

Proposal To create a campus-wide institute to foster interdisciplinary communication and collaboration between mathematics (applied, computational, theoretical) and the sciences (physical, chemical, biomedical, engineering, social) on education and research. The purpose of this draft is to initiate discussion which will eventually be crafted into the Provostial planning process.

1. Motivations: We propose to establish an institute that will act as an umbrella organization to coordinate and benefit the common interests of scholars and students dispersed throughout the university whose work stands to benefit from and stimulate the creation of new mathematics, models, and numerical techniques. The emphasis is on the creation and application of new mathematics driven by and for science, rather than mere application of existing ideas.

We envision a system of cross-appointments between existing faculty coupled with strategic new appointments in vital areas, and a new interdisciplinary program of graduate studies designed to facilitate joint mentorship of students and postdoctoral fellows between scientists and mathematicians working in different disciplines. Our concrete goals include the following:

We aim to encourage interdisciplinary interaction and to integrate abstract mathematical expertise with specific domain knowledge (such as numerical analysis with projects involving large-scale simulations in a variety of areas; number theory with cryptography; pure probabilistic approaches to random graphs with more applied questions; partial differential equations with pattern formation, nonlinear physics, reaction chemistry, and spatial economics; harmonic analysis with signal processing, inverse problems with medical imaging, mathematics with genomics, proteomics, molecular and evolutionary biology). We are certainly not asserting that all abstract expertise resides within the math department!

We aim to build on recent hiring in applied mathematics both within the math department, and in joint-appointments with other departments (ECE, CS, PHYS, STAT, SGS); and to showcase interdisciplinary work already taking place on campus and develop more ties and cross-unit research links

We hope to create an dynamic interdisciplinary environment, helping with recruitment of world-class applied mathematical scientists and theoreticians in other disciplines.

The NRC is currently considering a proposal to create a nationwide laboratory in Computational Science, consisting of up to 100 positions distributed across the country. The proposed institute will complement the NRC initiative, create a natural home for additional NRC positions, and encourage NRC to maximize their investment in the University of Toronto.

2. Goals: The main focus of this initiative is on research (with the training of grad students and postdocs understood as an integral part of our research endeavor).

Short-term goals: strengthen current interdisciplinary research projects and initiate new ones. A major means of carrying out such projects will be through joint funding and supervision of p.d.f's and graduate students by faculty members from different units with shared research interests.

enhance training of HQP by creating structures to encourage students to get a broad education in mathematical and computational sciences. (The mathematics department graduate program in applied mathematics needs a serious reworking, and the institute will play a role in this. This reworking should allow new possibilities for integrating work in mathematics with work in other disciplines.)

Long-term goals: new positions, joint positions, some possibly funded by the NRC initiative. Shared space, possibly including seminar rooms, a faculty/student lounge, meeting rooms, centrally

located office space for students/postdocs working on interdisciplinary projects, interdisciplinary graduate program

3. Details of the **institutional structure** will need to be worked out through discussions with all involved parties. We believe that the following principles should guide these discussions:

First, our focus is on improving the climate for research and for the training of HQP, as well as improving the actual output. *Faculty members should not be asked to devote time to activities that do not contribute directly to these goals.*

Second, the scientific quality of participants and of the research program will be at the highest level.