REPORT ON THE DEPARTMENT OF MATHEMATICS,
UNIVERSITY OF WESTERN ONTARIO

Reviewers:
Edward Bierstone, Fields Institute and University of Toronto
Douglas Ravenel, University of Rochester

Date: April 20, 2010

The External Review took place April 8 and 9, 2010. We met first with David Wardlaw, Dean of the Faculty of Science. We had meetings with Linda Miller, Vice-Provost, Graduate and Postdoctoral Studies, and John Doerkson, Vice-Provost, Academic Programs and Students, as well as with several Associate and Assistant Deans of the Faculty of Science. We conducted interviews with the Department of Mathematics Chair David Riley, Associate Chair (Undergraduate) Ajneet Dhillon and Associate Chair (Graduate) Andre Boivin, and also with the Chairs of Applied Mathematics (David Jeffrey), Statistics and Actuarial Sciences (Bruce Jones), Computer Science (Robert Mercer) and Earth Sciences (Gerhard Pratt). We met more than half of the Department of Mathematics faculty, its two staff members, two postdocs and seven graduate students. Our schedule included a meeting with undergraduates, but none showed up. We also met with Matt Davison of the Departments of Applied Mathematics and Statistics.

We were provided comprehensive background information, planning documents and data that were very helpful in providing a clear picture of the Department and the Faculty of Science.

1. Recent achievements of the Department. Western can take pride in the recent achievements of the Department of Mathematics; in particular:

1. The funding for NSERC Discovery Grants in the Department has increased by 95% in the past 10 years and by 31% in the past two years alone. The recent big increase is a measure of the Department’s research strength and success in hiring young faculty, and is especially impressive in light of recent budget cuts at NSERC.

2. Enrolment in the Department’s PhD program has increased from 6 to 24 in the past 9 years. Total graduate enrolment is approaching 35 students, exceeding the Department’s ambitious targets set just two years ago. The current student/faculty ratio is comparable to that of the best Canadian universities. Although there might be room for further modest expansion, we believe that the university’s stated goal of 3.5 graduate students per faculty member is unrealistic for mathematics.

Recent Ph.D. students have been graduating mostly within four years and have been very successful in finding academic employment.
3. **Postdoctoral fellowship program.** The PDF program is admirable. The Department currently has 7 postdocs and is expecting 9 next year. PDFs in general have two-year appointments and teach two half-courses per year. Many of the postdocs are excellent teachers. They provide faculty-level teaching at less-than-assistant-prof salaries. The program is an effective way of bringing young people and new ideas to the department, and plays an important part in attracting new faculty.

The Department has found it challenging to hire highly qualified women in a competitive environment; the PDF's expected next year do include one woman.

*Caveats.* The PDF program should not be understood as a substitute for tenure-track positions, but as a complement to an appropriately-sized faculty needed for a stable research and teaching environment. PDFs have been financed in recent years by soft money; stable central funding would be desirable.

In general, the Department is collegial. Faculty, staff and students are upbeat and regard the Department as a pleasant place to work. A reduction in teaching load from four to three half-courses for faculty supervising at least one graduate student seems to be a good formula. But strains on the Department in the areas of budget, administration and faculty renewal threaten morale.

II. **The effect of budget cuts.** Last year the Department’s staff was reduced from three to two, when the least senior (nevertheless very long-serving) staff member was dismissed, apparently in a heavy-handed way. We were very impressed by the loyalty and dedication of the two remaining staff members, who are literally working overtime *without compensation* to handle the extra load due to the cut. About half the work of the former secretary has devolved onto faculty members; among other things, they now have to order their own textbooks, type their exams and reserve their own exam rooms. This is a poor use of university resources.

Suspension of the Concurrent Mathematics and Education program is unfortunate — the formation of math- and science-literate school teachers is vital to Canada's economic future. We believe that, if the number of participating Mathematics students makes it hard to justify the program during hard times, the Faculty should consider expanding the program to include other science departments.

Inadequate funding of a central department like Mathematics undermines the core of the sciences at the university and does a great disservice to its students.

III. **Major issues facing the Department.** The next chair of the Department will have to deal with two big issues that were raised during our meetings:

1. **School or Institute of Mathematical Sciences.** The question of reunification of the Departments of Mathematics, Applied Mathematics and Statistics
and Actuarial Sciences is much on the minds of all the faculty we interviewed. We were happy to be able to speak to the chairs of all three departments.

We understand that the Departments of Applied Mathematics and Statistics separated from Mathematics in 1966 and 1980, largely because of personality differences. The three departments have since gone in separate directions. We were nevertheless struck by the feelings of mutual respect among members of the three departments, and we got the impression that the members of each regard their colleagues in the cognate departments in high esteem. The three departments seem to have created very collegial communities. The relatively small size of each has had the beneficial effect of unity — members have worked in close cooperation to develop strength in certain areas in which the departments now have an international reputation.

Some of the faculty we spoke to suggested that the separation of the mathematical sciences departments has resulted in each of them taking rather extreme directions; in particular, that the Department of Mathematics is at the purest and the Department of Applied Mathematics at the most applied end of the spectrum. We believe that this is an oversimplified viewpoint which is not shared by all members of either department. Both departments have evolved along with current developments in mathematics which involve increasing interest in interdisciplinary problems.

There is admirable interdisciplinary research being done in both departments. For example, in the Department of Mathematics, Rick Jardine has been working on applications of algebraic topology to computing, and Dan Christensen, also trained as an algebraic topologist, has been working in theoretical physics and is currently supervising Ph.D. students in both Mathematics and Applied Mathematics. In the Department of Applied Mathematics, Linda Wahl is collaborating with biologists, and Matt Davison is collaborating with economists and statisticians in the area of financial mathematics. This is only a partial list of the transformative interdisciplinary projects underway in the mathematical sciences departments.

A divided discipline may lead to the neglect of certain areas on the interfaces of subgroups (though coherent subgroups may also have positive aspects, as we have noted). At Western, partial differential equations and probability are two big areas of great current importance in the mathematical sciences that are neglected. They need to be developed even for the purpose of undergraduate education. Other areas needing attention are discrete mathematics and scientific computation.

We believe that some form of reunification can be only to the benefit of all the mathematical sciences departments in the long term. It will give the mathematical sciences a much higher profile in the university. It will lead to more opportunities for interdisciplinary collaboration. It will make for broader and more attractive graduate and undergraduate programs. (The current division of courses between Mathematics and Applied Mathematics in
confusing to students.) The graduate and undergraduate programs and office support are areas that would benefit immediately from integration.

Nevertheless, any form of reunification can be carried out successfully only if it is done with great sensitivity to the needs of all people involved. There is fear that reunification might be a threat to certain areas, and even that some members of Applied Mathematics might want to flee to other science departments in the event of a merger. It is up to the Dean to reassure all parties that their subjects will prosper under new arrangements.

Moreover, although reunification might provide opportunities to rearrange administrative work for a more efficient operation, there is no room for further staff cuts — too much administrative and clerical work has already been shifted to the faculty.

We believe that some kind of umbrella structure (along the lines of proposals for a School or Institute of Mathematical Sciences) is the best way to begin the process of reunification, with integration of office support and programs for graduate and undergraduate students. Initially, it will be necessary for the three subgroups to retain autonomy in matters of hiring, promotion and tenure due to the differing evaluation criteria, research methodologies and publication practices in the three fields. It is reasonable to expect that Mathematics, Applied Mathematics and Statistics and Actuarial Sciences might evolve towards a single structure as the dynamics of the disciplines change. In the short term, however, it would be unwise to expect faculty in one group either to make informed judgements about the qualifications of existing and prospective faculty in another, or to be comfortable themselves being judged by members of another.

2. Teaching opportunities for graduate students. In the mathematical sciences, evidence of strong teaching skills has become a crucial factor in hiring decisions at all levels. Graduate students need teaching experience as well as letters of reference and evaluation data on their teaching; they are otherwise at a substantial disadvantage on the market for jobs, even at the postdoctoral level. Both the faculty and graduate students in the Department are well aware of this. At present, there are obstacles both to the systematic evaluation of teaching assistants and to having graduate students teach lecture sections in the Mathematics Department.

We heard several different accounts of the nature of these problems (some people attribute them to regulations of the faculty or graduate student unions), and we do not have a precise solution to suggest. The lack of teaching opportunities was identified as a problem in the 2009 Report of the Appraisal Committee to the Ontario Council on Graduate Studies, but the problem remains unresolved. At the beginning of our meeting with the Chair Selection Committee on the second day of our visit, it was suggested that solutions to the problems of lack of TA performance evaluations and graduate student
teaching experience are in the works. We would be very pleased if this were the case. Since the question is one of the two main concerns raised during our visit, however, we feel obliged to highlight it in this report.

A somewhat related issue raised by graduate students is that members of the Mathematics Department (and the science departments, in general) need to be more involved in graduate student and TA support programs that are available at Western. (For example, writing and speaking workshops are valuable to graduate students, but seem to attract little interest of faculty outside the arts and humanities.)

IV. Undergraduate recruitment. We did not have a lot of discussion of the undergraduate program, but the issue of recruitment was raised by several faculty members. The Department is very active in outreach to students beginning at the elementary school level. Promising school students in the region have sometimes profited from working with members of the Department for as long as ten years before beginning university. But the Department is rarely successful in competing with Waterloo for the best local students, even for those with whom it has had long contact. We support the suggestion that the University develop a program of generous “geek scholarships” to raise the level of undergraduates enrolled in science departments.

V. Current chair. We conclude by remarking that, during our meetings with the faculty, many expressed satisfaction with David Riley’s work as Chair and his contribution to the positive atmosphere in the Department.