Canadian Biochemistry, Molecular Biology and Cell Biology on the Flat Earth

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It is not news to us in basic biomedical research in Canada that funding of fundamental research has reached a cross-roads and the path for Canadian science is heading downwards. The results from recent CIHR competitions tell the story all too well. The cutoff for funding is well above 4.0. Any grant rated 4.0 or higher is considered by peer reviewers to be excellent. Thus, CIHR is not funding excellent science. Those of us who have served on peer review committees know that these grants are first rate, world-class science. The cutoff for funding only a few years ago was in the high 3s (e.g. ~3.8). These grants are rated as very good. At that time we knew that CIHR was not funding grants that certainly deserved to be funded. Grants with a rating of 3.5 or lower had some major problems and the committee members rarely felt that the grant should be funded. Thus, the number of highly qualified grants submitted to CIHR that are not being funded has increased significantly. In hard numbers, in March 1998, the MRC had 945 applications and funded 403 with a success rate of 42%. In March 2005, the CIHR had 1678 applications and funded 478 for a success rate of 28.5 %. In the September, 2005, competition, 1833 grants were submitted and 454 were funded at a success rate of 25%. Thus, only a few more grants are being funded in 2005 than in 1998. It is true that the average amount per grant has increased from $74,400 in 98-99 to $111,483 in the September, 2005, competition (1.5-fold increase). However, in 1998-99 the MRC budget was $245 million and this increased to $657 million in 2005-6 (2.68-fold increase). However, these numbers ignore inflation. When inflation is taken into account, we can see that the budget of CIHR has approximately doubled whereas the value of a CIHR grant has remained static. Clearly, basic researchers have not made the case for the importance of basic science to the CIHR President, the Council or the Canadian government for improved funding.

One policy that has endured in the transition from MRC to CIHR is the budget reduction policy. When the peer review committees rank grants, they also examine budgets and make recommendations to the Council. The committees on which I participated are tough on budgets and rarely approve budgets as submitted. Thus, the peer reviewers are not generous since they know that money taken from one budget will be available to fund another. Thus, the committees recommend a minimum dollar amount that is perceived to be necessary to accomplish the proposed research. Nevertheless, in every grant competition that I can remember, the governing Council reduced the peer reviewed budget from somewhere between 10 and 20 percent. In the September, 2005, competition the budget reduction was an average of 18%. Thus, a bare-bones budget is skewered by the governing Council. These are tough decisions. Every time the Council has been faced with either funding fewer grants with recommended budgets or slicing the budget and funding more grants, the latter option has been chosen.

If you are wondering where the 2.7-fold increased government funding is going, investigate the CIHR web site (e.g., www.cihr-irsc.gc.ca/e/25845 .html) and you will see the results for 2006. Note that a request for applications (RFA) for a topic entitled "Scoping Reviews and Research Synthesis: Priority Health Services and System Issues" generated 22 applications, 11 of which were funded (50% success rate).

The point from the discussion so far is that we as basic medical researchers have not successfully made the case for improved funding of operating grants. The result is that our resources are stretched, that excellent grants are not funded and the Canadian biomedical research effort is spiraling downward. We are therefore compromised in our ability to compete internationally that will no doubt have a negative impact on the economy of Canada and the development of improved health care in our country.

The rather dismal course of events has occurred during the last ten years at a time where there was a change of attitude of the Canadian Government that has had a very positive impact on universities and biomedical research. As noted above, the funding for MRC/CIHR has nearly tripled. Particularly, impressive has been the development of the Canadian Foundation for Innovation, which has made large investments in infrastructure to support research, and the Canada Research Chairs program, which eventually will provide salary support for 2000 university faculty members. Thus, we have the space, the equipment and faculty salaries to support biomedical research, but operating budgets are limiting our abilities to produce world-class science and to compete internationally. What is the point of having the infrastructure to do research if the funding for conduct of the research is inadequate?

International science on the flat earth

Over the Christmas vacation I had the time to read a book by Thomas Friedman entitled "The World is Flat". Mr. Friedman is a highly respected columnist for the New York Times. The thesis of his book is that third world countries can, and now are, competing internationally due to the remarkable developments in the digital revolution, the internet and the governments of these countries. No longer do people from India need to come to Canada to participate in new technologies, since these developments have empowered them to be able to do this work in their own country. This is a book that we as scientists would benefit from reading and digesting.

Ten years ago India and China were not major players on the world scientific scene. Now they are connected and competing in the global market place since much that used to be done in Toronto can now be done at a much reduced cost in Bangalore, India, or Dalian, China, and many other places. The governments of these countries see the economic benefits and are developing policies to assist entrepreneurs.

Mr. Friedman also notes that this is true in science. In India, for example, they have a strong tradition in excellent teaching. But graduates were handicapped because the employment opportunities after earning a Ph.D. were limited. With the improved economies of India, China and other countries, these governments are better able to direct dollars into research, including biomedical research. Because their costs are much lower, they are able to compete in science with fewer dollars. It is not unusual now to see papers in Science or Nature from China, and not just from Chinese trainees working in North America, Europe and other established centres of the world. The international recognition of China in science is exemplified by the recent inclusion in 2006 of the Chinese journal "Cell Research" in the Nature family of journals. North Americans are publishing in Cell Research and the trend will no doubt continue.

Thus, Canadian biomedical researchers are no longer just competing with countries such as the United States and Japan, but also with newer players on the flattened earth. How long will it be before the chronic under-funding of investigator-initiated operating grants in Canada and the downward trend in funding basic research put Canadian biomedical research in a league with Portugal that has never had a serious profile in health-oriented research. Will Canada follow in the footsteps of Argentina that in previous times had a significant research commitment? Since the devaluation of the Argentine currency a few years ago, the scientists are struggling heroically to have a world presence. One aspect of the tragedy is that the scientists in Argentina are very well trained, as those of us who have had Argentine postdoctoral fellows in our labs can testify. Thus, while China

and India are seeing improvements in their research environments and capacity, Argentina is heading in the other direction.

Biological research is booming in Singapore

Singapore is a small island-country of 683 sq km in diameter (3.5 times the size of Washington, D.C.) with a population of 4.4 million. Unlike the situation in Canada, the government of Singapore has made a huge commitment to basic research. In addition to the traditional areas of research at the National University of Singapore and the academic hospitals of this small nation, the government is investing heavily in biological research. In 2002, Biopolis was established with three objectives. First, Biopolis is to be a focal point for scientific talent to do world-class research and to serve as fertile training ground for undergraduate and graduate students. This magnet of talent is the single most crucial element required for expansion of the biomedical industry. The second stated objective is to integrate and synergize the capabilities and resources of research institutes and to encourage cross-disciplinary research. Third, Biopolis is to bridge research in the private and public sector by creating an environment that fosters exchange of ideas and close collaboration. The expectation is not only that biomedical research will be greatly enhanced, but that there will be very significant economic dividends. Such developments and the inspired support of government attracted Novartis to establish a public-private partnership called the Novartis Institute for Tropical Diseases in Singapore. So it is not only the government that is spending money in Singapore on fundamental biological research.

We don't have to come to Singapore to learn about the economic benefits of support of basic medical research since a stunning example is found in Alberta. The Alberta Heritage Foundation for Medical Research was started in 1980 by the visionary government of Peter Lougheed. In the 25 years of it existence, AHFMR with its nearly $1 billion endowment has certainly changed the picture of health research as well as health care in Alberta. The bonus has been the substantial economic benefit derived from this investment. AHFMR has been such a success story that the current government of Ralph Klein has pledged to boost the endowment by $500 million over a 3 year period.

Future generations and biomedical research

When I speak to colleagues in the United States, there is a definite concern about the lack of interest of college graduates in a career in biomedical research. One only needs to read the literature to see that many more papers originating in the United States have foreign graduate students and postdoctoral fellows as lead authors compared to the last century. I see the same trend in Canada but perhaps to a lesser extent. In one sense this may not be a problem since this trend supports the thesis that biomedical research is an international affair and may the best people in the world work in the best labs. On the other hand, it seems unfortunate that our best students are not pursuing a career in research. I am not concerned about those excellent students who choose to study Medicine. After all, one day I might be their patient and I want a smart, dedicated doctor to take care of me. Moreover, occasionally physicians choose a research career subsequently and these rare individuals are badly needed.

To attract the best students into science, I think there are two major problems that need to be addressed. First, in a recent commentary in the journal Cell by Bruce Alberts (2005), he suggests we should change the way we teach science in high schools and in the first years of university and thereby attract more students into science careers. He discusses his own career and how he was almost turned off science by the early courses at Harvard. He likens many of these lab courses to being more like cooking lessons. I always tell prospective graduate students that doing research is almost nothing like the lab courses they have taken. Dr. Alberts says, "Our goal as teachers and educators should be to expose our students to the discovery process and to excite them about challenges at the frontiers of knowledge". Amen. Toward this end, one program that we have in Alberta is a very strong summer research program for undergraduates largely funded by AHFMR. If they end up in a first-rate lab, the

student obtains first hand experience of research and the excitement that comes with it. AHFMR even has a small program for high school students to work in vibrant labs. I hope that Canadian scientists and teachers re-examine the way science is taught with Bruce Alberts' goal firmly in mind.

The second problem is the view by the next generation that a career in science is almost a lottery. They see 75% of scientists fail in their attempt to obtain a grant from CIHR. Why should they put all of this sweat and effort into becoming a scientist, produce an excellent grant and then not be funded? I guess they have a point. It would not be fun to be a scientist and yet have minimal or no funds to conduct research. Thus, the need to persuade the Canadian Government and most Provincial Governments to invest more in research is an issue for current scientists but also impacts on the quality of students we attract into science.

What should we do?

We need to get proactive in informing the Government and the public about the many benefits of basic biomedical research. We have all heard this many times over our careers yet little is ever done. I am as guilty of inaction as most other Canadian scientists. I am busy doing my science, getting cutting-edge research accomplished so that I can publish in the best journals and survive in the next grant competition I enter. I am also a teacher of the next generation. And I have other commitments such as reviewing grants and research papers.

I don't really know how to gain access to governments, or speak to the public who pay the research bills. But if someone said that they had organized a meeting with 3 MPs from Edmonton, and would ask me to come and talk to these public servants, I would be there. I would like to tell them that my basic, curiosity-driven research on phospholipids is having an impact today on the possible treatment of persons with heart disease, stroke or persons with non-alcoholic steatohepatitis. The data are there. Basic research is fundamental to the next generation of treatments of human disease.

Thus, I suggest that CSBMCB takes the money from their endowment and dues and hire someone full time whose job is to work with the universities to set up appointments with government ministers, MPs, MLAs and anyone else who will listen. That person should give us ideas of how to talk to these people. We would then be in a better position to make the case for biomedical research and its many benefits.

A person such as this could work with the universities to get us to present public lectures to high schools and civic organizations so they can understand science and its multitude of benefits. In Singapore, the university has such an outreach program. They have asked us to give such a public lecture to the three top high schools in this country. But no-one ever asked us to do this in Edmonton, or when we lived in Vancouver. It was a lot of work for us to prepare this lay lecture in the first place. But now it is done and is just waiting for someone to ask us to give this type of lecture in Edmonton or in Ottawa next time we are there.

We also need to be organized by this new person to talk to members of the CIHR governing council and President Alan Bernstein. These are the people who have made these decisions to support other initiatives at the expense of investigator-initiated research. They decided to limit investigator-initiated research grants and budgets and expand other programs with the large influx in resources from the Canadian Government. We need to persuade them that support of basic biomedical research is heading towards a crisis that is already having a multitude of serious consequences.

Finally our universities, our faculties of education and our public schools need to take a very hard look at the way science is taught. They need to pay attention to the call to action by Bruce Alberts.

Footnote:

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