External Review Report
Department of Chemistry
University of Toronto

Alan Campion
The University of Texas at Austin

Paul B. Hopkins
University of Washington

James L. Skinner
University of Wisconsin-Madison

February 4, 2008
Executive Summary

The Department of Chemistry of the University of Toronto has made significant progress towards achieving its goal of being generally recognized as among the premier chemistry departments in the world. Over the past decade the department has made the transition from very good to uniformly excellent through an aggressive campaign that included: 1) hiring a large number of exceptional, mostly junior, faculty members and ensuring their success by providing them with excellent space, start-up packages and mentoring; 2) building the new Davenport Research Laboratories, renovating the Lash Miller research space, and equipping the facilities with new state-of-the art instrumentation; 3) imaginatively restructuring the undergraduate curriculum to provide a better student experience for all, elevating the Teaching Stream faculty to positions of responsibility with expectations for excellence in teaching and research, and re-engaging the Research Stream faculty in teaching the first and second year courses and laboratories; 4) designing and constructing new undergraduate teaching laboratories that are flexible, efficient and attractive to serve the needs not only of Chemistry Program students but those from other departments and faculties—these laboratories are uniquely effective and their design is likely to be widely replicated on other campuses worldwide; 5) successfully increasing the size of the graduate program in advance of the Provincial initiative to do so and carefully managing the increase in part by growing the graduate programs at the Mississauga and Scarborough campuses. The Department can now be considered distinguished by any measure for the quality of its scholarly work, the excellence of its undergraduate program and the contributions its graduates make to the scientific and economic development not only in Canada but also around the world. Sustaining the progress made over the past 50 years, and particularly over the past decade, will require considerable and consistent institutional support and, in particular, the continued close collaboration between the Department and the Faculty of Arts and Sciences.
1. Introduction: the review process

Members of the external review committee for the Department of Chemistry were invited to serve by the Dean of the Faculty of Arts and Sciences and the schedule for the visit was agreed upon in mid-July 2007. Details of the schedule were worked out in early October and binders containing background material for the review were delivered well in advance of the visit, giving the review team ample time to prepare. The binders contained the schedule and instructions for preparing the written report. It also contained the Department’s Self-Study, assembled by the Chair in consultation with the Department’s numerous stakeholders, that presented a comprehensive review of the past 10 years of achievements, challenges and opportunities and plans for the future. Extensive supplemental information and supporting documentation were also provided that proved especially helpful (almost essential) to the committee members who are all on faculty at American public universities. Key elements that helped us put the current status of the Department in context as well as judge its progress against previously stated goals included: Solidifying the Foundation: Chemistry’s Academic Plan (2004) and the Decanal Response to that plan; the Brief for the Periodic Appraisal, External Consultants’ Appraisal and Dean’s response in connection with most recent OCGS Periodic Appraisal (approved March, 2005); and the Report of the Cluster 8 External Review Committee, submitted in April, 1999. These materials greatly helped us understand the state of the Department in the late 1990’s, and the factors that led to the development and implementation of strategic initiatives. Additional information that was indispensable included Faculty CV’s and Awards, Undergraduate Programs of Study, Undergraduate and Graduate Course Listings, and the Undergraduate Survey of Student Engagement. Finally, the Undergraduate Handbook, the Alumni magazine Distillations, the Environmental Colloquium Brochure and the 2006 – 2008 Colloquium Schedule were very helpful in assessing the climate of the Department.

The committee met in private on the evening of November 4, 2007 to plan our visit, which covered two full days on site, November 5th and 6th. We began with a breakfast meeting with Dean Sinervo and Vice-Dean Gertler to share our initial impressions based upon the written materials received as well as to ask if there were any issues of special interest or concern from the Dean’s perspective. We were specifically asked to comment on the growth of the graduate program, on the restructured undergraduate curriculum and on the redefined role of the Teaching Stream faculty and on the climate of the Department. The Chair, Scott Mabury, gave us a tour of the Department’s facilities and we then met with him and the Associate Chairs to review the Department’s structure and function and to identify areas of particular concern from the Department’s perspective. We were asked to assess the adequacy of institutional resources made available to the Department to meet its teaching and research obligations. The rest of the visit was devoted to meeting with and hearing about the Department from faculty, staff and students, organized along disciplinary or functional lines. We met the faculty of each of the traditional divisions in groups but also had separate opportunities to meet the new faculty for lunch as well as the faculty from the UTM and UTSc campuses to discuss issues of particular relevance to them. We had separate meetings with the Administrative and Technical staffs to help us understand internal staffing issues, and with a group comprising three chairs of other departments and an academic advisor to help us understand how other departments and units on campus perceive the Department. We met with a select group of undergraduate students and also
with a group of graduate students and postdoctoral fellows. We had the opportunity to visit with the students again in an informal setting at one of their monthly Chem Club functions and with the faculty at dinner. All in all we met with nearly 150 faculty, staff and students who were very receptive to our questions and very candid and forthcoming about their experiences. The visit ended with an opportunity to ask follow up questions of the Chair and a discussion of our observations and preliminary conclusions and recommendations with Vice-Dean Gertler. We believe that the written materials provided and the intensive two-day visit have given us a comprehensive view of the Department that forms the basis for this report.
2. Faculty

(a) Overview: quality of research activities in the department overall and in specific disciplines

The quality of the faculty in the department is very high indeed, comparable to those in the best departments in U.S. public universities. They conduct research at the forefront of chemistry and related interdisciplinary fields and the impact of their work has been substantial. There is a nice balance between efforts to advance the traditional chemistry subdisciplines and interdisciplinary work. And, while the faculty is committed to a recruiting strategy that seeks the best candidates irrespective of field, we note that they have been successful in developing some depth in the interdisciplinary areas they have chosen to focus on, such as environmental chemistry and biological chemistry. We believe that having a critical mass in each of the interdisciplinary areas, especially at the UTM and UTSc campuses, will be key to their successful development and we commend the department for paying attention to this issue.

The quality and impact of the department’s research can be judged by both quantitative and subjective measures that consider both the generation of new knowledge and understanding, as well as the production of well-trained young scientists. We can synthesize and put into context the data made available to us but we were also asked for an impressionistic assessment, which may be equally useful. (This not an exact science; the National Research Council devotes more pages to methodology than it does to the rankings themselves in their decennial assessments of U.S. graduate programs!)

Productivity, as measured by the number of scientific publications, is second only to Berkeley among the peer group selected by the Department. Productivity per faculty member is higher than Berkeley’s. We assessed the quality of their research by examining the individual faculty *curricula vitae* and through our own personal knowledge of the work, where possible. The vast majority of their publications appear in the most highly respected, peer-reviewed journals in their fields, which attests to their quality. Of the faculty members whose work we know, we can state unequivocally that it meets the highest standards. Although we had only limited interactions with the rest of the faculty, graduate students and postdoctoral fellows during our visit, it was clear to us that they are working on important problems and that they set and meet high standards for themselves. The number of citations per article published is another commonly cited measure of impact; here too, the department’s record is impressive. Finally, the number and stature of national and international awards bestowed upon the faculty demonstrates clearly that their peers worldwide hold them in the highest esteem.

Educating and training M.Sc. and Ph.D chemists to become independent and productive scientists is as important a mission for the Department as advancing our understanding of chemistry through research. The faculty have been exemplary in this regard. We have reviewed the list of recent graduates and their current positions and commend the department for producing such well trained and highly sought after students.
(b) Recruitment and retention of junior faculty

The department has been extraordinarily successful in recruiting and retaining superb junior faculty over the past decade. More than 90% of those initially appointed as Assistant Professors have been promoted to Associate Professor, with tenure, a sure sign that considerable attention was paid during recruitment to identify the best young candidates available and that they were provided the support they needed to succeed. The eight junior faculty members we met were trained at the top departments in the world, both as graduate students and as postdoctoral fellows. Their research interests are varied and, although the department has taken great care to ensure that they hire only the best scholars, irrespective of area, each one has a home, either in one of the traditional subdisciplines or in one of the interdisciplinary focus areas.

We commend the department for its approach to recruitment and start up. The candidate is contacted within a day or two of the faculty vote and invited back for a visit to discuss space, startup, housing, etc. This approach builds upon the momentum generated during the interview and quickly establishes a connection to the department, we were told. The junior faculty also appreciated the flexibility offered with respect to the timing of their appointments. They were allowed to finish up their postdoctoral research, if desired and/or outfit their laboratories before arriving on campus so that they could hit the ground running. We understand that it is also possible to apply for an initial NSERC grant prior to arrival. These are enormous benefits not only for the young faculty member but also for the Department, especially given the shorter tenure clock they face in comparison to their U.S. counterparts.

We note that the Department conducted 11 searches over the past four years resulting in 10 hires. This is a success rate unheard of in the U.S. and it speaks volumes about the collaboration between the Department and the Dean that allows more than one appointment per search when two outstanding candidates are identified. It also demonstrates a level of trust between the units. Multiyear resource commitments may be pooled as needed and the Department has shown that it will not make an offer solely out of fear that a slot will disappear. We encourage both units to continue this very healthy and productive collaboration.

The research stream assistant professors with whom we met seemed satisfied with their experiences. They were appropriately focused on establishing their research and teaching programs. Senior faculty helpfully directed new graduate students towards the assistant professors to help them get established. Most indicated they have identified one or more mentors among the faculty from whom they receive advice that they value. They expressed satisfaction with the level of feedback they are receiving concerning institutional expectations for their performance. They also commented favorably upon the support and mentoring they receive in their teaching from the teaching-stream faculty. Nevertheless, the committee recommends that as a pre-emptive measure the department consider implementing an annual meeting of the chair (or an evaluative/coaching committee appointed by the chair) with each assistant professor. These meetings can serve the valuable dual purposes of causing the assistant professor to reflect annually on and document progress to date and plans for the coming year, and for the chair (or his/her delegates) to comment upon the progress and plans. Particularly when the outcomes of
such meetings are documented, they can reduce the likelihood of misunderstandings between an assistant professor and the institution (which can yield unpleasant results).

(c) Teaching stream faculty

We feel that it is appropriate to comment on the teaching faculty separately here because the Department has re-defined the role of the teaching faculty, giving them much more autonomy and responsibility and clear expectations for their professional development. The teaching faculty, in consultation with the research faculty, are primarily responsible for the development and delivery of the undergraduate courses and laboratories for the first two years of the curriculum. We believe that the model developed by the Department is working extremely well. More senior faculty are now teaching the first and second year courses than in years past, giving the students an opportunity to learn from these distinguished scholars. The teaching faculty coordinate the courses, ensuring consistency and continuity. The junior research faculty expressed their appreciation for the mentoring they received as they began their teaching careers. The teaching faculty are expected to conduct research either in chemistry or in a related interdisciplinary field, or in chemical education; the number of papers published by members of the department in chemical education has more than tripled since the role of the teaching faculty was re-defined. It was clear during our meeting that the teaching faculty feel valued by the department and that there is mutual respect between the research and teaching faculty.

The committee was specifically asked to assess the unusual model that Chemistry has pursued, increasing the number of teaching-stream faculty members while reducing the number of research-stream faculty members. The logic of this choice is inescapable: Toronto faced a limited amount of research space and a relatively high demand for undergraduate instruction, especially labor-intensive laboratory instruction. The situation they found themselves in is obviously best accommodated with a reduced research stream faculty count and increased teaching stream count. Nevertheless, it is nearly unheard of in our experience for a Department to explicitly recommend and adopt such a course of action. The plan has been phenomenally successful as evidenced by undergraduate student satisfaction, an engaged and valued teaching faculty and research faculty who feel that their research programs are supported by an adequate infrastructure.

It is also worth noting that while the teaching stream faculty count is at the high end, it is not wildly out of line with the U.S. system. It is not unusual for top U.S. chemistry departments of ca. 35 research stream faculty to have a complement of 4 FTE of teaching stream faculty. What is unusual, and laudatory in our view, is for the teaching faculty to be so highly regarded by the research faculty and not viewed as a distinctly second tier.

(d) Age and gender distribution

We commend the Department on its proactive approach to recruiting energetic young faculty in general, and women in particular. We were struck by the vibrancy of the faculty whose median age is about 45 today, compared with 54 a decade before. We were also struck by the number of women on the faculty, something like 20 – 25% of the research faculty members on the St.
George campus. This is a remarkable achievement compared to the best departments in the U.S., which average between 10 and 12% women faculty members, and we encourage the Department to continue to seek out and offer opportunities to the best women faculty candidates.

3. Undergraduate Education: structure, content and quality of the program

Comprehensive reforms in the undergraduate curriculum, the elimination of contract limited term appointments in favor of an expanded Teaching Stream Faculty and the renovation of the undergraduate teaching laboratories have transformed the undergraduate student experience in chemistry. By every measure—our own assessment of the course content and organization, the enthusiasm expressed by both the teaching stream and research stream faculty, the student surveys we reviewed and the anecdotal impressions gleaned from a very bright group of undergraduates we met—this reform has been phenomenally successful. Since the components of the reform were implemented at about the same time it is difficult (and probably not very useful) to assess their impact independently. What follows, then, is our assessment of the undergraduate program as a whole. Details can be found in the 2007 Self Study but we review the essential features here for completeness and to put our comments in context.

Structure

The department offers a wide variety of course to meet the needs of both Chemistry Program students and those students in other majors for whom some chemistry is a requirement for the degree. Prior to the 2000/2001 academic year the first two year-long courses in chemistry were the traditional “General Chemistry” course in the first year followed by the introductory “Organic Chemistry” course in the second year, both courses having a laboratory component. In recognition of the fact that entering chemistry students in Canada typically have had two years of high school chemistry, taken in the 11th and 12th grades (as opposed to the typical student in the U.S. who most often takes only one year, in the 10th grade) the department decided to eliminate one semester of essentially review material from the curriculum for students not majoring or minoring in chemistry or seeking one of the chemistry specialist degrees, reducing the introductory requirement from 2.0 courses to 1.5 courses. The two new first year courses created can be taken in any order, one covering essential general and inorganic chemistry topics and the second being an introduction to organic chemistry. A one-semester course in organic chemistry taken in the second year completes the chemistry requirement for students not in the Chemistry Program. Most of the students taking these courses are majoring in the Biological Sciences. Students in any of the various Chemistry or Chemistry Specialist Programs are encouraged to take a different sequence in their first year, a year-long course that covers introductory physical chemistry in more detail as well as introductory organic chemistry to better prepare those students for more advanced work in chemistry.

The Committee believes that the structural changes implemented in the first two years of the curriculum were well thought out and meet the needs of students enrolled in chemistry, irrespective of major. Although developed, in part, to address the logistical issues associated with rising enrollments, we believe that the changes are justified on pedagogical grounds alone.
The department offers a wide variety of degree plans for Chemistry Program students that are well designed to prepare them either for employment immediately after graduation with their B.Sc. degrees or for postgraduate education in chemistry, the health professions or other fields. The structure of the program has been well thought out, giving students many options but also very clear guidance to help them choose among them.

Students can major or minor in chemistry or enroll in one of six Specialist Programs, which are distinctive, in our view. They may specialize in Chemistry, Biological Chemistry, Chemistry and Geology, Chemical Physics, Environmental Chemistry or Materials Chemistry. These programs require significantly more science and mathematics courses than either the major or the minor and provide students with considerable depth and breadth in each area. It appears to us that students in these Specialist Programs take more math and science courses than those required for the American Chemical Society certified B.S. in Chemistry, the most rigorous of the degree plans offered in the U.S. and that they will be especially well prepared for immediate employment or for graduate school.

Content

The department offers an astonishingly broad array of advanced courses in support of the Specialist Programs. Many of these appear to us to be the equivalent of special topics graduate courses in our departments (and are cross listed as such in their catalog); students are fortunate to have exposure to so many courses that will enhance the breadth and depth of their education. Courses like Environmental Chemistry, Atmospheric Chemistry, Materials Chemistry, Biomolecular Chemistry and Polymer Chemistry will introduce students to emerging multidisciplinary fields. Advanced courses in the traditional chemistry subdisciplines will prepare students to conduct original research as undergraduates or to pursue advanced study in graduate school. The Committee commends the department for the breadth and depth of these offerings. Finally, the department encourages students to do research as early as in their first year by enrolling in a research course (CHM 299Y) under the supervision of either a teaching or research faculty member. Enrollment in this course has risen dramatically in recent years and about half the students work under the supervision of a teaching stream faculty member. We believe that this arrangement is healthy for the professional development of the teaching faculty as it encourages them to become and remain active in research. Undergraduate students have many other opportunities to do research, which include summer programs, an international exchange program and the fourth year research course CHM 499Y that culminates in the writing of a thesis. The number of undergraduate students engaged in research more than doubled during the 2001-2007 period, an achievement for which the Department is to be commended.

Quality

We have reviewed selected syllabi and required textbooks to get a feel for the level and quality of the courses and laboratories offered. We also solicited the opinions of the undergraduate students with whom we had lunch. Finally, the survey of student engagement provided by the department was very useful to us. By all measures, the undergraduate program is an outstanding success. The courses are taught at a high level, which is appropriate given the stature of the department and the excellent high school preparation of its students. The student surveys (despite
the confusing phrase "re-take rate") clearly show that the students feel that they are getting a
good education and, if they had to do it over again, that they would take the same courses. They
also reported positive laboratory experiences, in stark contrast to their evaluation of the teaching
laboratories prior to their renovation. Having walked through the new labs it is easy to see why
they enjoy doing experiments there. The enthusiasm of the undergraduates is palpable; as one of
us put it in his initial notes "the students are vivacious and fired up". It's an apt characterization.
Finally, we also noted a very high retention rate, another important measure of success; it
appears that between 50 and 60% of the students who enter the Chemistry Program graduate
with chemistry degrees, a remarkably high yield.

4. Graduate Education: structure, content and quality of the program

The structure of the graduate program is very similar to those with which we are familiar in the
U.S. The M.Sc. degree requires two half-year courses and a thesis reporting the results of
original research; the Ph.D. degree requires four to six half-year courses and a dissertation
reporting the results of original research. Major fields of specialization include: Analytical
chemistry, Environmental Chemistry, Inorganic Chemistry, Organic and Biological Chemistry,
Physical Chemistry and Chemical Physics (with Theoretical Physical Chemistry as a
subspecialty) or Polymers and Materials Chemistry. Combinations of these fields are permitted
and are classified as Interdisciplinary. Students take cumulative and/or comprehensive
examinations depending upon their chosen major, and are required to participate in seminar
programs and to present at least one seminar.

The content of the program is also comparable to those with which we are familiar. The graduate
courses offered provide ample breadth and depth and prepare students well for their research.
We did hear that some students found it difficult to take all of their required courses before the
beginning of their third year due to the rotation of these courses. We also heard from some of the
faculty that they were not happy with the way that graduate course assignments were handled
and that they would appreciate the opportunity to provide their input or meet to work out the
assignments collaboratively. We suggest that the Associate Chair for Graduate Studies look into
these issues, since they are coupled, and see how best to resolve them.

The quality of the program is excellent, as judged by the placement of its graduates and from the
discussions we had with a large of number of graduate students and postdoctoral fellows at
lunch. Mentoring is excellent and the formal annual meetings with supervisory committees are a
real resource for the students, one that they specifically brought to our attention as something
that they appreciate. The opportunity to get the advice of faculty members other than the advisor
is invaluable, in our opinion, and this mechanism undoubtedly makes it easier for the students. It
also ensures that they are making timely progress towards their degrees. The normative time to
the Ph.D. is an impressively short 4 to 4 ½ years, compared with the U.S. average of 5 ½ years.
The students also pointed out that informal mentoring is offered and welcome. One student, in
particular, appreciated the spontaneous offer of one of the women faculty members to talk with
her about the opportunities and challenges for women in academia once she learned of the
student’s interest in an academic career.
Our luncheon with some 25 graduate students mirrored our experience with the undergraduates. These students were bright, happy, and articulate. They voiced no serious concerns with the programs. They seemed well satisfied with their choice to attend the U of T, and their experiences there. In addition to lunch, we were treated to one of their monthly Chem Club events, organized by the graduate students but open to the entire Chemistry community. Chem Club raises funds to support a wide range of academic and social enrichment activities as well as undergraduate scholarships. It does a remarkable job of bringing the entire Chemistry community together. We had the opportunity to visit informally with a number of graduate students during the Chem Club event and found them to be engaging, with unusually broad interests.

It is laudable that Chemistry has grown its graduate program by some 40% in recent years, from 180 to 250, and that it had a plan in place to increase the visibility and impact of its graduate program to meet its own goals before the Province provided an additional incentive to do so. In response to the initiative, the Department ramped up its growth rate to meet its own internal goals three years early. The graduate student count is comparable to top-quartile departments in the U.S. The health of a Chemistry Department turns on having a critical mass of talented and motivated graduate students who pursue research in close collaboration with the faculty. Toronto has now achieved this critical mass and it has handled the process in an exemplary manner.

5. Relations with other units: Departments, Faculties, Campuses, Centers, Institutes and Colleges

Three-Campus System

The committee left with no doubt of Chemistry’s commitment to develop a three-campus graduate program. That large challenges remain, though, was clearly evident. One of the two newer campuses (UTSc) reportedly has (or shortly will have) excellent space but not enough graduate faculty, whereas UTM has a critical mass of graduate faculty but insufficient or inadequate research space. We also heard one anecdotal comment that attracting graduate students with interests in biophysical chemistry to one of the newer campuses was problematic. Providing the resources necessary to achieve Chemistry’s (and indeed the institutional) goal of growing the graduate program will require the active collaboration of the three deans involved (FAS, UTM and UTSc). The chair of chemistry has been insistent that graduate faculty with undergraduate appointments in one of the branch campuses have setup funds, facilities and salaries that are comparable to those at the St. George campus. The committee strongly supports that position; it is essential to avoid having a two-tier research faculty. It is our understanding that the campus deans are responsible for funding these faculty members so we encourage the Dean of FAS and the Chair of Chemistry to work closely with these deans to ensure that they understand the costs and benefits of a fully functional graduate program operating on their campuses and that cooperation will be necessary to achieve their mutual goals.

Every effort must be made to increase the interactions between the branch campuses and the St. George campus. Graduate education in chemistry requires a substantial and proximal infrastructure of instrumentation and staff who support it. The department has addressed this
issue, in part, by aggregating research faculty with common interests at each campus (biological chemistry at UTM and environmental science at UTSc) and providing essential instrumentation support at each campus. Nevertheless, there is a substantial amount of instrumentation available only at the St. George campus that should be readily available to faculty, students and postdocs at the other campuses. Shipping samples back and forth for analysis is not sufficient; interaction with the senior scientists and technicians who run the facilities is an indispensable part of graduate education.

Transportation between the branch campuses is a serious challenge, one that affects not only the ability of researchers to use the instrumentation facilities but, perhaps more importantly, to interact with visitors who participate in the departmental colloquia. In our collective experience, interactions of this type are an extremely important component of graduate education and serve to increase the visibility of the Department externally (more on that elsewhere). We recommend that convenient, regularly scheduled shuttles run between the campuses at no cost to members of the campus community and that these shuttles be of such quality and convenience that the service will encourage their use.

In addition to improving intercampus transportation the committee recommends that Department establish reliable and easy-to-use video conferencing facilities to support two-way participation in colloquia and other (for example, divisional) seminars. We recommend that videoconferencing capabilities be available not only in the main Davenport seminar rooms but also in at least one other location to support conference calls between research groups or between researchers and professional staff responsible for instrumentation or other facilities.

Interaction with other units

The committee had only limited opportunities to assess the level and quality of interactions with other units but those interactions that were reported to us were uniformly positive, even laudatory. In particular, the meeting we had with externals—the Chair of the Department of Physics, the Chair of the Department of Chemical Engineering, the Undergraduate Chair of the Department of Ecology and Evolutionary Biology and the Director of Student Affairs—provided us with a remarkably consistent view of a Department that serves its external constituency in an exemplary manner. These interactions span a broad range; they include, for example, quality education for the undergraduate students not in Chemistry programs, cooperation in transferring the undergraduate Chemical Engineering teaching laboratories to the newly renovated Chemistry space, to the benefit of all, and engagement by Chemistry students in programs outside their discipline that are designed not only to increase the breadth of their educations but also to interact with the University and external communities at large. These externals characterized the Department as “A model department for the student experience.”

6. Departmental administration

The department has long functioned with what we would call a “strong chair” or “head” leadership style in the U .S., and that style has served them well over the years. In particular, we were impressed with the imaginative transformation of an already fine department into a truly
distinguished department, a transformation initiated by Martin Moskovits, capably continued by Dave Farrar and now largely completed under the leadership of Scott Mabury. By design, the Department makes very limited demands upon faculty time for committee service, faculty meetings, etc. The Chair and Associate Chairs (who deserve a great deal of credit for supervising the day-to-day operations of the department) are an effective management team that ensures a well-run operation. A superb administrative and technical staff, whose members are all invested in the Department's success, supports them. The staff clearly expressed their dedication to and enthusiasm for the Department in our meeting with them.

Scott Mabury's leadership deserves special mention. Everyone with whom we spoke—faculty, staff, students, the Dean and Associate Dean—expressed their thanks and admiration for his untiring efforts on behalf of the department. He consults when necessary, moves with consensus on the larger issues (faculty hiring, for example) but trusts his instincts and experience to move the Department forward where the issues are ones of management and not governance. The Department will be lucky to find a successor with his vision and talent.

7. Facilities and support staff

The Department's support facilities are extensive and excellent. Instrumentation, computational facilities, the library, machine shop, glass shop, and stores are all well equipped and maintained at the state-of-the-art. It appears to us that there are more opportunities for "hands on" access to the specialized instrumentation by graduate students than is typical in our institutions—this is healthy in our view and the department (and staff, in particular) is to be commended for their efforts.

We heard concern expressed about the difficulty in finding operating support for major research instrumentation beyond the first five years, for which we understand that there is the possibility of a separate grant associated with the equipment acquisition proposal. We also heard concern expressed about the difficulty in adding instrumentation in core facilities (e.g. NMR) to meet expanding needs. We are sympathetic on both of these issues because we face them as well but, on balance, it appears to us that the Department is faring at least as well, if not better, than its U.S. counterparts.

The Department has documented the need for at least six additional permanent staff members and has proposed that these positions be funded as part of a conversion of research stream faculty lines into teaching stream faculty positions and staff positions. The committee commends the Department for proposing a comprehensive solution to the combined problems of increasing enrollments and fixed amount of research space and the Faculty Planning Committee in Arts and Sciences for approving the proposal. The number of staff positions requested is on the lower side of the range that could easily be justified on the basis of the size and quality of the graduate program—in our departments, with programs of similar size and quality, we have between 45 and 50 institutionally funded staff positions, compared with the 42 positions that would result from the proposed increase. The committee recommends that funding be provided to support at least the six new positions requested and that Chemistry be allowed to "borrow" against future retirements to get the required staff in place as soon as possible.
8. Future directions

The progress made by the Department over the past decade has been remarkable. It required strategic thinking and planning, strong leadership by several chairs, buy in from the faculty and the support of several A&S Deans. The Department has demonstrated that it can develop sound plans to substantially strengthen all of its programs in the face of known constraints, that it can execute those plans on, or in advance of, schedule and that it is capable of raising significant funding to support its efforts. We believe that the plans set forth for the future represent a coherent vision for sustaining the excellence already achieved and for propelling the Department forward. We encourage the Faculty of Arts and Sciences to continue to support the Department as it strives to achieve its goals, with specific recommendations enumerated below.

9. Climate

The Department has a strong sense of community and all members are clearly invested in its success. Faculty, staff and students were happy and engaged. There is a great deal of trust between these groups and the Chair (and his office), and a clear sense of mutual trust and respect between the Chair and the Dean of A&S. The high level of trust established is commendable and we encourage its continuation as new leaders are selected for both units.

We met with the vast majority of the tenured research-stream faculty in groups organized by sub-field of chemistry. As one would expect for an ambitious faculty, these sub-groups reported various agenda items that would improve their ability to pursue their professional activities. What was striking to the committee, though, was the absence of any problems that resonated across the faculty. We take this as strong evidence that this Department is functioning at a very high level. The assistant professors with whom we met seemed satisfied with their experiences. They were appropriately focused on establishing their research and teaching programs. They commented favorably upon the support and mentoring they receive in their teaching from the teaching-stream faculty. The teachings stream faculty also expressed satisfaction with their professional situations. They feel that their contributions are valued.

A number of faculty members expressed interest in establishing closer ties with other departments and interdisciplinary activities. It was difficult for us to tell whether there are barriers to fostering such interactions or if it is primarily a communications issue. We were told, for example, that the A&S website was not a particularly useful source for upcoming seminar announcements but given the size of the faculty perhaps that’s not so surprising; it could be overwhelming to list everything of potential interest. We suggest that the Chair look into this issue to see what the Department can do to facilitate the interactions the faculty seek. If it’s just an awareness issue there are a number of easy fixes. Faculty could ask to be added individually to e-mail lists of departments, institutes or interdisciplinary programs that interest them. Someone in the Department could compile a weekly “On Campus” list of seminars likely to be
of interest to Chemistry faculty, staff and students and either e-mail it or post in on the Departmental website. Various schemes of this type have worked in our departments.

Interest in a Commons room was expressed. We believe that this can be a very effective mechanism to foster contact and encourage collegiality. They are in widespread evidence in the U.K. and the Chemistry Department of the University of Washington has recently established one that has been very well received. We suggest that the Chair explore this idea with the faculty to see if there is broad interest and, if so, develop a plan to secure one.
Recommendations

1. The committee recommends that the institution fully fund the Department’s TA budget, with perhaps 80% being derived from an increase in the base budget and 20% to be argued for annually as OTOTA funding. Undergraduate teaching is a core institutional responsibility and we have confirmed that the time allocated to teaching assistant assignments is fully devoted to those assignments; as far as we can tell there are no “light” assignments that, in effect, support a student’s research. We recognize that units experiencing enrollment growth will ask for additional resources but are generally reluctant to release them as enrollments decline. We think that it is unlikely that the demand for Chemistry courses will diminish significantly in the foreseeable future and that having 20% or so to be argued for annually will provide sufficient institutional flexibility to meet changing needs. As a matter of principle we believe that it is unreasonable to ask Chemistry to fund a significant portion of its TA budget from precious discretionary sources. As a matter of practice we are confident that releasing those funds will allow Chemistry to be imaginative, but responsible, in enhancing its programs.

2. The committee recommends that the Department be allowed to make the six staff appointments already approved in advance of upcoming retirements and that some consideration be given to making additional appointments. The Department is clearly understaffed by comparison to its peers in the U.S. and the lack of support compromises its ability to compete at the highest levels. We understand the uncertainty associated with the end of mandatory retirement as it relates to planning but we believe that the Department’s need is real, well justified and urgent.

3. The committee recommends that the institution either increase the Department’s base budget or redirect overhead generated by, but not currently flowing to, the Department to support its research efforts. It appears that the Department is covering about $500,000 annually in indirect, but very real, costs from its precious discretionary funds. The committee recommends that the institution allocate to the Department its share of the overhead provided by the Federal Granting Council that is intended to cover indirect costs. Departmental discretionary funds should be used for enhancement, as mentioned above.

4. The committee recommends that the Deans work closely with the Department to ensure that only the very best graduate faculty candidates are appointed to the undergraduate faculties of the UTM and UTSc campuses and that salary, space and startup funds comparable to those of the St. George faculty be provided to ensure their success.

5. The committee strongly recommends that the Department consider expanding its colloquium and seminar programs to increase the number of visitors from outside Canada in order to enhance its visibility and also to improve graduate education. The excellence of the Department is evident to those who visit; increasing visibility is a key next step toward achieving the international recognition it seeks. Seminars presented by external speakers also provide invaluable sources of breadth in graduate education. We recommend that the Department survey peer departments in the U.S. and ramp up the frequency and breadth of their offerings. We recommend that the additional funding required be provided by the Dean of A&S in recognition of the fact that Chemistry seminars are of widespread interest to A&S faculty and students.