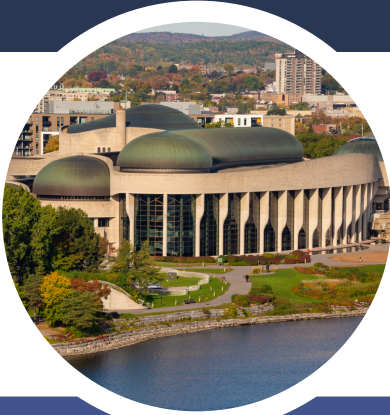# Advancing Science for Society: Health, Migration and Technologies

2025 Summit of the S7 Academies
May 6-8 2025 | Ottawa, Ontario, Canada

Dear Colleagues of the S7,

Welcome to Ottawa!

At a time of global uncertainty, it is of utmost importance that we do everything we can to reaffirm our commitment to working together in order to generate evidence and insights for the leadership of the G7.
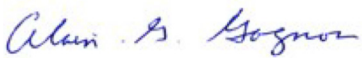
Thank you, then, for having come to Canada for the 21st Summit of the Science Academies of the S7 hosted by the Royal Society of Canada.

Our programme this week is in keeping with previous S7 Summits, and is the culmination of a year of concentrated organizational effort overseen by RSC International Secretary Dr. R. Paul Young.

Supported by the RSC International Committee, an S7-specific scientific oversight committee, teams of authors, teams of peer reviewers, and experts designated by each of your Academies, the S7 process has once again been a truly collective effort across disciplines and across borders.

We are grateful to the Academies of the S7 for your ongoing and collegial support throughout 2025, and we look forward to additional mobilization activities in order to contribute to greater public awareness of global challenges as well as productive engagement with the elected leadership of the G7.

Sincerely,

Alain-G. Gagnon, FRSC
President

Chères, chers collègues du S7,

Bienvenue à Ottawa!

En cette période d'incertitude mondiale, il est de la plus haute importance que nous fassions tout ce qui est en notre pouvoir pour réaffirmer notre engagement à travailler ensemble afin de générer des données probantes et des idées porteuses en soutien aux leaders du G7.

Je vous remercie d'être venus au Canada pour le 21e Sommet des académies des sciences du S7, organisé par la Société royale du Canada.

Notre programme cette semaine s'inscrit dans la continuité des précédents sommets du S7 et constitue l'aboutissement d'une année chargée en travail de coordination mené sous la gouverne du secrétaire aux affaires internationales de la SRC, Paul Young.

Soutenu par le comité de l'engagement international de la SRC, un comité de supervision scientifique formé spécialement pour le S7, des équipes d'auteurs, des équipes d'évaluateurs de même que par les experts désignés par chacune de vos académies, le processus de préparation de ce S7 a une fois de plus été basé sur un véritable effort collectif transdisciplinaire et international.

Nous sommes reconnaissants pour le soutien qui nous a été fourni tout au long de l'année 2025 par les académies du S7 et nous sommes impatients de participer aux futures activités de mobilisation qui sous-tendront la sensibilisation du public aux défis mondiaux actuels ainsi qu'aux échanges productifs à venir avec les leaders du G7.

Je vous prie de recevoir mes meilleures salutations,

Alain-G. Gagnon, MSRC
Président

Tuesday, May 6, Royal Society of Canada, Walter House, 282 Somerset Street West	
5:00 pm	Welcome Reception (Informal)

Wednesday, May 7, National Arts Centre, 1 Elgin Street		
6:30 - 8:30 am	*Breakfast available at the Lord Elgin Hotel, Grill 41*	
8:30 am	*Departure from hotel lobby for the National Arts Centre, (250m from hotel)*	
9:00 am	**Opening Remarks and Territorial Welcome**	**Alain-G. Gagnon**, President, Royal Society of Canada **Grandma Karen MacInnis**, Indigenous Elder **R. Paul Young**, International Secretary, Royal Society of Canada
9:30 am	**Panel 1: Advanced Technologies and Data Security** *What is happening regarding the topic in your academy and country?*	
	Moderator	**Raouf Boutaba**, Fellow, Academy of Science, Royal Society of Canada
	Panelists	**HIBIYA Junko**, Vice-President, International Affairs, Science Council of Japan
		Bettina Rockenbach, President, German National Academy of Sciences Leopoldina
10:30 am	*Health Break*	
10:45 am	**Panel 2: Sustainable Migration** *What is happening regarding the topic in your academy and country?*	
	Moderator	**Catherine Dauvergne**, Fellow, Academy of Social Sciences, Royal Society of Canada
	Panelists	**Françoise Combes**, President, *Académie des sciences de France*
		Maria Francesca Matteucci, Member of the Board, *Accademia Nazionale dei Lincei*
11:45 am	*Lunch*	
12:45 pm	**Panel 3: Climate Action and Health Resilience** *What is happening regarding the topic in your academy and country?*	
	Moderator	**Sharon Straus**, Fellow, Academy of Science, Royal Society of Canada
	Panelists	**Vaughan Turekian**, Executive Director, Policy and Global Affairs Division, National Academy of Sciences
		Mark Walport, Co-Chair, International Committee, The Royal Society
1:45 pm	*Health Break*	
2:00 pm	**Roundtable Discussion: Issues for the Future** *How do we as academies ensure that expert advice is generated and received by government? How effective is the S7 engagement process?*	
	Françoise Combes, President, *Académie des sciences de France*	
	Alain-G. Gagnon, President, Royal Society of Canada	
	HIBIYA Junko, Vice-President, International Affairs, Science Council of Japan	
	Maria Francesca Matteucci, Member of the Board, Accademia Nazionale dei Lincei	
	Bettina Rockenbach, President, German National Academy of Sciences Leopoldina	
	Vaughan Turekian, Executive Director, Policy and Global Affairs Division, National Academy of Sciences	
	Mark Walport, Co-Chair, International Committee, The Royal Society	
3:00 pm	Walking Tour of the Parliamentary Precinct in Ottawa	
5:00 pm	*Shuttle departure from the Lord Elgin Hotel lobby to the Embassy of France*	
5:30 pm	**Reception**, Embassy of France, 42 Sussex Drive	
7:30 pm	*Return Shuttle to the Lord Elgin Hotel*	

Advancing Science for Society: Health, Migration and Technologies

Thursday, May 8, Royal Society of Canada, Walter House, 282 Somerset Street West	
6:30 - 8:30 am	*Breakfast available at the Lord Elgin Hotel, Grill 41*
9:00 am	*Departure from the Lord Elgin hotel lobby for Walter House (500m from hotel)*
9:30 am	**Academies Meeting** 1. Maritime Security 2. Follow up on the Berlin meeting of December 2024 3. Preparations by l'Académie des sciences de France for S7 2026 4. The role of Social Sciences 5. Other business a. S20
11:00 am	**Insights from Canada's Chief Science Advisor**
	Dr. Mona Nemer, Chief Science Advisor of Canada, Government of Canada
11:45 am	**Presentation of the 2025 Declarations of the S7 to the Government of Canada and Group Photograph**
12:00 pm	*Lunch*
1:00 pm	**Adjournment**

RSC SRC

ACADÉMIE DES SCIENCES INSTITUT DE FRANCE

Leopoldina Nationale Akademie der Wissenschaften

ACCADEMIA NAZIONALE DEI LINCEI

SCIENCE COUNCIL OF JAPAN

THE ROYAL SOCIETY

NATIONAL ACADEMY OF SCIENCES

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Francis-André Wollman	Vice-President, International Relations	Académie des sciences
César Manrique	Senior Policy Officer International Relations	Académie des sciences
Bettina Rockenbach	President	German Academy of Sciences Leopoldina
Ruth Maria Narmann	Head International Relations Department	German Academy of Sciences Leopoldina
Maria Francesca Matteucci	Member of the Board	Accademia Nazionale dei Lincei
HIBIYA Junko	Vice-President International Affairs	Science Council of Japan
OHNUMA Kazuyoshi	Director International Affairs	Science Council of Japan
KUBOI Kohki	Section Chief International Affairs	Science Council of Japan
Mark Walport	Co-Chair International Committee	The Royal Society
Ruth Cooper	Senior Policy Adviser	The Royal Society
Vaughan Turekian	Executive Director Policy and Global Affairs Division	National Academy of Sciences
John Boright	Deputy Director Policy and Global Affairs Division	National Academy of Sciences
Ourania Kosti	Director Board on International Scientific Organizations	National Academy of Sciences

CANADIAN DELEGATES

Mona Nemer	Chief Science Advisor of Canada	Government of Canada
Alain-G. Gagnon	President	Royal Society of Canada
Françoise Baylis	President-Elect	Royal Society of Canada
Paul Young	International Secretary	Royal Society of Canada
Sheila Embleton	President Academy of Arts and Humanities	Royal Society of Canada
Audrey Moores	President RSC College	Royal Society of Canada
Michel Tremblay	President Academy of Science	Royal Society of Canada
Raouf Boutaba	Fellow Academy of Science	Royal Society of Canada
Catherine Dauvergne	Fellow Academy of Social Sciences	Royal Society of Canada
Sharon Straus	Fellow, Academy of Science	Royal Society of Canada
Luc Gauthier	Chief of Staff	Office of the Chief Science Advisor of Canada
Sandy Hanna	Senior Policy Advisor	Office of the Chief Science Advisor of Canada
Nicholas Anderson	Senior Policy Analyst G7 Engagement & Public Affairs	G7/G20 Summits, Government of Canada
Grandma Karen MacInnis	Indigenous Elder	
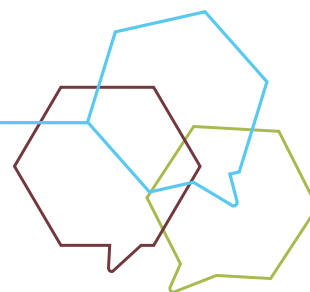
In 2024 and 2025, the Royal Society of Canada (RSC) has partnered with Université du Québec en Outaouais to present the RSC Dialogues @ UQO series to advance public discussion on key themes.

RSC Dialogues @ UQO | Climate Action and Health Resilience (October 9, 2024)

This dialogue, led by RSC College Members Damon Matthews, Andrew Tanentzap, and moderator Frédérik Doyon, examined key aspects of climate action and their potential benefits for human well-being, in Canada and across the globe.

RSC Dialogues @ UQO | Advanced Technologies and Data (January 22, 2025)

This dialogue, led by Benoît Dupont (RSC College), Atefeh (Atty) Mashatan, and moderator Stéphane Gagnon, assessed the current level of cybersecurity debt for people and organizations, reflected on future trends, and suggested practical measures that can be adopted by governments and businesses to alleviate this burden on our digital growth.

RSC Dialogues @ UQO | Sustainable Migration (April 2, 2025)

This dialogue, led by François Crépeau (FRSC), Laura Madokoro (RSC College), and moderator Anyck Dauphin, explored the complexity of the challenges that migration poses to contemporary societies. It also considered how to make access to migration, migration processes and outcomes more sustainable and just for migrants, host societies and home countries alike.

Recordings of these events are available on the RSC Website and YouTube channel.
www.rsc-src.ca || www.youtube.com/@RSCSRC1

Getting Around Ottawa
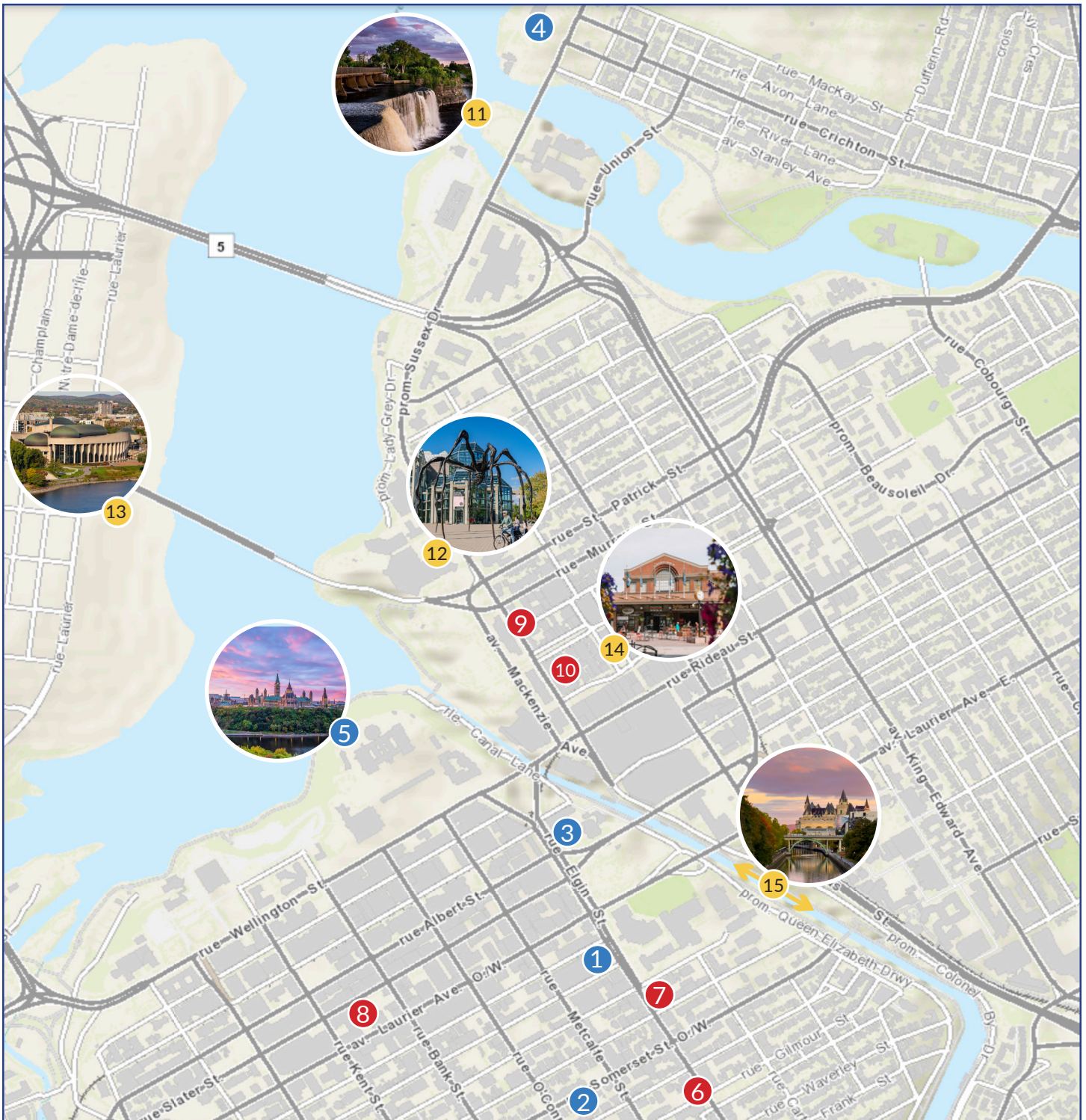
IMPORTANT LOCATIONS
1. Lord Elgin
2. Walter House
3. National Arts Centre
4. Embassy of France
5. Parliament Hill

RECOMMENDED RESTAURANT & CAFÉS
6. Happy Goat Coffee | Close to RSC HQ
7. The Whalesbone | Ethical Seafood
8. North & Navy | Northern Italian Kitchen
9. Play Food & Wine | Top Selection
10. Planet Coffee | Byward Market

PLACES TO VISIT
11. Rideau Falls
12. National Art Gallery
13. Canadian History Museum
14. Byward Market
15. Rideau Canal

S7

ADVANCING SCIENCE FOR SOCIETY: HEALTH, MIGRATION AND TECHNOLOGIES
2025 SUMMIT OF THE S7 ACADEMIES | MAY 6-8 2025 | OTTAWA, ONTARIO, CANADA
ADVANCED TECHNOLOGIES AND DATA SECURITY

DEFINING THE ISSUE

The last two decades have seen a remarkable increase in the number, scope, utility and purposes of both systems for data collection[1] and data processing and archiving technologies, including AI systems, that use data to make inferences or perform actions. According to the *International Scientific Report on the Safety of Advanced AI*, the potential of AI to benefit humankind is counterbalanced by potentially serious risks[2]. Therefore, a multi-level, holistic and human-centric and smart approach to governance and regulation is needed to avoid stifling the benefits of these technologies, while confronting the problems. In the remainder of the document, we use the term *data security* to refer to this interconnected set of concerns.

BACKGROUND

As documented by the panel of the *International Scientific Report on the Safety of Advanced AI*, the tremendous potential from anticipated advances in AI, and the demand for data availability and data quality for legitimate reasons like research in areas critical to the betterment of humankind, are counterbalanced by potentially serious risks due to intentional misuse (e.g., disinformation and other threats to democracy), loss of control, human rights violations, labour market disruptions and loss of livelihoods, and climate / environmental damage. There are high uncertainties on both the magnitude of the potential disruptions and their timeline, but there is consensus on the lack of preparedness in scientific, developer and policy spheres. Following the precautionary principle, it is thus crucial to invest in data security as well as research into how to harness and control advanced AI systems. Social, policy and technological innovations are required at all levels to identify and maximize the collective benefits, and to ensure that guardrails are continually maintained and updated to anticipate, prevent and mitigate risks.

Both specific national and international governance and regulation, and coordination between these, will play an important role in mitigating these risks. Governance and regulatory bodies should outline technical and organisational expectations and guidelines to ensure risks and benefits are properly identified and addressed. They should implement responsive compliance and enforcement regimes that protect people and planet without stifling innovation and economic prosperity. We understand effective governance and regulation as policy innovation are needed, enabling benefits to be shared more equitably across society and providing a framework for innovating responsibly and using technology to meet societal goals. Parties involved in data security include practitioners (e.g., industry and public sector), academic researchers, and the public, whether as individuals or (self-) identified groups.

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1 These systems include smartphones, wearable and other personal devices, home and industrial automation, smart meters, medical devices, autonomous vehicles, and public and private surveillance systems.

2 International AI Safety Report (DSIT 2025/001, 2025), https://www.gov.uk/government/publications/international-ai-safety-report-2025

POLICY RECOMMENDATIONS

RECOMMENDATION 1

Because advanced technologies can rapidly become critical infrastructure, it is essential that their management is left neither to corporations that develop them, markets, social adaptation, nor to education and training as a way of transferring all responsibility to people. Corporations, markets and education all play essential roles, but governance and regulation are essential:

> a. to protect those who are adversely affected by the differential opportunities and effects of new technologies; and
> b. to help ensure that these technologies do not continue to concentrate economic and political power and accentuate existing inequalities.

RECOMMENDATION 2

Regulating data collection and retention is both a regulatory and an ethical challenge. Once data have been collected, two crucial aspects about data-use merit careful regulation: preventing unintended data leakage and ensuring data quality. Emerging regulations such as the *EU AI Act*[3] recognize these concerns but contain gaps. For example, regulations recommend:

> a. pseudonymization of data to prevent unintended leakage—although privacy experts have shown that this is often insufficient, and stronger measures like differential privacy are needed; and
> b. ensuring that demographic distributions in data used to make useful inferences (e.g., train an AI model) match the population it is intended for—but do not specify how this might be done without violating data confidentiality.

Policymakers should more closely engage with experts, including academics, and members of the public whose data this is, to address these gaps. Two-way communication should guide interpretation of legislation into technical features, such as ensuring that relevant demographic data (e.g., language, age, race, gender) are adequately sampled and secured so that inequities are not further exacerbated. It should also inform directions that academic or industry researchers should prioritise to develop technologies that facilitate compliance by practitioners and enforcement by regulators (e.g., through the invention of data analysis approaches that produce verifiable guarantees).

RECOMMENDATION 3

Given that data-driven systems have entered every aspect of human endeavour, the "threat surface" of such systems has dramatically increased. People from all walks of life are now involved in using and managing these systems. Commissions, omissions, and mistakes by them can lead to security breaches. The number of instances where human error led to ransomware or other attacks against critical infrastructure such as hospitals illustrates the scale of the problem. A broad-based and ongoing effort to bring about security/privacy "literacy" is needed. Policymakers should incentivize the ongoing development of tools and training programs to bring about and continuously improve such literacy, and the development of alternative "backup" systems and procedures to mitigate human errors.

RECOMMENDATION 4

Publics can't be thought of as one undifferentiated group, whether it is "users", "consumers" or "people." Groups and individuals engage with and are affected by advanced data and surveillance technologies in very varied ways, and these have consequences that can range from trivial to vital, from minor changes in convenience like automated home delivery, through invisible forms of discrimination, for example, the embedding of racial and gender prejudice in automated hiring or sentencing, to exclusion from countries as the result of no-fly lists based on categorical suspicion, or even death in the case of AI-based weapons-targeting systems. Considering "data justice"—fairness in the way people are categorised and treated in the collection and use of data—is therefore an essential addition to existing understandings of legal, economic, social and environmental justice.

RECOMMENDATION 5

Specific vulnerabilities also need to be addressed, for example, the very young, the elderly, particularly those with cognitive impairments, and those with illnesses, who may be more likely to fall victim to malicious use of advanced technologies, for example scammers recruiting older people, the use of ransomware against hospitals, and predators targeting children. However, such vulnerabilities should not be used as an excuse for the extension of unjustified and generalised surveillance and restrictions on human rights. When increased security and surveillance are introduced,

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3 EU AI Act, https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

such measures may contribute to the further marginalisation of the very groups who are already the victims of data injustice.

RECOMMENDATION 6
Regulators will have to incorporate data security considerations linked to emerging technologies into their existing mandates and, as a result, ensure that they develop the required in-house expertise and capacities, communication and coordination. New governance systems and regulatory entities may also be needed at both national and international levels to coordinate enforceable guidelines, standards and best practices across sectors and interested parties when advanced technologies trigger systemic and disruptive changes in society, such as is the case with AI. Data security matters because data and advanced technologies now mediate not just innovation and prosperity but health, education, creativity, the arts, expression, and knowledge.

RECOMMENDATION 7
Clarity is needed when it comes to the responsibilities of each regulator, so that new regulatory entities do not lead to inefficiencies from a more fragmented regulatory landscape. The G7 is one such forum for coordination, but there must also be a much wider discussion that involves existing recognised regulatory bodies (even if responsibilities are contested), for example UNESCO and the International Telecommunications Union (ITU), the nations of the Global South, and non-G7 economic and technological leaders.

RECOMMENDATION 8
We recognise that advanced technologies inevitably raise national security concerns, however it is the responsibility of academies and governments to consider the interests of global humanity and the planet. Cooperation for peace and global security is necessary. We would support the creation of a "CERN for AI" –providing widespread and equitable access to compute power for researchers from around the world, enabling them to build datasets, and also supporting multi-way learning between researchers from the Global North and South.

RECOMMENDATION 9
We recommend that to address the difficulty in training the appropriate experts for regulation enforcement, policymakers should incentivize work done in the open-source model. Such incentives could come in the form of dedicated funding and allocation of resources to support the open-source community in maintaining the software and its integrity. Popular open-source projects have shown that openness and transparency can also lead to strengthened security. However, decisions on allowing or restricting open-sourcing of powerful AI systems must be subject to democratic oversight, and safety regulations that apply to proprietary systems must also apply to open-source systems.

RECOMMENDATION 10
Generative AI models can produce media of impressive quality and are being misused for deception. Such models are also flooding the internet with misinformation, not necessarily deliberate deception but false information which can then in turn go on to be used and recycled again by AI models, leading to both model degradation and further misinformation. Regulations, like the EU AI Act, attempt to address this concern[4]. "Watermarking"—the practice of embedding patterns in AI-generated content which enables them to be identified as such[5]—is one solution, but it is known to be brittle. Watermarks verified by the owners of the AI models may not be enough to stem harms from deceptive AI-generated data, and may not change people's behaviour in terms of the way they interact with data—particularly in highly technology-driven societies. Policymakers should incentivize exploration of different techniques for verifiable data provenance.

RECOMMENDATION 11
Finally, cloud-based, AI technologies such as Large Language Models (LLMs) have a large direct impact on the global climate. For example, the energy use resulting from a ChatGPT query is far higher than from a simple web search. This is not addressed by unevidenced assertions that increasing energy use creates incentives to accelerate the switch to sustainable sources of power. Governance and regulation of data and its processing should be coordinated with policies for environmental and energy sustainability.

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4 EU AI Act, https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence

5 https://www.brookings.edu/articles/detecting-ai-fingerprints-a-guide-to-watermarking-and-beyond/

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S7

ADVANCING SCIENCE FOR SOCIETY: HEALTH, MIGRATION AND TECHNOLOGIES
2025 SUMMIT OF THE S7 ACADEMIES | MAY 6-8 2025 | OTTAWA, ONTARIO, CANADA
CLIMATE ACTION AND HEALTH RESILIENCE

DEFINING THE ISSUE

Climate change is profoundly harming health through its impacts on human and natural systems, and risks undermining health progresses achieved in previous decades. Widespread and rapid changes in the Earth's climate system harm the health of people, animals and ecosystems and the resilience of health and social services[1]. Heat waves are increasing illnesses and deaths globally. More frequent and intense climate events drive population displacement, food and water insecurity, and undernutrition through disruptions to agricultural and food systems. Changing temperatures and biodiversity losses are making more areas hospitable for vector-borne and zoonotic disease transmission by altering insect and wildlife habitats, driving the spread of diseases like dengue and malaria to new regions, and increasing risks of epidemics and pandemics. Growing wildfire-related atmospheric pollution caused by global warming is worsening chronic illness and death from cardiovascular and respiratory diseases, while earlier spring pollen seasons in northern latitudes are increasing risks of allergic respiratory diseases. Mental health challenges are increasing through the trauma and psychological stresses of climate change-related loss of homes, livelihoods, or culture. Heat has direct effects on the nervous and endocrine systems and extreme weather events have indirect psychosocial consequences. Climate change impacts are not experienced equally by all populations. Women, children and youth, older adults, Indigenous Peoples, low-income households, displaced populations, socially marginalized groups, and people in remote communities, Low- and Middle-Income Countries, and the Small Island Developing States are the most at-risk of immediate health threats and worsening of existing health concerns.

Climate action is urgently needed in response to what the UN has defined as the "Triple Planetary Crisis" of interconnected challenges of climate change, biodiversity loss, and pollution. Leveraging the important health benefits of climate mitigation while strengthening adaptation efforts can minimize immediate and long-term health risks. Health systems are already facing profound challenges. Transformation toward more sustainable, low-carbon, climate-resilient health systems is needed to face the double challenge of reducing the carbon footprint of health facilities, products, and supply chains, while improving their ability to prepare for, recover from, and adapt to climate change impacts.

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1 WHO (2024). *COP29 special report on climate change and health: Health is the argument for climate action*. World Health Organization, Geneva. https://cdn.who.int/media/docs/default-source/environment-climate-change-and-health/cop29-report_summary.pdf?sfvrsn=2556cbaf_7; IPCC (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* https://www.ipcc.ch/report/ar6/wg2/; IPCC (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* https://www.ipcc.ch/report/ar6/wg1/; OECD (2024). *The Climate Action Monitor 2024*, OECD Publishing, Paris. https://doi.org/10.1787/787786f6-en

POLICY RECOMMENDATIONS

RECOMMENDATION 1
Develop and optimize climate change mitigation strategies to maximize transformative health impacts. Reducing greenhouse gas (GHG) emissions from energy, industry, transportation, building sectors, agriculture and food systems can bring enormous health benefits. Some immediate actions include: replace fossil fuels with renewables for energy generation; improve ventilation and insulation of buildings and homes using the passive house concept; employ lower-emissions electric vehicles, public transit, and active transportation; increase consumption of healthy, sustainable diets; and, expand urban green infrastructure. Societal benefits of these actions are fewer deaths, illness, and injuries from extreme weather and air pollution, increased food security, reduced spread of vector-borne diseases to new areas, reduced heat-related mortality, and reduced social and geographic inequities. These health benefits will occur on a shorter timescale than the climate benefits, and will accrue locally even in the absence of strong climate action from other countries in relation to CBDR. Importantly, the health argument for GHG emission reductions could make climate mitigation strategies more desirable and more cost-effective to motivate rapid action.

RECOMMENDATION 2
Support mitigation and adaptation options that mainstream health into biodiversity, food, infrastructure, social protection, and water policies. Climate-resilient agriculture and fisheries can help promote sustainable water and soil management and biodiversity conservation, along with food system transformation to address climate change impacts on food supply and nutrition, improving access to potable water, and reducing exposure of water and sanitation systems to flooding. Ecosystem-based adaptation measures can help safeguard biodiversity and improve ecosystem health. Climate-resilient urban planning (including urban greening and low-carbon transportation networks) can reduce urban heat island effects and improve air quality. Strengthening public health infrastructure, workforce training and capacity, programs, surveillance, and early warning and response systems can help address climate change-related risks and climate-sensitive diseases. Emergency response and recovery planning, evacuation, and shelter provision can address unique challenges faced by underserved populations.

RECOMMENDATION 3
Invest strategically in public health and longevity. Develop new regulations nationally and internationally to facilitate comprehensive transformations of health and social services, increasing their readiness and safeguarding human health from climate change impacts. Reinforcing preventive actions can promote short-term resiliency by alleviating the burden on health systems and longer-term transitions to climate neutrality. Related workforce demands require investments to train healthcare professionals. Strengthening the social safety net through programs and policies that alleviate poverty and protect people from economic shocks helps to secure a livable and sustainable future for all. Adopting a whole-system preparedness approach recognizes health security and the adaptiveness of a nation's socio-economic capacity as essential factors in overall security.

RECOMMENDATION 4
Provide economic and regulatory incentives to foster adaptation, resiliency, and mitigation. Examples of these incentives include reducing taxes or introducing subsidies for new products or technologies that address health impacts of climate change while reducing subsidies and considering a global carbon pricing mechanism and taxation for products that contribute to climate change; working proactively at different levels of government to update and coordinate development, building, or zoning regulations and codes (including planning and construction codes), with consideration of future climate change; supporting the development of occupational safety protocols (through trade deals or supply chain regulations) that address workplace conditions and practices that expose employees to climate change-related risks; and, incentivizing climate change mitigation policies that consider health by promoting them through national and international bodies.

RECOMMENDATION 5
Assess and strengthen climate-resiliency of critical infrastructure, communities, and societies. This includes: strengthening water, sanitation and hygiene infrastructure to protect water safety and security; securing access to key infrastructure and safety shelters, including infrastructure for active transportation; developing relocation plans as a means of last resort (and only implemented with the agreement of affected communities) to protect critical infrastructure and communities with known vulnerabilities, especially in remote areas; designing and retrofitting buildings with low-carbon solutions to enhance indoor air quality, reduce exposure to harmful pollutants, and maintain comfortable

indoor temperatures during extreme heat or cold; and, strengthening the resilience of health systems and public health supply chains to withstand disruptions caused by extreme weather events. Diversifying supply sources, increasing local production capacities, and maintaining strategic reserves of essential medicines, medical supplies, and equipment can maintain the reliability and effectiveness of health systems despite disruptions caused by climate change. Equitably distributed resources for health surveillance, including biomonitoring and genome sequencing, and biomanufacturing for vaccines and treatment technologies, can support One Health and Planetary Health approaches that integrate human, animal, and ecosystem health to better face future pandemics.

RECOMMENDATION 6

Invest in innovative solutions. Increasing investments in knowledge and research driven innovation, generating new approaches to better understand and address risks to health through climate change mitigation, adaptation, and resilience. Also critical are societal and political innovations that involve affected individuals and communities, including Indigenous Peoples, in the definition and co-construction of climate action. Innovative solutions require rigorous data collection, analysis, and sharing on biodiversity, health, socio-economic, and equity impacts of climate change; and, on effectiveness of adaptation and mitigation interventions (e.g., pandemic preparedness, vaccine development for emerging diseases) on ecosystems, health and social systems, and on food, water, and critical infrastructure systems. Policies that foster trans-sectoral collaborations (e.g. between academic institutions, governmental agencies, and private sectors), knowledge mobilization and exchange, and technical capacity building to conduct health analytics, modelling, and intervention implementation relative to climate change, extreme weather events, and emerging diseases provide important foundations to develop innovative climate solutions.

RECOMMENDATION 7

Implement an equity-focused approach in data collection, policy development, and service delivery. Ensuring that climate action policies and health interventions prioritize those at the highest risk of inequities is crucial. This includes adopting inclusive data collection practices that capture the diverse impacts of climate change on communities with known vulnerabilities and those being marginalized or historically overlooked, within and between countries and regions. Policies should be informed by high-quality, appropriately scaled data to identify and address the specific needs of these populations, such as women, children and youth, older adults, Indigenous Peoples, low-income households, people in remote communities, displaced populations, and racialized or socially marginalized groups. Service delivery should be tailored to consider cultural contexts, Indigenous and local knowledges, and involve affected communities in decision-making processes from the beginning. By centering equity, health systems will be better prepared to provide targeted resources and support to those most affected. This will enhance resilience, reduce health disparities, and support the attainment of health-related SDGs.

CANADA

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ADVANCING SCIENCE FOR SOCIETY: HEALTH, MIGRATION AND TECHNOLOGIES
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SUSTAINABLE MIGRATION

DEFINING THE ISSUE

Migration is part of the human condition. It affects all people, everywhere—directly or indirectly. Our focus, international migration, concerns people moving from their home country to another on either a permanent or temporary basis. Currently, the number of international migrants, i.e. moving from their home country to another on either a permanent (at least a one-year stay) or temporary basis (between 3 and 12 months) was estimated to be just over 304 million. This represents a 74% increase since 2000.[1] Labour migrants and forcibly displaced persons make up the two largest groups and neither are exclusive categories though certain classes of labour are often seen as desirable for sustainable migration and demographic planning purposes.[2]

What makes migration "sustainable" is a complex question involving a range of factors. Sustainable international migration ensures a well-balanced distribution of costs and benefits for the individuals, societies and states affected. For host countries, current discourse highlights the importance of social cohesion, and many point out that the integration of immigrants is not possible without feeling a sense of belonging and being part of a shared project.[3] For sending countries, there are concerns about sustainability in terms of loss of skills and resources, unstable remittances, weakened diasporic connections, and an overall brain-drain in light of the stark economic and demographic disparities. For people in the process of migration, priorities include safety and security for themselves, their families, and their communities, employment, dignity, and the fundamental respect for and recognition of their human rights.

The capacity of all countries and regions to provide safe, secure, and prosperous futures for their citizens and the international community is tested by the multifaceted factors behind migration such as armed conflict, growing economic volatility, labour precarity, political instability, environmental degradation, climate change, gender discrimination, and religious intolerance. These factors can lead to acute social, economic, and cultural vulnerability, with a knock-on effect being migration - by choice, coercion, or force.

PRAGMATIC APPROACHES TO MIGRATION

Questions about the most appropriate, effective, and sustainable migration policies are laced with tensions which manifest, for example, in hate crimes targeting individual migrants and migrant communities. Implicit in such questions are assumptions about whom migration is for, such as sending societies, host societies, or individual migrants and

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1 Data informing this number come from International Migrant Stock 2024. https://www.un.org/development/desa/pd/content/international-migrant-stock

2 Two studies have informed these number: IOM (International Organization for Migration) UN Migration's *The World Migration Report 2024* https://publications.iom.int/books/world-migration-report-2024 and UNHCR's *Global Trends: Forced Displacement in 2023* https://www.unhcr.org/global-trends-report-2023.

3 OECD (2024), *International Migration Outlook 2024*, OECD Publishing, Paris, 106, https://doi.org/10.1787/50b0353e-en.

their families and communities, and what the end goal of any migration policy should be. The goals and objectives for migrants in host countries can align with the existing citizenry in economic pursuits, shared values and family reunification, but sharp divergences can emerge when it comes to labour competition or to a person or group's class, race, social identity, and/or gender. This exposes tensions that may be complicated further by the very laws and regulations that are intended to govern and regulate the movement of people. Think here of policies in effect among those countries often referred to as "white settler societies" such as the United States, Australia, and Canada. These countries, until the late 1960s, promoted white immigration to the detriment of migrants from other backgrounds.

While immigration policies are often structured around categories of movement that are meant to reflect hierarchies of desirability (e.g. labour) and the reasons why people migrate and how they do it, the lived reality for the person in transition from one country to another is complex. Host states use classification categories of migration (refugee, labourer, student, spouse) to restrict or regulate movement across regional, national, or international borders yet not all migrants can fit within the often-narrow categories. People inherently possess multiple and shifting identities—migrant, yes, but perhaps also woman, mother, and doctor. Additionally, the distinction between voluntary and involuntary migration is complex and often involves varying degrees of choice and coercion, depending on the context. The rise in the number of "undocumented" migrants is influenced by the fact that increasingly complex legal landscapes and restrictive migration governance make it easy for people to fall outside of official categories of movement. This encourages further state interventions, which can be unsustainable in terms of policy consistency and the expenditure of resources. In terms of social cohesion, increasingly complex migration management regimes are problematic since they erase and suppress migrant agency, constrain labour mobility, impede integration and place significant (and additional) pressure upon the bureaucracies of host country to 'categorize' migrants. It also ignores how one country's gain can be another country's loss.

MIGRATION AS ROUTE TO DEMOGRAPHIC AND ECONOMIC SUSTAINABILITY

Sustainable migration requires all parties to understand—or endeavour to understand—the complexities inherent within a person's decision to move across international borders and the motivations of a host country for opening immigration pathways. Strategies for sustainability must consider the demographic imbalance between rich and poor countries and its impact on national labour forces. Legal categories of refugees and labour migrants do not always capture the complexity of the reality. However, there is a legal and moral requirement for distinguishing amongst impulses for movement. Legally, the 1951 Refugee Convention stipulates protections for refugees by providing against non-refoulement and insisting that no person seeking refuge should be sent back before their case for refuge has been assessed. This compels host countries to protect the human rights of those whose home countries do not or cannot. When the lines become blurred, such as when people suffer economic hardship in their countries of origin for reasons of ethnic background, sexual orientation, or climate change, host countries need to consider carefully the fundamental difference between migrants and refugees. Under these circumstances, host countries have an obligation to provide the political protections for people whose home country do not or will not protect them and to provide employment opportunities that accommodate their skills.

DISRUPTION OF DEMOCRACIES WITH DISINFORMATION

Disinformation, which includes the demonization and the spreading of false information about the effects of migration, is causing significant harm to receiving societies and to individual migrants by undermining their ability to cross borders safely and securely. Moreover, on one level, disinformation about the putative cost of migration to receiving countries and the threat posed to the legal institutions that its citizens depend upon for the good governance of their societies. This undermines trust in democratic principles and erodes social cohesion. On another level, disinformation about the opportunities available to migrants in host countries sets unrealistic expectations of what life will be like for them upon arrival. Combatting disinformation requires a long-term commitment across the political spectrum to push against disinformation. Care must be taken to ensure that the language used in relation to migrants and migration does not create or foster social division. The inadvertent perpetuation of stereotypes and myths about migrants inhibits socio-economic inclusion and this is especially damaging to young people who often find themselves caught between two or more worlds. Additionally, and since return migration is common, enabling a positive experience in the host state has the potential to inform long-lasting and formative change in home states particularly among women, children and young people, and sexual minorities.

DAMAGING THE GLOBAL RESEARCH ECOSYSTEM

As the science academies of the G7 nations, we are particularly concerned about the impact that the forced migration and displacement of scientists from a growing number of countries around the world is having upon the sustainability of our global research ecosystem. The loss of scientific expertise in a growing number of nations due to war, conflict, and persecution is causing major disruptions to or decimating research capability. Universities, colleges, and research institutes tend to be the early targets of authoritarians, oppressors, and/or dictators with the result being the loss of large numbers of highly skilled and highly educated people through intimidation, disappearance, murder, or forced displacement. The exact number of displaced scientists is impossible to know but what is certain is that the consequences of such a dramatic loss of scientific capital to a country's post-conflict future are catastrophic. This loss undermines or eliminates opportunities for diplomacy, the recovery of vulnerable economies, the preservation of language and culture, and discovery research.

While recognizing that patterns of migration are shaped by dynamic and ever-changing economic, environmental, political, and cultural factors, it is essential that we adhere to the SDG's guiding principle of leaving no one behind which means doing what we can to level the field. The S7 academies are committed to ensuring the dignity of all human beings. Communicating the diversity of the migrant experience in the past and present, and across a range of geographical spaces can support the kind of informed and evidence-based integration strategies that make all our societies more innovative, resilient, and sustainable.

POLICY RECOMMENDATIONS

RECOMMENDATION 1

The creation of a co-developed training program wherein policy makers, researchers, and other experts come together to acquire deeper awareness of the complexities and differences inherent in short-term and long-term migration. Expanding insights on the various acute and chronic factors associated with migration in response to changing climatic conditions or internal sectarian or political violence, for example, and how these may influence involuntary displacement and/or adaptive migration can build stronger pathways for secure and stable refuge.

RECOMMENDATION 2

That particular attention be paid to the most vulnerable migrant groups and that appropriate protections and strategies for their inclusion be put in place to enable them to reach their full potential and to help our societies progress in sustainable, prosperous, and inclusive ways.

RECOMMENDATION 3

The creation of a multilateral agreement to develop a process whereby the credentials of displaced scientists may be recognized and accepted by the host country. We also recommend the introduction of dedicated funding streams to enable universities to provide longer-term (3+ years) placements, language training, and health supports for displaced researchers.

RECOMMENDATION 4

The development of more robust communication strategies to combat disinformation within both migrant communities and host countries. More must be done to highlight the contributions that migrants and their descendants make and have made to the evolution of our national stories and to the public good. We see a strong need for a special focus on employment, specifically the needs of host countries and the actual roles that migrant populations play in national labour markets.

RECOMMENDATION 5

That additional supports be put in place to ensure that newcomers are equipped with the information needed to adapt and integrate with host countries over the long term. Specifically, we recommend enhancing the ways in which information about the host country and society, such as that relating to housing, employment, and education, is provided so that newcomers will be able to make informed decisions about the integration pathways available to them.

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MAMORU MITSUISHI

The German National Academy of Sciences Leopoldina, the National Academy of Sciences, and the Royal Society abstained from endorsing this document.

Grandma Karen MacInnis (She/Her),
Indigenous Elder

Karen, (Nenookaasiwag kwi), I am Ojibwa from Walpole Island First Nation (Bkejwanong).

While living in the Timmins area, I spent many years working across the North as a therapist and traditional healer both on and off reserve using Indigenous healing & western psychotherapy.

In 1998 I moved to the unseeded territory of the Algonquin people (Ottawa) as a therapist, healer, knowledge keeper and Elder, I work with both Aboriginal and non-Aboriginal organizations, providing guidance, around traditional roles, teachings and ceremonies for both individuals, groups and organizations.

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