with Europe. Over the course of the pandemic, we've launched calls for innovation proposals on challenges related to COVID and beyond and it's been great to see the response. We've worked in collaboration with these deep enduring bonds we've established over the years, and at times of crisis, we've really turned to one another to be able to work collaboratively.

You mentioned science and I just was thinking of how proud it was for me to hear our team at the Herzberg Institute have three projects with members from our team that will be among the first in the new space telescope, the James Webb space telescope, which brought in over a thousand proposals from around the world, to have the privilege to be able to have them up and running in the early days of that telescope's peering into the universe and to have us participating with such great international collaborations to be part of that story. I think we really unite. We unite when we're in a crisis, we unite when we're in the heavens and I think it really tells us that we can remove a lot of the boundaries that perhaps we somehow work under from day to day and we can see beyond that and maybe even just now we're connecting digitally. We've kind of democratized the platform because we can get together and really, I think, we can get more people involved in what we do and the kind of reach we can have. So there really is a calling now for science and technology to respond and I think we have the means to demonstrate we can really move forward. And then next challenge, of course, is obviously we've got to concentrate on the climate challenge and that will be obviously, where we're pushing in the years ahead after coming out of COVID to work even more closely together on that challenge.



Moderator: And Mona, you bring science and scientists together right across Canada, but you also represent us with all the chief advisors around the world, and so it's only appropriate that you get to tell us a little bit about how Canada and the world can move together in the future.

Dr. Mona Nemer: This is a fantastic question and as we speak right now, just as an example, as part of the G7 under the U.K. presidency this year, we're working together to see how we can better prepare for future pandemics, how we can shorten the time from the inception of a drug to the time it can be manufactured and distributed, vaccines, the same thing. And this is going to involve a lot of collaboration, collaboration between regulators, collaboration between researchers, but also collaboration between the supply chains. There are a lot of things that go into making any product and these supply chains have to be integrated and coordinated. So this is just an example right now and throughout the pandemic, of course, we were collaborating, working together to speed up the deployment of testing, the quality of some of the tests, what works, what doesn't work. So we're joined at the hips. As they say, it's one world, it's one health and it sure is one environment.

Moderator: And we have wonderful leaders in Canada, and I'm sure that everyone at this conference joins me in applauding you and thanking you for your wise words.