Submission to NSERC Mathematics and Statistics Long Range Planning Committee

It appears to us that, with respect to funding the mathematical and statistical sciences, there are several challenges facing NSERC. We briefly describe these and suggest one possible means for addressing them within the current evaluation group. Exploiting the existing mathematical sciences infrastructure currently supported by NSERC, namely the institutes, should figure prominently.

1. **Interdisciplinary research:** Here, the question concerns how NSERC can support linkages between mathematicians, statisticians and other scientific and engineering researchers. For example, there is currently little or no support for statistical scientists whose expertise could make a substantial difference to the way research projects are carried out in important fields such as information science, climate change, environmental sustainability, health and wellness, and so on. In addition, recent trends in the allocation of Discovery Grants have not favoured the collaborative statistician further aggravating the situation. Yet supporting interdisciplinary and collaborative research is one of NSERC's objectives.

   One of the difficulties is a failure to recognize that scientific research is not exclusively the domain of the so-called subject area scientists. One of the over-riding assumptions in the Canadian science community is that it is the physical and experimental scientists (biologists, chemists and physicists) who are working on the "Big Science" problems and that the mathematicians and statisticians can be called in for consultation from time to time to assist with an equation or a p-value, often as an afterthought or as a requirement for a journal publication. Statisticians study methods to extract information from noisy data, which is a skill that takes time and experience to develop and understand it so it can be used effectively. Mathematicians and statisticians must be recognized as full partners and collaborators, and it must be recognized that just as a biologist who works on a genomics problem is still considered to be a biologist, the statistician who collaborates on that problem is still a statistician; thus, the genomics problem is not only a biological problem but also a statistical problem.

2. **Small grants:** NSERC's recent policies regarding minimum grant sizes and lower success rates for discovery grants is rapidly eroding the mathematical and statistical research infrastructure at almost all of the institutions with small and medium-sized departments.

   Despite significant restructuring at NSERC aimed at disrupting inertia in the Discovery Grant program disparities remain between evaluation groups where the costs of research are similar. This inertia is coupled with NSERC's perennial campaign that mathematical and statistical researchers should be subjected to similar minimum grant sizes. It is very important to recognize that, in many cases, a mathematician or statistician can make very significant advances in scientific research. While many statisticians will benefit from larger grants which would allow the hiring of technical assistants, programmers and post-docs, in addition to graduate students, some also will benefit greatly from smaller grants. Statistics as a discipline now ranges from work involving larger teams, to some problems require only fewer resources.Even a grant of $6000 per year would be sufficient to meet the research needs of some in these communities.

One of the down sides of this new NSERC funding model is to reduce the training opportunities for graduate students. Not all students learn well in a large graduate department; some learn well in a smaller one-on-one setting. Additionally the breadth of problems to be studied by graduate students is reduced in the current NSERC model.

3. **Institutes:** How should the funding envelope that includes the Discovery Grants in the mathematical and statistical sciences be modified to include funding for Fields, CRM, PIMS and BIRS in a context where the institutes don't represent a national constituency (they are "regional" institutes) and do not fund all research areas in the mathematical sciences in anything near a proportionate manner (for example statistics, computer science and actuarial science are seriously under-represented on boards and theme years).

   This is controversial since statisticians see a real need for the support of collaborative research but (despite past institute support for NPCDS/NICDS) do not view the institutes as currently supporting this to the extent they should (and once did). In addition mathematical scientists may view the movement of the institute funding into the discovery grant envelope as a possible incursion on their discovery grant allocation. Statisticians worry the net effect will be a relatively large transfer of resources from the statistical community to the mathematical community.

4. **Resources:** A perennial complaint from researchers in the mathematical sciences is the relative size of grants for individuals researchers when compared to other disciplines where the costs of research are similar (computer science, industrial engineering). This has been further aggravated by restructuring at NSERC, reduced success rates and increased noise in the allocation of resources that has left a sense of bewilderment. This may be contrasted with the success of several major initiatives that have been wildly successful due to the imagination and resourcefulness of the mathematical sciences community. This includes MITACS, ACCELERATE, NPCDS and the four institutes. Here the ability to leverage their resources and to impact the broader scientific community notably rivals any existing NSERC program.

Research Institutes in Mathematics and Statistics

A possible way to address these problems is through the introduction of a new structure in the Mathematical Science Evaluation Group: Research Institutes in Mathematics and Statistics (RIMS). This structure would serve to significantly enhance activity at the existing institutes as well as bring the oversight necessary to fold their funding into the EG, address existing concerns, and govern new funding programs. This structure would be a virtual centre, responsible for allocating funding to the math institutes as well as to individual researchers across the country. In addition to the allocation of funds to the existing institutes (PIMS, CRM, Fields and BIRS), RIMS would be responsible for

- A program of collaborative team grants for interdisciplinary and applied research that exploits the institute's infrastructure and where there is significant potential for leverage and partnerships. This could be similar to the NPCDS model but with a broader scope that includes applied mathematicians and computer scientists.

- A program of small individual grants to researchers wishing to engage in institute activity (eg: thematic programs, collaborative research groups)
- A program for small individual training grants to enable researchers who, for whatever reason, are not funded directly by the DG program to supervise a small number of graduate students or upper level undergraduate students.
- A program for the allocation of all postdoctoral fellowships in the mathematical and statistical sciences

Governance of RIMS would be undertaken by a board whose make up would consist of researchers from the mathematical sciences and statistics communities. Representatives from each community would be selected to make up the board according to a reasonable approximation to proportional representation.

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