ANNUAL REPORT OF THE

Chief Science Advisor

2019–2020

Office of the Chief Science Advisor of Canada
Bureau du conseiller scientifique en chef du Canada
Canada

Office of the Chief Science Advisor
235 Queen Street
Ottawa, Ontario
K1A 0H5 Canada

science@canada.ca

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A MESSAGE FROM THE CHIEF SCIENCE ADVISOR

Back in mid-2019, my staff and I took part in three separate tabletop simulations: exercises designed to simulate the stresses of decision-making in emergencies. One simulation was domestic, conducted with Public Safety Canada and the Department of National Defense. The other two were international, conducted in the United States and the United Kingdom.

These exercises were part of an ambitious 2019-2020 work plan for this office. In addition to these simulations, our staff were simultaneously active in many files across all areas of our mandate: providing better science advice to decision-makers, establishing open-science principles for federal research, improving federal government science, and conducting science-based international diplomacy. The year 2019 was only the second full calendar year of this office's existence. We were taking up our role with increased confidence, solidifying relationships with some federal departments and establishing new ones with others.

As we conducted our mid-year simulations, I expected they would provide helpful guidance on how science can assist government decision-makers in times of crisis. I also expected that we would likely have at least a year to follow through on their recommendations, putting in place the structures that would ensure timely flow of sound data and scientific analysis for the moment when a true emergency eventually took shape.

I was correct about the former. I could not have been more wrong about the latter.

When the COVID-19 pandemic took hold in Canada, my staff and I took the lessons learned from the simulations and implemented them as quickly as we could. And we succeeded, I believe, in setting up a network of pathways that brought scientists together, and allowed information to flow swiftly from Canada's most knowledgeable researchers through to government decision-makers.

Our efforts were successful thanks not only to the work of my staff, but to the willing participation of the scientific community across Canada, from multiple disciplines: public health, clinical medicine, immunology, epidemiology, mathematical modeling, risk modeling, risk communication, behavioural sciences and beyond. Words cannot express the depth of my appreciation and gratitude for their generous help and advice.

Our work is far from complete, neither on COVID-19 nor on my office's many other initiatives, all of which are discussed in the pages of this report. Through it all, Canadians can be proud of the way their scientists and researchers are answering the call, working together, applying their knowledge and seeking solutions to the perplexing problems of our time.

On December 12, 2019, Dr. Mona Nemer met with Prime Minister Justin Trudeau and Minister of Innovation, Science and Industry Navdeep Bains before the year's end to talk about the highlights from 2019 and what's on the horizon for 2020.

Dr. Mona Nemer, C.M., C.Q., FRSC
Chief Science Advisor
Government of Canada

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Executive Summary

The Office of the Chief Science Advisor (OCSA) was created by the Government of Canada in late 2017, with the appointment of Dr. Mona Nemer to the post of Chief Science Advisor. This is the second annual report of the Chief Science Advisor, and it details the activities of her office for the 15-month period from January 1, 2019 to March 31, 2020.

An ambitious work plan was established in 2019 and progress against that plan was consistent and robust. To illustrate, the OCSA:

- Continued its work on scientific integrity, ensuring the ability of federal scientists to pursue their research and speak freely about their results.
- Expanded the fledgling network of departmental science advisors, and shaped it to form the foundation of a robust advisory function that can filter and funnel the best scientific information and counsel to federal decision-makers.
- Put in place a framework for open science and open data for all research conducted within the federal government, as well as a timeline for expanding the principles of openness to all federally funded scientific research.
- Reviewed the funding and operations of Canada's major research facilities and of the Government of Canada's laboratory facilities, with recommendations for improvement that will ensure the facilities' excellence while making the most of federal investment.
- Was active in the international promotion of scientific cooperation and collaboration, briefing members of Canada's foreign service, participating in state visits, and leading delegations to major international scientific conferences.

- Deepened its relationships with Indigenous peoples in Canada, to better understand the intersections between Indigenous and scientific knowledge, and encouraging Indigenous communities to set their own research priorities.
- Established a youth council to help mentor Canada's next generation of scientists.

In addition, the Chief Science Advisor was a frequent speaker in public and the media on issues relating to science in Canada. She was also an outspoken supporter of diversity and gender equity in the STEM disciplines, participating in numerous roundtables, media interviews and other public forums on the topic.

As part of its work plan, in mid-2019 the OCSA also participated in a series of simulation exercises designed to mimic a global health emergency, to better understand how scientific information flows to government decision-makers in times of crisis. Just months later, the lessons learned from those simulations helped to shape the OCSA's role in helping to fight the COVID-19 pandemic. The OCSA's initiatives on this file included:

- A series of COVID-19-related science advisory panels, which gathered together top scientists from across Canada. These advisory panels, and the task forces that derived from them, provided the government with expert counsel from outside the halls of government itself.
- A successful international collaboration to apply the principles of open science and open data to all coronavirus-related research, past and present, in order to help speed the pace of discovery.
- A heightened role for the Chief Science Advisor in public engagement, to help Canadians understand the science behind COVID-19 and the mitigation measures needed to slow its spread.

In its second year of operation, the Office of the Chief Science Advisor grew more fully into its role, advancing a range of initiatives in all areas of its mandate. The OCSA accelerated its operations in its policy work, its international engagements, its science advisory function, and in its support for federal research facilities and scientists. The Chief Science Advisor intends to harness this momentum and translate it into further achievements in 2020-21.

The OCSA team wore red as part of Wear Red Day to raise awareness about women's heart health in Canada during the month of February.

Introduction

Every day, the Government of Canada makes crucial decisions that affect our economy, the sustainability of our climate, and the well-being of our society – just as all governments do, both here at home and around the world. The best decisions are those guided by clear priorities and supported by evidence. And scientific knowledge can be a crucial contributor to this process: scientists collect information, analyze data, and provide evidence-based, non-partisan recommendations that can help governments identify their best course of action.

The Office of the Chief Science Advisor (OCSA) was created in September 2017 with a mandate to support the Government of Canada's decision-making processes. More specifically, the Chief Science Advisor's mandate can be broken down into four key areas:

- **Open science:** Help ensure that government science is fully available to the public, and that federal scientists are able to speak freely about their work.
- **Better science:** Recommend ways for the government to better support quality scientific research within the federal system.
- **Science advice:** Ensure that scientific analyses are considered in government decisions, coordinate expert advice to Cabinet, and recommend ways to improve the government's science advisory function.
- **Science diplomacy and outreach:** Promote a positive and productive dialogue between federal scientists and academia, both in Canada and abroad, and raise awareness of scientific issues.

With the OCSA's second full year of operation now complete, this report details its main accomplishments in each of these four key areas, as well as its priorities for the year ahead. In addition, this report also provides a review of the broader scientific endeavours taking place within the federal government, and makes recommendations to better conduct and coordinate them.

Key Achievements

Open Science

MODEL POLICY ON SCIENTIFIC INTEGRITY

Adoption, effectiveness and early assessment

Upon the creation of the OCSA in 2017, its first priority was to develop, in collaboration with the Treasury Board Secretariat and the Professional Institute of the Public Service of Canada, a model policy on scientific integrity to be adopted by a subset of federal government departments and agencies. The policy's purpose was to ensure that federal scientists and researchers conduct themselves responsibly in their work, to encourage public dissemination of federal research, to affirm researchers' freedom to speak openly about their findings, and to shield that freedom from political, commercial or stakeholder interference.

The model policy was targeted to 25 federal departments and agencies whose staff includes a substantial complement of scientists engaged in research-based activities. (See Appendix A for a complete list, and Appendix B for a list of the top federal departments and agencies in terms of total spending on scientific research and development activities.) A "model policy" approach was taken so that individual departments and agencies could either adopt the model as is, or adapt it to suit their specific circumstances.

In 2018-2019 the OCSA rolled out this model policy, and the adoption was swift: 20 of the 25 implicated departments and agencies now have a scientific integrity policy (SIP) in effect, with two more pending approval, while SIPs are currently in development for the remaining three departments.

The OCSA then shifted its focus toward providing assistance to departments and agencies in implementing their SIPs. The OCSA led the establishment of a SIP interdepartmental working group, which is working to develop guidance tools that departments can adopt or adapt to support their SIPs, as well as a model SIP compliance monitoring plan and a model SIP performance evaluation framework, the implementation of which will allow departments to determine whether the policy is achieving its objectives.

In January 2020, working in conjunction with the Treasury Board Secretariat and the Professional Institute of the Public Service of Canada, the OCSA conducted an initial compliance assessment of the policy's non-discretionary provisions. The survey showed that compliance was high across most departments, in part because many of them already had policies and guidelines in place (such as policies on the open communication of science and research) that directly supported SIP objectives. Individual departmental policies closely resemble the model, with variation largely arising from the need to tailor elements of the model policy to a department's specific circumstances. The model policy's adoption provides a more integrated approach, allowing for greater sharing, coordination, and tracking of outcomes.

The assessment also identified three key opportunities for improvement:

1. The creation of mechanisms for soliciting the advice of an organization's scientists and researchers on its capacity to meet current and future scientific challenges.
2. The provision of training, education and professional development opportunities for all staff to learn what scientific integrity is, and what its implications are for employees that conduct, manage, communicate or use science.
3. Developing clear expectations for external contractors and collaborators with respect to compliance with departmental SIPs.

The OCSA continues to provide ongoing advice to departments and agencies on all SIP-related issues.

ROADMAP FOR OPEN SCIENCE

Key recommendations, with timeframes for delivery

The Government of Canada, through its many departments and agencies, conducts a great deal of ongoing scientific research and inquiry. The results generated by that research contribute to an ever-growing global body of scientific knowledge.

Open science is the practice of making scientific data, research and results freely available to all, with minimal restrictions. The practice of open science respects privacy, security and ethical considerations, as well as intellectual property protections — all while promoting accountability, reducing duplication and accelerating knowledge transfer. Early in 2020, the OCSA published the Roadmap for Open Science, whose objective is to guide timetable-driven efforts to make federal science and research more readily and easily available to Canadians. The roadmap seeks to achieve two key specific outcomes:

- **Open access:** The articles in peer-reviewed academic journals authored by federal scientists should be made openly accessible by January 2022. Other publications by federal government researchers — reports, conference papers, monographs, book chapters and more — should be openly accessible by January 2023.
- **Open data:** The data collected and used by federal scientists in the course of their publishable research should adhere to FAIR data principles ("findable, accessible, interoperable and reusable") by January 2025.

Achieving these outcomes will require the harmonization and coordination of disparate data collection and research publication practices between — and even within — federal departments and agencies, each with its own distinct organizational culture. To reach these objectives and provide ongoing support for open science within government, the roadmap also makes a number of additional recommendations, including:

- The creation of a high-level open science steering committee that includes the Chief Science Advisor, the Chief Information Officer of Canada and the President of Shared Services Canada, with terms of reference to be developed by the end of 2020.
- The appointment of departmental chief scientific data officers by November 2020, to coordinate data strategy and management.

- The convening of internal departmental consultations by November 2020. Based in part on these consultations, departments and agencies should develop open science action plans by January 2021, featuring a common, phased approach to their implementation.
- The identification of the specific criteria under which some scientific research outputs could be kept private or confidential, led by the Chief Science Advisor, by December 2020.
- All these recommendations apply specifically to government departments and agencies engaged in scientific conduct and inquiry. By December 2021, the Chief Science Advisor, in partnership with the federal granting agencies, learned societies, and provincial and territorial funders, will hold consultations with scientific communities and their administrative leadership on how to establish a broader pan-Canadian open science strategy for Canadian science.

The Roadmap for Open Science was presented to the Honourable Navdeep Bains, Minister of Innovation, Science and Industry, during a student research showcase in Ottawa on February 26, 2020

OPEN SCIENCE AND COVID-19

In March 2020, the chief science advisors from 17 different countries, building on the work of the London-based Wellcome Trust, called upon researchers and publishers around the world to make their COVID-19 and coronavirus-related publications — past, current and future — immediately and freely accessible in public repositories such as PubMed Central, the free publication archive of the United States National Library of Medicine.

The 17 chief science advisors also called upon researchers to publish their data in an open, machine-readable format. The purpose of the initiative was to help speed the pace of discovery to assist in the management and containment of the pandemic, by giving all researchers swift and unconstrained access to each other's work.

This call for international open-science collaboration was first signed on March 13, and includes the signatures of the chief science and technology advisors for the following nations and jurisdictions:

Australia
Brazil
Canada
European Commission
France
Germany
India
Ireland
Italy
Japan
New Zealand
Portugal
Republic of Korea
Singapore
Spain
United Kingdom
USA

This joint effort was successful: later in March, more than 30 academic journals and publishing houses (including large publishers such as Elsevier, Sage, Springer, Taylor & Francis, Wiley and others) made all their COVID-19 and coronavirus-related publications available via PubMed.

For more information on the OCSA's efforts on the COVID-19 pandemic in Canada, see pages 24 to 27.

Key Achievements

Science Advice

ESTABLISHING A NATIONAL SCIENCE ADVISORY SYSTEM

Appointing departmental advisors, creating a network

Prior to the creation of the OCSA, Canada – unlike many European nations – did not have a structured and formal path for the provision of science advice in government decision-making. In its efforts to establish such a path, the OCSA has been able to learn from the prior experience of other governments. A key lesson has been that providing good science advice to deputies, ministers and Cabinet comes not from a single official or office, but from a network of science advisors within governmental departments and agencies who are formally engaged at critical steps in a process. As a result, in 2018 the OCSA announced it would seek to establish a network of departmental science advisors.

The construction of that network has proceeded apace in 2019-2020. The Departmental Science Advisors Network now has seven members; its scientists, and the federal organizations they represent, are listed in Appendix C.

The network established terms of reference and meets on a monthly basis. Its members were essential contributors to the OCSA's work on implementing departmental Scientific Integrity policies and in developing the Roadmap for Open Science. The Departmental Science Advisors Network also plays a leadership role in the newly created CanCOVID network.

Within their respective departments, the Science Advisors perform a range of functions: ensuring high standards of research, promoting departmental science portfolios, assisting with recruitment of scientists, developing external scientific partnerships, advising on communications, and promoting a culture of scientific excellence.

With this early success as a guide, the OCSA intends to continue working with federal government leadership to expand the membership of the Departmental Science Advisors Network, both within the 25 science-based departments and agencies (listed in Appendix A) and beyond.

Departmental Science Advisors: from left, Vik Pant, Shawn Marshall, Cara Tannenbaum, Pascal Michel and Sarah Gallagher. Missing in the photo are Paul Snelgrove and Dan Wayner.

BUILDING A COMMUNITY OF PRACTICE

The federal government workforce includes thousands of scientists from all disciplines working in many departments and agencies. During the course of the year, the Office of the Chief Science Advisor led community of practice meetings that also included the departmental science advisors, the vice-presidents of the government's granting agencies and assistant deputy ministers in the government's science-based departments and agencies, to share information and identify areas of interest that are currently unaddressed by existing forums.

The community of practice identified the need for continuing work on Indigenous knowledge systems, science literacy, and the renewal of the Career Progression Framework for the federal government's scientists. The OCSA hopes to play a leading role within the community of practice on these priorities.

SCIENCE ADVICE IN EMERGENCIES

Assisting decision-makers at crucial moments

At the outset of 2019, months prior to the discovery of the novel coronavirus and the onset of a global pandemic, one of the OCSA's top planning priorities was to investigate the Government of Canada's current status with regards to the flow of science advice during emergencies.

To that end, in mid-2019, the OCSA, together with Public Safety Canada and the Department of National Defence, conducted a science advice simulation of a complex emergency that impacts multiple government departments. The OCSA also observed similar exercises that took place in the United Kingdom and the United States. Among the observations the Chief Science Advisor's office drew from that simulation are:

- Scientific information is critical to successfully coping with most, if not all, emergencies the government can expect to face.
- Canada relies on a distributed science advice system, in which individual departments provide scientific and technical advice to decision-makers.
- This distributed system does not provide a science advice forum to consider the emergency at hand in a holistic way that spans individual department mandates; as a result, advice risks being fragmented and even contradictory.
- In emergencies, the federal government has limited capability to rapidly solicit expert scientists from the private or academic sectors because those scientists are either unknown to government or they do not have proper security clearance.

The OCSA also examined international best practices, particularly the United Kingdom's Scientific Advisory Group for Emergencies (SAGE) process, chaired by that country's chief science advisor (and co-chaired by its chief medical officer in public health emergencies). SAGE coordinates technical advice to Cabinet in emergent situations and maintains a list of pre-cleared experts from academia and the private sector.

In November 2019 the OCSA organized the opening plenary discussion of the 2019 Canadian Science Policy Conference, entitled "Leveraging data for science advice and rapid response to health emergencies." The Chief Science Advisor moderated the discussion, which focused on how scientific data is gathered during emergencies and how it is used in the formulation of science advice to governments. Panelists included the top science advisors from the United Kingdom and European Union, Sir Patrick Vallance and Rolf Heuer, as well as Public Health Ontario's Yasmin Khan and University of Toronto professor Kamran Khan, whose company, BlueDot, uses artificial intelligence to track and predict infectious disease spread. These activities helped the Chief Science Advisor provide government with recommendations to improve science advice in emergencies that proved timely in the following months.

On November 13, 2019, the Office of the Chief Science Advisor organized the opening plenary session at the Canadian Science Policy Conference titled, *Leveraging Data for Science Advice and Rapid Response to Health Emergencies*.

From left to right: Rolf Heuer, Chair of the European Commission's Group of Scientific Advisors; Yasmin Khan, Consultant Physician, Public Health Ontario; Emergency Physician, University Health Network; Assistant Professor, University of Toronto; Kamran Khan, Founder and CEO, BlueDot; Professor at the University of Toronto; Sir Patrick Vallance, Chief Scientific Adviser to the Government of UK.

SCIENCE ADVICE AND COVID-19

Assembling experts for an unprecedented national emergency

The OCSA's research on science advice in emergencies, as well as its work to expand the Departmental Science Advisors Network, all took place prior to the onset of the COVID-19 pandemic. The timing of these efforts proved fortuitous, however, as they all helped shape the OCSA's support to the government in the first weeks of Canada's pandemic response.

The COVID-19 Expert Panel

In particular, the OCSA sought to immediately fill one of the gaps observed during its research on federal emergencies, namely that the federal government does not always have direct channels to the most knowledgeable scientists from across the industry and university sectors. In late February, the Chief Science Advisor assembled the COVID-19 Expert Panel, a group of distinguished researchers and practitioners in infectious disease research and treatment, disease modeling and the behavioural sciences. Its members are listed in Appendix D.

The COVID-19 Expert Panel held its first meeting on March 10 and has met regularly since, providing the knowledge and context needed for the Chief Science Advisor to develop the advice and recommendations she provides to the government. Given that COVID-19 is caused by a novel coronavirus, the available knowledge on its spread, its course of infection, its mitigation and its broader social impact was partial and evolving. The Expert Panel's role was to stay abreast of developments in data collection and research, so that federal officials were making decisions based upon the best evidence currently at hand.

COVID-19 Expert Groups and Task Forces

In mid-March, at the request of Health Canada, the COVID-19 Expert Panel established the Expert Group on Health Systems. Co-chaired by the Deputy Minister of Health and the Chief Science Advisor, the group's purpose is to provide practical advice to the federal government on issues such as data sharing, testing, infrastructure and personal protective equipment. A second group, the Expert Group on Modeling Approaches, was formed shortly thereafter. The members of these two expert groups are listed in Appendix D.

The Chief Science Advisor drew heavily on the Expert Panel and groups to set up a series of expert task forces to help advise the government on scientific standards and best practices on specific issues related to COVID-19 management.

From left to right, top to bottom: Louise Lemyre, Maziar Divangahi, Allison McGeer, Guillaume Poliquin, Caroline Colijn, Kamran Khan, Daniel Krewski, Joanne Langley, Cara Tannenbaum, Gary Kobinger, Samira Mubareka, Daniel Coombs, Deborah Cook, Matthew Gilmour, Supriya Sharma, Caroline Quach, Steven Taylor.

They included:

- Task Force on Reprocessing of Respirators/N95 Masks
- Task Force on Ventilators
- Task Force on Virtual Care
- Task Force on Long-Term Care
- Task Force on Data Analytics
- Task Force on Optimal Use of Health System Capacity
- Task Force on COVID-19 in Children

Each was created rapidly in response to emerging questions amid the COVID-19 pandemic, and each worked swiftly to provide timely insight that informed the government's response.

Public Engagement

As Canada's response to the pandemic evolved, Dr. Nemer took on a greater role as a public speaker to clarify key scientific issues and questions for Canadians. During the first two months of the national COVID-19 response, Dr. Nemer participated in more than 20 English and French media interviews, including several on live national television, to help inform the public on the science related to the novel coronavirus pandemic. The OCSA developed several products to support the communication of this scientific information, including videos and charts on diagnostic and serological testing.

From left to right, top to bottom: Joanne Liu, David Buckeridge, Tom Noseworthy, Nicole Basta, Seyed Moghadas, David Fisman, Louis-Martin Rousseau, Irfan Dhalla, William Ghali, Nick Ogden, David Earn, Jonathan Dushoff, Robin Tamblyn, Alan Forster, Ashleigh Tuite, Jianhong Wu, Constantin Polychronakos, Amy Plint, Paula Rochon, Boyan Paunovich, Andrea Moser, Roger Wong, Judith Hall, Paul Kubes, Frédéric D'Aragon, Jerome Leis, Thomas Stelfox, James Strong, Dominique Cousineau, Susan Benseler, Eyal Grunebaum, Christine Chambers, Ronald Laxer, Réjean Hébert.

Key Achievements

Better Science

IMPROVING CANADA'S MAJOR RESEARCH FACILITIES

A strategic national approach for Canada's "big science" infrastructure

The Government of Canada supports a number of large research facilities: specialized technology platforms that provide the underpinnings of Canadian-based, world-leading research and innovation. These research facilities, some of which are subject to international or federal-provincial partnerships, are increasingly essential to fields such as physics, health, environment and agriculture. Yet there is little coordination in terms of either strategic management or funding for these facilities. In 2018, the Prime Minister asked the Chief Science Advisor to provide advice on a strategic national approach for these research facilities, so that the federal government can better plan and manage its investments and enhance its support for the work of Canadian scientists.

The Chief Science Advisor's review was supported by multiple national and international consultations with experts across a broad range of disciplines. Among the facilities are bricks-and-mortar research centres, such as the TRIUMF particle accelerator in Vancouver, the Canadian High Arctic Research Station in Cambridge Bay, and SNOLAB, the underground neutrino and dark-matter physics laboratory near Sudbury. Others are mobile units, such as the Arctic research icebreaker CCGS Amundsen and the International Space Station. Still others are distributed infrastructure, such as the computing and communications networks maintained by CANARIE and Compute Canada.

The analysis revealed considerable complexity and heterogeneity in the government's approach to support these major research facilities, with no formal coordination among the multiple organizations who fund and operate them. While this state of affairs is understandable given the diversity of the facilities themselves, they all depend upon federal funds, and could all benefit from greater predictability and accountability to enable long-term planning – without creating additional rigidities in decision-making or administration.

The Chief Science Advisor recommended the government adopt a portfolio approach to its major research facilities, with a central steward to handle oversight and long-range planning of its investments. Furthermore, it was recommended that cyclical five-year reviews of each facility be conducted using independent experts to determine future plans and ensure the continued excellence and relevance of these facilities.

The Chief Science Advisor visited the facilities at TRIUMF, Canada's particle accelerator, during a visit in Vancouver, British Columbia, December 2019.

Monika Stachura, Research Scientist (left) and Esther Schirrmacher, Director, Institute for Advanced Medical Isotopes Operations (right).

FACILITATING BETTER PANDEMIC RESEARCH

The creation of the CanCOVID network

In March, the Chief Science Advisor helped create a platform designed specifically for COVID-19 researchers, clinical collaborators and healthcare stakeholders from across Canada. Known as the CanCOVID network, its purpose is to facilitate lateral communication among researchers who are tackling similar problems, assist in the research and measurement of COVID-19 immunity, and share evidence-based tools with clinicians on the frontlines. It also provides a line of communication between all these groups and government decision-makers.

The need for such a network was identified jointly by the Expert Panel on COVID-19, the Departmental Science Advisors Network, and the U15 Group of Canadian Research Universities. Dr. Nemer appointed two departmental science advisors, Dr. Cara Tannenbaum of Health Canada and Dr. Sarah Gallagher of the Canadian Space Agency, to lead the CanCOVID network's implementation. The stakeholders held a conference call to develop an action plan; within a week of that call the network was up and running; within two weeks it had over 1,000 active members.

The CanCOVID network currently consists of more than a dozen subject-based, moderated discussion channels, on topics ranging from diagnostics to clinical trials to Indigenous health.

CanCOVID is a broadly based, by-invitation network designed for verified members of the COVID-19 research and response community. In a situation characterized by a rapidly evolving knowledge base on how best to counteract and treat COVID-19, the CanCOVID network provides multiple team-specific and topic-specific channels through which to share the latest developments and results.

RENEWAL OF FEDERAL LABORATORIES

In its 2018 budget, the Government of Canada announced its intention to provide $2.8 billion over five years to renew federal laboratories, including the construction of sustainable, multi-purpose, collaborative federal science facilities. As a first step in this process, the Office of the Chief Science Advisor was given a mandate to assemble external advisory panels to provide advice on how to improve scientific outcomes from these laboratories, strengthen partnerships, and respond to long-term science trends and opportunities.

Throughout 2019 and into January 2020, the Chief Science Advisor convened five external advisory panels to review different clusters of laboratory facilities and operations. Taken together, the panels provided a battery of common themes, including:

- **Opportunity:** the Budget 2018 announcement can allow clusters to build critical mass, engage in collaborations with academia, industry, and Indigenous communities, and increase collaboration with one another.
- **Leadership:** A full-time leadership team, including a scientific director, would best advance the clusters' vision and objectives.
- **Planning:** Science outcomes would be strengthened through strategic plans for partnership governance, and for equipment, infrastructure and data sharing.
- **Training:** There are opportunities for the clusters to address current and future skills, while integrating local communities, Indigenous peoples and youth.
- **Future:** Science and infrastructure planning will need to prepare for the integration of new technologies in artificial intelligence, climate change resilience, materials science, robotics, and information management.

The OCSA intends to work with all clusters to assist in advancing next steps.

The Chief Science Advisor gets an explainer from a federal scientist during a visit to the Centre for Aquaculture and Environmental Science (CAER) and the Pacific Science Enterprise Centre (PSEC) in British Columbia.

Key Achievements

Science Diplomacy and Outreach

DIPLOMACY THROUGH SCIENCE

How Canadian science is key to achieving our foreign policy objectives

For decades, Canada's foreign policy has been centered around Canadian values such as human rights, democracy, equality, fairness and diversity. Canada's diplomatic efforts are a projection of those shared values. And while "science" is not typically included in lists of Canadian values, it is a defining characteristic of our nation on the international scene.

Globally speaking, Canada punches far above its weight in terms of scientific acumen, research and discovery. Canadian scientists account for nearly 4 percent of the world's peer-reviewed research publications, in comparison to our 2 percent share of world GDP and our 0.5 percent share of world population. Canada has federal programs in place to support research and development in business and in academia; in agriculture, in the oceans, in the arctic and in space. In the past 11 years alone, six Canadian scientists have become Nobel laureates.

Our scientists, our research infrastructure and our contributions to major scientific endeavours and discoveries help promote Canada as a place to invest, to study and to work.

Canada's strength in science gives our country a platform to reinforce international ties and advance global cooperation. Climate change, ocean sustainability, and human health – to name three examples – are issues that no one country can address alone. Scientific expertise is required to develop international agreements such as the Intergovernmental Panel on Climate Change, in the negotiation of treaties and other cooperative agreements and protocols. When political relations between countries are strained or when conventional forms of diplomacy break down, joint research efforts have served as a way to maintain relations and build trust. As a result, science has a crucial role to play in Canada's international diplomacy.

The Canadian approach to evidence-based policy making and the role of the Chief Science Advisor have garnered considerable international interest. The OCSA's international engagements highlight Canadian strengths in science and advance binational and multinational science and technology cooperation. They also present opportunities to promote international mobility for students and researchers, and to advance equity, diversity and inclusion initiatives.

International Activities in 2019

1. In May 2019 Dr. Nemer was a keynote speaker at the Canada-Mexico Forum on Science, Technology and Development in Mexico City. The event was held to commemorate 75 years of diplomatic relations between Canada and Mexico.
2. In fall 2019 Dr. Nemer visited Germany, where she attended the 47th annual Carnegie Group Meeting of G7 Science Ministers in Dresden and the annual Falling Walls Conference on great scientific and social breakthroughs in Berlin.
3. In October 2019 the Chief Science Advisor went to Japan as a panelist at the Science and Technology in Society Forum, a premier international gathering of scientists, policymakers and businesspeople. She also spoke at the Advisory Committee Meeting of the Japan Science and Technology Agency.
4. In November 2019 the Chief Science Advisor served as a member of the Governor General's delegation on her state visit to Estonia and Lithuania. Both Baltic nations have their own respective global expertise in applied science – Lithuania in climate change and environmental science, Estonia in cybersecurity, e-residency and electronic government services. Dr. Nemer was able to help connect scientific leaders in these countries with their counterparts in Canada for future collaboration.
5. In February 2020 the Chief Science Advisor led the Canadian delegation to Seattle for the annual conference of the American Association for the Advancement of Science, the world's largest scientific conference with over 10,000 attendees from more than 70 countries. Canada's delegation included representatives from NSERC, SSHRC, the National Research Council, the Canada Foundation for Innovation, MITACS, and Perimeter Institute. The delegation's message focused on the benefits Canada offers as a global destination for top researchers.

In addition to these activities, throughout the year the Chief Science Advisor has led training sessions on science diplomacy for members of the foreign service and other public servants and has engaged ambassadors and other heads of mission on the benefits of using science in and for diplomacy. In Canada, she has met with several foreign ambassadors and welcomed delegations from the U.S., the U.K., France, the European Union, Japan and New Zealand.

The Chief Science Advisor discusses science and technology collaboration with Elena Alvarez-Buylla, Director of the National Council of Science and Technology in Mexico.

Members of the Canadian delegation join the Chief Science Advisor at the Canada booth during the 2020 AAAS conference in Seattle, Washington.

The Chief Science Advisor was a member of the Governor General's delegation on her state visit to Estonia and Lithuania in November 2019.

SUPPORT FOR WOMEN IN STEM

The Chief Science Advisor is a strong supporter of diversity initiatives in the pure and applied sciences, and is a highly sought-after speaker on the issue of women in STEM. Among her recent speaking engagements on the topic:

On February 11, the Chief Science Advisor spoke about the advancement of women in STEM as part of a celebration at the National Research Council for International Day of Women and Girls in Science.

February 2019, Washington, D.C.: Dr. Nemer hosted a women in STEM roundtable at the Canadian embassy on the margins of the AAAS 2019 annual conference.

March 2019, Vancouver: Dr. Nemer served as a panelist at the Women in Science, Health and Innovation: Leadership Looking to the Future conference, co-organized by the University of British Columbia and six Vancouver consulates.

March 2019, Tokyo, Japan: Dr. Nemer gave opening remarks and led a roundtable discussion with Japanese representatives from academia, industry and government. She also spoke at a business event held at the Canadian embassy on the occasion of the first Canadian women-only business mission to Japan, entitled "Building Women's Partnerships in the Care Economy."

April 2019, Toronto: Dr. Nemer was the featured guest at a roundtable discussion hosted by the University of Toronto student organization Women in Chemistry.

February 2020, Ottawa: Dr. Nemer gave the keynote address at a symposium hosted by the National Research Council to celebrate the International Day of Women and Girls in Science.

CANADA'S GLOBAL SCIENCE LEADERSHIP

In recent decades, the work of Canadian scientists has led to a number of world-leading initiatives and discoveries, bolstering our international reputation for scientific excellence.

Aerospace: The Canadarm remote manipulator system, first developed for NASA's space shuttle program, has evolved to become one of the International Space Station's essential components, detachable at both ends and able to walk across the station's exterior to wherever its services are required. The Canadarm and its robotic module, Dextre, have made Canada a global leader in aerospace robotics, and their technologies have been adopted for other applications, such as robot-assisted brain surgery.

Vaccines: In 1999, Canada's then-new National Microbiology Laboratory (NML) in Winnipeg began research into the deadly Ebola virus. By 2005, the NML had developed a vaccine proven by clinical trials to be 100 percent effective in macaque monkeys. The vaccine, known as Ervebo, is now approved for use in humans, and the NML has gained global recognition for this work.

Particle physics: The contributions of Canadian physicists, and of the TRIUMF particle accelerator at the University of British Columbia, were integral to the 2012 discovery of the Higgs boson – also known as the 'God particle' – at Europe's Large Hadron Collider (LHC). Canadian technology is now powering the LHC's next generation of experiments, deepening our understanding of our universe's origins.

AN INTERNATIONAL RESPONSE TO MICROPLASTICS POLLUTION

Canada co-hosts G7 science advisory roundtable

Microplastics are a global phenomenon, and their environmental impact is of increasing concern for government policymakers. Microplastics are already present across air, soil and sediment, freshwaters, seas and oceans. The current body of scientific knowledge on microplastics tells us that these particles are present all over the planet, sometimes in overwhelming quantities. It also tells us that there are no standard approaches to their identification, sampling, extraction or purification.

As a deliverable of Canada's G7 presidency, Canada's Chief Science Advisor, along with the European Commission's Group of Chief Scientific Advisors, co-hosted the Microplastics Pollution Roundtable in February 2019 in Washington, D.C., attended by the G7 and European Union science advisors. Participants at the gathering were able to develop a better shared understanding of existing microplastics research, and of the science that will be needed to support policymakers in addressing the challenge of microplastics pollution.

Roundtable participants were in broad agreement on the need for standardization and harmonization of research methods to track and assess environmental effects of microplastics pollution. As a follow up to this meeting, and as part of its 2019 G7 presidency, France hosted a workshop in October 2019 on standardized microplastics monitoring. The call for international collaboration and action on microplastics pollution is clear.

In October 2019, Canadian representatives, including Dr. Nemer, joined other G7 nations in working towards standardizing data collection and monitoring approaches for microplastics pollution.

FACTS ON MICROPLASTICS AND PLASTICS POLLUTION

- Microplastics are pieces of plastic less than 5 millimetres in their longest dimension, down to the nanometre scale.
- They are present in many personal care products, often used as gentle abrasives in soap, body wash, and facial cleanser. Microplastics are ubiquitous in other products too, from pharmaceuticals to table salt.
- Some microplastics are too small to be separated out by typical water filtration systems. As a result, they can remain present in treated wastewater and are flushed out into our lakes, rivers and oceans.
- Microplastics are also produced by the decaying of larger plastics over time. Over 8 million tonnes of plastic, large and small, flow into the ocean every year, the equivalent of dumping one garbage truck full of plastic into the ocean every minute.
- As of July 2018, microbeads have been banned for use in Canada. Microbeads, and products with microbeads in them, can no longer be manufactured, imported or sold in Canada.
- As part of its 2018 G7 presidency, Canada spearheaded the Ocean Plastics Charter, which contains commitments and targets aimed at stopping plastic waste and the flow of plastics and microplastics into the environment.

CANADA'S PLASTICS SCIENCE AGENDA

In 2019 the federal government published Canada's Plastics Science Agenda, which established priority needs for research and action on plastics in Canada – all part of working towards the goals of the Canada-Wide Strategy on Zero Plastic Waste, which was signed by the Canadian Council of Ministers of the Environment in November 2018.

The Plastics Science Agenda identifies five key themes for scientific activity:

- **Detection, quantification and characterization of plastics in the environment,** to ensure proper monitoring.
- **Impacts on wildlife, human health, and the environment,** to better avoid adverse effects.
- **Plastic design and alternatives,** to reduce their carbon footprint.
- **Sustainable use of plastics,** to encourage responsible management.
- **Waste diversion and recovery,** to minimize the creation – and maximize the capture – of waste plastics.

For each theme, the Plastics Science Agenda lays out the current gaps in scientific understanding, as well as the federal government's contributions towards filling those gaps. Canada's Plastics Science Agenda will serve as a guide for scientists and funders from all sectors, as they join efforts to advance the science of plastic pollution.

NEW INROADS FOR INDIGENOUS PEOPLES

Weaving scientific and Indigenous knowledge

The Office of the Chief Science Advisor is committed to engaging with Canada's Indigenous peoples. In February 2019, the OCSA and the Institute for Governance co-hosted a roundtable that explored traditional Indigenous knowledge and scientific knowledge, how the two systems function, and how they can be woven together to shape and inform public policy and decision-making. The roundtable members proposed the following three recommendations:

1. Indigenous communities should be encouraged to self-determine their research needs and work alongside researchers to co-develop research projects to address them.
2. The Indigenous and scientific communities should work methodically and patiently to build understanding between them, and within the non-Indigenous research community.
3. The OCSA should lead collaborative efforts to design a framework for the conduct of research with Indigenous peoples, and to codify that framework as a set of binding policies.

The Chief Science Advisor, in her role as a member of the Canada Research Coordinating Committee (CRCC), assisted with the coordination of a year-long engagement process that included the awarding of 116 Indigenous Research Capacity and Reconciliation–Connection Grants. The purpose of these grants was to support interdisciplinary events, outreach activities and targeted knowledge mobilization initiatives that contribute to the dialogue of reconciliation. This engagement process culminated in a national dialogue on Strengthening Indigenous Research Capacity on March 12 and 13, 2019, in Ottawa.

In December 2019, the CRCC published a strategic plan entitled "Setting New Directions to Support Indigenous Research and Research Training in Canada, 2019-2022." The document established four key strategic directions for the next three years:

1. Building relationships with First Nations, Inuit and Métis peoples, with new tools and opportunities to promote communication and collaboration among Indigenous researchers.

2. Supporting research priorities of Indigenous peoples, ensuring that First Nations, Inuit and Métis knowledge systems are recognized.
3. Creating greater funding accessibility to granting agency programs, so that Indigenous peoples lead research projects for the benefit of their communities and career pathways are opened up for Indigenous students.
4. Championing Indigenous leadership, self-determination and capacity building in research, through greater representation at the federal granting agencies, the decolonization of Indigenous research, and the creation of an Indigenous leadership circle to guide the implementation of this strategic plan.

On February 8, 2019, the Office of the Chief Science Advisor and the Institute on Governance co-hosted a roundtable to explore ways to better weave Indigenous knowledge and scientific knowledge in government decision making.

FUTURE RESEARCHERS

Supporting the next generation of Canadian scientists

Science is for everyone – kids and teenagers, boys and girls, of all backgrounds. Science is a means of encouraging and channeling natural curiosity and inquisitiveness, a method of exploring and discovering the world around us, and a way of making sense of new experiences. It builds problem-solving and analytical skills. And its rewards can last a lifetime, whether as a hobby or as a career.

The OCSA deepened its commitment to youth science initiatives in 2019-2020. Building on its continued support for organizations and initiatives such as Let's Talk Science and Science Meets Parliament, in summer 2019 the OCSA launched a recruitment drive for its first-ever Youth Council, whose role would be to advise the Chief Science Advisor on youth perspectives and to identify issues and challenges facing young researchers in Canadian science. Positions on the youth council were available to Canadians aged 18-30 interested in the STEM disciplines and their societal dimensions.

A total of 1,115 young Canadians applied to serve on the Youth Council, from which 20 were chosen (members are listed in Appendix E). They represent all regions of Canada and a remarkable diversity of scientific fields, including chemistry, geomatics, psychology, aerospace, immunology, physics, marine biology, and health and science policy.

The Chief Science Advisor visits a class of young students during the Governor General's State visit to Estonia and Lithuania, November 2019.

Dr. Nemer listens to a young researcher explain their research during the CICan on the Hill + Student Showcase event in Ottawa.

SCIENCE PROMOTION AND PUBLIC ENGAGEMENT

Speaking appearances, media interviews, and more

In its second full year of operation, the OCSA's public profile increased steadily, as did that of the Chief Science Advisor herself. The OCSA received many invitations for Dr. Nemer to speak at science conferences and other gatherings, as well as interview requests from media. As part of her mission to engage in science promotion and outreach, Dr. Nemer made herself available to as many such invitations as her schedule would allow.

On September 20, 2019, Dr. Nemer presented her keynote speech entitled, Reflections on Science and Society: Disruptive Technologies and the Need for Ongoing and Inclusive Dialogue during the Royal Society of Canada's G7 Academy Research Summit in Ottawa.

Among her speaking and outreach engagements in 2019:

- In May Dr. Nemer served as the honorary chair of the 2019 Acfas Conference in Gatineau, Quebec, which brought together more than 5,000 scientists from francophone nations around the world.
- In September Dr. Nemer was a keynote speaker at the Royal Society of Canada's G7 Academy Research Summit in Ottawa, entitled "Science, Trust and Democracy in the Digital Age."
- In November Dr. Nemer served as both a featured speaker and a panel moderator at the Canadian Science Policy Centre's annual conference in Ottawa, which brings together science policy decision-makers from across Canada.
- In December Dr. Nemer served as a panel moderator at the Canadian Institute for Advanced Research's second annual Pan-Canadian Artificial Intelligence Strategy Meeting, on the subject of "Fairness, Transparency, Explainability in Machine Learning."
- In February 2020, Dr. Nemer was the featured speaker at a Science and Innovation luncheon organized by the Montreal Council on Foreign Relations.

On February 3, 2020, Dr. Nemer was a guest on BEaTS Research Radio, a weekly scientific podcast produced by researchers at the University of Ottawa Heart Institute.

In addition to these speaking engagements, Dr. Nemer made many media appearances both domestically and abroad, including with hosts Pénélope McQuade of Radio-Canada's radio program ***Pénélope*** and Bob McDonald of CBC Radio's Quirks and Quarks. In April 2019 Dr. Nemer was featured on the Working Scientist podcast produced by Nature. And in January 2020 Dr. Nemer authored the introductory essay for a special issue of Physics in Canada, to be published in June 2020, on the theme of "Fake News, Junk Science, and Anti-Science for the Physicist."

In her engagements, Dr. Nemer highlights key issues such as the importance of diversity in the STEM disciplines, the need for international scientific cooperation, and how science can help inform decision-makers on issues affecting the public.

The Year Ahead

The coming year will be an important one for scientific endeavours in research facilities throughout Canada, within the federal government and beyond. Canada's response to the COVID-19 pandemic will rely on scientific research and discovery. Canadian scientists and researchers will be actively working on all aspects of pandemic science, on university campuses, in public and private laboratories, in hospitals and care facilities, and other settings as well. The role of the Office of the Chief Science Advisor is to stay abreast of all these efforts, to identify gaps in the national response, to propose timely solutions to emerging problems, and to help with science and research coordination – all in order to support a more effective and robust recovery from the health and economic hardships caused by the pandemic.

The year ahead for the Office of the Chief Science Advisor will be dominated by COVID-19 efforts, but it will not be its only area of focus. The OCSA has a number of additional initiatives, both new and ongoing, which will also move forward in the year ahead.

OPEN SCIENCE

- The OCSA will monitor the implementation of the Model Policy on Scientific Integrity across all 25 targeted departments and agencies, to ensure that federal scientists can speak freely about their findings, and publish them free of charge and with easy accessibility for the public.
- The OCSA will also act upon the recommendations of the Roadmap for Open Science, including the establishment of the Open Science Steering Committee and developing a framework identifying when limiting access to federal science is warranted.
- Building on the success of COVID-19 open science initiatives and the CanCOVID network, the Chief Science Advisor will work to advance the principle of open access for federally funded research and publications, both for COVID-19 research and beyond.

SCIENCE ADVICE

- The OCSA will work with federal departments and agencies to increase the membership of the Departmental Science Advisors Network, whose value and utility was quickly proven thanks to its leadership role in the creation of the CanCOVID network, its contributions to the adoption of the science integrity policy, and its foundational work on science literacy.
- The OCSA will continue its engagement with the COVID-19 Expert Panel, including the creation of subcommittees, research teams, and task forces as required, to address emerging issues.
- The Chief Science Advisor will take up responsibilities as part of the leadership group for the newly established COVID-19 Immunity Task Force. The task force will establish priorities and oversee the coordination of a series of country-wide blood test surveys that will tell us how widely the virus has spread in Canada and provide reliable estimates of potential immunity and vulnerabilities in Canadian populations. Until we have a vaccine, a better understanding of the main characteristics of the virus is essential to elaborate relevant policy and operational response.
- Learning from the experience of the COVID-19 pandemic, this office will draw upon lessons learned as we formalize the pathways for providing science advice in emergencies. These pathways will take into consideration not only health emergencies such as COVID-19, but also other risk areas identified by the National Risk Profile, such as floods, wildfires and earthquakes.
- The Chief Science Advisor will also continue her responsibilities as part of the Government of Canada's Advisory Council on Artificial Intelligence (ACAI) as it seeks to expand its work. The ACAI's mandate is to establish a long-term vision for Canada on AI both domestically and internationally.

BETTER SCIENCE

- The OCSA, in its role as a member organization of the Canada Research Coordinating Committee, will continue to provide support for the CRCC's key priorities, which include:
  - Enabling interdisciplinary, international, high-risk/high-reward, rapid response research, notably through the New Frontiers in Research Fund.
  - Fostering greater equity, diversity and inclusion to enhance Canada's research excellence.
  - Growing Indigenous research capacity.
  - Responding quickly to new challenges and opportunities in key emerging research areas, as was done for COVID-19 research.
- The OCSA will follow up on its recommendations for strategic long-term planning of Canada's major research facilities.
- Following the provision of royal assent last June to Bill C-69, Canada's revised Impact Assessment Act, the OCSA will complete the development of a framework for use in evaluating the methods and the integrity of the science used in decision-making under the Act.
- Canada is recognized among the international leaders in quantum physics research, but maintaining that reputation will necessitate a more coordinated effort of all Canadian stakeholders. The OCSA will work with the research community towards a Canada-wide strategy to advance research and development of quantum computers and quantum communications technologies.
- To support an agile response to the evolving COVID-19 pandemic, the OCSA will work with the CanCOVID network so they provide timely and transdisciplinary evidence on key areas of COVID-19 emerging science. The OCSA will support expansion of both the membership and the activities of the network, so researchers connect and collaborate on their novel coronavirus research. By sharing insights, results and emerging issues, Canadian researchers can eliminate duplication of effort, improve outcomes, and quicken the pace of findings.
- The OCSA will produce recommendations on roadmaps in areas of national importance for research and development, including quantum technologies and infectious diseases.

SCIENCE DIPLOMACY AND PUBLIC AWARENESS

- In the global absence of physical gatherings, the Chief Science Advisor will continue to exploit technologies to reach out to her counterparts around the world and foster continued dialogue and cooperation. This will be especially important with regards to COVID-19, as the pandemic has underlined the importance of international science cooperation.
- The OCSA will continue its engagement with international counterparts, and work with the Canadian research community and government departments such as Innovation, Science and Economic Development Canada and Global Affairs Canada, to maximize the contributions of science to national prosperity and international relations.
- The Chief Science Advisor will continue to engage with domestic and international media upon request, in order to promote the value of science to Canada's overall health, economy, and society. The COVID-19 pandemic has sparked a crucial public dialogue on the role of science, and scientists need to take advantage of the opportunity to engage with the public.
- The CSA will convene her youth council to provide young Canadians in STEM with a stronger voice on scientific issues that matter to them. A key activity for the youth council will be to engage their peers and others on social media to fight against "fake news" and misinformation about COVID-19.

Conclusion

The Office of the Chief Science Advisor's second full year of activity was marked by a sense of momentum and acceleration. Cooperative relationships with several federal departments were built, while others flourished and deepened. The Chief Science Advisor continued to develop a strong working relationship with the Prime Minister and Cabinet. The work plan undertaken by OCSA staff, along with the events that shaped the year, have focused this office's mandate, spurred new initiatives, and sped progress across all its endeavours.

The year ahead will be a challenging one for Canadians, as the COVID-19 pandemic continues to run its course, economic activity ramps up, and new social and cultural routines take root. Science will be an essential contributor to the solutions, and the OCSA will ensure that the best scientific knowledge is available to Canadians as we chart our course for the future.

Appendices

DEPARTMENTS AND AGENCIES IMPLEMENTING A POLICY ON SCIENTIFIC INTEGRITY

The Model Policy on Scientific Integrity was targeted to the following 25 federal departments and agencies, whose staff includes at least 10 staff members engaged in scientific research and development activities.

1. Agriculture and Agri-Food Canada
2. Canada Border Services Agency
3. Canadian Food Inspection Agency
4. Canadian Grain Commission
5. Canadian Heritage
6. Canadian Space Agency
7. Correctional Service Canada
8. Crown-Indigenous Relations and Northern Affairs Canada
9. Environment and Climate Change Canada
10. Fisheries and Oceans Canada
11. Global Affairs Canada
12. Health Canada
13. Impact Assessment Agency of Canada (formerly the Canadian Environmental Assessment Agency)
14. Indigenous Services Canada (ISC)
15. Infrastructure Canada
16. Innovation, Science and Economic Development Canada
17. Library and Archives Canada
18. National Defence
19. National Research Council
20. Natural Resources Canada
21. Public Health Agency of Canada
22. Public Services and Procurement Canada
23. Royal Canadian Mounted Police (Civilian Staff)
24. Statistics Canada
25. Transport Canada

DEPARTMENTS' AND AGENCIES' SCIENTIFIC ACTIVITY

The list below shows the top federal departments and agencies in Canada in terms of expenditures in scientific research and development.

	($ millions)	
	2018-19	2019-20
Natural Sciences and Engineering Research Council of Canada	1329	1351
National Research Council Canada	1212	1245
Canadian Institutes of Health Research	1151	1201
Social Sciences and Humanities Research Council of Canada	873	932
Environment and Climate Change Canada	670	805
Statistics Canada	632	539
Innovation, Science and Economic Development Canada	591	572
Natural Resources Canada	573	650
Health Canada	545	543
Global Affairs Canada	544	577
National Defence	500	520
Agriculture and Agri-Food Canada	494	534
Canada Foundation for Innovation	401	405
Fisheries and Oceans Canada	338	384
Canadian Space Agency	278	299
Atomic Energy of Canada Limited	269	353
Sub-Total	**10400**	**10910**
Other departments and agencies	1861	1797
Total	**12259**	**12709**

*All data is from Statistics Canada: Table 27-10-0026-01, *Federal expenditures on science and technology by major departments and agencies.*

CURRENT MEMBERS OF THE DEPARTMENTAL SCIENCE ADVISORS NETWORK

Name	Title	Organization
Sarah Gallagher	Science Advisor to the President	Canadian Space Agency (CSA)
Shawn Marshall	Departmental Science Advisor	Environment and Climate Change Canada (ECCC)
Pascal Michel	Chief Science Officer	Public Health Agency of Canada (PHAC)
Vik Pant	Chief Scientist & Chief Science Advisor	Natural Resources Canada (NRCan)
Paul Snelgrove	Departmental Science Advisor	Department of Fisheries and Oceans (DFO)
Cara Tannenbaum	Departmental Science Advisor	Health Canada (HC)
Danial Wayner	Departmental Science Advisor	The National Research Council (NRC)

MEMBERSHIP OF THE COVID-19 EXPERT PANEL AND EXPERT GROUPS

COVID-19 Expert Panel

Disease modelling

- Caroline Colijn, PhD, Simon Fraser University
- Daniel Coombs, PhD, University of British Columbia
- Kamran Khan, MD, St Michael's Hospital and BlueDot
- Babak Pourbohloul, PhD, Complexiscope Consulting Inc. (until April 10, 2020)

Risk and behavioural sciences

- Daniel Krewski, PhD, University of Ottawa
- Louise Lemyre, PhD, University of Ottawa
- Steven Taylor, PhD, University of British Columbia

Biomedical and clinical sciences

- Deborah Cook, MD, McMaster University
- Maziar Divangahi, PhD, McGill University
- Matthew Gilmour, PhD, Public Health Agency of Canada (until May 19, 2020)
- Gary Kobinger, PhD, Université Laval
- Joanne Langley, MD, Dalhousie University
- Allison McGeer, MD, Mount Sinai Hospital
- Samira Mubareka, MD, Sunnybrook Research Institute
- Guillaume Poliquin, MD PhD, Public Health Agency of Canada
- Caroline Quach, MD, Université de Montréal
- Supriya Sharma, MD, Health Canada
- Cara Tannenbaum, MD, Université de Montréal

Expert Group on Health Systems

- David Buckeridge, PhD,
  McGill University
- Irfan Dhalla, MD,
  Unity Health Toronto, University of Toronto
- Alan Forster, MD,
  Ottawa Hospital, University of Ottawa
- William Ghali, MD,
  University of Calgary
- Joanne Langley, MD,
  Dalhousie University
- Joanne Liu, MD,
  Université de Montréal
- Louis-Martin Rousseau, PhD,
  Polytechnique de Montréal
- Allison McGeer, MD,
  Mount Sinai Hospital,
  University of Toronto
- Tom Noseworthy, MD,
  University of Calgary
- Robyn Tamblyn, PhD,
  McGill University
- Cara Tannenbaum, MD,
  Université de Montréal

Expert Group on Modeling Approaches

- Nicole Basta, PhD,
  McGill University
- Caroline Colijn, PhD,
  Simon Fraser University
- Dan Coombs, PhD,
  University of British Columbia
- Jonathan Dushoff, PhD,
  McMaster University
- David Earn, PhD,
  McMaster University
- David Fisman, MD,
  University of Toronto
- Seyed Moghadas, PhD,
  York University
- Nick Ogden, PhD,
  Public Health Agency of Canada
- Ashleigh Tuite, PhD,
  University of Toronto
- Jianhong Wu, PhD,
  York University

MEMBERSHIP OF THE CSA'S YOUTH COUNCIL

From left to right, top to bottom: Keeley Aird, Justine Ammendolia, Marie-Ève Boulanger, Andréa Cartile, Erin Crockett, Landon Getz, Sara Guzman, Amelia Hunter, Natasha Jakac-Sinclair, Chelsie Johnson, Max King, Audrey Laventure, Chedi Mbaga, Taylor Morriseau, Sophie Poirier, Farah Qaiser, Madison Rilling, Ali Sbayte, Molly Meng Hua Sung, Arthur Van Havre.