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CONVOCATION ADDRESS, MCGILL UNIVERSITY

It is a great honour, and a particular pleasure for me as an expatriate Canadian who retains close ties to the land where he grew up, to address you on such a momentous day, and to congratulate those now graduating. You have met successfully the challenges that McGill has offered you, and now you must meet the challenges of the wider world outside these walls. That is indeed a daunting task, but one for which you have been preparing, I hope diligently, over the last few years at university. By that I do not mean that you have mastered all of the necessary skills, an impossibility given the rapidity of change in the world today. What I do mean is that McGill has done its best to teach you how to learn throughout the rest of your life -- an absolute prerequisite for real fulfillment both in and outside your future careers.

I hope, and expect, that your professors have done for you what my professors did for me in those far off days when I attended Dalhousie, with a student body of less than a thousand, and a biology faculty of only four professors. One botanist, Hugh Bell, infected me early on with his contagious enthusiasm for all aspects of plant science, without which I would never have become a professional plant ecologist. The other, Bill Dore, introduced me to the joys of field biology. From Dixie Pelluet in zoology I gained an appreciation of the history of science that has led me into that field occasionally. Today all too few students, or indeed faculty, have the time to explore the origins and development of their discipline and its fundamental ideas, given the exponentially growing literature of the sciences. However, it does provide a valuable perspective for those who seek it. It also teaches us humility, as we learn -- often reluctantly -- that the ideas we regard as new have a long and respectable history that has been forgotten as the pace of change quickens. Lastly, from Ronald Hayes in zoology I learned to examine ideas, not only my own but also those expressed in textbooks and in scientific articles, and by my professors, with a very skeptical eye. It was from him, then, that I learned the critical rigour so necessary to the scientific life, and indeed to life in general as one is besieged by advertising that is often misleading and electioneering that is commonly both shallow and insincere. Skepticism is a faculty to be cultivated because, as Nobel

Laureate Linus Pauling has said. "In order to have good ideas it is first necessary to have lots of ideas". The good can only be sorted from the rest by the practice of informed skepticism. I commend it to you for the future.

I would like now to turn to the challenges that you will face in the days and years ahead. My generation, growing to adulthood during and just after World War II, faced vast problems in reconstructing a world shattered by conflict almost global in its extent. That we and those who followed us did so successfully -- but only in part -- can be gauged by the comfort and security in which we in the developed nations live amid the scientifically based innovations that have been a major factor in our "good life". Let me name a few of them for you: superhighways, jet travel, TV, computers, credit cards, automation, satellites, miracle medicine, the green revolution in agriculture, and the biotechnology revolution now in prospect.

You will note that I said my generation was successful only in part. In fact we have exacted a heavy price for our success, by plundering the planet to support an often profligate and materialistic lifestyle, by failing to provide adequate help to the poorer developing nations, and by allowing factional disputes to compromise your future. Because of this neglect of some of my generation's important responsibilities, your generation must take them on and demonstrate that idealism, backed by both knowledge and wisdom, can provide a better world for your children and my grandchildren. Many of your tasks in building a better future will involve your training in science and its offspring, technology. But because both are amoral, and can be used either for good or for ill, you will also confront ethical problems in pursuing your diverse professions. In the fields of molecular and cellular biology, how best can developing medical, agricultural, and industrial biotechnology serve society, and how can we mitigate the risks associated with genetic engineering? In medical research, can we ensure that amniocentesis or early postnatal diagnosis of a great variety of genetic defects will not compromise the future of those born with such defects? Should tissues from aborted fetuses be used for research? Should we legalize active euthanasia for the terminally ill? In the case of organismal biologists and ecologists, can we justify saving the snail darter, the Furbish lousewort, the spotted owl, or the diverse ecosystems of the tropical rain forests at some cost to human welfare, particularly in poorly developed countries or poorly developed regions within our own country? Can we justify not saving them? As for engineering technology, is the vast James Bay project environmentally sound? Does it contravene the rights of aboriginal

peoples? Can we maintain a proper degree of privacy in the midst of the computerized revolution in information transfer? Can the technologies of mass destruction be redirected to humane ends? In dealing with these questions you will, from time to time, have to doff your scientist's or engineer's hat and put on that of the citizen. Do not let so-called scientific objectivity get in the way of your citizen's duty to take a stand on the social and human issues that result from scientific and technological advances, but do not suppose or claim that your standing as an expert should give you equal standing on those issues that lie outside science and technology, although related to them.

I have left the greatest scientific, technological and social question that we all face until the last: how can human society continue to survive and prosper as we begin - - largely in ignorance -- to manipulate the planetary ecosystem on Nature's own global scale? We are presently putting Nature at risk in three major ways: by threatening to alter drastically the earth's climate through "greenhouse" warming, by depleting stratospheric ozone, and by creating a terrible holocaust of species destruction unprecedented in recent geological epochs. We are taking these risks as sorcerer's apprentices, without knowing, or even having clearly defined ways to know, what the ultimate effects of these manipulations may be. Those of us interested in ecology, environmental engineering, and what is now called biogeochemistry, cannot possibly foresee more than a small part of the dire consequences of operating carelessly on such a scale. That is because our understanding of how Nature herself operates globally is rudimentary in the extreme. The situation will not change as long as we focus our science and engineering budgets chiefly on military and medical research, with little funding for studies of the global ecosystem. In the United States, for instance, the budget for investigator-initiated research grants by the National Institutes of Health is about 20 times the same budgets of all other federal agencies for environmental studies. You can imagine how these relate to the budget of the so-called Department of Defence. In Canada, the most successful program of freshwater research in the world has had its funding greatly reduced just as it becomes highly relevant to problems of global warming. Those of us who are or become environmental scientists and engineers must in the immediate future justify and create an unprecedentedly large and expensive program to learn how the planetary ecosystem works. To do less is to risk severe problems, and quite possibly catastrophe, within the next century or two, and perhaps within your lifetimes. The challenge is far greater than that which my generation faced after World War

II, but your generation is also much better trained and educated than mine, and you must -- as custodians of the future -- rise to that challenge!

Finally, I would like to say a very little about career planning. First, I believe that you should try to do what you like best, because that is what you will do best. Do not choose what will pay best, or what your parents think best -- that is not the way to happiness. Second, I do not believe that your plans should be too detailed. My own career has been governed largely by chance and serendipity, as I believe yours is likely to be. But remember the oft-repeated words of Louis Pasteur: "Chance favors the prepared mind". Your minds are now prepared, so keep an eye out for the chances! I have no more advice to give on that score, and will close with some lines from John Masefield's poem "The Ending", in his book "The Wanderer." They seem to me particularly relevant to your situation, although the language from the 1930's is unfortunately not gender-neutral as I would wish it to be:

*Therefore, go forth, companion: when you find  
No highway more, no track, all being blind,  
The way to go shall glimmer in the mind.*

*Though you have conquered Earth and charted Sea  
And planned the courses of all Stars that be,  
Adventure on, more wonders are in Thee.*

*Adventure on, for from the littlest clue  
Has come whatever worth man ever knew;  
The next to lighten all men may be you.*

Eville Gorham