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# COMMENTARY



## NSERC Discovery Grant Competitions: Arguing Over Crumbs?

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To many geoscientists, especially those new to Canada, or new to academic positions within Canada, the NSERC 'system' may appear somewhat reminiscent of the impenetrable black obelisk in the classic film "2001, A Space Odyssey". The general function of the obelisk, and the language resounding from out of it, can, at times, seem obscure. Applicants are, for example, sometimes baffled (as has been the experience of this author) – when they receive unanimously positive comments from external reviewers with a notice that funding was reduced or not even granted at all. How can this be?

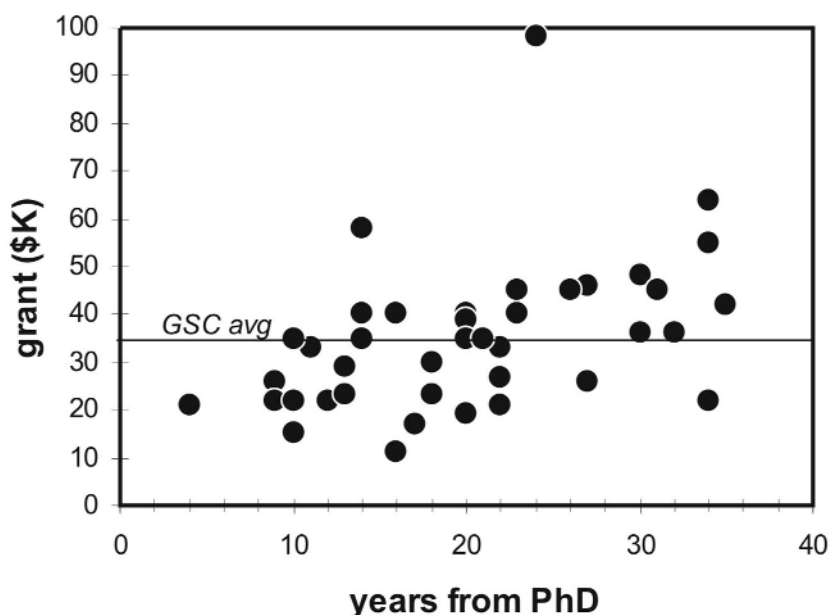
As a member of the Solid Earth Grant Selection Committee (GSC08) over the past three years, and chair of the committee in the last year, I will make an effort here to expose several growing issues for geoscientists across Canada, who access NSERC for their research funds. This commentary high-

lights problems evident to me as a reader of NSERC proposals, and attempts to disseminate information to the greater community, to remove some of the mystery behind decisions that come out of NSERC competitions. Furthermore, I wish to make the point that the NSERC system is not sustainable in light of changing demographics in the scientific community, ongoing budgetary constraints and new funding for Canadian science, such as the Canada Foundation for Innovation (CFI) and Canada Research Chair (CRC) programs. The centerpiece of the commentary is the Discovery Grants program (previously known as Research or Operating Grants), which I view as the "meat and potatoes" and most cherished money of many researchers. NSERC DG grants seem the most difficult to increment, but they are the backbone of

our curiosity driven research efforts. Other perhaps less publicized aspects of this and other programs are also mentioned.

### A FAIR COMPETITION

First and foremost, new researchers should be aware, and older ones occasionally reminded, that DG funds are distributed in a *competition*. No matter how meritorious applicants or their proposals are, they are in the running with many others (typically more than 100) that may be equally meritorious or better. So for established researchers with a track record renewing their proposal, the competition is not just a "rubber stamp", confirming progress and allowing the applicant to proceed along more-of-the-same. Indeed, several criteria must be met, but more importantly, a proposal for continuation of funding



**Figure 1.** Incoming Discovery Grant level vs. years from Ph. D for renewal applicants in GSC08 for the 2005 NSERC DG competition. Also shown is the GSC average from 2004.

can be viewed with many others that exceed it on all criteria and are more worthy of funding within the budget of a given year. The same is true for new, first time applicants (called FTA) who are breaking into a system with other FTA and competing directly with each other for even more scarce funds (see below).

The relative ranking of proposals lies with the committee members who present and review each one over four or more days of deliberations. At least 10 to 15 person hours are spent reading and evaluating each proposal and the four papers that applicants are asked to contribute. NSERC criteria are robust, and revisited in the deliberation of every proposal. The 'system' is constantly guarded for fairness. In a committee of eight to ten readers, there is an assuring self-regulation of "axe grinders", and pointed exclusion of biases stemming from schools of thought, anecdotal information, or an applicant's pedigree (e.g., current university, prior history). The NSERC organization is well aware of such pitfalls to fair evaluation, and they are purposefully disallowed. I can say, without hesitation, that the competition process is extremely fair. However, decisions can be harsh because demand for support far exceeds the available dwindling funds (the 'crumbs' to be addressed below).

### NO "OLD BOY" NETWORK

A sentiment amongst young or up-and-coming applicants (sometimes espoused in department coffee rooms or conference hallways) is that much NSERC DG money is tied up in support of researchers who have been in the system longer than they have. Although it may not seem evident to many new or young researchers, within a given competition, well-established scientists can have their grants reduced while young up and comers can be awarded increases. As an example, Figure 1 shows the incoming grant level of several members from a recent competition. Youth is measured by years from the Ph.D. There is only a weak positive correlation on this plot, and clearly some outliers. Particularly notable is that the GSC08 average grant level (~ \$33K in 2004) is being achieved by both young researchers 10 years from the Ph.D, and by those who have been in the system through several funding

cycles. The percentage change in an incoming grant also does not scale with years from Ph.D, indicating that there is no tendency to resist large funding reductions for more seasoned applicants. Thus, inertia in the system is minimal.

In addition, NSERC actively encourages the spending of funds on new applicants. A portion of the budget, set by a funding formula at NSERC, is allocated for incoming FTA and none of it can be used to augment the budget for renewal applicants. The converse is not true however—FTA can be funded by transferring funds from the renewal portfolio. FTA are guaranteed a success rate greater than 50% in a given competition, and the grant to new applicants must be near 70% of the GSC average grant to returning applicants (~\$33k in 2004 competition). Unfortunately, the per capita sum that new applicants bring into the competition budget (less than \$14K) is below a level at which most FTA are first funded. FTA bring new NSERC dollars to the budget but these provide only a fraction of what is awarded on average (70% of \$33K = \$24K). Thus, FTA compete amongst themselves for the funds they bring to the global budget and the competition is vigorous.

### MENTORSHIP

In the three years on the committee, it has become painstakingly obvious that many new applicants have not had their proposals reviewed by seasoned research colleagues prior to submission. To be blunt, many FTA submit poorly written, unrealistic grant proposals that offer weak descriptions of what they expect to accomplish in the first five years. Worse yet, some are unable to articulate sound hypotheses or describe the most appropriate methods by which to assess them. Of the many ingredients to writing a "winning proposal" prescribed by NSERC, critical constructive review by an experienced researcher seems to be the one most frequently overlooked.

Why is this so often the case? Senior, seasoned researchers in earth science departments have a social obligation to see their younger colleagues do well and obtaining an NSERC DG is a key step in this direction. Are older researchers not bothering to spend the time to mentor their younger colleagues? One hopes not, for a rising tide lifts all

ships, whereas sink-or-swim attitude for new applicants hinders the funding profile of a department in the long term. Sound mentorship of first time applicants for Discovery Grants is a long-term investment in the health of an entire department's research profile.

Submission of a first DG application is not trivial. Many FTA have just assumed their first position at a Canadian university, and are in a scramble to prepare lecture courses, establish a lab, recruit graduate students, orient themselves to a new place, a new culture, and a new organization, and win funding for their research. They are often writing a proposal for the first time in their careers. Sometimes FTA are writing from afar before moving to their new appointment. This may not be an issue for first-time applicants who are already established scientists at other institutions outside Canada, but one wonders whether new researchers should be counseled to let the dust settle before writing a research proposal. Perhaps a year should pass to allow new researchers to get their bearings, concentrate on their teaching, think carefully about what they would really like to research and how to do it, and only then submit a proposal? A pessimist would say that a year's wait will in the long run negatively affect the 'tenure clock' for many new academics, but not having a proposal funded in the first attempt can be no better for the tenure process. Being denied a first DG can make a negative impression on the new department and be very embarrassing for the new applicant.

### THE "CRUMBS"

The most daunting issue is the progressively dwindling budget for earth sciences at NSERC. This is an outcome of the Reallocation Exercises, in which all GSC's at NSERC are reviewed, and 10 % of their collective budget is re-distributed as an outcome. Solid Earth and Environmental Earth Sciences have lost in the last three re-allocation exercises. The long term budgetary impact has been disastrous, and the situation is now desperate. In the most recent 2005 competition, for example, the budget assigned to returning applicants was less than 90 % of the collective value of their previous awards. What does that mean? An applicant who maintained

level funding of his or her current DG actually saw the grant decrease by 10%.

This budget debacle has been inadvertently exacerbated by other funding schemes. The Canada Research Chairs program, for example, was designed to attract highest-quality researchers to Canada. Many such Chairs in the Tier 1 (Senior) category are internationally renowned scholars with large programs and/or infrastructure. These individuals deserve to be awarded a level of funding similar to current levels received by their senior peers in Canada. However, NSERC assigns incoming CRCs to the FTA pool, which brings only about ~14K per capita to the global budget. Many CRCs have research profiles or infrastructure that demand several times that level. From where should the resources come to fund these scientists at the levels their programs and stature warrant? The funds are simply not there. The NSERC DG system was, and remains, ill-prepared for the CRC program. Internationally renowned researchers are lured to Canada only to be awarded DG funding at or even below the GSC average. The mishandling of this aspect of the CRC initiative is a national embarrassment.

The establishment of the Canada Foundation for Innovation has also stretched the NSERC DG system. The CFI has brought much new instrumentation to both new and established researchers in Canada. Much of this new infrastructure is expensive, but even more so, it is costly to run and maintain. The hardware investment to date now measures in the billions, but support for operating and maintenance costs has not kept pace. As pointed out by one proposal reviewer in the 2005 competition, "I wonder if the NSERC DG system can support all the newly acquired CFI equipment". NSERC and the CFI need to coordinate a solution to this issue, else there will be a surfeit of newly acquired but underutilized equipment in this country.

The creation of the CFI indirectly imposed another stress on the NSERC system. Proposals for major pieces of equipment costing more than \$150K have not been accepted by NSERC in the Research Tools and Instruments (RTI) competition for the last few years. Some Readers may be interested to know that the budget

established for the RTI competition each year depends partly on the number of applications received and the total level requested. Thus, more proposals in the pool can increase the budget. More applications in the RTI competition may not increase the success rate, but can increase the funds available to those who are successful (so apply).

NSERC's decision stems from the need to concentrate funds into the DG system, but it can also be traced to the fact that "some" major instrumentation can be covered by the flourishing CFI system. Unfortunately, in reality there are many items of necessary major equipment that are not of big enough profile and/or expense to fit well with the CFI mandate. Electron microprobes - a geological mainstay - provide one excellent example. How are we now to fund these and similar tools, with NSERC running on the coat-tails of CFI and quickly running out of breath?

### THE URGENCY - TURNING CRUMBS INTO BREAD

In summary, the NSERC DG system is incredibly fair and painstakingly careful with the evaluation process and criteria, but it simply does not have enough money. The 2005 Competition for GSC 08 consisted of four long days of deliberations over proposals from countless researchers doing great work. With current funding levels, however, these five days are an exercise in arguing over crumbs. The competition is heartwrenching and stressful.

The budget for the 2005 competition was ~\$2.5M. Imagine that 10 % of the budget had not been lost, or even that 10 % had magically been added, leaving a total of another \$500K to be distributed nationwide. That's the minimum necessary to reestablish optimism. How can we, as a community, do this? How can we turn crumbs into bread? Either we must win at the re-allocation game next time, or we must challenge its fairness. As noted by John Waldron, in his 2004 GSC08 Chairs Report to NSERC, "the structure of the Reallocations process needs to be addressed by NSERC so an entire community of enthusiastic, hard-working, and productive scientists is not penalized at a stroke by the results of the review of one document by a single committee".

During a 30 minute visit to the members of GSC08 and GSC09 in the 2005 competition, Tom Pedersen (the GSC09 Chair) pointed out to the NSERC president that, "Kyoto, Walkerton, water, global change, permafrost, drought, extreme events, acid rain, earthquakes, volcanic eruptions, tsunamis are all keywords in the headlines of every newspaper; they affect the lives of all Canadians, and they all fall into the domain of the committees of GSC08 and GSC09". So why are we losing ground at the NSERC table? We are not getting our message out effectively, and this must change, at every level. Make your voice heard. The Reallocation process has clearly failed for some disciplines and should be abandoned more than reformed (at least in the present format). We need to find out how to recoupe the losses, not just halt the cuts. Let it call for transformation of the Reallocation system internally and the level of support externally.

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