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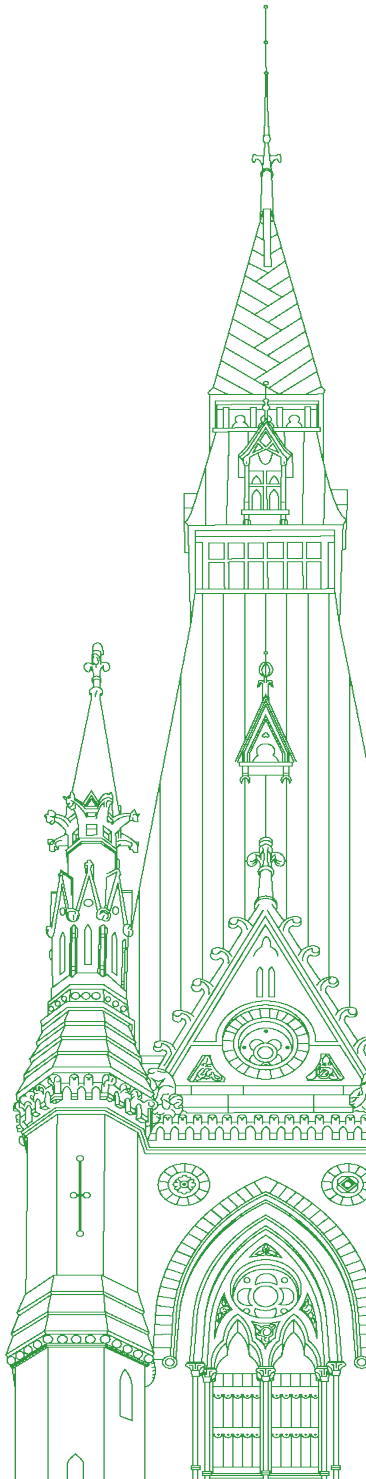

Chair: The Honourable Kirsty Duncan

Standing Committee on Science and Research

Monday, December 5, 2022

● (1830)

[*English*]

The Chair (Hon. Kirsty Duncan (Etobicoke North, Lib.)): I call this meeting to order. We have a wonderful meeting ahead of us.

Welcome to meeting 25 of the House of Commons Standing Committee on Science and Research.

As you know, tonight's meeting is taking place in a hybrid format, pursuant to the House order of June 23, 2022. We have members attending in person in the room and remotely using the Zoom application.

I'd like to make a few comments.

As you all know, this meeting is regarding moon shot programs. For those who are new tonight, please wait until I recognize you by name before speaking. For those participating via video conference, click on the microphone icon to activate your microphone, and please mute it when you are not speaking.

For interpretation for those on Zoom, you have the choice at the bottom of your screen of English, French or floor. For those in the room, you can use the earpiece and select the desired channel. As a reminder, all comments should be addressed through the chair, and please use the “raise hand” function.

I want you to know that all of our witnesses tonight completed the required connection tests in advance of the meeting.

I'd like to welcome Mr. Ruff, who is joining us tonight.

I'd like to welcome our witnesses.

From the U15 Group of Canadian Research Universities, we have Dr. Chad Gaffield, who is the chief executive officer. We welcome you. We are delighted you can join us.

From the Ocean Frontier Institute, we have Dr. Anya Waite, chief executive officer and scientific director. Thank you for joining us. We welcome you.

Friends, we are trying to reach Sir Jeremy Farrar from the Wellcome Trust, who is travelling in Japan right now.

We will have five-minute statements. At the four-and-a-half-minute mark, I will hold up a yellow card. It lets you know there are 30 seconds left. I would ask that you wrap up then.

We'll begin with Dr. Gaffield.

The floor is yours.

[*Translation*]

Dr. Chad Gaffield (Chief Executive Officer, U15 Group of Canadian Research Universities): Good evening.

Thank you very much for inviting me to testify before the committee.

[*English*]

I want to start by emphasizing how energizing it has been to see the leadership of the standing committee addressing Canada's challenges and opportunities for building a better future through science and research. Your recommendations this year propose promising and urgently needed steps forward for Canada in what I think we all agree are turbulent times.

In contributing to your work on international moon shot programs, I would like to focus on Canada’s potential to play a leadership role in global research networks. My main conclusion, however, is that we cannot realize this potential without immediate action to respond to the rapidly increasing international competition in science and research.

This international competition is particularly focused on the development of highly qualified talent through participation in world-class research projects in our leading research universities. While all research projects aim for significant breakthroughs, discoveries and insights, the development of talent in these research projects is the guaranteed result that is crucial in the short and long term both domestically and internationally. Developing top talent in research projects not only gives Canada access to the global pool of knowledge but also ensures a supply of highly qualified individuals who can drive innovation across all sectors.

As you know, the Canadian research community is among the most highly internationalized in the world. Not surprisingly, our granting agencies have pioneered promising models of international research funding in recent years.

For example, through the transatlantic platform funding opportunity, Canada showed other national governments and funding agencies a way around the established position that money doesn't cross borders for academic research. The recent joint call for research on recovery, renewal and resilience in a postpandemic world brings together 16 humanities and social science research funding agencies from 12 countries in South America, North America and Europe. Clearly, though, such sporadic initiatives must be elevated into a systematic national framework with structures and dedicated funding envelopes.

The good news is that the advisory panel on the federal research support system will soon be recommending governance and structural steps forward to support Canadian researchers in the global research enterprise and propose mechanisms to incorporate multidisciplinary perspectives and practices to address global challenges in moon shot programs and related initiatives. The bad news is that Canada is falling behind in having the funds to develop the required highly qualified talent through participation in research projects.

Increasingly, those outside Canada are puzzled by the current level of federal support for science and research in Canada. This past Friday, for example, the magazine Science, one of the world's top academic journals, had a headline lamenting that "In Canada, scientists are struggling with stagnant funding". The problem for Canada with stagnant funding is that the rest of the world is significantly increasing their investments based on the conviction that science and research must inform all efforts to confront global challenges.

Most immediately, we must respond to what is happening south of the border. Over the next five years, the CHIPS and Science Act in the United States will essentially double the base budget of the National Science Foundation. This massive funding will put enormous additional pressure on Canadian universities as they struggle to compete for and retain top research talent and the best graduate students. This and similar initiatives in other countries demand our immediate attention.

Canada now ranks at the bottom of G7 countries in the number of those with graduate degrees. Moreover, Canada ranks only 28th among OECD countries in the proportion of our population with graduate degrees. In other words, our talent-based innovation ecosystem has great potential domestically and internationally, but it is operating at a scale that is too small for the challenging 21st century.

In the case of international moon shot programs, Canada risks being overlooked as a partner when we have, in fact, the potential to play a global leadership role.

Thank you very much. I look forward to your questions and comments.

● (1835)

The Chair: Thank you so much, Dr. Gaffield. We're very pleased to have you.

Now we go to Dr. Waite for five minutes.

We look forward to your testimony. The floor is yours.

Dr. Anya Waite (Chief Executive Officer and Scientific Director, Ocean Frontier Institute): Thank you, Madam Chair.

It's my great pleasure to appear before the committee today. Thank you for this opportunity.

The ultimate moon shot of this century is climate survival. Without climate mitigation, our future will be confined under the weight of many concurrent catastrophes: mass numbers of refugees, new human health crises, food security challenges and, ultimately, a weakened economy and a weakened quality of life.

The question that remains, then, is, how do we achieve this moon shot? How do we improve the lives of Canadians and support Canada to deliver an outsized impact for the world?

Canada recognizes the critical importance of decarbonization to our planet and our nation's future. We're actively working towards net-zero emissions by 2050, but that's simply not enough, not by a long shot. To reach our goal of climate survival, we need to get to net-negative, in fact, and today you'll hear about a new partnership between universities in Atlantic Canada and Quebec that will transform Canada's climate action.

One important consideration in reaching net-negative is that our climate solutions are currently focused on the uptake of carbon on land and the blue carbon sometimes stored within our coastal waters. However, our research shows that these carbon sinks are simply a drop in the bucket. They are just not enough.

More than 90% of carbon is actually stored in the ocean, the majority of which is located in the high seas beyond national jurisdiction. It is known as deep blue carbon. If we really want to make an impact on the global carbon budget, which is the only way to save the world from itself, we must turn our attention to deep blue carbon and the emerging science of ocean-based carbon dioxide removal, or CDR. This includes innovation and a suite of technologies, many Canadian-born, that could take carbon from the atmosphere and safely sequester it in the deep sea.

Canada actually has the opportunity to bring meaningful climate leadership in this area. Deep blue carbon and ocean-based CDR—carbon dioxide removal—represent a potential global climate solution. Committing to this solution will encourage research investment right here at home while providing both environmental and economic benefits to Canada. It will also give us information about the time scales of climate change and how the ocean is responding, which helps us frame the social adaptation that our communities need to address the current global climate crisis. For example, sea-level rise, drought and catastrophic hurricanes are all directly related to the ocean and the ocean's impact on our climate.

The reason this is a moon shot is that it will require a huge lift of support. Research generally progresses slowly, and this needs to move quickly. In fact, it needs to move very fast. There are ocean CDR practitioners with huge amounts of capital to put towards this effort, but they're looking to us for guidance on how to use it effectively.

Strategic and sustained ocean observation and ocean and climate science synthesis is a major gap that must urgently be addressed. We need a system that can monitor what is happening in the ocean in real time, which would enable improved climate forecasts, better climate mitigation methods and facilitate what has the promise to be a trillion-dollar deep blue carbon credit market.

One solution proposed by us at the Ocean Frontier Institute is an ocean carbon observatory that would bring nations together to frame this problem properly and to help implement a collective solution: a regional exemplar or example in the North Atlantic.

We are already revving this engine with the recent submission of Dalhousie University's transforming climate action proposal. This is a joint initiative with the Université du Québec à Rimouski, Memorial University of Newfoundland and Université Laval to the Canada first research excellence fund. This proposal represents a groundbreaking alliance between French- and English-speaking ocean-focused institutions.

● (1840)

Let's recap. The moon shot of our time is climate survival. It requires increased ocean observation of deep blue carbon beyond national jurisdiction and the safe implementation of ocean-based carbon dioxide removal technologies at scale, which only the ocean can offer. There is an urgent need for a moon shot-type program that can enable transformative global initiatives that transcend the priorities of individual regions and individual department mandates in government. We have less than eight years to avoid a future shaped by climate catastrophe, and every day the global climate crisis clock is ticking. This is where we need to put our energy. If not now, when?

● (1845)

The Chair: Dr. Waite, thank you for your testimony. You have a very interested committee. I know they will want to ask questions.

I will let our committee know there have been connection difficulties with Japan, so we will have two witnesses for this panel. However, we thank Sir Jeremy Farrar for trying so hard.

We'll go to a round of questions. We begin tonight with Mr. Soroka for six minutes.

Mr. Gerald Soroka (Yellowhead, CPC): Thank you, Madam Chair, and thank you to the witnesses for coming this evening. I will start my questions with Dr. Gaffield.

You brought up a lot of things that we've dealt with in the past about retaining top talent here, and you were talking about the loss of it to other countries, especially now potentially the United States. I have to admit that my family is among them as well.

How can we actually avoid this? You talked about funding. What kind of funding do we need, and what kind of research facilities do we need to build?

Dr. Chad Gaffield: My sense is that one thing that's been overlooked in recent years is what I like to think of as the guaranteed ROI, return on investment, of research, which is the development of talent. In other words, while we hope in our projects to have breakthroughs, the real benefit and ongoing enduring value of those projects is the people we produce out of them who end up leading across society. In recent years, there's been a bit of an emphasis on projects making new discoveries, which is great when they do. However, what's happened is that Canada has really let itself fall behind regarding the individuals who can really help us drive innovation across all sectors.

One thing that is really important in this is the fact that while Canada is often criticized for having, for example, a low level of business innovation and business expenditures on R and D for innovation, it's only in recent years, the last few, that the competitive pressure is now across all sectors. In my sense, all sectors are now attempting to adjust to this new world, a world in which we're driving towards net zero and a world in which we're driving toward handling far more appropriately in a very complex way the digital technologies. We've learned now that the digital transformation is a really complex phenomenon that underpins all aspects and is not simply a good thing. We have to learn about all sorts of aspects of handling that and optimizing it well.

My sense is that every business and every institution is now trying to move towards sustainability and trying to embrace a digitally enabled world, and I think, therefore, that innovation has gone to the top of the agenda. However, there's a huge talent gap now given the complexity of actually making that happen.

Mr. Gerald Soroka: Dr. Gaffield, do you think that by addressing this with more money and maybe even more facilities to bring in...? We had the Stem Cell Network last week, and they said they were forefront leaders in the world in this area. We have a couple of areas where we might be leaders, yet it doesn't seem like we're very good at leading.

You're talking about how far we've fallen behind, so what more can we do? The commercialization is great, but at the same time, regarding money we're not coming close to what other countries are doing. That's my concern.

Dr. Chad Gaffield: Emphasizing the facilities part is really important because we found that leaders in many fields emerge out of serious research facilities that are connected to global networks.

There was a story that often got told during the pandemic. When Canada was realizing that we didn't have a domestic capacity in vaccine production, what happened? It was quickly worked through our researchers in an international context to find others elsewhere who could link with us to help us get the support we needed in choosing the vaccines we were going to buy, which eventually attracted Moderna to Canada. However, that's just one example.

It seems to me that, yes, it's great that some sectors are real leaders, but we need that across the board, because there's no aspect.... When we think about farming and agriculture, for example, that industry is transforming itself now and is just as in need of top talent as any other sector.

This really is a transformational change for Canada, and when Canada decides to move on what I think is a talent-based innovation system, we need to realize that we need far greater investments for it to realize its potential.

● (1850)

Mr. Gerald Soroka: You mentioned vaccines, and I know that the University of Alberta, through the virology department, was developing a vaccine at the time. They had to put in a bid in case they were successful, and they were very close to developing a new vaccine, yet the government did not choose them.

Do you think one of the problems is that there isn't support from the government when there are these breakthroughs?

Dr. Chad Gaffield: One of the difficulties, I think, is that the funds are not allowing us to make a sufficient number of investments given the possibilities. One really important thing is the idea that you can't put all your eggs in one basket. We need many centres across this country to help us in all the places where we need it.

Mr. Gerald Soroka: Dr. Gaffield, that's where I think—because you represent so many universities—there's a great opportunity for you to bring more unique sciences to the table. There are so many areas that need to be discovered. As Dr. Waite talked about with regard to the climate crisis, there's so much with carbon sequestration and—

The Chair: Mr. Soroka—

Mr. Gerald Soroka: The chair is telling me to be quiet.

The Chair: —I hate to do this to you. You're just getting going, and I can see how interested you are.

Mr. Gerald Soroka: If they could follow up with any information, I'd be appreciative.

The Chair: Okay. Mr. Soroka has requested a written response to what he was saying.

Thank you, Mr. Soroka.

With that, we will go to Ms. Bradford for six minutes.

Ms. Valerie Bradford (Kitchener South—Hespeler, Lib.): Thank you, Madam Chair.

Welcome to both of our witnesses. Thank you so much for joining us and talking about this very exciting topic tonight.

Mr. Gaffield, the U15 Group of Canadian Research Universities is an organization representing Canada's most research-intensive universities. Its 15 member institutions undertake 80% of all competitive university research in Canada, rank among the world's premier institutions and conduct about 8.5 billion dollars' worth of research annually. It's very impressive.

What role do universities play in moon shot programs?

Dr. Chad Gaffield: One of the opportunities we have now as a result of what you mentioned is for Canada to play a leadership role in the world. The challenges we're facing have what we might think about as domestic articulations, but they're global. Canada has the possibility, given its history and a few things I can mention, to offer, on some level, to convene a global research effort. I think the example of oceans that my colleague suggested is one example of that. In fact, Canada does play a leadership role there.

On the world stage, what I've noticed is that Canadian leadership is often welcomed. We're seen as good chairs of international research teams. We're seen as very effective leaders in mobilizing diverse interests and finding often what you might think of as the “sweet spot” in collaborations to advance things quickly. It seems to me that the opportunity for us now is to use some of our strengths, which I don't think are at the scale we need but have some potential. If we offer that internationally, we can leverage from around the globe.

That's why this is exciting, and we're hopeful to see, for example, Canada's negotiations finish with Horizon Europe, which would be a great thing. There's a big world now, and there are opportunities for us around the world.

Canada could, as part of its moon shot thinking, say, “You know what? Let's try to make an outsized contribution to the world's problems.” We have some contributions to make. Frankly, given the importance of climate change and this digital transformation, I think we have some strengths that position us well to play those global leadership convening roles.

My sense, at least, is that there is enormous potential, and our challenge is to say what we can do systematically to move us there.

● (1855)

Ms. Valerie Bradford: That leads into my next question, so thank you for that.

What structures and supports help encourage co-operation among universities, the federal government, provincial governments and the private sector in the development and deployment of ambitious research programs?

Dr. Chad Gaffield: One thing we've seen recently is interesting, and it's not even remarked internationally. Twenty-five years ago, Canada was thinking about what it was going to do in higher education, and at the time, in the 1990s, Canada had an okay domestic higher-education system. However, it had kind of moved from where it had been in the 1960s, when Canada was very much importing almost everything. By the 1990s, we had a pretty good domestic side.

There was a debate in Canada about facing this new century. We had talked already about climate change. We were talking about digital and how we were going to face it, and there was a debate. Do we import it, do we buy it or do we make it? Do we have to do it ourselves or can we import it? The decision was that, if we were not in the global effort regarding research and science, we wouldn't even know what to import. We had to be part of that global effort.

Canada decided that it was going to do it through investing in talent. That's why it built the Canada research chairs program. It built a whole series in our facilities, as another member was saying earlier.

My sense at least is that in a number of areas we're on the world stage. We have some access to the global pool of knowledge, but what are we going to do to take that to the next level? How are we going to move it now, especially now that the private sector is moving towards innovation very rapidly in all sectors? There's competitive pressure everywhere. Innovation is in the public and private sectors and the non-profit sector, and they're collaborating everywhere.

Our universities, given the strategy that was developed years ago and has continued, have deep links with their communities and with businesses. This is unique in many ways internationally. I was talking to colleagues in Europe, and recently someone who was visiting Israel was being asked why universities in Canada were so connected with the private sector and with their communities. That's very unusual. In other countries, they build separate institutions that are not connected to the main universities.

This turns out to be, I think, the real strength for Canada, because as your committee has been studying this year, this is really about the circulation of people. It's about talented people moving across campuses, into the communities, into companies and back and so on, and we're comfortable with that.

The Chair: Dr. Gaffield and Ms. Bradford, I'm sorry to interrupt. Thank you to you both.

Now we're going to Mr. Blanchette-Joncas.

[*Translation*]

Mr. Maxime Blanchette-Joncas (Rimouski-Neigette—Témiscouata—Les Basques, BQ): Thank you, Madam Chair.

I'd like to welcome the witnesses joining us for the study tonight.

Dr. Gaffield, we're pleased to meet you in person tonight for the first time. We met your predecessor, Mr. Patry, when he appeared before our committee.

I believe you made it clear in your opening remarks that funding is flatlining and we can't develop our own capacity due to lack of resources.

You were also quite clear as a representative of the U15 Group of Canadian Research Universities. Your group does about 80% of its research in Canada. So it's very important that we take into account what you're telling us tonight.

My first questions are going to be about funding, since that topic has caught my eye.

The leading funding organization in the United States will double its investments in the next five years. On the other hand, we know the Canada is the only G7 country to have lost researchers in the past six years. I'm trying to figure out with you how it will ever be possible to come up with ambitious projects if we're unable to retain talent or even develop it to its full potential due to a lack of funding.

● (1900)

Dr. Chad Gaffield: Thank you very much for your question.

Right now, there's no doubt that Canada is in jeopardy, in a way, and we're in danger of dropping in the world rankings rather quickly. That's what the future holds.

It's not just in relation to the United States, even though it's closer to us. It's in relation to Europe too, undoubtedly. Of course, China is also increasingly focused on science as it looks to the future.

[*English*]

There's been a lot of emphasis in Canada recently on the fact that the United States has embarked on a really aggressive Inflation Reduction Act. It actually did, last summer, two things. Right before it did the Inflation Reduction Act, it did the CHIPS and Science Act. Those two go together. It clearly has a two-pronged attack, and there's going to be significant development in a whole variety of infrastructure and a whole variety of aspects of the United States and their transformation. It's all going to be driven by a serious thrust in research and science.

This is sending a clear signal that in building a better future for the world, geopolitical borders are going to be really important. This is interesting because it wasn't that long ago that we were being told all the time about globalization and that the role all countries would have is to be part of global networks and chains, supply chains and so on. There was even a debate about the end of geopolitical borders, as if we wouldn't have to worry about them and there would be all these great transcontinental and globalized forces. However, it turns out that geopolitical borders make a big difference.

[*Translation*]

We're even seeing that in Quebec. For example, the Fonds de recherche du Québec is working well and it complements federal initiatives. In my opinion, that's an asset.

From a federal perspective, it would be very good if the other provinces had research funds as well to increase the effort across Canada. However, federal leadership in Canada is key.

[*English*]

There's no doubt in my mind, as we're now having this conversation, that we can say Canada has some strengths, and we have the possibility to play a leadership role globally. That's thanks to federal leadership starting in the 1990s and being pretty consistent ever since. The difficulty is that the international competition has been getting greater and greater.

I think we've maybe taken for granted a bit—and we read it a lot—that Canada has a great post-secondary system. Some say, "Isn't it wonderful?" However, in Canada, it's not like that. We don't like to pat ourselves on the back, and we shouldn't. We should say, "Look, we have work to do. The international competition is intense. We have to double down." That's why your committee is so important to have at the parliamentary level, the federal level. It's a concerted effort to say that we have to get much more serious about this.

[*Translation*]

Mr. Maxime Blanchette-Joncas: Thank you, Dr. Gaffield.

You talk about leadership and the fact that Canada must be internationally competitive. Right now, Canada ranks 18th out of 34 OECD countries for research and development expenditure as a percentage of GDP. Canada is also the only G7 nation to have reduced its research and development expenditure from 2000 to 2020.

If the government were to move in a direction, would it be better to invest in ambitious projects or make up for the shortfall of recent years in research and development expenditure?

Dr. Chad Gaffield: As I see it, they are two sides of the same coin. If we invest in the grassroots and increase funding, that opens the door to a leadership role in global initiatives.

● (1905)

[*English*]

The Chair: Dr. Gaffield, since you didn't get much of a chance to answer, perhaps Mr. Blanchette-Joncas would like a written answer to that.

[*Translation*]

Mr. Maxime Blanchette-Joncas: I'd like a written response, Dr. Gaffield.

[*English*]

The Chair: Thank you to you both.

Now we will go to Mr. Cannings for six minutes, please.

Mr. Richard Cannings (South Okanagan—West Kootenay, NDP): Thank you.

I'd like to continue with Dr. Gaffield on that line.

You talked about how Canada is falling behind, and you mentioned the number of Canadians with advanced degrees. As I recall, 3% of Swedes have Ph.D.s and it's less than 1% of Canadians. Germany is at 2%. We are falling behind there.

One of the things we've been hearing about at this committee and elsewhere in the House is that tri-council funding for graduate students hasn't been raised since 2003, so many are being lured or forced away to do their graduate studies elsewhere. They're living in poverty here.

I'm just wondering if you think that's important. Obviously it may not be the entire problem, but is that one thing we should fix sooner rather than later?

Dr. Chad Gaffield: It's actually a bit humbling for us to think about the fact that we arrived at this point and we're surprised to learn that the level hasn't increased since 2003-04. To me, that's a bit of a sign that we weren't looking; we weren't paying attention to that.

I think you're putting your finger on part of this phenomena. If you think about Canada's decision to build a talent-based innovation system producing the people we really need for driving innovation across all of society so we have access to the global pool of knowledge, it shows we have really lost focus of that pretty basic item.

Those students, though, are just a small proportion of all graduate students, so where do the rest of them get funding? It's through research projects. At least half of all the research funds given for research projects go to people. They are paying research assistants, graduate students and so on. They're really investing in people.

One thing that's really important to think about is how embarrassing it is for us that those fellowship levels are the same. The punchline is that if we fix that, it's going to be a small aspect of the larger issue of what effort and investments are being put into the leaders of society we need for the transformational change that our society is undergoing.

Mr. Richard Cannings: You mentioned the CHIPS and Science Act, which I think is about $280 billion. How does that stack up with what we spend in Canada on science? I guess I'm trying to think of what the federal government would have to put up to compete with that from a Canadian standpoint. I know we only have 10% of the U.S. population.

Dr. Chad Gaffield: I would be happy to provide the calculation, but our calculation says that to get us to roughly catch up, as Monsieur Blanchette-Joncas was saying earlier, would mean $1 billion a year. On the other hand, when we think about the ways we can really help Canada build a better future and help all sectors and all aspects of our country from coast to coast, $1 billion is a good investment.

Mr. Richard Cannings: How much time do I have?

The Chair: You have a minute and a half.

● (1910)

Mr. Richard Cannings: With a minute and a half, I will go to Dr. Waite from the Ocean Frontier Institute.

I'm really curious about carbon dioxide removal. I will give you a minute and a half to talk about the how and the timeline involved.

I know little about carbon dioxide. Is it being stored in the water? Is it being stored in the sea floor? I will give you a little more time to expand on that.

Dr. Anya Waite: There are a number of technologies and techniques being used right now and developed here in Canada. We're hoping to do some coastal and deep ocean test beds.

This is an area where Canada can take leadership. We have been asking them to do so through the G7, for example. We believe that if nations joined across the Atlantic with a space station model—an ocean space station—we could lift the global performance really strongly.

This is a place where acceleration.... We have connection to industry. We have a very strong graduate student pool that is out of proportion to our size. Canada can really hit above its weight here, so it might be a place to start to show the world what we can do.

We're hitting above our weight in the ocean stage. If we do a major initiative in the North Atlantic, we are right up there with the U.S., U.K., France and Germany. We are doing more than they are doing already.

Carbon is stored in the sea floor in the deep sea—in the animals, plants and root systems on the sea floor. Different techniques enhance those storage depots in different ways.

The Chair: Dr. Waite, I apologize for interrupting.

Thank you to both our witnesses. It's a really interesting discussion.

We'll now go to our five-minute round. This time we're going to Mr. Mazier.

Mr. Dan Mazier (Dauphin—Swan River—Neepawa, CPC): Thank you, Chair.

Dr. Gaffield, you mentioned in answering Mr. Soroka that in agriculture, there is a need to keep top talent. What did you mean by that?

Dr. Chad Gaffield: I'd be happy to connect with experts in this field, but what we've been learning is that a transformation in the world of agriculture is occurring, as it is in all sectors. There's no question about it. We have major research projects under way in all parts of the agrobusiness world now.

One thing Canada should embrace is the fact that we have a very diversified country. We have all sorts of strengths, and it seems to me that showing world-leading innovation in agriculture should be one thing we aspire to and treat as a real priority.

When I think about our institutions, whether they're in Saskatchewan or elsewhere, we know.... In many corners of our country, we're learning that there are important transformations in how we ensure food security that is world-leading. We have an opportunity in agriculture to play the same kind of global leadership role that I'm suggesting we are playing in other fields.

Mr. Dan Mazier: With regard to the balance of everything we research in Canada what we can research in Canada, do you think agriculture should take a more prominent role in what we are studying?

Dr. Chad Gaffield: Food security is an issue globally. Regarding how to optimize the potential of land and everything from production to distribution networks, it seems to me that there is a real paradigm shift in thinking and practice going on now.

Canada is just as well situated in agriculture as in other fields to take advantage of, for example, AI and other sorts of strategies. This is already happening in our leading industries, and there are important research projects, which have my attention, with the possibility for global research leadership.

Mr. Dan Mazier: You mentioned earlier that we're at the bottom of the G7 countries for graduate students. We've also heard many times in this study about the draining of people down to the United States.

Besides giving $1 billion—because everybody wants money since money makes the world go around—what one thing could we do to make Canada more competitive for graduate students so that we stop the bleeding and stop them from leaving our country?

● (1915)

Dr. Chad Gaffield: I am so proud to have a chance to contribute to Canadian higher education, and I think the research and innovation ecosystem we have built over the last 25 years has some very serious strengths that have proven to be even more important along the way than they were ever imagined to be. For example, earlier we were talking about the links that our universities have with surrounding communities and private, public and non-profit sectors. We've never, ever in Canada talked about ivory towers. I like the fact that we have such a strong public system. I like the fact that we have access to the top talent. We're able to do it.

We definitely need the policy changes that we've been working on. We need to do better in equity, diversity, inclusion and indigenization. There is a lot of policy work under way now that we've embarked on. We have a ways to go.

Mr. Dan Mazier: I have one short question. Is it more expensive to do research in Canada than it is in the United States? Between the carbon tax that universities have to pay and the heating students have to pay for their homes, does it cost more in Canada for a person to do research than it does in the United States or in any other country?

Dr. Chad Gaffield: I haven't heard that. I haven't seen comparisons like that. My sense is that the top talent is attracted to Canada when they have the facilities, when they can get the support—

The Chair: I'm sorry to interrupt, gentlemen.

Mr. Mazier, would you like a written answer to that?

Mr. Dan Mazier: Yes. That would be great.

The Chair: Okay.

Thank you to our two witnesses for being so gracious with your time and expertise.

We'll now go to Ms. Diab for five minutes, please.

Ms. Lena Metlege Diab (Halifax West, Lib.): Thank you very much, Madam Chair.

Let me thank both of our witnesses here this evening for taking the time to contribute to our study.

Dr. Waite, it's lovely to see you again. In September 2016, as I remember, I was thrilled to be at the original funding announcement for the Ocean Frontier Institute at Dalhousie University. My recollection is that at the time, Scott Brison was the minister for the Treasury Board and was there representing the Government of Canada. I was there as a representative of the provincial government.

I believe that $94 million is what Canada contributed at the time, and there was great support from Nova Scotia, Newfoundland, P.E.I. and a number of other partners, with another $125 million. That showed us a wonderful example of how governments at different levels, but also universities and national and international research partners, can collaborate and work together.

We're talking about moon shots and the extraordinary efforts that it took years ago to get mankind to the moon and the immense scientific spinoff that came from those voyages. I'm curious: What you would say to the claim that we know more about space than we know about the deep sea?

I'm going to take you to deep blue carbon—I wrote that down. It's about taking carbon from the atmosphere and storing it in the deep sea. It sounds to me like we have a long way to go. Can you speak to us about that and the value of researching the ocean floor with the same ambition that people researched space with years ago and probably still do?

Dr. Anya Waite: Yes.

Thanks for the reminder of the great funding that the Ocean Frontier Institute received. I have to say that the scale of funding is transformative. Our community is completely different now from what it was in 2016. It's absolutely exploding here in terms of the intellectual intensity and the connectivity with industry and government.

We are becoming a big international hub for graduate student training. I want to endorse and support my colleague Dr. Gaffield with his comments on graduate student training being so critical.

The deep sea is a huge unknown. It is absolutely the place where most of the carbon in the world sits, and that means technologies can pull more carbon there. They can do that by sinking things like kelp and plankton down into the deep sea. They can chemically change the ocean so that it absorbs more carbon. They can do that by putting what they call alkalinity—the opposite of acidity—into the ocean and then sinking that water.

These technologies are under way. They're being tested here in Halifax. They're being tested in teacups, in tanks and in embayments now, and what we need is regulatory movement so that we can start to test these technologies broadly and scientifically in a really robust way. We had a philanthropist say to us a couple of months ago, “I have $923 million to put into buying carbon credits.” We want blue-chip credits and that means a scientifically robust measurement of carbon sinks in the ocean.

We are revving this up. Research is relatively slow, and we need to be fast because the industry is moving super quickly. Regulation is moving a little more slowly than that, so we have people working on the London protocol. We are working provincially and federally to see what we can do in terms of regulation, and then we need the research to be revved up as quickly as it can be to support these massive venture capitalists. I note that at Economist Impact's world ocean tech summit in Halifax a couple of months ago, we were flooded in our offices with venture capitalists coming in and saying, “Where can we invest? Build these blue-chip carbon futures and we will come.”

We're super excited, but this would not be possible without that investment in the Ocean Frontier Institute that started in 2016. When the Government of Canada invests intensively in one sector, you get a lift in that sector that can be globally transformative. We can do this in the ocean. We need more.

● (1920)

Ms. Lena Metlege Diab: Regarding the types of spinoffs you've been talking about, aside from the potential climate spinoffs, what other spinoffs are there? I'm thinking about aquaculture and fishing. Can you comment on those?

Dr. Anya Waite: They are huge. First of all, with quantum, we're seeing big shifts in the use of moving—

The Chair: Dr. Waite, I'm sorry to do this. I have the worst job. I hear this great testimony, and I'm the one who has to interrupt.

Ms. Diab, would you like a written answer from Dr. Waite?

Ms. Lena Metlege Diab: Yes, please. Thank you.

The Chair: Thank you both for being so gracious.

We will now go to Mr. Blanchette-Joncas for two and a half minutes, please.

[*Translation*]

Mr. Maxime Blanchette-Joncas: Thank you, Madam Chair.

Dr. Gaffield, in a previous committee study, we learned that around 15 universities share about 72% of public research funding. We know that ambitious projects require massive investments. I'm trying to explore with you what impact this might have on the balanced distribution of funding among small, medium and large universities.

Dr. Chad Gaffield: There's no question that we need strong universities across the country. However, there's also no doubt that we need pillars in order to advance research. In my view, we need both.

The problem is quite simply the size of investments. Ideally, we would have enough money to develop the research sector across Canada.

[*English*]

In fact, one of the strengths of Canada is that we have really strong universities across the country. However, at the level of financing we currently have, there's no doubt that access to it is going to be limited.

● (1925)

It seems to me that the key is what our leading universities do, as in the case of Dalhousie's leadership on our oceans: They involve other universities in the region. Ideally what we would be moving toward is clusters across the country. This is increasingly the case, so we can have good connections and good collaborations between smaller, mid-sized and larger universities, all of which are optimizing their own strengths to make an even greater collective effort.

My sense is that inevitably we need leading universities at the same time as we need diversity. Certainly 15 members is not enough for a country like Canada. We need, in fact, 15 hubs or regions to which all of our universities are actively contributing. That is going to take a much larger investment.

[*Translation*]

Mr. Maxime Blanchette-Joncas: Thank you, Dr. Gaffield. I know that—

The Chair: I'm sorry, but your time is up, Mr. Blanchette-Joncas.

Mr. Maxime Blanchette-Joncas: In my opinion, I had a few seconds left.

[*English*]

The Chair: Do you want to come and check?

Voices: Oh, oh!

The Chair: I'm very careful. I want to treat everyone carefully and honestly.

Thank you, Mr. Blanchette-Joncas.

Now we'll go to Mr. Cannings for two and a half minutes, please.

Mr. Richard Cannings: Thank you.

I'm going to continue with Dr. Gaffield.

You were talking about global research networks and how moon shots are necessarily international in scope. I'm just wondering if you want to expand on that and maybe use our experience with vaccine production as an example.

Canada didn't have any domestic production. How did we change that, and how can we perhaps make that even better so that we have adequate domestic production? How does that whole international ecosystem work in science.

Dr. Chad Gaffield: That's such an important question.

As a historian, I always try to understand these things historically. I focused on the debate in the mid-1990s because they asked that question. They said Canada was a small country and that we were obviously not going to be self-sufficient in everything, so they asked, “What do we do?” The solution, the answer to that question, was to ensure that we were domestically self-sufficient in certain areas and to work hard such that we had access to and were connected to everything else internationally so we could call upon it. I think it's access to that international pool of expertise, capacity and so on that requires people who are actively part of these global networks. So much of this is an effort to tap into a global network of people.

In the case of vaccine production and the immediate need, there were two questions.

On the one hand, we needed to buy a lot of vaccines and acquire a lot of vaccines, but we didn't know what to buy. At that time it was not obvious. There were dozens of potential candidates, so you had to have experts who were able to look at the global possibilities. I think with the way it worked, the committee chose six vaccines, and then five of the six ended up being the top ones that in fact saved Canada and saved countries around the world. You therefore needed the first level of these networks to pay off.

The second thing was the actual production that led to Canada's attraction of Moderna. We said—

The Chair: Dr. Gaffield, I'm sorry, but I have to be fair to everyone.

I want to thank Dr. Waite and Dr. Gaffield for coming here and sharing their time and expertise, and I want to thank our committee for a really interesting discussion. I also thank Sir Jeremy Farrar, who tried very hard to join us.

To our witnesses, we hope it has been a good experience for you and we hope you'll come back.

Dr. Chad Gaffield: This is the best time I've experienced this year.

[*Translation*]

Thank you very much. I really appreciate it.

[*English*]

The Chair: Thank you.

Dear colleagues, we are suspended.

● (1925)

(Pause)

● (1935)

The Chair: Dear colleagues, I'll call us back to order.

We're so pleased to welcome a new set of witnesses.

[*Translation*]

I would like to make a few comments for the benefit of the new witnesses.

Please wait until I recognize you by name before speaking. For those participating by videoconference, click on the microphone icon to activate your mike and please mute yourself when you are not speaking.

Regarding interpretation for those on Zoom—you have the choice, at the bottom of your screen, of either Floor, English or French. For those in the room, you can use the earpiece and select the desired channel.

I would now like to welcome our witnesses.

As an individual, we have Dr. Guy Rouleau, director of the Montreal Neurological Institute and Hospital.

[*English*]

Welcome. We're delighted to have you.

From BioCanRx, we have Dr. Stéphanie Michaud, president and chief executive officer, and Dr. John Bell, scientific director. Welcome to you both.

Coming back to us again, we're so pleased to have Joseph McBrearty, president and chief executive officer of Canadian Nuclear Laboratories.

I'd like to welcome all the witnesses. Each group will have five minutes to present. At the four-and-a-half-minute mark, I will hold up a yellow card to let you know that you have 30 seconds left and I hope you'll wrap up. We aim to be fair.

With that, let's start with Dr. Rouleau. The floor is yours for five minutes.

Mr. Guy Rouleau (Director, Montreal Neurological Institute and Hospital, As an Individual): Thank you very much for giving me this opportunity to present to your committee.

I'm going to talk about the brain, and I'm going to make the argument that our brains are our greatest wealth and Canada's greatest wealth because brains are what allow us to do everything.

There are many diseases of the brain, and I think that interests all Canadians. Just to be clear, all neurodevelopmental diseases, including intellectual disability and autism, which affect 5% to 7% of the population of Canada; all neurodegenerative diseases, including dementia, Alzheimer's and Parkinson's; all psychiatric diseases; and all mental illnesses come from the brain. It's quite clear that there's no Canadian who is not affected, directly or indirectly, by brain diseases.

I've been in this field for a long time. Cardiologists have been doing a great job, and heart disease is declining. Survival is increasing, and I think that's great. Oncologists are also doing a great job, but oncology is complicated, with many different diseases. There are also many cancers that can be either controlled or cured, although there is still work to do, I admit. However, for one organ we've really not done very well, and that is the brain.

There is no drug that reliably slows down the progress of dementia. There are virtually no drugs that we can use to treat the core problems of autism, intellectual disability and so on. The drugs we use in psychiatric illnesses are blunt instruments.

Why is this? Really, the problem is that the brain is very complicated. This is why we haven't been doing so well. You need to understand the system to be able to design smart treatments, and we don't know the system well enough. The good news, though, is that there are revolutionary methods that I could go into detail about, such as single-cell sequencing, imaging, AI and iPSC, and these many different methods and techniques have now made studying the brain much easier and much more possible.

In Canada, there is a very large, very vibrant and very strong neuroscience community, and we punch well above our weight in the world. Not only that, the neuroscience community in Canada is quite unified. In Canada, there's a lot of collaboration and a lot of people working together, and I think that it is exactly the kind of condition you should have for what you call a moon shot. You want a large-scale collaboration. You want a strong cadre of experts and people who are opening up the field.

I heard a little earlier about the brain drain to the United States. I can tell you that in the neurosciences, the brain drain is going in the other direction. We've just hired a few superstars from the United States who have come to Canada because Canada is a good place to work and collaborate, and people work together.

My message is that the brain is super important. It's an area where we are very strong in Canada, and we could make a big difference in understanding the brain and finding treatments for it.

If I do less than five minutes, do I get the extra time later?

Voices: Oh, oh!

● (1940)

The Chair: Thank you, Dr. Rouleau, for joining us this evening.

We will now go to BioCanRx.

The floor is yours for five minutes.

[*Translation*]

Dr. Stéphanie Michaud (President and Chief Executive Officer, BioCanRx): Thank you, Madam Chair.

It's a pleasure to be back with the committee this evening.

My name is Stéphanie Michaud. I'm joined by our scientific director, Dr. John Bell, an internationally recognized research scientist in the development of immunotherapies as cancer treatments. Together, we work closely with partners from multiple sectors, all aligned with our ambitious vision: to make all cancers curable diseases.

[*English*]

When we hear the word “moon shot”, it is often prefaced by the word “cancer”, reflecting the indisputable reach of this disease, which affects one in two Canadians and leads to the death of one-quarter of our population. That number is increasing as we speak due to pandemic-related delays.

There is also a cost, which was $26.2 billion in 2021 alone, with $4.8 billion of that amount representing the direct out-of-pocket costs that are borne by cancer patients and their families. Cancer is a grand challenge for Canadians, anchored in unaddressed real-world needs. This fits the Brookfield Institute's definition, which is laid out in “Canada's Moonshot”, as previously noted by other witnesses at this committee.

The U.S. and the EU are treating cancer as a moon shot by investing significant sums of money and setting ambitious goals to move the needle. Canada has also invested in a mission-oriented type of approach—albeit at a much smaller scale—with BioCanRx. With Canada's support, BioCanRx is tackling one of Canada's wicked problems: the lack of coordination and support for translational research and biomanufacturing. In so doing, Canada's investment has allowed BioCanRx to achieve remarkable success in the development of novel immunotherapies and deliver results for Canadian patients today.

Dr. John Bell (Scientific Director, BioCanRx): As I am sure you can appreciate from the work your committee has already done to date, the hallmarks of a successful moon shot program include building cross-disciplinary teams of thought leaders, creating a nimble, independent decision-making body that manages a portfolio of innovative projects with clearly defined deliverables, and providing transformative and multi-year funding.

With these concepts in mind, in 2015 we created BioCanRx, a network of centres of excellence to develop, test and provide Canadian cancer patients novel and effective treatments for cancer. Our focus was on the burgeoning field of immunotherapy, which uses strategies to train a patient's own immune system to recognize the cancerous form and destroy cancers within their body. We built upon the world-class science being developed in Canada and the existing Canadian infrastructure to build an innovative research program, moving a portfolio of Canadian discoveries into products that can be provided to Canadian patients in need.

The BioCanRx translational research engine is nimble and able to respond to discoveries made around the world in the fast-moving field of cancer immunotherapy. One example is the development of personalized engineered immune cells, or so-called CAR T cells. In 2017, BioCanRx started a cross-country, made-in-Canada CAR T program. By 2019, we were treating Canadian cancer patients who otherwise would have no access to this innovative cancer treatment.

With her permission, I want to tell you the story of Camille Leahy, a 37-year-old single mother in Newmarket, Ontario. She was diagnosed with leukemia at the beginning of the pandemic. She received an aggressive chemotherapy regimen that failed her, followed by a gruelling stem cell transplant that also failed her. She was essentially at the end of life with no other therapeutic options available to her. Camille enrolled in our BioCanRx-sponsored, made-in-Canada CAR T trial and is alive and well today and able to enjoy life with her 14-year-old daughter.

There are many more Canadians like Camille who are thankfully to still be with us today because of the transformative work BioCanRx has done.

With the sunsetting of the networks of centres of excellence program and the rapidly approaching end of our runway in March 2023, we are extremely concerned that we will no longer be able to support the preclinical to clinical development at the pace and cost required to rapidly advance technologies for those who need them the most—Canadian cancer patients. We urge the government to consider funding organizations that have a demonstrated track record in addressing an unmet, real-world need in Canada. BioCanRx is a current-day successful implementation of the government's biomanufacturing and life sciences strategy for the development of cancer immunotherapies. I would argue it is a great model for building a Canadian moon shot program.

Thank you for the opportunity to speak to you today.

● (1945)

The Chair: Thank you to you both. We're grateful for your presentations and for you being here.

We'll go to President McBrearty. We're glad to have you back.

Mr. Joseph McBrearty (President and Chief Executive Officer, Canadian Nuclear Laboratories): Thank you, Madam Chair and members of the committee. It's a pleasure to once again appear before the House of Commons Standing Committee on Science and Research.

I would like to begin by acknowledging that our operations at CNL take place on the unceded and unsurrendered traditional territories of numerous first nations across Canada. At CNL, we recognize the unique history, spiritual beliefs, cultural practices and languages of indigenous people in Canada. We appreciate the responsibility that they have as stewards of the environment.

My remarks today seek to inform the committee's study of international moon shot programs. The topic that I want to discuss is radiopharmacy or radioisotopes.

As Canada's national nuclear laboratory, CNL and our predecessor, AECL, have a deep and profound history of innovation. The first nuclear reaction outside of the United States took place at Chalk River Laboratories in 1946. At one time, we were home to the most powerful research reactor in the world. That period was marked by ambition, and that pioneering work produced groundbreaking feats of engineering, leading to the dawn of an industry that today employs over 76,000 people, to the construction of Canadian-made nuclear reactors around the world and to the delivery of over one billion treatments in the fight against cancer.

What brought the United States to the moon is the same spirit that led us to explore the mysteries of the atom. It was national ambition, aggressive research and development, bold leadership and, perhaps most of all, a real sense of urgency and the competitive instinct that says “we must be first”. When it comes to the research, production and processing of medical isotopes, we, for many decades, have led the way in Canada.

I do not think I am breaking any news to this committee when I say that over the years, that sense of urgency and purpose began to wane at Chalk River Laboratories. It wasn't until 2014, when we were given a new lease on life by the Government of Canada, that our scientists were once again able to aim higher and to think bigger. We asked ourselves this: What are we good at and what will improve the lives of everyday Canadians? What will put us on the map again as a company that can change the world? What is our moon shot?

Today, I am proud to say that CNL intends to win the global race to produce the rarest isotope on earth, a compound known as actinium-225. Simply put, we intend to help cure cancer.

It will come as no surprise to me if you have never heard of actinium-225. The isotope is so rare that the annual global production is less than a grain of sand. However, its unique properties have also made it one of the most sought-after isotopes in the world, and at CNL, we recognized that we were one of the few companies that could produce it.

Over the past three years, we have developed a small-scale generator that produces meaningful quantities of actinium for our studies and for our strategic partners, but we have bigger ambitions. We see an opportunity to build on our legacy in isotope production and processing, and we are now pursuing the construction of new facilities on or near our Chalk River campus that would establish a stable commercial supply for this valuable isotope. In fact, we have already signed a memorandum of understanding with a leading German biotech company as part of that effort.

I want to be clear. This is an enormous undertaking, and it will not be easy. It means that we must raise hundreds of millions of dollars. It requires a deep network of partners and suppliers, and to be frank, it comes with risk. One of our competitors, TerraPower, is backed by Bill Gates.

As every Canadian knows, you miss 100% of the shots you don't take. If I had any advice for Canada, it would be to apply the same approach to innovation on a larger national scale. It would be to leverage the strategic resources we have in this country, including our vast national laboratory network, and use them collectively to focus on big and bold issues of national importance, to once again pursue projects that seem to be out of reach to us, to focus on what we do well as a nation and to unleash the scientific visionaries we have in this country. It means making tough decisions and leaving some projects behind, and it comes with risk, both political and financial. Most of all, it requires urgency.

● (1950)

Thank you once again for the opportunity to be here today. I'll be happy to answer any of your questions.

Thank you, Madam Chair.

The Chair: Thank you so very much.

I'd like to thank all of our witnesses. We're grateful for your time and expertise and for you joining us.

We're now going to our members, who are keen to ask you questions. This is a six-minute round.

We begin with Mr. Tochor tonight.

Mr. Corey Tochor (Saskatoon—University, CPC): Thank you, Madam Chair.

To start with, I'm going to talk a bit about cancer with BioCanRx. I'm a big supporter of pharmacological treatment for different diseases, including cancer, but changing gears a bit on the cancer side, where would the treatment of cancer be without isotopes and/or the diagnosis equipment that comes with nuclear science?

Dr. John Bell: I hate to admit it, but we'd be nowhere. I mean, we need the isotopes for imaging. Many kinds of therapies that are effective for cancer, especially if the disease is localized, require radioisotopes. I think the challenge in cancer, though, is that for most patients who come to the clinic with what we call widespread or metastatic disease, treatments like that are not really going to help, unfortunately. We have to try to find new approaches to treat people at the greatest risk of dying, those with metastatic disease.

Mr. Corey Tochor: I encourage you to continue your work on the moon shot aspect of things to hopefully find some additional cures and treatments for cancer. Thank you for being here tonight.

Switching gears, I'll go to CNL.

Mr. McBrearty, we're talking about moon shots, and I think you outlined that CNL was somewhat created out of the moon shot need in 1946 to study nuclear and all the potential of nuclear. One of the aspects I think about is missed opportunities and how much of a leader we were in the nuclear field with CANDU.

Can you unpack a bit what CANDU could have done for Canada? As much as it was a success story, I'm fearful that we've lost the opportunity to encourage more use of the CANDU reactor around the world.

Mr. Joseph McBrearty: Let me frame it by putting some stuff in perspective. Today, there are 19 CANDU reactors operating safely and reliably in Canada across two provinces. There are, I think, a total of 29 CANDU reactors operating across the world.

This is reactor technology that was born out of AECL well back in the 1950s and 1960s, and it took on a great need in the country. It should not be lost on folks in Ontario that 60% of the electricity produced in this province comes from CANDU reactors.

The reactors themselves are reliable and safe and have demonstrated, through operation by OPG and Bruce Power, very successful refurbishments that have kept this technology operating and providing clean, reliable power over the last several decades. It should be noted that these reactors continued to be produced even after the United States stopped most reactor production and construction after Three Mile Island.

The fact that you have safe, reliable reactors with CANDU is remarkable, to say the least, but it has also allowed us to spur into another more advanced industry with small modular reactors, which three provinces—New Brunswick, Ontario and Saskatchewan—are becoming heavily invested in. We know you cannot solve the decarbonization problem with renewables alone, so if you want to get off fossil fuels, you have to use nuclear. That's an established fact.

● (1955)

Mr. Corey Tochor: Yes, and we've heard witnesses in another study on SMRs say that if we're going to meet our emissions targets, we must have nuclear as part of the mix, so I appreciate those comments.

Earlier today, we heard testimony that research is slow and that on the SMR side, as much as it's moving seemingly in the right direction.... We had an announcement out of Ontario that was very supportive last week, but we are slower on the SMRs.

What can reduce the emissions? We heard in other testimony today about the importance of reducing emissions and that the technology is on the shelf. Would that technology be CANDU?

Mr. Joseph McBrearty: Certainly the technology could be CANDU for large-scale nuclear production, and it could be small modular reactors for more advanced or newer types of production. I should remind everyone that small modular reactor technology is, for the most part, existing technology that is present in the world today, but CANDUs are really the only large reactor designed in Canada that can provide a large amount of energy.

Mr. Corey Tochor: Perhaps you can give a bit more meat to the bone with respect to isotopes. Can you quickly explain what we are harvesting from the CANDUs today?

Mr. Joseph McBrearty: Today, we're harvesting the isotope of most importance from a cancer perspective. It is an isotope known as lutetium-177, which is being produced by the Bruce Power reactors. Lutetium-177 is a beta emitter. Similar to what I discussed with actinium, which is an alpha emitter, beta emitters target specific cancer tumours and cells.

Mr. Corey Tochor: Thank you very much. I believe I'm almost out of time.

I just want to pass along warm regards to everyone who works so hard at the CNL. Thank you so much for being here tonight.

The Chair: Thank you, Mr. Tochor.

Thank you, again, to all of our witnesses.

With that, we'll now go to Mr. Lauzon.

[*Translation*]

You have six minutes.

Mr. Stéphane Lauzon (Argenteuil—La Petite-Nation, Lib.): Thank you, Madam Chair.

First of all, I'd like to thank all the witnesses with us today. They've made some great and very enriching speeches.

Dr. Rouleau, you piqued my curiosity when you talked about artificial intelligence. I understood that there's a connection between artificial intelligence and everything that happens in the brain. I'd like you to explain what artificial intelligence technology we'll be able to use to treat diseases that originate in the brain.

Mr. Guy Rouleau: The current technology is generating staggering amounts of data. Sequencing the first genome cost $30 billion and took 10 years, whereas now it would cost only $800 and take only a day.

AI can analyze the huge amounts of data generated in a lab. That's really where it comes in handy. We're now generating such vast amounts of data that it would be impossible to study and interpret them without artificial intelligence.

Among other things, artificial intelligence is helping to improve diagnosis and interpret tests. Therefore, it has a big role to play in medicine in general, and more specifically in neuroscience.

I'd also like to mention that the “Canadian flavour” of AI is copying the brain. Neuroscience and artificial intelligence go hand-in-hand. We've made a great deal of progress in AI because of the circuits and approaches we've mastered in neuroscience.

● (2000)

Mr. Stéphane Lauzon: What's the connection between neuroscience and robots that can diagnose diseases related to fairly intricate surgeries? What developments widely applied in health care could be even more widespread one day through medical technologies? Could such technologies be considered an ambitious program in Canada?

Mr. Guy Rouleau: There's no doubt that many technologies are used to do surgery. They're being developed at my institute and elsewhere. This could be an ambitious program, but I'm not an expert in that branch of medicine. For it to be an ambitious program, we would need a critical mass of people who are the world's best in the field. I don't know that community—

Mr. Stéphane Lauzon: Thank you.

Now's your chance to tell us whether our government is investing enough in artificial intelligence: Could we do better in this area?

Mr. Guy Rouleau: Honestly, I'd say we can always do better. On our end, we interact a lot with various groups that do artificial intelligence. It has so many applications and it's an exploding field.

At our institute, a group of researchers is looking at multiple sclerosis to improve diagnosis and create algorithms for how to treat patients and how their disease will progress.

There's certainly a lot to do. At the institute, we're very interested in artificial intelligence for its medical applications.

Mr. Stéphane Lauzon: Thank you.

Dr. Michaud, you've talked a lot about light therapy, which has been an incredible revolution in terms of treatment. Is there any connection between light therapy and cancer prevention or detection?

Dr. Stéphanie Michaud: To my knowledge, there is no connection to cancer detection.

However, in terms of cancer prevention, I can tell you the following: A few months ago in the United States, clinical trials were held with people suffering from colorectal cancer. Before having surgery, this small group of 14 people received light therapy. Since then, they have all gone into complete remission.

Mr. Stéphane Lauzon: That's great. Thank you.

Dr. Bell, you talked about the importance of cancer detection. A hematoma is a clue for detecting the presence of cancer, but there are no such clues for some types of cancer.

Has your research allowed you to make advances in cancer detection in the absence of a hematoma that would be detected pretreatment by x-ray or nuclear medicine?

[*English*]

The Chair: Mr. Lauzon, I'm sorry, but that's the end of your time. Perhaps you could ask Dr. Bell for a written answer to that.

Mr. Stéphane Lauzon: I will come back in the next round to ask my question.

The Chair: Okay. Thank you, Mr. Lauzon.

Now we will go to Mr. Blanchette-Joncas for six minutes.

[*Translation*]

Mr. Maxime Blanchette-Joncas: Thank you, Madam Chair.

I'd like to welcome the witnesses here for the second hour of the meeting.

Dr. Rouleau, you're the director of the Neuro, or the Montreal Neurological Institute and Hospital, whose mission is to help understand the brain. Your institute conducts research while also providing care to patients. It also teaches the next generation of neuroscience physicians and researchers. In addition, the Neuro is the first institute in the world to fully embrace the principle of open science.

Can you tell us more about how open science principles are reflected in what your institute does?

● (2005)

Mr. Guy Rouleau: That's an interesting question.

To put everyone on the same page, the philosophy of open science is to quickly share all data, knowledge and materials generated.

It would take me more than six minutes to explain it all, but briefly, we've created tools to be able to share information of all kinds and from different sources. We worked with patients to develop an ethical framework so that we could share patient data and information. We've created a biobank that contains all this information, but also biospecimens that are available to any researcher for the purpose of studying diseases.

We've done a great deal of educating internally to make sure people buy into the principles around open science. In addition, we've been working to convince other Canadian neuroscience institutes to adopt open science. Three Canadian institutes have now adopted it, but no others have anywhere in the world. So it's an area where Canada is ahead of everyone else.

Mr. Maxime Blanchette-Joncas: Do you believe that getting researchers to embrace open science more broadly could have a transformative or catalyst effect, particularly in the pursuit of ambitious projects?

Mr. Guy Rouleau: Absolutely.

We saw what happened with COVID-19. When it hit, people decided quickly that everyone was going to openly share the data and all the information. It wasn't perfect, because some people didn't share their data, but the vast majority did, and that played a huge role in finding ways to prevent or treat the disease rapidly.

It will certainly accelerate the discovery and development of new treatments in medicine and many other fields.

Mr. Maxime Blanchette-Joncas: Can you tell us if there are any other specific challenges or difficulties related to implementing this approach? Why have other institutes not bought into it yet?

Mr. Guy Rouleau: It's the dream of making lots of money. Historically, universities got patents and were supposed to issue licences to generate profits. In reality, it didn't work, because universities do research and train students, but they're not designed to generate profits. Businesses have the expertise in that area.

The biggest hurdle is probably that people don't want to share the fruits of their research because they think if they keep it to themselves, they can develop products and make money. However, a study has shown that in Canada, the revenue from open science and open patents exceeds the revenue from all licensing. I've seen data showing that for every new company founded, there are 3,000 patents registered. So it's a very inefficient system.

Mr. Maxime Blanchette-Joncas: Thank you very much, Dr. Rouleau.

In your field, which is neuroscience, are there any projects that would benefit from an ambitious program strategy? I mean making significant investments to ensure sustained research efforts with the goal of solving a problem or making a major discovery.

Mr. Guy Rouleau: I see two possibilities.

The first is neurodevelopment. We're beginning to understand neurodevelopmental diseases better and better and we can design treatments. We're seeing the very beginnings of this approach. In this field, an ambitious program would help us find treatments for several forms of autism, developmental disabilities, and so on. For example, we could treat someone with one of those conditions so that they have a regular IQ and can contribute to society. That type of thing could be promising.

The second possibility involves treatments for dementia. In Canada, a lot of investments are being made in dementia research. An ambitious program would allow us to find Canadian treatments for these very significant diseases.

● (2010)

Mr. Maxime Blanchette-Joncas: We had Yoshua Bengio of the Quebec Artificial Intelligence Institute appear recently. Do your two institutes currently have any partnerships?

Mr. Guy Rouleau: Yes, we have a tremendous amount of partnerships. I've recruited people who only work there. One of our neurology residents is doing a doctorate with him.

[*English*]

The Chair: Dr. Rouleau, I'm sorry to interrupt. I really have the worst job. I have to interrupt these interesting remarks.

Mr. Blanchette-Joncas, would you like a written response?

[*Translation*]

Mr. Maxime Blanchette-Joncas: No need, Madam Chair, he's answered my question.

[*English*]

The Chair: Thank you.

Now, dear colleagues, we will go to Mr. Cannings for six minutes.

Go ahead, please.

Mr. Richard Cannings: Thank you.

Thank you again for being here.

Some of you I'm seeing for the first time in real life—I've been on Zoom with you—so it's good to have you here.

I'm going to continue on with Dr. Rouleau.

Canada does have this deep history in neuroscience. As you said, we have a strong international presence in that field, and McGill seems to be the centre of that. You talked about the collaboration that Canada is also strong at. I'm just wondering how broad that is across the country and how important it is. When I worked at UBC, there were studies on spinal cord research in zoology where I was.

I'm just wondering how broad those collaborations are and how connected Canadian researchers are versus being connected to more international labs outside of Canada.

Mr. Guy Rouleau: There is a lot of excellent neuroscience research being done in many places in Canada. McGill is strong—I thank you for mentioning that—but so are universities in Toronto, Calgary, Halifax and many other places.

Over the past years, two things have happened.

One is that the Canadian Association for Neuroscience was created and has become a unifying force, with a very active meeting every year. It includes everybody who does neuroscience in Canada who wants to be part of it.

The second is something called the CBRS, the Canadian Brain Research Strategy group, which brings together at least 30 different institutions that are involved in neuroscience research in Canada. We meet regularly. We talk about the issues we have in common and what we need to do. Collaborations are established and many of the different researchers work together. I would say it is a very close group that works a lot together and works well together.

Mr. Richard Cannings: You were talking earlier of the open science concept, and you said that seemed to be restricted to Canada, at least in neuroscience, or perhaps even smaller than that. How broad is that across the country? Is it shared by all these institutions, or is it just in McGill? How broad is that in Canada? I think you tried to answer why it isn't happening everywhere else in the world.

Mr. Guy Rouleau: I do think this notion of open science hits the Canadian philosophy, the way Canadians think—and I'm just saying what I think. We're much more socially driven and more wanting to work together.

I mentioned the University of Calgary's nurse science group, called the Hotchkiss Brain Institute. It has joined The Neuro. The Douglas Mental Health University Institute has also joined The Neuro. We have UBC, where the Mowafaghian is working towards adopting open science. The University of Western Ontario is working to adopt open science, as are multiple institutions in Toronto, including CAMH and the Baycrest university health network. Quebec City has expressed interest. Université de Montréal has expressed interest. Edmonton is on board.

It's really blossoming. Most, if not all, neuroscience research institutes and groups in Canada are coming on board. There is very little resistance. Once people do the education and once they understand, they come on board.

There's no such institution on the planet, anywhere in the world.

● (2015)

Mr. Richard Cannings: Thanks.

I have 100 seconds. I'll turn to BioCanRx.

One thing about these treatments is they're quite expensive, I understand. I'm wondering what a moon shot would do. Where are we with that trend of bringing those costs down to make it easier for provinces to say they're going to cover those, and cover more? That does seem to be a big issue.

Dr. John Bell: Maybe I'll respond. In line with what Guy was just saying about the different models and new approaches, we believe it is a new approach for science, not only in discovery, as Guy was referring to, but also in translation. Rather than fill the coffers of companies, we feel a better approach is to use our treatments in Canada with not-for-profit types of entities that we create. Then we actually make sure the patients get treated, but also the money that goes into that sort of organization gets put back into science.

I think that complements the open science part that Guy was speaking about.

Dr. Stéphanie Michaud: There's an excellent opportunity for Canada to capitalize on its existing bone marrow transplantation centres. This is what we've done with the extension of our point-of-care manufacturing network, to roll out the manufacturing of expensive therapies, like CAR T cell, across the country. We're able to significantly lower the cost of this product, while at the same time capitalizing on existing infrastructure—

The Chair: Dr. Michaud, I'm sorry to interrupt.

Thank you, Mr. Cannings.

We appreciate, again, all of our witnesses.

We will now go to the five-minute round. We have Mr. Ruff tonight.

Mr. Alex Ruff (Bruce—Grey—Owen Sound, CPC): Thanks, Chair, for having me.

I have a few questions, ideally for all three witnesses.

First off, I do want to point out, Mr. Rouleau, that I did take issue with your first point about everybody having a brain. You are talking to a bunch of federal politicians, and the jury is still out on whether or not we actually meet that requirement.

My specific question to you and to BioCanRx is with respect to a specific incurable disease right now, diffuse intrinsic pontine glioma, DIPG as it's known. Is there any progress there? Is there something here? I know you're both talking about the moon shot here and investment, but here's a disease that I know is impacting youth across the country, not in large numbers, but it is incurable. It's basically a death sentence for those families who find out.

I'm wondering where your research is on DIPG, specifically. Perhaps I could ask both Mr. Rouleau and BioCanRx.

Mr. Guy Rouleau: Maybe I can start.

I know this very well. There's a lot of research being done on that in Montreal and in Toronto. There is even a company that has been created. It has been created in the open space. It's called M4K, Meds for Kids, and it's working on development of a potential treatment for this disease.

It's a nice example of a rare, terrible disease where when we started understanding some of the biology, ideas appeared as to how to find treatments for this disease.

Dr. John Bell: Just to add to that, in California now, again using the CAR T-cell approach in this particular indication, they are seeing some promising activity in young kids suffering from it.

I think there are things happening, as Guy mentioned, and I think there are a lot of new opportunities, so it's time to be optimistic, although it's tough when you're right in the middle of it, for sure.

Mr. Alex Ruff: Is there anything we can do to speed it up or to help advance it?

● (2020)

Dr. John Bell: I think what we're all talking about is trying to find ways to create more cohesive research programs that will advance these sorts of new discoveries faster. That's certainly one of the objectives of BioCanRx, but also of the neuroscience networks: that is, trying to find ways to rapidly get our discoveries out of the test tube and into people. That's really what I think we all think is the way to move forward.

Mr. Alex Ruff: Super.

I will move over to the nuclear side a little bit because it's all interlinked.

I represent Bruce—Grey—Owen Sound, and a number of my constituents work at Bruce Power. Considering I'm subbing in for Mr. Lobb, who does represent that area, I think it's appropriate. I spent a number of years up in Petawawa in my previous career as well, so I know the Chalk River area quite well.

I think it's great news that you guys were given that new lease on life by the Government of Canada in 2014, and I applaud you for everything you're doing. Canada is recognized as a world leader with our isotope technology, in particular what's coming out.

Could you expand a little bit on the medical isotopes, not only this actinium-225 that you're focused on, but what percentage of the market is the global market and how you guys are leading the way for Canada in this field.

Mr. Joseph McBrearty: I'm not sure I can give you an exact figure on the percentage of the global market. Right now, I would say it's probably fairly small in the lutetium-177 area. In the alpha therapies that I mentioned, which is the actinium, we're really just on the cusp of starting to get companies involved in this. Right now we are still very much in pre-clinical trials, so when we look at the actual amount of material that's out there, as I said, it's very small.

One of the issues we have in actually being able to advance further development of these treatments is getting enough material so that the industry or the clinicians can be ready to use it.

I know I have just a couple of seconds here. We believe that Canada has the opportunity—not only with Bruce Power and the reactors at Bruce Power and OPG, but also with CNL—to take over the radioisotope leadership in the world. I think the talent is here, the production capabilities are here and the urgency is here as well.

Mr. Alex Ruff: Thank you.

The Chair: Thank you, Mr. Ruff.

We're glad you have joined us tonight.

Now we will go to Monsieur Lauzon, for five minutes, please.

[*Translation*]

Mr. Stéphane Lauzon: Thank you, Madam Chair.

Dr. Michaud and Dr. Bell, I'm coming back to you because what you have to say is compelling. We were talking about detecting metastases, where there were none, and how to detect them. You were on a roll and we interrupted you.

How can we use research and development? How can we help you fund these technologies?

[*English*]

Dr. John Bell: You're absolutely right. The earlier the detection, the better. Everybody knows that's the case. For some cancers that's fairly straightforward to do, but for many, as you say, they are silent. We don't know the answer.

What's happening is that people are starting to use—back to your original point about artificial intelligence—that kind of computing power to analyze samples from patients in a much more sophisticated way. For instance, we look for what's called circulating tumour DNA, which may be in your blood and be a very early marker of cancer. That sort of stuff is starting to happen now, applying artificial intelligence to deconvolute some of these things and make them possible.

[*Translation*]

Mr. Stéphane Lauzon: We know there are all sorts of food preservatives. Could artificial intelligence also process data about what people eat, where their food comes from, and what dietary patterns could influence cancer? With AI, could some of the data help you?

[*English*]

Dr. John Bell: Potentially, I think, to your point.... It's complex, obviously. Our diets are very complex, so using something like artificial intelligence, which has the computing power to begin to deconvolute these things, potentially could be used in a larger population study to say that this particular population eats a particular kind of food and this one doesn't. That sort of stuff could come out of it, I imagine.

● (2025)

[*Translation*]

Mr. Stéphane Lauzon: You're really making me think. It goes back a long way. It's very complex.

I represent the rural community and our farmers. We're in the process of reinventing fertilizer products. We learned that some of these products were more harmful to our health than others, and that contact with these fertilizer products was having an impact on animals and our food, in turn. It goes way back in the food chain. We're talking about an upswing of certain cancers that could be due to what we're eating.

Could you go so far as to work with our farmers and those who work on the food chain?

[*English*]

Dr. John Bell: I think so, for sure. That makes a lot of sense, actually. My son is a scientist as well. He works with farmers all the time in trying to understand different aspects of it. I think that's totally a viable pathway forward, for sure.

[*Translation*]

Mr. Stéphane Lauzon: Okay.

Dr. Rouleau, you've talked a lot about high-level cooperation. You also mentioned that, unlike other fields, you are recruiting some people from the United States.

What's inspiring the most talented people from the United States to join you in your field? It certainly isn't our cold winters. You must be attracting them with something.

Mr. Guy Rouleau: I'll give you a concrete example. A woman, a world authority at Yale University, was offered a position as the director of an institute in Germany with a budget of $100 million. When we invited her to come here, she said that here was where she wanted to be. I asked her why and she said that it would cost her $100 million to build what we already have at the Montreal Neurological Institute and Hospital. She also told me that the members of our community were very collaborative. She is therefore coming because she was attracted by our infrastructures and the people who would be her colleagues.

Last week I also met a man of considerable renown from New York. He too wanted to come here. When I asked him why, he said that it was a place where people can work together, rather than the competitive environment typical of the United States. He added that we could provide him with all the equipment and colleagues needed to do exploratory work of the best kind in science.

When you have critical mass and quality, you can attract superstars.

Mr. Stéphane Lauzon: Thank you.

I only have 20 or 30 seconds left. Because you are the leading light in several fields of nuclear science, I'd like to ask you if you intend to work aggressively on actinium for the future treatment of cancer?

[*English*]

The Chair: Monsieur Lauzon, I'm sorry. That's the end. Perhaps you might—

[*Translation*]

Mr. Stéphane Lauzon: Could the witness send us his reply in writing? I'd like to know more about actinium.

[*English*]

The Chair: Yes, there you go. That's excellent. Thanks to both of you for that.

Now, if we could, we'll go to Monsieur Blanchette-Joncas for two and a half minutes, please.

[*Translation*]

Mr. Maxime Blanchette-Joncas: Thank you, Madam Chair.

Ms. Michaud and Dr. Bell, I'm pleased to see you here in person.

Ms. Michaud, in 2016, the National Cancer Institute launched Cancer Moonshot, an ambitious initiative to combat cancer. In February 2022, Joe Biden, the President of the United States, announced ambitious objectives to reduce the U.S. mortality rate attributable to cancer by at least 50% over the next 25 years.

How can Canada draw inspiration from projects like these?

Dr. Stéphanie Michaud: We can do so in many ways. The first would involve support for translational research in Canada. That's something that is simply not subsidized here.

We subsidize the part of it that is related to biomanufacturing, and preclinical to clinical work. That enabled us to be remarkably successful. However, you need to be really capable of taking the results—our discoveries—from our laboratories and convert them into products that can be tested on, and potentially cure, human beings. It's essential.

We have to do that in Canada before even beginning discussions with our American and European colleagues, and those in Great Britain in particular. To have a large-scale mission, you really need to be able to treat all forms of cancer and make them curable. That's our organization's vision.

● (2030)

Mr. Maxime Blanchette-Joncas: Thank you very much, Ms. Michaud.

Over the past few years, as we were discussing, investments in biomanufacturing and the life sciences enabled you to pursue your mission. These investments have now ended.

Are the federal investments of the past few years adequate to allow your organization to develop and pursue its mission?

Dr. Stéphanie Michaud: Unfortunately, the grants program we had been receiving was eliminated in December 2018. There have therefore not been any programs until the launch of the Strategic Science Fund, under which we have, of course, submitted an application. We are awaiting the outcome because our current funding will come to an end in March 2023.

Mr. Maxime Blanchette-Joncas: If you were not to receive this funding, what would be the concrete impact on your organization?

Dr. Stéphanie Michaud: It would mean having to end our preclinical studies and our clinical trials.

Mr. Maxime Blanchette-Joncas: Thank you very much.

What progress was made under the Cancer Moonshot initiative launched in the United States in 2016?

Dr. Stéphanie Michaud: This 2016 initiative in the United States was so successful that it's one of the reasons why immunotherapy…

[*English*]

The Chair: I'm sorry, Dr. Michaud. I have to be fair.

Mr. Blanchette-Joncas, would you like a written response?

[*Translation*]

Mr. Maxime Blanchette-Joncas: Yes. Ms. Michaud, please send us your response in writing, if you could. Thank you very much.

[*English*]

The Chair: Thank you, all, for being very understanding.

We'll go to Mr. Cannings to finish off the two and a half minutes, please.

Mr. Richard Cannings: I'd like to allow Ms. Michaud and Dr. Bell to finish that thing.

How can Canada compete with the United States and Europe? You said they were treating this seriously as a moon shot. What should the federal government be doing to help that?

Dr. Stéphanie Michaud: Both the United States and Europe have expressed very bold visions with respect to what they wish to accomplish. I would state that our vision is also very highly lauded in that we're looking to, effectively, bring cures to Canadian patients. This is something that we are currently doing in terms of advancing CAR T-cell therapy right here in Canada, and taking a very Canadian approach in ensuring that all Canadians are able to access these types of therapies.

Both Europe and the United States have put forward incredible amounts of monies. To go back to Monsieur Blanchette-Joncas' question with respect to what has been accomplished, the advancement of immunotherapies is an outcome of the 2016 vice-president Biden's moon shot.

It is an incredible new arrow in our quiver in the treatment of cancer. I believe we will be able to see massive advances being realized and, certainly, the Europeans and the U.S. probably being able to achieve their objectives.

I'd like to say the same for Canada.

The Chair: You have about a minute.

Mr. Richard Cannings: I'll go back to Dr. Rouleau.

This may be a very unfair question, but if you had to pick one moon shot for neuroscience in Canada.... You mentioned dementia. You mentioned developmental diseases. Maybe they're related. If you had to pick one, which one do you think Canada could accomplish with what we have now, with the people we have now, and how?

Mr. Guy Rouleau: Of the neurodegenerative diseases, it would be dementia and Parkinson's disease. They're very highly related.

Mr. Richard Cannings: That's fine. Thanks.

The Chair: Thank you, Mr. Cannings. You're always very gracious.

Dear colleagues, we've reached the end of our time here.

I'd like to thank all of our witnesses. It's a real privilege to be able to listen to you and to hear your expertise and the work you're doing for Canadians and for the country. We thank you all.

We're going to suspend, and then we're going to go in camera.

Thank you.

[*Proceedings continue in camera*]