

Science in the 21st Century
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We are entering this new century after decades of unprecedented advancement in the sciences. Our current knowledge allows us to tackle questions that were not even being asked fifty years ago. Much of what we know today, and much of what we will discover in the coming decades, relies on research accomplished at universities like the University of Toronto. In light of this, I thought it useful to ask some of our leading researchers in various areas of science to highlight what they see as the major challenges in their fields that will occupy scientists in the years ahead. While areas of investigation will emerge serendipitously from research, universities need to be aware of these significant questions that will inevitably come to shape our academic planning. As Canada's leading teaching and research university, the University of Toronto must play a role in defining the future of research in the country, and with this in mind, I have approached a number of colleagues for their views on this subject.

When I mentioned this initiative to Tom Simpson, he felt that this topic would make for an interesting discussion at Governing Council through the medium of the President's Report. If the format is successful, I am prepared to address this issue at further Governing Council meetings by referencing, in an expanded way, responses from professors in various disciplines of science, social science and the humanities. To some degree, this issue, by its nature, intersects with the Provost's Academic Planning initiative. My comments will be intended to capture, to the degree possible, the excitement that can be generated among researchers by the contemplation and engagement of major intellectual problems. By doing this, I do not intend to suggest content or particular direction for the Academic Plan. I will leave that task to the Provost.

In the way of a general introduction, though, I can say that virtually all of the responses that I have received to date point to a profound need for interdisciplinary collaboration if we are to solve the big questions.

At the upcoming meeting of Governing Council, I propose to speak to the responses I have received from the following four professors: Jerry Mitrovica in Geophysics, Eugene Fiume in Computer Science, as well as Dick Bond and Peter Martin

in Astrophysics and Astronomy. I will only briefly outline some of their suggestions on the big questions here, since I intend to elaborate on them more in our proposed discussion at Governing Council.

Jerry Mitrovica's work in the earth sciences leads him to ponder "the underlying physical processes responsible for the evolution of the planet and its sub-systems." Eugene Fiume sees the challenges of Computer Science to be in the areas of "conquering scale in its many forms, understanding and adapting to people, the stimulation of natural systems, and figuring out how to put it all together in the systemic construction of complex software." Dick Bond's views capture concerns shared by Cosmologists and Astronomers, namely, the need to learn all we can "about the dark sector -dark energy, dark, matter, dark baryons", and searching for "gravitational waves from the early universe" and "terrestrial planets." These points are echoed by Peter Martin who describes the on-going search for life in the universe as "one of the long-standing big questions." He, like Bond, is also deeply curious about resolving the questions surrounding "dark energy" and "dark matter"; "gravity and gravitational waves." Obviously, there is a great deal of content behind each of these topics, and I look forward to enlarging on them as we discuss them and their implications at the meeting.