ANNUAL REPORT OF THE

Chief Science Advisor

2020–2021

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

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Message from the Chief Science Advisor

It has been a year of science in action. As the COVID-19 pandemic took hold, it summoned scientists to take up the challenge of a lifetime: to understand a mysterious new strain of virus, slow its spread and devise treatments for the disease it inflicts. The challenge was met with an unprecedented effort by the international scientific community, one in which Canada's scientists—in universities, hospitals, private enterprise and the federal public service—played an important role. That global effort culminated in the development of highly effective vaccines.

It has also been a year of science in the spotlight. Scientists are used to going about their work quietly, with little public exposure outside of key breakthroughs. This year was different: Canada's business and government leaders, as well as its citizens, took a keen interest in every new COVID-19 development as it emerged. The science significantly affected individual choices and decisions, as well as government policies and priorities. As a result, Canadians became familiar with the dynamic nature of the scientific process as scientists tested hypotheses and added to our knowledge of the pandemic, with every incremental discovery building on the last.

The pandemic highlighted the important role of the Office of the Chief Science Advisor, as we gave the government impartial advice on the latest and most reliable scientific knowledge to assist it in its deliberations and decisions, while communicating the scientific evidence to the public. Our government has never been more in need of timely, responsive and impartial scientific counsel than it was this past year.

To meet this challenge, early on, my office convened a COVID-19 expert panel composed of top scientists from Canada's public, private and academic sectors. The panel, together with its task forces, swiftly produced briefings on key topics, from aerosol transmission to infection control in long-term care settings. At the same time, I maintained close contact with my international counterparts, keeping Canada's government abreast of international trends, early signals and best practices for COVID-19 science and pandemic management.

While the pandemic consumed most of our efforts, the OCSA also pushed other key files forward: ensuring the integrity and quality of government science, enshrining the principles of open science within government, and engaging in international science diplomacy. Our work continues on all these fronts, matching the swift pace of science itself and making the benefits of science more accessible to all Canadians and the government.

The pandemic unequivocally demonstrated the essential value of science and research. It also underscored the need for greater investment in both fundamental and applied research to better equip us for the many challenges humanity must tackle in order to build a better world for all.

Dr. Mona Nemer,
CM, CQ, FRSC

Dr. Mona Nemer and Minister of Innovation, Science and Industry Navdeep Bains during the national announcement of the COVID-19 Immunity Task Force, April 23, 2020.

In April 2020, the federal government announced the creation of the COVID-19 Immunity Task Force, of which Dr. Mona Nemer was a core member. The announcement also included more than $1 billion in support of a national medical research strategy to fight COVID-19 through vaccine development, the production of treatments, and tracking of the virus.

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Executive Summary

From March 2020 to March 2021, the Government of Canada's overarching priority was responding to the pandemic. Accordingly, the Office of the Chief Science Advisor (OCSA) focused most of the year's operations on providing a timely, science-based foundation to those pandemic response efforts.

In March 2020, when the World Health Organization declared COVID-19 a pandemic, the OCSA put in place a COVID-19 expert panel made up of scientists from across the country in a range of fields, allowing the Chief Science Advisor to access on-the-ground knowledge and expertise from within and outside government. The COVID-19 Expert Panel provided the Chief Science Advisor with information and diverse, transdisciplinary perspectives that were then incorporated into the OCSA's advice to government decision makers.

In addition, the expert panel, together with additional experts, authored or assisted in the publication of four timely public reports on COVID-19 in the following areas: long-term care, children, ventilation and vaccine certification. At a time when reliable scientific counsel became more crucial than ever for government and for all Canadians, the OCSA responded swiftly and comprehensively.

The Chief Science Advisor served on a number of pandemic committees initiated by other departments and conducted more than 50 media interviews over the course of the year. She also joined her counterparts from other countries in the international Call for Open Access to COVID-19 Publications, a successful effort to urge all scientific publishers to make COVID-19 research publications openly available without cost in order to accelerate scientific discoveries and broaden knowledge dissemination.

As encompassing as the OCSA's pandemic-response efforts were, the OCSA also made progress in all of its mandate's key areas: science advice, open science, better science, science diplomacy and public awareness.

- The Departmental Science Advisors (DSA) Network, established by the Chief Science Advisor in 2018, matured into a trusted and insightful sounding board on emerging issues. Individual DSAs successfully launched a variety of initiatives to promote scientific excellence within their departments and beyond.
- The OCSA led the government's science-based departments and agencies across key milestones along the Roadmap for Open Science, the government's plan to accelerate knowledge creation, innovation and discovery by making all government-sponsored research open and accessible.

- The OCSA held several meetings of the interdepartmental science integrity working group, with representation from all science-based departments and agencies. The working group supports the government's continuing efforts to adopt and implement scientific integrity policies within each department.
- The Chief Science Advisor continued her efforts in support of greater equity, diversity and inclusion within the science, technology, engineering and math (STEM) disciplines through speaking engagements and other activities. Notably, this year the OCSA helped create the Indigenous Interdepartmental STEM (I-STEM) Cluster, which works to inform and advance Indigenous aspirations and innovation in natural science stewardship.
- As part of its mandated review of science-based decision making under the government's recently enacted *Impact Assessment Act*, the OCSA identified the need for a set of standard tools to help government officials assess the scientific reports and evidence presented to them as part of impact assessments. The OCSA then committed to creating those tools; by year's end, their development was underway.
- The Chief Science Advisor was in regular contact with her international counterparts, both bilaterally and multilaterally. The OCSA was a partner in establishing the G7 Pandemic Preparedness Partnership and participated in UNESCO's Multistakeholder Consultations on Open Science, with the objective of adopting an international declaration on open science principles.

In its first two years, the OCSA grew steadily into its role. This past year, the OCSA's third, called for a quicker pace. All aspects of its mandate came into sharper focus. New advisory bodies were established with clearly defined objectives and tasks. New relationships were forged across a broad range of government departments and agencies, and with other organizations and actors in Canadian society and around the world. The OCSA responded to emerging needs while still progressing on its broader, long-term objectives.

The Chief Science Advisor looks forward to further strengthening science and science advice in Canada in the year ahead, across all areas of the OCSA's mandate, including: the development of a complete Canadian model for science advice; streamlining and clarifying advisory structures and accountabilities in emergencies; entrenching the federal government's commitment to open science; and broadening Canada's engagements and partnerships on the international scene.

On December 15, 2020, the Chief Science Advisor participated in a virtual panel discussion organized by the International Economic Forum of the Americas entitled *The Scientific Community in the Midst of the Health Crisis*.

Clockwise from top left: Peter Singer, Special Advisor to the Director-General, World Health Organization (WHO); Patrick Child, Deputy Director General for Research & Innovation, European Commission; Dr. Mona Nemer; Gary Kobinger, Director, Research Centre on Infectious Diseases at Université Laval.

Introduction

Science has been part of the Government of Canada's mission since before Confederation. In 1842, the United Province of Canada, the precursor to modern-day Ontario and Quebec, established its very first scientific organization: the Geological Survey of Canada. Its purpose was to use science to help build Canada's economy by mapping its landscape, developing agricultural methods suited to its climate, and locating deposits of precious minerals and fuels.

Today, more than 175 years later, the Geological Survey of Canada remains a part of the government's vast scientific endeavour that now spans dozens of disciplines. Every day, members of the federal public service use science in a wide array of crucial functions, including: ensuring the safety of foods, pesticides and medicines; forecasting weather patterns, tracking changes in climate and analyzing how to counteract its impacts; managing forests, fisheries and other natural resources; gathering and analyzing data on Canada's population, economy and society; helping to assure Canada's national security; space exploration; and pandemic response.

In total, the Government of Canada spends over $7 billion annually operating its science-based departments and agencies. In addition, the government allocates another $5 billion in grants for scientific research through its major funding agencies,[1] including National Research Council Canada (see Appendix A).

In addition to its financial support, the Government of Canada is also committed to a set of core principles in support of science, namely: that research be conducted and communicated with the utmost integrity; that federal government science be accessible to Canadians; that research in Canada keep pace with, and contribute to, global scientific developments; and that Canada engage with other countries on matters of scientific knowledge and application. It is also committed to the principle that key government decision makers, including the federal Cabinet, should have access to the best scientific data and advice, both within the federal public service and outside it.

The Office of the Chief Science Advisor (OCSA) was created in September of 2017 with a mandate to support the Government of Canada's science functions and improve the flow of scientific advice to decision makers.

1 Statistics Canada, "Federal government spending on science and technology, 2021/2022," *The Daily*, June 10, 2021.

The Chief Science Advisor's mandate covers four key areas:

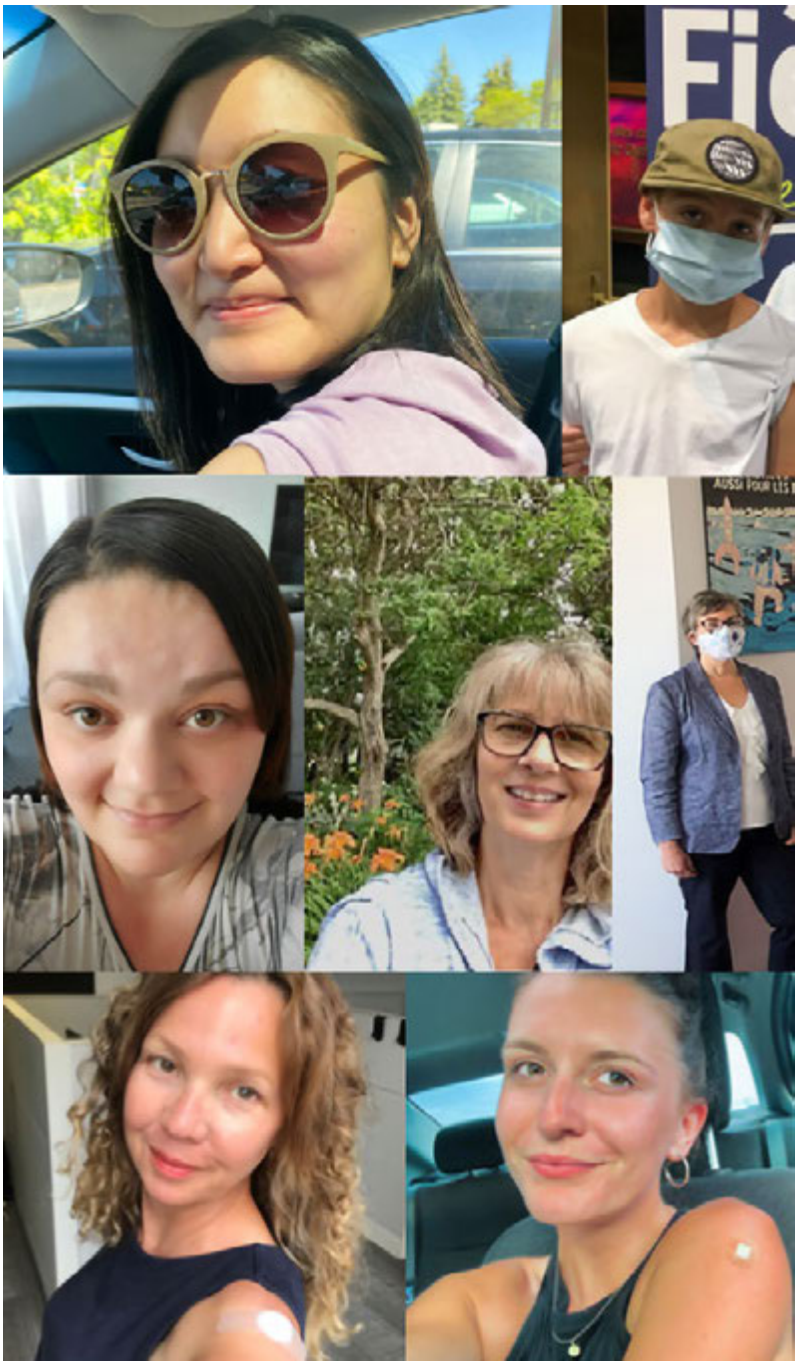
1. **Science advice:** Ensure that scientific analyses are considered in government decisions, coordinate expert advice to Cabinet and recommend ways to improve the government's science advisory function.

2. **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.

3. **Better science:** Recommend ways for the government to better support quality scientific research within the federal system.

4. **Science diplomacy and communication:** Promote a positive and productive dialogue between federal scientists and academia, both in Canada and abroad, and raise awareness of scientific issues with the public.

Throughout 2020–2021, much of the OCSA's activities were focused on supporting Canada's efforts to combat the COVID-19 pandemic. The OCSA's pandemic-response efforts touched all areas of its mandate, primarily in the area of science advice. At the same time, the OCSA's activities on matters unrelated to the pandemic also continued apace.



The Office of the Chief Science Advisor team members in a “show of arms” during the initial phase of the coronavirus vaccination campaign.

KEY ACHIEVEMENTS

Science Advice

Science Advice and COVID-19

Building and activating an advisory network for pandemic response

The coronavirus pandemic forced governments to grapple with decisions of a magnitude not seen in decades, including those related to: halting global and domestic travel; closing borders, schools and businesses; preserving health system capacity; and implementing and enforcing public health guidelines. In each case, simple but crucial questions recurred: what measures should governments take, when, how and for how long?

Scientific knowledge is crucial in all these deliberations. The more we learn about the SARS-CoV-2 virus, the more informed our choices become. The novelty of the virus meant there was limited scientific knowledge at the outset, but this rapidly evolved. Given these circumstances, the Chief Science Advisor set out to create advisory structures that could continuously gather the latest information on COVID-19, identify key issues, study them expeditiously and provide timely advice to the government. The structures needed to be forward thinking, anticipate future areas of concern, identify knowledge gaps that required research and compile the relevant scientific knowledge for policy deliberation.

The COVID-19 Expert Panel

First convened in March 2020 by the OCSA, the COVID-19 Expert Panel's primary role is to inform the Chief Science Advisor of emerging scientific knowledge. The expert panel quickly became the OCSA's central clearing house for the latest scientific developments on COVID-19 and focuses on understanding the on-the-ground challenges in terms of preventing and treating the disease, and identifying emerging issues.

Bringing together leading scientists from within and outside government, the expert panel's collective knowledge covers a broad range of disciplines, from infectious disease research and treatment, to modelling and behavioural science (see Appendix B). Its work established a pipeline of information from the scientific community to government and decision makers. The expert panel met 40 times in its first year; guests at its meetings included federal ministers and deputy ministers, as well as experts from across Canada's scientific community.

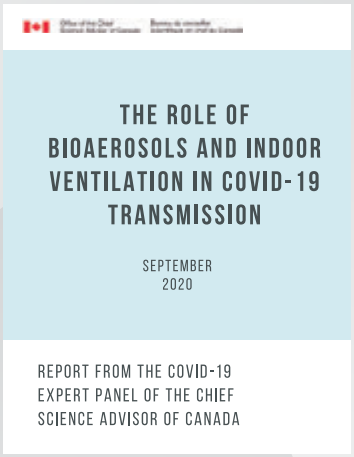
Its work also led directly to four public reports:

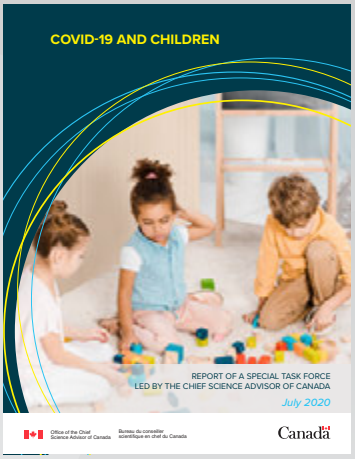
1. *Long-Term Care and COVID-19: Report of a special task force prepared for the Chief Science Advisor of Canada* (summer 2020), which looked at the unique challenges of combatting COVID-19 in long-term care homes and identified systemic long-term care issues revealed by the pandemic.

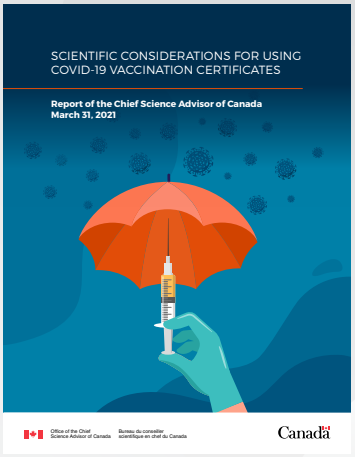
2. *COVID-19 and Children: Report of a special task force led by the Chief Science Advisor of Canada* (July 2020), which focused on the science concerning children as vectors for the spread of COVID-19, how the disease manifests in children and whether they contribute to its spread.

3. *The Role of Bioaerosols and Indoor Ventilation in COVID-19 Transmission* (September 2020), which summarized the body of knowledge on ventilation and provided a hierarchy of actions for making indoor spaces safer.

4. *Scientific Considerations for Using COVID-19 Vaccination Certificates* (March 2021), which considered the scientific basis for the use of vaccination certificates to support a safe return to travel, public services and other economic activities.



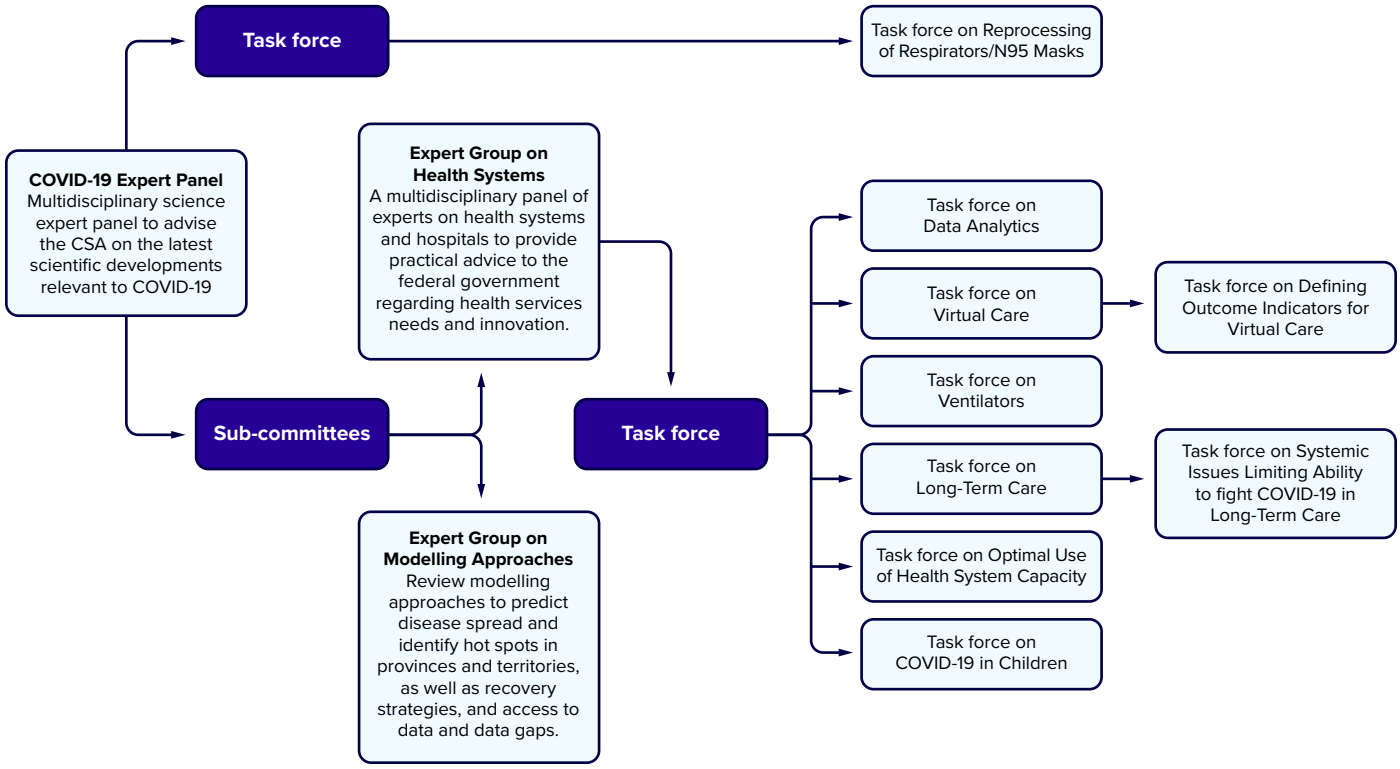




Expert panel sub-committees and task forces

Managing the COVID-19 pandemic called for sound, reliable knowledge based on a rapidly expanding pool of available data. The expert panel moved quickly to create two subcommittees: one on modelling approaches to predict disease spread and one on health systems, which in turn created a series of task forces on key issues (Figure. 1). These task forces allowed the expert panel to benefit from additional, focused expertise in gathering practical and scientific information and formulating advice.

FIGURE 1: *Organization of expert engagement on COVID-19*



Each task force was given a clear mandate to quickly study an issue, prepare a summary of its deliberations and offer proposals for the Chief Science Advisor to consider as part of her advice to government. Each task force also included representatives from Health Canada to facilitate direct and immediate access to task force findings.

- **Task Force on Reprocessing of Respirators/N95 Masks.** Mandate: To examine available evidence on the reprocessing and reuse of N95 face masks (also referred to as respirators) and provide recommendations regarding the use of reprocessed masks in light of potential shortages.
- **Task Force on Data Analytics.** Mandate: To examine what data should be captured on COVID-19, how best to gather and use it, and how to make it accessible. Reported back in April 2020.
- **Task Force on Virtual Care.** Mandate: To examine opportunities for the rapid and orderly deployment of virtual care in support of COVID-19 containment efforts. Reported back in May 2020.
- **Task Force on Virtual Care Outcome Indicators.** Mandate: To identify best practices for measuring the effectiveness of virtual care adoption. Reported back in September 2020.
- **Task Force on Ventilators.** Mandate: To advise on how to effectively distribute federally acquired ventilators. Reported back in April 2020.
- **Task Force on Long-Term Care.** Mandate: To provide recommendations on how to address the unique challenges of combatting COVID-19 in long-term care homes. Reported back in May 2020.
- **Task Force on Long-Term Care Systemic Issues.** Mandate: To identify the systemic barriers in long-term care revealed by COVID-19. Reported back in June 2020. The findings of the two long-term care task forces were compiled into a public report, *Long-Term Care and COVID-19*, published in the summer of 2020.
- **Task Force on COVID-19 in Children.** Mandate: To assess evidence and knowledge gaps related to COVID-19 children. The task force filed an interim report in May 2020; its final deliberations were compiled into a public report, *COVID-19 and Children*, published in July 2020.
- **Task Force on the Optimal Use of Health System Capacity.** Mandate: To provide practical advice regarding the optimal use of health system capacity to treat COVID and non-COVID patients. Reported back in May 2020.

Chief Science Advisor's participation in government committees

In addition to chairing the expert panel and directing its activities, the Chief Science Advisor served on a variety of government committees established through other offices and departments, including the Immunity, Vaccine and Therapeutics task forces, the Industry Strategy Council, the Deputy Ministers' Committee on Medical Countermeasures, the COVID-19 Testing and Screening Expert Advisory Panel and the Canada Research Coordinating Committee.

Establishing Clear Pathways for Science Advice

Building a resilient consultative network

The Government of Canada has nearly 37,000 employees in science and technology roles who engage in important research, development and monitoring activities that contribute to global scientific advancement.

Other countries' experience has shown that the best way to establish advisory pathways is through a chief science advisor's office, supplemented and extended by a network of key individuals across all departments. As detailed in the following pages, the OCSA made important strides in creating such a network and in providing timely advice to decision makers in challenging times.

A year of forward strides for the Departmental Science Advisors Network

In 2018, the OCSA recommended establishing a network of departmental science advisors (DSAs) from each of the government's science-based departments and agencies.

The DSA Network was designed and implemented to:

1. **Promote a community of practice:** meet regularly to share information and best practices, develop cross-departmental partnerships, promote a coordinated approach to providing science advice to government and expand the network's reach.
2. **Ensure high standards of research:** recommend approaches that enable high standards of research, champion departmental science portfolios and support a culture of scientific excellence and collaboration.
3. **Expedite advice:** serve as a major conduit in the timely development and provision of science advice to senior departmental decision makers, and as a sounding board and source of technical expertise for the Chief Science Advisor.

Seven science-based departments and agencies have appointed a departmental science advisor so far, a number unchanged from last year (see Appendix C). Most DSAs fulfill the role on a part-time basis while pursuing their own research or performing other research-related duties. They are subject matter experts who work closely with senior departmental officials and with one another. The DSAs met monthly throughout the year and deliberated on a variety of issues, including the following:

- establishing a coordinated career progression mechanism for federal scientists and researchers
- formulating recommendations for the Climate Science 2050 implementation plan initiated by Environment and Climate Change Canada
- prioritizing and framing research proposals for scientists in the CanCOVID network, a multidisciplinary online forum created with the DSA Network's help to enable rapid knowledge mobilization and science-to-policy action on COVID-19
- tracking federal scientific contributions to the government's coronavirus response, and the impact of the pandemic on federal scientific activities and research laboratories. Since March 2020, the pandemic response has been a standing item at every DSA meeting

The DSA Network and COVID-19

The DSA Network quickly realized that the pandemic response was significantly disrupting the entire range of federal science activities. Some laboratories increased staff and activity to assist with the pandemic response, while others shut down or scaled back operations, including some laboratories that would normally be considered contributors to high-priority government activities. Some adversely impacted laboratories lacked plans for ramping up operations once pandemic restrictions were lifted.

At the request of the Chief Science Advisor, DSA Network members worked with science leaders across departments and compiled their observations and proposed guidance in a report entitled *Restoring Balance: Re-Initiating Programs Post-COVID-19 Lockdown and Building Resiliency for the Future*.

The Restoring Balance report emphasized the importance of implementing all available controls and processes to curb the spread of coronavirus in laboratory settings. It also presented recommendations on how to improve resilience in laboratory operations in the event of future lockdowns, including the following:

- Assess which aspects of laboratory operations are most at risk due to viral spread, supply shortages, lockdowns or other public health measures.
- Ensure that supply chains can provide the materials needed for laboratory operations, from reagents to personal protective equipment.
- Build redundancy to minimize the impact of future stoppages or catastrophic events.
- Streamline laboratory processes, eliminating any unnecessary steps or workflows.
- Assess which aspects of the work can be done remotely, and which require extraordinary assistance or support to continue.
- Engage employee task teams to implement changes.

The Restoring Balance report highlighted how scientists within the federal government, led by departmental science advisors, can reach across their departments and work together to create a set of shared goals and a common framework for achieving them.

DSA Network: A sampling of key initiatives in 2020–2021

Health Canada

Departmental Science Advisor: Dr. Cara Tannenbaum

Dr. Tannenbaum led the development and design of Health Canada's Framework for Science and Research Excellence, which established a common vision and lexicon for research cooperation and excellence at Health Canada. Dr. Tannenbaum also spearheaded the creation of Health Canada's first Science and Research Integration Network (SciRIN), which connects scientists from across all branches of Health Canada and serves as a grassroots forum for sharing expertise and advancing priorities.

Natural Resources Canada

Departmental Science Advisor: Dr. Vik Pant

Dr. Pant led the expansion of Natural Resources Canada's Digital Accelerator, where government scientists partner with one another and with other organizations to develop new solutions to current problems using artificial intelligence. The Digital Accelerator's projects, which aim to leverage the department's existing databases, include:

- developing a forest information system to improve forest management
- modelling and predicting the power demand resulting from the increasing use of electric vehicles
- improving the monitoring and verification of EnergyStar appliances

Canadian Space Agency

Departmental Science Advisor: Dr. Sarah Gallagher

Dr. Gallagher designed guidelines for the Canadian Space Agency's advisory committees, which work with the broader space science community to determine the science priorities for future space missions and activities. The advisory committees are the crucial mechanisms through which the agency engages with universities, industry and other government departments. The guidelines ensure a consistent structure across all advisory committees and outline requirements for transparency, diversity and inclusion in their membership.

The Chief Science Advisor's Youth Council

A growing voice for young scientists

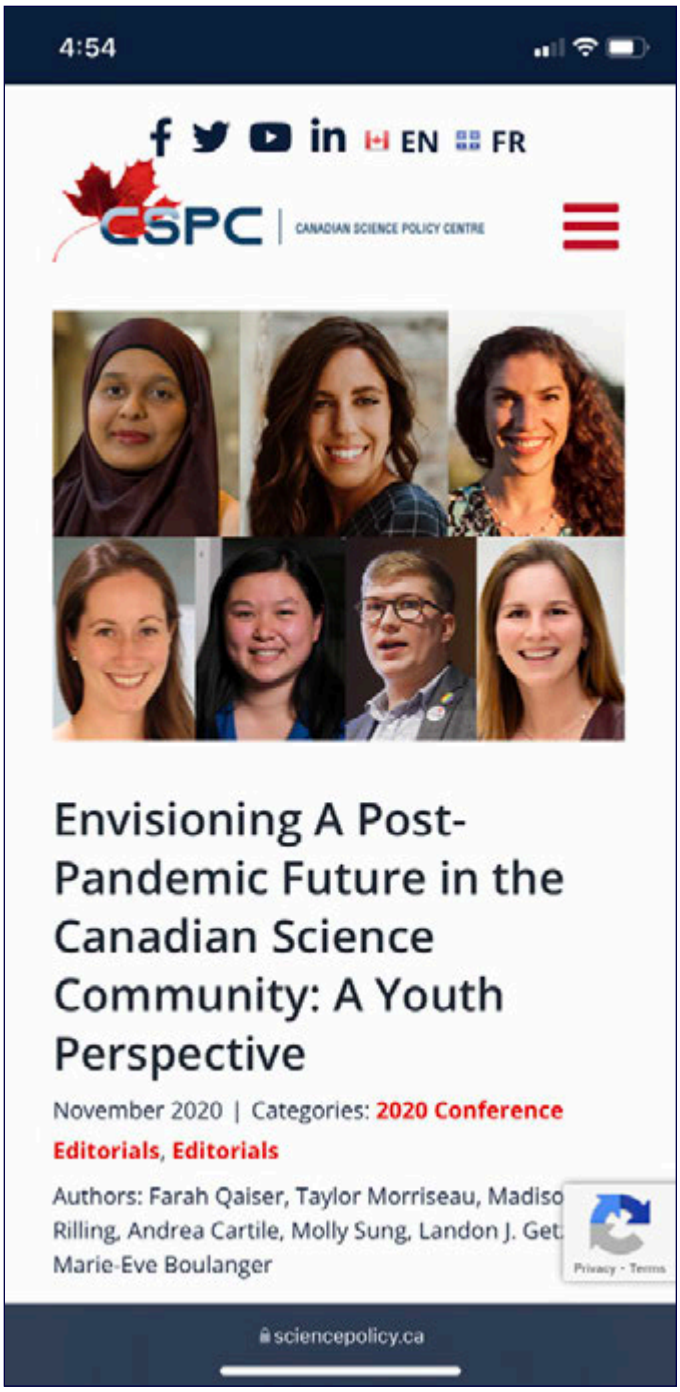
Every generation of researchers brings a fresh perspective to the table: new sensibilities, concerns and priorities that shine a different light on the issues facing the theory and practice of science. In early 2020, the Chief Science Advisor established a Youth Council (CSA-YC) to serve as a crucial component in the provision of science advice to government. Currently, the panel has 20 scientist members: 14 women and 6 men from diverse backgrounds from all across Canada and who are either in the midst of their studies or the early stages of their career (see Appendix D). Their role is to raise issues that are important to young scientists and act as a sounding board on select scientific issues.

In its inaugural year, and despite the complications brought on by the pandemic, the Youth Council made important contributions to the OCSA's science advice mandate:

- In September 2020, as part of Science Literacy Week, the CSA-YC hosted two virtual public discussions with undergraduate and graduate science students on how COVID-19 was impacting their education and research. To supplement these findings, the CSA-YC also conducted a review of early data on the impact of COVID-19 on students and young professionals.
- In November 2020, building on its work in September, the CSA-YC hosted five virtual discussions as part of the Canadian Science Policy Conference.
- In February 2021, to support the work of the Expert Panel on COVID-19, the CSA-YC conducted a literature review of young adults in Canada's knowledge, attitudes and behaviour in terms of COVID-19 vaccines and the pandemic.
- Also in February, the CSA-YC prepared a report on youth perspectives to support the Chief Science Advisor's participation in the Canadian Institute for Advanced Research's (CIFAR's) Futures Council meeting, offering future-facing ideas and proposing bold questions about how scientists can do research differently, communicate and collaborate better, and be more inclusive.
- In March 2021, the Chief Science Advisor consulted the CSA-YC on the issue of vaccination certificates. Its feedback was incorporated in the Chief Science Advisor's public report on vaccination certificates in April.

A number of CSA-YC members have also represented the Youth Council in talks and panel discussions, as part of a broader effort to engage young scientists in the policy process. The CSA-YC is developing its vision for the future of science culture in Canada, which will be released in 2022.

Chief Science Advisor's Youth Council
Conseil Jeunesse de la Conseillère Scientifique en Chef



On November 17, 2020, members of the Chief Science Advisor's Youth Council led several roundtable discussions under the theme *Build Back Better: Envisioning a Post-pandemic Future in the Canadian Science Community* during the Canadian Science Policy Conference.

KEY ACHIEVEMENTS

Open Science

An Open Science Foundation for Government Research

Meeting key milestones in the open science roadmap

Federal government scientists conduct research that helps keep Canadians safe, pushes the frontiers of knowledge and translates discoveries into policies and innovative products. In a typical year, federal researchers and scientists will co-author approximately 5,000 papers in peer-reviewed scientific journals. The government's largest science-based departments and agencies are the most significant contributors to this total.[2]

- National Research Council Canada, whose scientists work with private industry to take new research from the lab to the marketplace, publishes 1,080 articles annually.
- Agriculture and Agri-Food Canada scientists publish roughly 1,040 papers annually.
- Environment and Climate Change Canada publishes 720 articles annually.
- Natural Resources Canada accounts for some 650 publications annually.
- Health Canada researchers, together with their colleagues at the Public Health Agency of Canada, author more than 500 peer-reviewed articles annually.
- Fisheries and Oceans Canada scientists publish roughly 430 articles annually.

Why open science matters

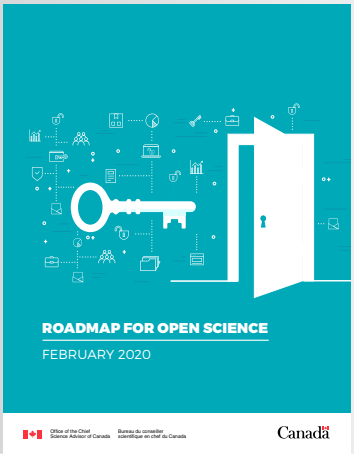
Open science is a set of principles and actions for making scientific data, research and results freely available for reuse, with minimal restrictions. The principles of open science have been gaining traction within the global scientific community in recent years. The digital transformation has made it possible for scientists to share data and results widely and swiftly, which accelerates discoveries, knowledge translation and scientific innovation.

Making publicly funded Canadian science open will maximize its benefits for the country's well-being, health and economic prosperity. But the task is not a simple one: it requires the adoption of new tools, systems and procedures for science-based departments and agencies, each of which currently has its own unique practices for research publication and data sharing.

2 Annual publication figures are based on a 10-year average over the period of 2008 to 2017.

The value of open science

Nothing better illustrates the value of open science than the work of Professor Zhang Yongzhen at China's Fudan University; his team of researchers was first to sequence the genome of the novel coronavirus. The researchers' results were published openly on January 11, 2020, and the knowledge they shared made it possible for scientists everywhere to develop tests, treatments and vaccines in record time.



The Roadmap for Open Science

In February 2020, the OCSA, in its facilitation and coordination role, published the Roadmap for Open Science, which provides a clear, step-by-step pathway for applying open science principles to federal science and research.

The roadmap leads to two key destinations:

1. **Open access:** The articles in peer-reviewed academic journals authored by federal scientists to 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.

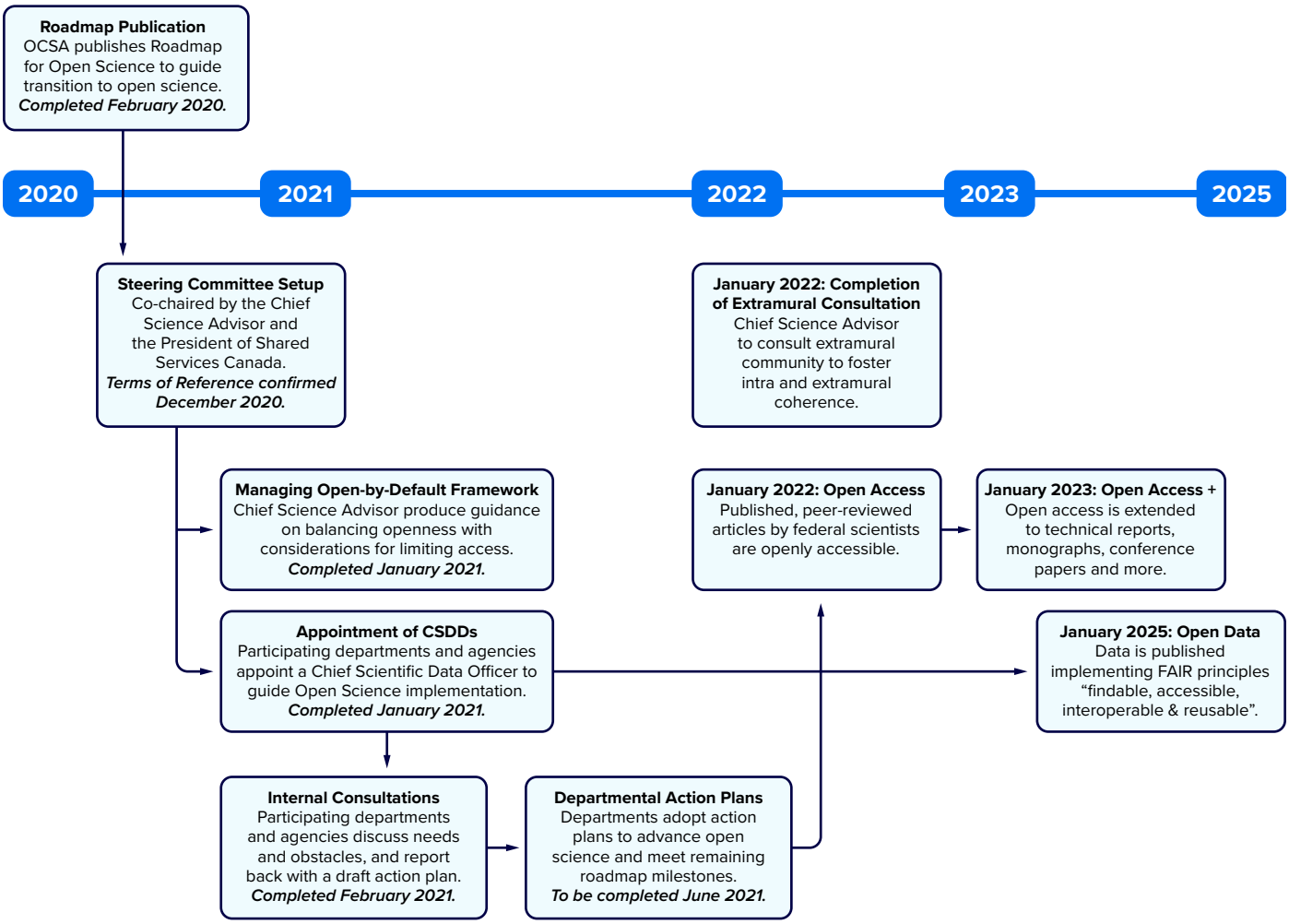
2. **Open data:** The data collected and used by federal scientists in the course of their publishable research should adhere to FAIR data principles (findable, accessible, interoperable and reusable) by January 2025.

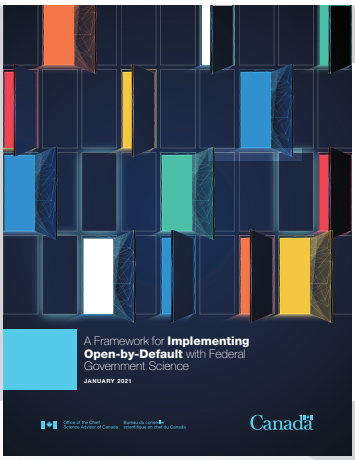
Notwithstanding the government's focus on the pandemic response, important progress was made over the course of the past year, including:

- establishing the Open Science Steering Committee
- designating chief scientific data officers within participating departments and agencies
- departments and agencies conducting internal consultations with their scientists and drafting departmental action plans
- publishing the Framework for Implementing Open-by-Default with Federal Government Science

Each of these achievements represents an important step on the path to open science (Figure 2).

FIGURE 2: *Roadmap for open science: A visual timeline*





The publication of the Framework for Implementing Open-by-Default with Federal Government Science in January 2021 is a major step forward in this process. Essentially a guidebook for open science implementation, the framework anticipates and addresses a host of issues, including security concerns, intellectual property rights and legitimate criteria for open science exceptions.

Open Science and COVID-19

Global and domestic efforts to open up pandemic research

The COVID-19 pandemic presented the global scientific community with a generational challenge. But it also called into question the scientific community's traditional research practices and was an opportunity to rethink outdated conventions.

International call for open science on COVID-19

In March of 2020, chief science advisors from 17 different countries, including Canada, signed a declaration calling on researchers and publishers around the world to make their COVID-19 research findings and data open and accessible by sharing them in online repositories. By April 2020, more than 2,000 articles had been posted in the preprint archives of bioRxiv and medRxiv, while multiple datasets were made available through GitHub.

The resource centre for Canadian publications on COVID-19

As part of its commitment to open science principles for pandemic research, the OCSA now maintains its own updated online portal of COVID-19 publications by Canadian scientists.

The CanCOVID network

In April 2020, the Chief Science Advisor helped spearhead the creation of the CanCOVID network. Through its online portal, cancovid.ca, the network is a far-reaching transdisciplinary open science initiative on COVID-19.

The network's activities include:

- a weekly virtual speaker series on topics related to COVID-19 science, as well as monthly workshops and special events, all catalogued on the site for reference
- a searchable digital library of reports and other research products from trusted sources
- misinformation tools and resources to help people identify trustworthy information on COVID-19

In addition, CanCOVID makes its expertise available to the Chief Science Advisor, Health Canada and the Public Health Agency of Canada upon request. CanCOVID's theme lead advisors, a team of university researchers who are experts in the fields of public health, clinical research, behavioural science and health policy, work with their respective networks to mobilize scientific knowledge for government and public policy responses.

Scientific Integrity Policy

Ensuring the highest standards of scientific freedom and research excellence

Since its creation in 2017, the OCSA has worked with 25 different departments and agencies in the federal government, the Professional Institute of the Public Service of Canada (PIPSC) and the Treasury Board of Canada Secretariat (TBS) on the development, implementation and evaluation of departmental scientific integrity policies. The model policy on scientific integrity, designed as a model that could be tailored to individual departmental contexts, includes a number of key provisions that can be adopted by all departments and agencies, such as:

- ensuring that scientific research and endeavours are consistent with the highest standards of excellence and are kept free from political, commercial, client or stakeholder interference
- ensuring that federal government science and research are appropriately represented and communicated to the public
- establishing researchers and scientists' right to speak publicly about their work

Integrity policy adoption, implementation and support

To support the adoption and implementation of the model policy, in 2018 the OCSA established a scientific integrity policy (SIP) interdepartmental working group, with representation from TBS, PIPSC and all 25 departments that have to adopt a scientific integrity policy (see Appendix E). As of March 31, 2021, 20 departments and agencies have scientific integrity policies in effect, a number unchanged from last year. The OCSA continues to assist the remaining five departments and agencies with their policy development.

For departments and agencies with scientific integrity policies now in effect, the OCSA's focus is on implementation and performance evaluation. Throughout the year, OCSA staff have held one-on-one meetings with individual departments and agencies to answer questions, troubleshoot problems and assist with solutions. The working group's 25 departments and agencies represent a broad range of research teams: some have several dozen staff conducting research or scientific activities; others, such as Health Canada or Environment and Climate Change Canada, have thousands. While the OCSA's support is available to all, those with comparatively small teams call upon the OCSA's support more often.

Integrity policy and performance measurement

All 20 scientific integrity policies currently in effect include provisions for monitoring and evaluating the policy's performance. This past year, the OCSA, in collaboration with the SIP interdepartmental working group, developed a model scientific integrity policy performance measurement strategy that gives all departments and agencies a set of candidate performance indicators and complementary measures that can be tracked, as well as an employee survey designed to inform a number of the performance indicators.

A model policy and a model process

The current process of establishing scientific integrity policies across 25 departments and agencies—in which a model policy is first developed with input from individual departments, then adapted for each department, implemented and tracked in terms of its performance—is an innovation in its own right. This model policy approach, which was mandated by the original agreement between TBS and PIPSC, has proven to be effective in addressing some of the scientific and research issues that arise in multiple departments and are similar in nature yet unique in detail.

Building on this success, the OCSA is applying the model policy approach to other "horizontal" scientific files, with the objective of ensuring "whole of government" approaches to important science and research policy issues.

KEY ACHIEVEMENTS

Better Science

A Commitment to Scientific Excellence

Supporting scientists, facilities and research during a pandemic year

Through a variety of financial, human resources and facilities investments, the Government of Canada is committed to scientific and research excellence. The Office of the Chief Science Advisor (OCSA) helps uphold this commitment by continually assessing how the government can better support scientific research excellence. The COVID-19 pandemic required an unprecedented mobilization of researchers to generate scientific knowledge and swiftly translate it into policies and much-needed products and tools. According to figures compiled by Statistics Canada, spending on science and technology in 2020–2021 increased by 26.7% to over $16 billion (see Appendix A).[3]

The Government of Canada supports research activities at federal research facilities, where over 37,746 government scientists are involved in regulatory or exploratory science, as well as collaborative research and development activities. The government also supports research outside its own facilities, mainly at post-secondary institutions and their affiliated research centres. The pandemic presented a formidable challenge to the research enterprise, with the need for more COVID-19 research having to be balanced with public health measures that at times forced the closure of many laboratories and interrupted field-based research activities.

The OCSA provided support on multiple levels, ranging from advice on science and science workforce needs to research readiness and coordination, as well as the re-initiation of resilient intramural research programs following lockdowns. The government followed up with focused research and development investments, starting in April 2020, that spanned the continuum from basic research to genomic surveillance and the development of medical countermeasures. These programs were overseen by existing federal agencies, including the Canadian Institutes of Health Research, the Public Health Agency of Canada and the National Research Council of Canada, and by new or existing organizations, including such as Genome Canada and the COVID-19 Immunity Task Force. The Chief Science Advisor played an important role in COVID-19 science coordination, in collaboration with the leadership of these organizations and the deputy ministers of Health and Innovation, Science and Economic Development Canada.

The government also provided salary support for research trainees and staff, which enhanced their ability to complete their training, given the difficulties imposed by physical distancing and partial laboratory occupancy. The impact of delayed training may nonetheless be felt for years to come, notably in high-demand areas such as life sciences, and digital and data science and technology.

3 Statistics Canada, “Federal government spending on science and technology, 2021/2022,” *The Daily*, June 10, 2021.

One of Canada's major research facilities, the Canadian Light Source (CLS), is a national synchrotron light source facility, located on the grounds of the University of Saskatchewan in Saskatoon, Saskatchewan. More than 1,000 academic, government and industry scientists from around the world use the CLS every year, in innovative health, agriculture, environment and advanced materials research.

The federal science workforce, as well as academic scientists and trainees, also played critical roles in support of the urgent need during the pandemic to ramp up diagnostic testing, which required specialized equipment, reagents and know-how. In many ways, these researchers served as de facto medical laboratory reservists.

Given the pervasiveness of science and technology in the management of this and future emergencies, future emergency preparedness plans will need to include the ability to mobilize the science workforce with the appropriate skills readiness.

Diverse Perspectives Make for Better Science

Promoting a more inclusive STEM workforce

The OCSA is committed to promoting the principles of equity, diversity and inclusion in the STEM (science, technology, engineering and math) disciplines. Consider the situation of women in STEM, where advancement has been slow and uneven. Women now make up more than 55 percent of university enrolments in the physical and life sciences, but only 19 percent in engineering and 16 percent in computer science.[4] In the federal workforce itself, women make up 24 percent of research scientists and engineers. Gender is only one dimension; there are other under-represented and intersecting groups for whom data are currently lacking.

The Chief Science Advisor continues to support the principles of equity, diversity and inclusion in STEM through public engagements and works toward correcting under-representation in STEM at multiple levels, including actively participating in the Canada Research Coordinating Committee action plans on equity, diversity and inclusion and on Indigenous research, among other things.

4 Katherine Wall, "Persistence and representation of women in STEM programs," Statistics Canada, May 2, 2019.

Indigenous knowledge and the I-STEM cluster

Over the past year, the OCSA joined Agriculture and Agri-Food Canada, Environment and Climate Change Canada, Fisheries and Oceans Canada and Natural Resources Canada to help champion the creation and expansion of the interdepartmental Indigenous STEM cluster within the federal government. Known as I-STEM, the cluster works to inform and advance Indigenous aspirations and innovation in agriculture and natural science stewardship.

By January 2021, the I-STEM cluster included 10 departments and agencies committed to three key areas: departmental capacity building, bridging knowledge systems, and creating inclusive strategies and programs.

That same month, the I-STEM cluster began a series of outreach initiatives for Indigenous students in STEM. These initiatives included hosting two virtual Indigenous STEM student days, participating in the Indigenous STEM student gathering of the American Indian Science and Engineering Society in Canada, and distributing an online resource kit for Indigenous STEM students interested in joining the public service.

Dr. Kyle Bobiwash is a researcher in residence at the Office of the Chief Science Advisor and member of the I-STEM Cluster. Dr. Bobiwash is Assistant Professor and Indigenous Scholar in the Faculty of Agricultural and Food Sciences at the University of Manitoba.

"Having the opportunity to be part of I-STEM, as Indigenous ways of knowing are becoming increasingly foundational to the future of the Canadian science system, is exciting, as we set the course for more equitable futures for all."

– Dr. Kyle Bobiwash, researcher in residence at the OCSA

Canada and the Quantum Revolution

Steps toward a national approach to quantum technologies

Canada is a recognized international leader in quantum science and quantum computing. The world is on the cusp of a new scientific era, one with the potential to revolutionize computing as well as other fields, including communications, security, transportation, medical imaging, mining, pharmaceuticals and environmental stewardship. The quantum sciences are therefore at the centre of an intense international competition for knowledge, innovation and talent. Several countries now have a national quantum strategy and roadmap.

Over the past year, to assist her in formulating advice to government, the Chief Science Advisor met with a number of international experts on quantum computing and technologies and, in January 2021, she hosted a round table with Canada's top academic and private-sector researchers on the state of quantum sciences and technologies in Canada. The Chief Science Advisor also consulted with her international counterparts, including those in the United Kingdom, the United States and Australia; these countries have developed well-integrated quantum roadmaps.

The OCSA supports efforts to establish a national approach and roadmap for quantum computing and quantum technologies that includes enhanced research and infrastructure support and capacity-building objectives, and is informed by the needs of potential end-users in both the private and public sectors. Ultimately, a more coordinated approach for advanced technologies, one that includes quantum as well as machine learning and artificial intelligence, will ensure that Canada takes full advantage of these revolutionary tools while transforming its research leadership position into commercial successes and a skilled workforce.

Dr. Mona Nemer with members from the University of Waterloo's Institute for Quantum Computing (IQC) during the American Association for the Advancement of Science annual meeting (pre-pandemic photo).

From left to right: Christine Bezruki, Senior Manager, Marketing and Communications; Kevin Resch, Interim Executive Director and faculty member, IQC; Dr. Mona Nemer; Martin Laforest, Senior Manager, Scientific Outreach, IQC; and Angela Olano, Manager, Special Projects, IQC.

Credit: Institute for Quantum Computing (IQC), University of Waterloo

KEY ACHIEVEMENTS

Science Diplomacy and Communication

The Growth of Science Diplomacy

An effective means of advancing Canada's national interest

Science and technology play crucial roles in every nation's economy, its education and health systems, its communications networks, and its national security. Each nation also has its own unique suite of scientific capabilities—particular fields in which it excels—and those capabilities form the cornerstone of its national interests. It is to Canada's benefit that it shares its scientific expertise internationally with its chosen partners in order to mutually advance national interests. This is what science diplomacy is about.

Increasingly, Canada faces diplomatic issues that are transnational in nature, sensitive in terms of national security and national prosperity, and whose solutions can only be founded upon science. The coronavirus, which can cross borders undetected and precipitate devastating health and economic impacts, is just the most recent and most urgent example. Whether the issue is climate change, natural disaster preparedness and response, the future of the Arctic, social media impacts, global digital commerce, space exploration, or many others, Canada has an array of international engagements in which its scientific capabilities play an important part in diplomatic discussions.

The Chief Science Advisor's diplomatic role

The Chief Science Advisor serves as a sort of international science ambassador on behalf of the Government of Canada. The OCSA therefore makes efforts to raise Canada's international profile, both with the global scientific community and with decision makers from other governments, by hosting international meetings and conferences, attending events and conferences abroad, and leading international delegations from Canada's scientific community.

The OCSA also works to leverage the Canadian diaspora of scientists working abroad, supports the placement of Canadian scientists and experts in international institutions and bodies, and promotes Canada as a capable and trustworthy partner for international research projects and as a destination for international postgraduate research degrees.

Science diplomacy amid COVID-19

The coronavirus pandemic has had a profound impact on science diplomacy, not least because it largely eliminated international travel to the conferences and face-to-face meetings that are typically the foundation of international relations. It also instilled a sense of urgency to the work of science diplomats, which continued apace along virtual channels.

- The Chief Science Advisor met virtually with her science advisor counterparts in the United States, Europe and beyond on a weekly basis, as collaborative efforts intensified to combat the COVID-19 pandemic.
- The Chief Science Advisor participated in consultations that led to the creation of the G7 Pandemic Preparedness Partnership, an effort led by Sir Patrick Vallance, the United Kingdom's Government Chief Scientific Adviser. Canadian-born, Oxford-based immunologist and geneticist Sir John Bell was also involved in creating the preparedness partnership.
- The OCSA mobilized Canada's global scientific diaspora, inviting many Canadian researchers abroad to speak to the Chief Science Advisor's COVID-19 Expert Panel to share their expertise for Canada's benefit.
- The OCSA participated in a series of multistakeholder consultations on open science led by UNESCO in 2020 and early 2021, with the objective of achieving an international declaration on open science.
- As an observer, the OCSA participated in the European Union discussions that led to the creation of the Bonn Declaration on Freedom of Scientific Research. This declaration affords academic researchers the freedom to select and define their research topics and methods.

The Chief Science Advisor's work in science diplomacy gave the Government of Canada and its agencies ongoing, prompt access to data, and ensured open access to all COVID-19 research outputs, including data on the evolving epidemiology of COVID-19 and information on developing policies and practices, as well as the most effective public health and medical interventions. This unprecedented achievement was instrumental in enabling decision makers to use the latest science to inform policy and greatly accelerated the development of COVID-19 diagnostics, therapeutics and vaccines worldwide.

In 2020 and early 2021, the Office of the Chief Science Advisor actively participated in a series of consultations organized by UNESCO, with the objective of achieving an international declaration on open science.

Science Communication for Canadians

Acting as a domestic champion for science

The Chief Science Advisor also plays a crucial role as a domestic champion and spokesperson for a variety of scientific issues, from the general promotion of scientific excellence in Canada to informing Canadians on the latest scientific developments in a broad range of research domains.

In 2020–2021, the Chief Science Advisor delivered remarks at more than 20 virtual public events for universities, major science policy conferences and research institutions. The subjects addressed a wide range of topics, including open science; equity, diversity and inclusion in STEM; the importance of science advice in emergencies; and recognizing the important contributions made by Canadian researchers.

On May 7, 2020, the Chief Science Advisor was a guest on GGconversations, a series of virtual discussions between the Governor General of Canada and guests from different backgrounds. This episode focused on the importance of research and science advice in times of global pandemic.

A trusted source for COVID-19 information

The pandemic greatly increased public demand for clear, concise and reliable information about COVID-19 as the science evolved. In response, the OCSA quickly became an important source of information and commentary on COVID-19 issues, including the effectiveness of various public health measures; virus monitoring and surveillance; the mechanisms of viral-vector and mRNA vaccination; vaccine acceptance and efficiency; and viral mutations.

In 2020–2021, the Chief Science Advisor participated as a guest expert in more than 50 media interviews, a marked increase from previous years. Her public communications, in English, French and Arabic, helped to dispel myths, combat misinformation and provide credible public information.

Dr. Nemer was a guest on Radio-Canada's *Les coulisses du pouvoir*, a French television news series that covers Canadian politics. October 11, 2020.

These communications included the following:

- making multiple appearances on daily and weekly televised political news programs, including Radio-Canada's *Les coulisses du pouvoir*, CBC's *Power and Politics* and CTV's *Power Play*; She also appeared on Réseau de l'Information's *24/60*, Global TV's *The West Block* and OMNI News's *Arabic Edition*
- giving radio interviews with CBC's *Quirks and Quarks*, Radio-Canada's *Les années lumière* and *Le 15-18*, and Radio-Canada International Arabic
- acting as an interview source for stories broadcast on nightly televised national news programs, including *Le Téléjournal*, *The National*, *Global National* and *CTV National News*
- giving interviews with print and online publications, including *La Presse*, *Le Devoir*, *The Globe and Mail*, the *Toronto Star*, *Maclean's*, *Huffpost Canada*, *L'Agenda Culturel*, *Diplomat Magazine*, *University Affairs* and *Research Canada*
- writing a guest column on the pandemic in *The Hill Times* in August 2020
- contributing to a year-in-review article in *Nature* magazine in December 2020

The Chief Science Advisor was interviewed on CTV *Power Play* following the government's announcement of the creation of the COVID-19 Community Task Force in April 2020.

Dr. Nemer was a guest expert on the Radio-Canada's *24-60* on April 23, 2020. The discussion was around the uncertainty of the coronavirus and how research is playing an important role in fighting the virus.

The OCSA also increased its social media presence and profile, using the Chief Science Advisor's Twitter and Instagram accounts to relay information on COVID-19 to the public. Both accounts saw their followers increase by 30 percent during the year. The Chief Science Advisor was also featured in a televised French-language public service announcement produced by the Government of Canada to promote safe public health practices.

The Year Ahead

During the past year, the OCSA has established a broader network of working relationships with the federal government's science-based departments and agencies, including its granting agencies, with provincial and federal non-governmental institutions, and with its international counterparts and international science organizations.

In the coming year, the OCSA will continue to expand its network of working relationships strategically, focusing on those in which its participation generates substantial added value both domestically and internationally. There has been an increasing demand for science advice to government this past year and this demand is unlikely to diminish in the years ahead. As new coronavirus variants emerge, as efforts progress to limit the effects of climate change, and as new and potentially disruptive technologies arise, governments will increasingly seek reliable scientific counsel on how best to meet these challenges.

The year ahead: Pandemic response

As the first wave of the COVID-19 pandemic took hold in Canada, government departments responded by creating advisory committees and task forces designed to assist with decision making, largely on an *ad hoc* basis. Over time, this proliferation of groups has resulted in overlapping mandates, areas of inquiry, jurisdictions and authorities, as well as uncertainty about where one set of pandemic scientific responsibilities ends and another begins.

The Government of Canada now has a unique learning opportunity: to review and rationalize its disparate pandemic-related committees and task forces, clarify their mandates, and make their accountabilities explicit. To this end, the OCSA will review its own activities, make recommendations and adapt its current expert panel and task force structures accordingly. A deliberative and well-structured system can improve information flow, decision making, goal setting, outcome measurement, public communications and public trust during future pandemics—and potentially other national or international health or security emergencies.

The year ahead: Science advice

The pandemic emphasized the need for a well-structured science advice mechanism to assist government decision makers, both in the normal course of policy making and in times of emergency. The OCSA will engage relevant departments in developing an efficient and well-integrated Canadian model.

The OCSA will nurture further growth of the Departmental Science Advisors Network. Key priorities for 2021–2022 will include the pandemic, research security, climate change, emergency preparedness, the career progression of federal scientists, science data and science communications. The OCSA will also expand the network to include representatives from more science-based departments and agencies, and network with other DSA networks among Canada's international allies and partners.

The OCSA will continue supporting the initiatives of the Chief Science Advisor's Youth Council. As the council's current members will complete their two-year terms in March 2022, OCSA staff will implement a succession plan.

The year ahead: Open science

Open science has always been central to the OCSA's mandate, and its value was clearly demonstrated during the pandemic. The OCSA will build on this momentum to ensure that the Government of Canada's scientific activities are open and accessible, and aspire to the highest standards of ethics and integrity.

The OCSA will build on the success of the past year in following the Roadmap for Open Science and continue to support efforts to develop a federal culture of scientific integrity, with a particular focus on evaluating the performance of departmental scientific integrity policies and producing model guidelines for peer review and research ethics boards. In 2021–2022, the OCSA will also develop a set of self-directed scientific integrity online training modules in partnership with the Canada School of Public Service.

The year ahead: Better science

The importance of the Government of Canada's scientific capabilities was never more evident than in the past year. In the year ahead, the OCSA will continue to support efforts to build capacity within the federal scientific workforce and promote the resilience and effectiveness of its research endeavours.

The OCSA will continue to review the methods and integrity of the science used in decision making under the 2019 *Impact Assessment Act*, with a focus on developing more tools to evaluate the integrity and credibility of impact assessment science.

The OCSA will engage with Canada's academic and industry leaders in key sectors, including health and the environment, to advise government on how best to ensure Canada's continued leadership in research and innovation in areas that are vital to the country's economy and well-being.

The year ahead: Science diplomacy and public awareness

The COVID-19 pandemic revealed the importance of international collaboration in science and technology, and of building relationships during normal times to serve all partners during international or global emergencies. The OCSA will continue to build on its international engagements to strengthen Canada's science and innovation priorities nationally and internationally.

The OCSA will engage in international consultations, meetings and conferences, including the following: the 2022 annual conference of the American Association for the Advancement of Science, to be held in Philadelphia in February 2022; UNESCO's multistakeholder consultation on open science; and the G7 Pandemic Preparedness Partnership.

In the fall of 2021, Canada will host the annual conference of the International Network for Government Science Advice (INGSA) in Montréal. The CSA will serve on the conference's organizing committee alongside INGSA's Founding Chair, Sir Peter Gluckman, and Professor Rémi Quirion, the Chief Scientist of Quebec and incoming INGSA Chair. The hybrid conference, accessible both in person and online, is expected to bring together more than 1,500 delegates.

The past year has also seen a widespread increase in public interest in science, one that reaches beyond its role in public health emergencies. And it has sparked an extraordinary level of engagement among scientists with legislators, policy makers and the general public. The OCSA will work to capitalize on these two developments to further enhance science literacy and the science-policy dialogue.

The OCSA will resume the Science Meets Parliament initiative in partnership with the Canadian Science Policy Centre. It is designed to give scientific leaders an understanding of parliamentary and policy processes, and to deepen parliamentarians' relationship with science across all of Canada's political communities and affiliations.

The Chief Science Advisor will continue to respond to media requests and inquiries on issues related to her mandate, including pandemic preparedness and response. This role is critical to ensuring that Canadians are informed about the latest scientific developments on important science and technology issues, and to combatting the flow of scientific misinformation and disinformation that is hampering Canada's pandemic recovery.

Appendices

Appendix A

Scientific Activity in Departments and Agencies

The list below shows the top federal departments and agencies in Canada in terms of expenditures on scientific research and development.	**2018–19** ($ millions)	**2019–20** ($ millions)	**2020–21*** ($ millions)
Public Health Agency of Canada	255	323	1,820
Canadian Institutes of Health Research	1,151	1,202	1,623
Social Sciences and Humanities Research Council of Canada	873	941	1,462
Natural Sciences and Engineering Research Council of Canada	1,329	1,355	1,365
National Research Council Canada	1,212	1,215	1,217
Environment and Climate Change Canada	670	808	975
Innovation, Science and Economic Development Canada	591	602	855
Statistics Canada	632	667	735
Global Affairs Canada	544	626	710
Natural Resources Canada	573	635	705
Agriculture and Agri-Food Canada	494	533	523
National Defence	500	483	508
Canada Foundation for Innovation	401	374	451
Health Canada	545	391	418
Fisheries and Oceans Canada	338	357	359
Canadian Space Agency	278	291	**
Atomic Energy of Canada Limited	269	276	**
Subtotal	**10,655**	**11,079**	**13,726**
Other departments and agencies	1,606	1,738	2,319
Total	**12,259**	**12,815**	**16,045**

Source: All data is from Statistics Canada's Table 27-10-0026-01, Federal expenditures on science and technology, by major departments and agencies, March 23, 2022. Due to rounding, components may not add to the totals.

* The last year of data in this table (2020–2021) represents preliminary estimates reported at the time of data collection.

** The department did not contribute 2% or more to the total fiscal year's science and technology expenditures, so its data is included in the "Other" category. The "Other" category comprises the rest of the departments and agencies in the survey.

Appendix B

Membership of the 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

Membership lists for the expert panel's working groups and task forces are available on the OCSA website.

Appendix C

Current Members of the Departmental Science Advisors Network

Sarah Gallagher
Science Advisor to the President
Canadian Space Agency

Shawn Marshall
Departmental Science Advisor
Environment and Climate Change Canada

Pascal Michel
Chief Science Officer
Public Health Agency of Canada

Vik Pant
Chief Scientist and Chief Science Advisor
Natural Resources Canada

Paul Snelgrove
Departmental Science Advisor
Fisheries and Oceans Canada

Cara Tannenbaum
Departmental Science Advisor
Health Canada

Danial Wayner
Departmental Science Advisor
National Research Council Canada

Gordon Lovegrove
Departmental Science Advisor
and Chief Science Officer
Transport Canada/Infrastructure Canada

Appendix D

Members of the CSA'S Youth Council

1. **Keeley Aird**
   Ontario
2. **Justine Ammendolia**
   Ontario
3. **Marie-Ève Boulanger**
   Quebec
4. **Andréa Cartile**
   Quebec
5. **Erin Crockett**
   Quebec
6. **Landon Getz**
   Nova Scotia
7. **Sara Guzman**
   British Columbia
8. **Amelia Hunter**
   Ontario
9. **Natasha Jakac-Sinclair**
   Ontario
10. **Chelsie Johnson**
    Ontario
11. **Max King**
    Alberta
12. **Audrey Laventure**
    Quebec
13. **Chedi Mbaga**
    New Brunswick
14. **Taylor Morriseau**
    Manitoba
15. **Sophie Poirier**
    Quebec
16. **Farah Qaiser**
    Ontario
17. **Madison Rilling**
    Quebec
18. **Ali Sbayte**
    Quebec
19. **Molly Meng Hua Sung**
    British Columbia
20. **Arthur Van Havre**
    Quebec

Appendix E

Departments and Agencies Participating in the Scientific Integrity Working Group

The scientific integrity working group supports the adoption of scientific integrity policies within their respective departments, and provides a forum for discussion and exchange on best practices in terms of implementing the policies. The working group's membership is comprised of the following 25 federal departments and agencies, whose staff includes at least 10 members engaged in scientific research and development activities. The working group also includes representatives from PIPSC and TBS.

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
15. Infrastructure Canada
16. Innovation, Science and Economic Development Canada
17. Library and Archives Canada
18. National Defence
19. National Research Council Canada
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