

## NSERC LONG RANGE PLANNING SUBMISSION

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The health of the discipline of statistics in Canada relies not only on the excellence of individual researchers but also on a national framework for research leadership, for training and for momentum in the statistical community as a whole. Achieving and maintaining these requires a strong Discovery Grants Program and would be greatly facilitated by the existence of a statistical institute.

### 1. SCIENCE

Statistical research ranges from highly collaborative and interdisciplinary to what we might call fundamental. Interdisciplinary research occurs when statisticians interact with non-statisticians such as medical researchers, atmospheric scientists and genome scientists. In these interactions, statisticians develop and assess new statistical methodology that enables scientists to answer their research questions in a valid scientific framework. In more fundamental research, statisticians carry out theoretical work to place new statistical methodology in a broad mathematical structure, a structure that provides a strong core that allows for the development of further new statistical methodology. Thus, interdisciplinary research feeds fundamental research and fundamental research builds a foundation that furthers interdisciplinary research.

Much recent funding has an increased focus on interdisciplinary research to the detriment of fundamental research. Support of the full spectrum of research is necessary for the health of the discipline of statistics.

Like researchers in many areas, statisticians use mathematical tools in their research. But statisticians do not carry out research in mathematics nor do they commonly collaborate with mathematicians. Therefore linking statistics research planning and mathematics research planning does not enhance the planning of either community.

### 2. CHALLENGES FOR THE CANADIAN STATISTICS COMMUNITY

The Canadian statistics research community is thriving and vibrant, with members found in industry, government and academia. The community is large, with, for instance, the membership of the Statistical Society of Canada almost as large as the Canadian Mathematical Society. Connections between academic research statisticians and external agencies remain important and strong. Jobs still abound, in Canada and beyond, but these job opportunities, especially in the United States under NAFTA, challenge us in retaining our HQP.

One challenge for the statistics community in Canada parallels a challenge of Canada: our population is spread over a larger area. The statistics community in Canada can be described as “few and far between”. There are few universities in

Canada with a critical mass of statistics researchers. Only six Canadian universities have statistics departments. Yet almost every university in Canada employs faculty members who are expected to carry out research in statistics and to train undergraduates in statistics. Often, these statisticians are spread across different academic units. Many of them work in isolation, with relatively little access to graduate students. Isolated junior statisticians, the HQP we have so proudly trained, do not receive the mentoring they need to develop their research nor to form the cross-disciplinary ties that lead to fruitful research collaborations. Employment opportunities outside of Canada then become attractive, leading to an exodus of HQP.

Active researchers in isolated environments keep statistics alive across Canada, even in universities with no active statistics graduate program. These researchers contribute to the mentoring of junior faculty and to the training of undergraduates. Unfortunately, because of changes in Discovery Grant funding criteria, some of these researchers have lost the funding necessary to support students and to travel to conferences to interact with other research statisticians. To partially resolve this problem, we recommend that the \$12,000 floor for grants be dropped to enable funding good researchers, for instance, those in institutions without graduate programs. Surely no one would argue that just because research costs less than \$12,000, it must be of poor quality.

The Canadian statistical community will suffer if research activity is limited to a handful of universities. The loss is not only in terms of diminished research capacity, but also in terms of a diminished supply of undergraduates with the statistical expertise necessary to meet continuing high manpower needs and to populate graduate programs.

### 3. RESEARCH FUNDING

The Discovery Grant Program's funding of curiosity-driven research is crucial to statistics in Canada. We are concerned about recent developments in funding for this program, in particular, the erosion of funding for Discovery Grants, the over-emphasis on the criterion "training of HQP", and the lack of funding for active researchers in isolated environments, as discussed in Section 2.

Statistics Discovery Grants are small, making it difficult to support graduate students and almost impossible to support post-doctoral fellows. While NSERC provides direct graduate and post-doctoral support for Canadians, support is also needed for international scholars.

We are concerned that the criterion "training of HQP" is too influential in funding decisions. Training of HQP is important and a researcher's capacity for training HQP should certainly be part of the decision for the level of funding. However, excellent researchers with strong research proposals should receive some funding, no matter what their level of training of HQP. Typically, statistical researchers with low levels of HQP training are either in isolated environments in institutions with a limited graduate program, or are working in fundamental areas of research, areas that are important to statistics, but may not attract large numbers of graduate students. Some researchers have temporarily low levels of HQP training due to parental and maternity leaves.

NSERC's apparent shift in criteria from quality of research and training towards a greater emphasis on quantity of training doesn't bode well for research in Canada.

Training of HQP should not be equated with quality of research. While research carried out by PhD students plays an important role in the discipline, typically research at a deep level is carried out by more senior researchers. MSc students can support certain important aspects of research, such as computing and simulation studies, but MSc students play only a small role in advancing fundamentals of the discipline of statistics itself.

The move to lower success rates will hurt statistics as a discipline, especially in small universities.

The emphasis on funding interdisciplinary research provides support for many areas of statistics. However, quality research that is not interdisciplinary is still worthy of funding. While an emphasis on industrial collaborations may kick-start Canadian industries to increase their research budgets, support of industrial collaboration programs must not be at the expense of support of basic research.

We support a statistics envelope for the funding of small teams of researchers, for either fundamental or interdisciplinary research. Having a statistics envelope for team grants would make such a program more visible, and would allow statisticians to determine important research directions.

A challenge to the statistics community concerns funding across agencies. Statistics is important to disciplines not supported by NSERC - that is, to disciplines supported by CIHR and SSHRC. Statistics collaboration with CIHR researchers is particularly common. Can NSERC do more to build funding bridges with these agencies? For instance, can funding programs be set up to support collaborative research infrastructures, one of the roles typically played by the consulting and collaborative research laboratories in several Canadian statistics research units? Can funding be set up for the support of co-supervised graduate students?

#### 4. INSTITUTES

The current structure of the Institutes does not provide the best venue for driving the research directions of our discipline. Effective statistics leadership requires an infrastructure and funding envelope specifically for statistics. Without this, we have the current situation where, typically, leadership and advocacy for statistics is run off the corners of desks of people who are busy teaching and carrying out their usual academic activities.

An adequately funded statistics institute would allow for a more coherent support of the discipline. We feel strongly that statistics research benefited more from the short-lived NICDS than from the math institutes combined. If a statistics institute were not possible, a partial step in that direction would be a dedicated funding envelope for statistics program(s) - programs determined by statisticians, with proposals adjudicated by statisticians. Such programs include support of international PDFs, collaborative or thematic programs, conferences/workshops/short courses, short-term visits (1-3 months) of researchers at both the junior and senior level, linkage with industry, and small projects involving two or three researchers in the same university.

An additional important institute-type program would be one that supports active research statisticians in isolated situations. These research statisticians might be given travel funds, along with funds for student support, to become part of a team of researchers and to co-direct students at other institutions. The direct research benefits to the individuals are clear, as are the benefits to the support

of the discipline of statistics at smaller universities. The team of researchers also benefits directly, through the expertise of another researcher and through valuable help in HQP training.

The three mathematical sciences institutes compete for funds in a country with a somewhat small number of researchers, and we question whether this is the best way to spend research dollars. Thus, we would be happy to have some of the institute funding re-allocated to support a statistics institute.

While the institutes do not provide us with a framework for leadership, they have provided useful staff support for workshops and their current programs have provided valuable research opportunities for individual statisticians and small groups of statisticians. Our main experience is with PIMS, and the experience has been a positive one. The only negative comment concerning PIMS programs is that we are sometimes required to seek research collaborators in places where we might not have them, in order to satisfy the “Pacific” in PIMS.

BIRS is useful to the mathematical sciences, although the proportion of statistics-related activities is small. BIRS’ purpose is well-defined. It functions well both in terms of adjudication of proposals and in terms of administration of conferences. BIRS programs lay the ground work for future research collaborations.