UBC Mathematics Department Contribution to the Long Range Planning Committee

April 18, 2011

1 Summary

Mathematical ideas and theories have had a profound impact on technology and the larger society over the years. Some of the recent examples include public key cryptography, the google page rank algorithm, tomography, and linear programming algorithms that solve scheduling and routing problems. Such epochal discoveries often emerge in an unpredictable way from a background of mathematical curiosity. Canadian mathematics has had a great deal of success in recent years, largely because of the CRC program, the efforts of the institutes, and enlightened NSERC policies. There is a widespread concern in the community that some of the recent changes at NSERC are undermining these gains. We feel that a speedy reversal of these trends is of the utmost importance.

We strongly support the envelope funding option being considered for the Mathematical Sciences community. We would like to see the Institutes enter the funding envelope at their current level. It is crucial that top pure and applied mathematicians are heavily involved in NSERC decisions; and in particular, are represented on the envelope distribution committee.

2 NSERC Policies

Canadian mathematics has made spectacular strides in the past 15 years. The CRC program has made it possible for Canadian universities to attract top researchers. BIRS has emerged as one of the world's foremost conference centres in the mathematical sciences. Mathematics research both pure and applied has been flourishing at Canadian universities, supported by a combination of innovative activities by the Institutes and sound NSERC policies.

Unfortunately, the recent changes at NSERC have led to a wide-spread dissatisfaction in the mathematical community, and a concern that they may have the effect of reversing some of our recent gains.

First of all, the overall level of funding for the mathematical sciences has decreased, relative to other disciplines; to build on and protect the gains we have made in recent years the overall level of funding needs to increase. Secondly, the NSERC evaluation processes designed to allocate existing funds are widely viewed, by applicants, panel members and independent observers alike, as being too rigid and rushed, and the results they produce as arbitrary, unpredictable and out of tune with the needs of our community.

2.1 Discovery grants

The heavy emphasis on HQP training and the establishment of the minimal grant size have had the effect of defunding entire departments without doctoral or postdoctoral programs. Many such departments are beacons of mathematical knowledge and activity in isolated regions and suppliers of talented students to graduate programs at major research Universities. NSERC should support a sustained research pipeline that is nationally based and not limited to a few elite departments. In this connection, NSERC should ensure that promising students are not disenfranchised from USRAs because of the requirement of an NSERC grant. We suggest that researchers without NSERC grants should not be excluded from supervising USRA students.

Another consequence of the heavy emphasis on HQP training in the NSERC evaluation process is that some of the most creative mathematicians in Canada have had their Discovery Grants severely reduced or in some cases entirely eliminated, because they have few (or no) graduate students. There is value in a deep, creative thinker working in relative isolation on difficult problems. In fact, a significant number of major breakthroughs in mathematics have come from such researchers. There are also some projects and approaches that benefit from larger groups working together. NSERC should realize the benefits of both types of endeavors, and not penalize one relative to the other. We suggest decoupling the contribution to HQP training from the evaluation of the excellence of the researcher and merit of the research proposal. The decision to fund a given researcher should be made on excellence and merit, while the training of HQP can play a role in determining the level of funding.

2.2 NSERC Fellowships

The NSERC Scholarships and Fellowships Selection Committee for the Mathematical Sciences have also had some problems in recent years. This year there was a severe decline in the number of NSERC PDFs. The small size of the committee and the rushed schedule made it difficult for committee members to evaluate the applications in a fair and uniform way.

Another concern is that some of the current NSERC procedures and regulations concerning postdoctoral fellows are out of step with the needs and common practices of our community. Three year postdoctoral appointments, which are now standard in mathematics, are currently only allowed in exceptional cases; they require a written explanation and approval by NSERC.

NSERC PDF awards are announced at the end of March, while the postdoctoral hiring season at the top universities in the US and Canada ends in mid-to-late February. NSERC PDFs can be used to much greater advantage if this announcement is made earlier. The situation with graduate fellowships is similar. A nationally coordinated set of deadlines, similar to those in the US and other developed countries, will go a long way towards leveraging NSERC Fellowships thus helping top Canadian graduate students and postdocs place into the very best programs.

3 Mathematics Institutes

Our department strongly supports the continued funding of the four mathematics institutes (PIMS, CRM, Fields and BIRS). The Institutes make Mathematics visible to our Universities, provincial governments and the federal government and give our discipline a vehicle to tap into programs which had previously been hard to access, thus leveraging the funding they receive from NSERC. Institute funding expands our grants through postdoctoral support, conference support (including BIRS meetings and local PNW meetings) and collaborative research group support, to name a few.

PIMS has had a transformative effect on our department since 1996. The $1.1 million PIMS received in NSERC funding is leveraged 3-4 times by cash support from its member Universities, Provinces and industrial sponsors. We support the current envelope proposal which gives the mathematical community an opportunity to consolidate its hard won gains and ensures the ongoing health of the Mathematics Institutes.

4 Industrial Mathematics

Mathematical tools can be used directly to understand and improve industrial processes and design. When solving such very applied problems, it is often the case that new asymptotic, analytical and numerical methods get developed and that these have a wider application than the limited context in which they first arise. Our department has a strong record in industrial applications of Mathematics including the modeling of fracture processes related to the Mining Industry; inverse problems in mining exploration; the rheology of oil well cementing processes and Hydrogen fuel cell design.

Often the biggest barrier between an industrial problem that could be solved with mathematical techniques and its solution is the effort involved in matching the problem to the right, abstract mathematical field. MITACS has been instrumental in this process. Our department would like to see ongoing NSERC support for this matching activity after the NCE funding for MITACS ends.

MITACS has had a transformative role in Canadian Mathematics, fostering and rewarding Industrial Mathematics activity. As appropriate for its pioneering role, MITACS supported relatively short term, very applied work. Our feeling is that this activity has matured and that mathematics relevant to industrial applications key to Canadian international competitiveness should be identified and supported.

In a previous phase, NSERC had a special GSC called "interdisciplinary". Many members of our department worry that in eliminating it, some scientists may fall through the cracks, as they will perceived as "outside" the traditional disciplines of Mathematics and application areas. NSERC should find a way to continue to encourage interdisciplinary work.

Prepared on behalf of the UBC Mathematics Department by Zinovy Reichstein and Brian Wetton.