
Speaking Notes

for

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to address

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I appreciate the opportunity to speak to you today.

The Canadian Club has a long history as a welcoming forum where ideas on how Canada should move forward in a rapidly changing world can be presented and discussed.

That is what I would like to discuss today – how Canada should move forward. What strategies should we adopt in these challenging times?

The world is changing at an unprecedented rate. The emergence of India and China as economic powerhouses, new global communication technologies, global warming, the emergence of new infectious pathogens like SARS, the powerful new insights into the workings of the human body, are creating tremendous challenges and opportunities for countries like Canada. In a flat world, no country is immune from these global tectonic shifts.

We are in a race without a finish line.

Let me start by telling you three stories. First, two years ago, I led a delegation of health researchers to India to discuss the possibility of research partnerships. While I was there, I participated in the annual All India Science Congress, an annual meeting of the country's scientists. The meeting was kicked off by the President of India who spoke for over an hour – with slides – on everything from space exploration to stem cells to silicone chips. At the front of the immense tent where he spoke, sat about 200 high school students who listened intently to everything he had to say. At the end of this talk, the President gave the students his email address and encouraged them to email him. But on one condition: it had to be about science.

Story #2, also about India, later on that same trip. I had one day of sightseeing in Jaipur. During lunch at a road side restaurant, an enormous elephant came lumbering by with a large bundle of sugar cane on its back and a young boy in the driver's seat. The boy had something in his hand – a cell phone!

Flash forward one year and now I'm leading a group to China. And there in Bejing, I meet Dr. Chen Zhu, Vice President for Health Sciences, Chinese Academy of Sciences. Literally, within one minute of meeting each other, we were fast friends. Why? We discovered that we had a long-time common scientific interest in how your blood cells develop normally and in disease like leukemia.

I think the lessons from these stories are clear: First, India and China both have their sights fixed on becoming major world players, and they are both convinced that they will do that through Science and Technology and by leap-frogging over 20$^{th}$ century technology. And second, the universal language and culture of science can bridge in an instant the enormous divide that separates two men – one born in a small village in the interior of China of peasant farmers and the other born here in Toronto into a middle class family. I'm reminded of what Louis Pasteur said over 100 years ago, "Science knows no country".

I'd like to develop these and other ideas in my talk. I'll start where I actually know something – health and health research.

The 20th century has been characterized by remarkable improvements in human health, virtually everywhere, except sub-Saharan Africa. Longevity in the West has increased by almost two years per decade for the past sixteen decades – initially, the result of a combination of good epidemiology, public health, the discovery of antibiotics and then vaccines. Those advances were then followed by new insights into the lifestyle origins of heart disease and diabetes – bad diets and lack of exercise and the development of powerful new drugs, starting with the discovery of insulin in 1921 right here in Toronto.

Cancer treatment is now moving out of the 'Dark Ages' with the profound new scientific insights into the molecular basis of cancer. New drugs, drugs like Avastin and Herceptin, are not just better drugs. They are a paradigm shift. They are based on knowing the most intimate molecular details of what makes a particular cancer different from its normal counterparts.

And, the technology behind diagnosis is changing just as rapidly and profoundly. X-rays have been replaced or augmented by ultrasound, MRI and CT Scans. Increasingly, gene chips and micro-arrays are displacing the microscope. This new generation of diagnostics will transform health care. It will permit us to prevent or slow down the onset of some diseases before clinical symptoms are apparent. Diabetes, Alzheimer's, mental illness, heart disease and some cancers may all become preventable diseases.

The sequencing of the human genome has transformed biology and medicine overnight, turning them from descriptive sciences into information sciences. We are, after all, nothing else but a combination of genetic hard wiring that we inherited from our parents, millions of years of evolution that molded this information into a coherent, purposeful and highly complex system that is our body, and our experiences as we go though life.

The health revolution of the 21st century will increasingly be a revolution built on information, fuelled by the new biological insights that give this information coherence.

What lies ahead for health and health care? In my view, there are a number of key drivers that will completely transform our approach to human health and health care delivery.

First, biology. Biology today has become the most exciting and fast-moving of all the sciences. It's a vortex, sucking in virtually every discipline from electrical engineering to the humanities to help it tease apart and put back together the complexities of our bodies and what it means to be human. Insights from biology are leading to new therapies, new diagnostics, individualized medicine, including the identification of at-risk individuals.

Second, Information and communication technologies (ICTs) will drive changes in how we analyze individuals, populations, and health systems. As our population ages, and as

we move increasingly from the acute diseases to the chronic conditions of aging (dementias, frailty), ICTs will serve to link together our homes, our bodies, our electronic health records, our clinics and our hospitals. Smart homes will monitor our heart rates, whether we've had a fall, and our blood sugar. This information will be processed in real time by computers linked to our family clinic.

Third, regenerative medicine including nanotechnology, bioengineering and perhaps stem cells, will transform how we repair or replace defective or worn out body parts.

But, most profoundly, it will be the synergy that will come from the combination of all three drivers, and a heightened sensitivity of our personal responsibility for our own bodies, that will transform human health and our health system.

Let me now turn to what I see as some of the implications of this profound shift in health care to a knowledge-based activity.

The first implication is clear – health care is a huge economic-driver. Using 2005 figures, in our country, it is a $140 billion dollars industry (Cdn $). In the U.S., that number is approaching $2 trillion. China currently spends about $60 per person per year on health care. For Canada, that number is $4,300. So, as China's spending on health care increases at least ten-fold over the next decade, the health care industry in China will become *a $800* Billion dollars (U.S.) industry. And, despite all our complaining and concerns about our own health system, Canada has arguably one of the best and well run health systems in the world. That know-how, that knowledge is as exportable and profitable as lumber or oil. We need to get it into our collective sensibilities that health care is Canada's largest knowledge industry, an industry that will experience phenomenal growth and export opportunities over the next twenty-five years.

Second, health care is just one example, albeit an important one, of the growing centrality of knowledge and knowledge industries to Canada's future.

Let me now generalize from health and health research examples to Science and Technology (S&T) more broadly.

Back in 1984, our productivity was 91.4% of the U.S. level. In 2004, it was just 73.7% of the U.S. level. Why is that? The OECD has written that the increase in U.S. productivity after 1995 was largely due to prior investments in R&D. In other words, productivity is no longer about lowering the unit costs of manufacturing picture-tube televisions. Productivity today is about inventing plasma, flat screen TVs. Productivity today is not about lowering the unit production costs of bovine insulin. Productivity today is about invention of recombinant DNA or gene cloning technology and being able to produce human insulin in bacteria.

Productivity today is not about improving the efficiency of our health system through training fewer doctors and nurses. Productivity today is about the invention and

application of new ideas and new technologies that will speed up and improve health delivery.

And so, if we are to improve our productivity, we must do what India and China are doing – invest in S&T. They are able to do that because they are acquiring enormous amounts of foreign capital through their lower labour costs.

But we shouldn't wring our hands in despair – we are also acquiring huge amounts of foreign capital through our export of natural resources – oil, base metals, lumber – that we are so fortunate to be blessed with. This gift creates an obligation to our children that we spend the money we get today from selling off our natural resources to build a stronger Canada for tomorrow.

So, what are the implications for Canada if we argue we have no choice but to transform our economy into a knowledge economy?

The process of discovery is itself transforming the nature of competition. In a resource-based economy, scarcity drives up price. But in a knowledge economy, it is just the opposite. Software is only useful if it is shared. The first fax machine or phone was useless.

In a manufacturing-based economy, companies compete for market share by lowering unit costs, improving delivery times and reliability and post-sales servicing.

But, in a knowledge economy, knowledge is the most precious commodity. And, as Michael Gibbons, Professor at the Science and Technology Research Unit at Sussex University has articulately pointed out, the ideas or intellectual property generated in one company or one university frequently acquires value only when combined with the ideas from another company or university. Companies, universities and countries must therefore strike strategic collaborations in an attempt to create the synergies and complementarities that can only come by merging ideas.

This new sort of competition is almost always global in scope. For who knows where the best ideas will come from? And companies that collaborate in one area are frequently competitors in others. And so, in a knowledge economy, competition ceases to be static and becomes dynamic - becoming more outward-looking, striking partnerships and building relationships with anyone, anywhere.

How should Canada reach out?

In my view, we reach out, we form those relationships and strategic partnerships that are so critical to our success, through the two things that transcend political boundaries, language and culture: first, through the universal aspiration for good health and second, through science, as my China story illustrated.

Science diplomacy, particularly health science diplomacy, will be a powerful way for Canada to reach out to the world. Importantly, it reflects the very best of Canadian values: our health care system and the importance we place on good health and a publicly accessible health care system. Those values, coupled with the exceptionally strong health research enterprise in this country and the objective, fair-minded, meritocracy and universality that characterizes science will make health science diplomacy as important a diplomatic tool in this century as Pearsonian diplomacy was for Canada in the last century.

If French was the language of diplomacy in the 18th and 19th centuries, science is assuming that role today. If we choose, we can become a health science superpower. We have the scientific credibility, the public health system, we started Doctors without Borders, and we're the country of Norman Bethune, Lucille Teasdale-Corti, Tommy Douglas and Frederick Banting.

The third implication for Canada is that in a knowledge economy, geography no longer matters. IBM's super computer Blue Gene, was put together by teams working in 6 different countries around the world. The human genome project was accomplished by the close collaboration of large research teams in Cambridge, UK, St. Louis, Missouri, and Bethesda, Maryland.

And so, for a city like Toronto to become a knowledge-based hub, proximity to market is no longer the issue. But, proximity to the world's best universities and to the best research talent is. Good health care, good restaurants, livable cities, connectivity, and good schools all count far more than low labour costs. Accountants in India balance the books of Wall Street stockbrokers while they sleep. A surgeon in London, Ontario can perform an operation in Paris using robotics and satellite communications.

We are witnessing the 'death of distance'.

Fourth as Richard Lipsey, Emeritus Professor of Economics at Simon Fraser University and Jeffrey Sachs of Columbia University have both pointed out, economics was called the dismal science because it assumed, like Newton's second law, that the amount of wealth on the planet was constant. Therefore, if I get richer, someone has to get poorer.

We now know, of course, that that's not true. The emergence of India and China as economic superpowers is actually creating opportunities for Canada. New science, leading to new technologies, is creating that new wealth.

And there seems to be no end to new knowledge. Knowledge is not like oil or a piece of capital equipment. Knowledge is not used up, worn out or consumed. Knowledge and new ideas are different … the more you use them, the more valuable they become.

I've already touched on a number of these factors – the changing nature of competition, the death of distance and the need to be outward looking, the common language of science diplomacy, and the opportunities that S&T is creating for everyone.

Let me add two last points. A successful knowledge economy requires not a well-educated workforce. It requires a highly-educated workforce – a work force that is trained in science and engineering. In the knowledge economy, highly trained scientists and engineers are what the Economist Magazine recently called "the hottest commodity on the planet".

And so, we need to place much greater emphasis and resources on early childhood education and we need to turn kids on to science and Mathematics, not turn them off. We need to rethink urgently how we teach science and Mathematics to our children so that they get excited about Science.

So, not only do we have to teach our children, we have to keep them here and we have to attract the world's top scientific talent. Because talent, unlike trees, wheat, oil or metal, is mobile. Talent will move to where the excitement is.

Second, in Canada we have focused, appropriately so, on Free Trade Agreements with various trading partners. But, in an S&T-driven world, free trade has very different consequences than in a commodity-drive world. It's about barriers to the movement of people, ideas, venture capital, drug approvals.

We need to start thinking about those consequences if we want to build a knowledge economy.

To me, science is not about memorizing the Periodic Table or the parts of a frog. Science is a process - science is the most powerful way of looking at the world. It is, quite simply, the best way humanity has come up to solve important problems. Indeed, some of the greatest opportunities for economic progress will come from helping the world solve its biggest problems – human health, energy, the environment, building sustainable cities.

In a speech to the Royal Society in Oxford in November, entitled 'Britain's Path to the Future – Lit by the Brilliant Light of Science' British Prime Minister Tony Blair said "Think of the big questions of our time – climate change, the spread of infectious diseases, water supply, biodiversity, terrorism. We need to consult the scientists over every one. If you want to change the world, become a scientist."

Science is now too important to be left just to the scientists. This means that scientists and our great universities cannot be detached from the society that funds them. We need to build new relationships between our universities and the private sector that respects the cultural differences, and differences in missions, but still allows strong, well traveled bridges to be built between them.

This is what science and innovation is all about – discovering and applying new scientific ideas, new knowledge to change the world. Real, cutting-edge research is tough to do.

But transforming science into new products and new policies is event tougher – it is a complex, non-linear process that involves iterative interactions between the producers and users of new knowledge.

In Canada, all too often, debates on the future of our country focuses on federal/provincial relationships, regional differences, our relationships to the U.S., our history. But I suggest that, as important as these topics may be, to see our future we need to stop looking in the rearview mirror. We need to start looking forward, we need to start discussing Canada's role in a world driven and shaped by science and technology.

Let me conclude. I said at the beginning of my talk that Canada is in a race without a finish line. It's a race to build a nation that provides rewarding careers for our children, that has a sustainable health care system, a leading edge education system, a strong social support and that is a paradigm for the planet. To do all of that, we're in a race to generate new ideas and to transform those ideas into economic advantage.

I believe Canada can win that race. But how on earth do you win a race without a finish line? First, you have to enter the race. And second, you have to enter it to win.

Thank you.