

FOR INFORMATION

**SIMON FRASER UNIVERSITY
OFFICE OF THE VICE-PRESIDENT, ACADEMIC**

MEMORANDUM

To: Senate
From: J. M. Munro, Chair
Senate Committee on Academic Planning
Subject: External Review - Department of Chemistry
Date: March 13, 1995

Attached for the information of Senate is a summary of the external review of the Department of Chemistry which was carried out in June 1994. The report and the response of the Department were reviewed by the Senate Committee on Academic Planning at its meeting of March 8, 1995 and the Committee approved a motion to receive the report. The full report and the response by the Department are available from the Secretary of Senate for senators to review.

The review team had the following membership:

Chair: Dr. Russell J. Boyd
Department of Chemistry
Dalhousie University

Members: Dr. Howard Alper
Department of Chemistry
University of Ottawa

Dr. Walter E. Harris
Department of Chemistry
University of Alberta

Dr. Rachel E. Klevit
Department of Biochemistry
University of Washington

Dr. Manfred J. P. Mackauer of the Department of Biological Sciences was the internal member of the committee.

J. M. Munro

External Review - Department of Chemistry

Summary

The Department offers a broad range of undergraduate programs and has a strong commitment to undergraduate teaching. The facilities in biochemistry and organic chemistry are especially good, while those in the other areas of chemistry have received much less attention and are less up-to-date. Curriculum revision is an on-going process, but there is an immediate need for further changes in upper-division lecture and laboratory courses in analytical, inorganic, organic and physical chemistry.

Despite the short history of the University, the Department has built up a fairly large graduate program with about 60 students enrolled in M.Sc. and Ph.D. programs. Typically about 60% of the graduate students are enrolled in the Ph.D. program. The most pressing needs are to improve the administration of the graduate program and the quality of the graduate students. Constructive steps to address the concerns raised by the external reviewers should reduce the average completion time for the M.Sc. degree by 4 semesters. Similarly the completion time for the Ph.D. degree should be reduced by 3 semesters. The current completion times are much too long.

The Department is well supported in terms of the complement of professors, and overstaffed, in the view of some external reviewers, with instructors and support staff. There is a need to improve the administrative procedures and to develop a more collegial approach to decision-making. Also, some groups have abdicated their responsibilities to others and therefore corrective measures are necessary.

Research funding has been increasing at a very impressive rate of 15% per year during the past decade. This has been achieved as a consequence of many excellent appointments during the past 6 years, plus the willingness of faculty members to seek out non-traditional sources of funding and to engage in interdisciplinary research.

The Department has been receiving good financial support from the central administration, but there is a strong case for renovation of some teaching laboratories and for the provision of more office space. The undergraduate program would be strengthened by providing space for a resource centre.

The future of the Department is bright. With nearly half of the professors retiring in the next decade, there is an excellent opportunity to build upon present strengths and to recruit new faculty members in carefully chosen branches of chemistry. While the achievements of the first three decades of the Department have been noteworthy, the potential for the next decade is even greater. The key ingredient will be strong leadership within the Department and within the administration of the University.

Department Response

Undergraduate program

The External reviewers did not identify any serious flaws in the program and seemed to be suggesting ways to make a good program better.

In regard to the general chemistry 100 level courses they noted that, similar to all Canadian universities, a high percentage of chemistry enrollments are in service courses. Furthermore, these courses are key prerequisites for the study of many science and related disciplines. 100 level courses must meet the needs of non-chemistry students and at the same time provide a sound base for students pursuing a chemistry degree.

The reviewers had specific recommendations for course changes in some of the specialty areas of chemistry. The department is in general agreement with these suggestions and had already noted that improvements were needed. In fact, the Department is currently reviewing its total undergraduate program with the aim of revitalizing and modernizing its offering. Modernization of the physical chemistry teaching laboratory will also be undertaken as resources permit.

The Department acknowledged that some graduate students with limited English communication skills should be encouraged to increase their English proficiency before taking on TA appointments, and will continue to monitor this concern.

Graduate program

The Graduate Studies Committee agrees that the Department should strive to have students complete their M.Sc. and Ph.D. programs in 2.0 and 4.5 years respectively. There is some concern that it will be difficult to reduce the time in the program due to the financial support arrangements for graduate students. Special efforts will be made by the Graduate Studies Committee to undertake new strategies for recruiting graduate students and to prepare updated information on the program and scholarships for students entering the program.

Administrative Structure

The reviewers felt that the committee structure of the Department was appropriate in principle. They did, however, recommend that the job descriptions of the Laboratory Coordinator and the Departmental Assistant be reviewed. They were particularly concerned that academic advice was currently the responsibility of the Laboratory Coordinator rather than a faculty member.

The reviewers were also concerned with some safety issues and recommended that the Department ensure that safe practices be followed. The Department does take safety seriously and has mechanisms in place to teach safe practice and identify unsafe situations. Laboratory safety courses are offered each fall semester and special first-aid courses are available. Safety practices and compliance procedures will need to be developed.

Faculty

Although the reviewers made no recommendations in regard to the faculty, they did comment that the number of faculty was appropriate for the Department's undergraduate and graduate programs. However, two of the reviewers did think that the number of laboratory instructors was more than needed. The Department has considered this comment and has come to the conclusion that the comment may have come from a lack of knowledge of how the SFU trimester teaching programs differ from the normal year program found at most universities.

Support Staff

Some of the reviewers identified what they perceived as a surplus of technical support in the teaching laboratories. The Department has discussed this issue at some length and feels that the reviewers did not completely understand the different mode of operating teaching laboratories at SFU. The Department has historically placed great emphasis on the laboratory component of the student's chemical training. For this and other reasons, it has separated out the laboratory component as separate courses where greater emphasis on experimental skills can be taught. Most other institutions conduct laboratories as part of the corresponding lecture course. The importance and attention placed on this aspect of the SFU program is sometimes overlooked.

Laboratory instructors provide a continuity and consistency to a laboratory course which is very difficult to accomplish with the trimester system and concomitant course offerings. Courses are offered 3 times a year whereas most other institutions offer the course once a year.

The question whether there are too many laboratory technicians involved in mounting the laboratories must include the physical layout of the teaching laboratories as well as the responsibilities of the technicians. Many institutions have a laboratory arrangement where one central dispensary can service several laboratories with inherent efficiencies. This is not the case at SFU. Future building plans should include such considerations, but until then the Department is faced with existing facilities. In addition, some of the technical support is used to prepare and assist in lecture demonstrations. Without this help, few lecturers would find the time to include this instructive component in their lecture course presentations.

Although the Department is currently reviewing the technical staff responsibilities with an aim to improving the match between Departmental needs and current staff, it is not expected that significant savings can be made in total staffing levels. The Department feels strongly that had all the reviewers fully appreciated the differences between our teaching needs and perhaps those of their own institutions, they would not have come to the conclusion that there seemed to be an excess of support for the teaching laboratories.

Research

The reviewers were generally impressed with the level of external funding for research programs. They did mention that faculty would be wise to maintain a strong base of NSERC funding while pursuing other sources. The Department is aware of this good advice and will strive to comply.

Space

The reviewers were not in a position to independently assess the space needs of the Department. They did, however, address the claimed shortage of office space and suggested that it was a serious matter which must be addressed by the administration of the University. They were specifically concerned with the safety of graduate students, as well as others, using laboratory space as offices where there is a risk of being overexposed to toxic and carcinogenic substances.

Resources and Facilities

The reviewers were impressed with the equipment in many of the research laboratories and the success the Department has had in NSERC equipment competitions. They did mention that the support of the teaching laboratories seemed to be uneven and suggest that the Department make improvements where needed. The Department has been trying to revise its teaching laboratories and is in a multi-year program to update and improve all of them.

The reviewers found no problems with either the library or computing services except with the need to increase the computers available for undergraduate instruction. The Department is in the midst of trying to increase its computer laboratory facilities within the strict space limitations it faces.

Budget

The reviewers formed the impression that the Department is not facing financial hardships. Other parts of Canada have been under greater financial strain than B.C. However, the Department feels this is not a reason to reduce everyone to the same inadequate funding level.

The reviewers appeared to understand that the department did not recover the cost of a range of consumables, but this is not the case. The department has reduced its secretarial staff to the lowest level within the Faculty of Science for budgetary reasons. It is also faced with the difficult problem of mounting new teaching laboratories without adequate funding for the required instrumentation. A temporary solution has been to borrow equipment from BCIT and apply for external funding. The Department will again review its charging practices in light of increased financial pressures and will come forward with a comprehensive plan to charge for all non-teaching supplies and services.

Institute of Molecular Biology and Biochemistry

The Institute of Molecular Biology and Biochemistry evolved from a joint program started by the Departments of Chemistry and Biological Sciences in the early years of the University. The Chemistry Department has always supported the Institute and the corresponding undergraduate Biochemistry program. The external reviewers formed the impression that the goals and wishes of the concerned parties are not far apart. Improved communication between all the parties was encouraged and the Department suggested that the presence of the Director of IMBB at Department of Chemistry meetings would aid cooperation.

Future Directions

The Department is in the process of formulating a future academic plan for the current Faculty of Science planning exercise. The Department has identified the area of analytical and environmental chemistry as a high priority and has been trying to make an appointment in these areas for some time. These are currently highly competitive fields and it is difficult to locate suitable candidates. Fortunately, the Department has recently been able to attract a highly qualified analytical chemist who has just joined the department.

The Department has always tried to attract excellent female scientists for appointment. Two out of the four recent appointments in Biochemistry are female. Unfortunately, the pool of qualified candidates in the other areas of chemistry is smaller. As a consequence, only 4 out of 97 and 7 out of 51 applicants for recent searches in physical and analytical chemistry respectively were female. In these cases the appointees were male. The Department will continue to make every effort to attract suitable female candidates in all future searches.

Conclusion

The Department agrees with the majority of the recommendations of the external review committee and was, in fact, in the process of addressing many of them. Some solutions will require University support such as additional space and financial resources. Some will be easily implemented within the Department's activities and resources. In either case, the Department has taken the position that it will make every effort to implement these recommendations.

There are a few recommendations that the Department feels should not be implemented. The difference of opinion between the reviewers and the department is believed to result mainly from the significant difference between the trimester system and the conventional year system.

In total, the Department felt that external review process has been a timely and generally productive exercise. It forced the Department to consider its present condition and initiate planning for the future with a clearer understanding of the current and future conditions. This planning is continuing with the goal of producing a future academic plan for the Department.

Summary prepared by Ms. Alison Watt, Director, Academic Planning Services and Dr. J.M. Munro, Vice-President, Academic from the External Review Report and Departmental Response.

EXTERNAL REVIEW
DEPARTMENT OF CHEMISTRY
SIMON FRASER UNIVERSITY

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September 1994

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I. INTRODUCTION

The external reviewers visited the Department of Chemistry for three full days on June 27 to 29, 1994. A schedule of activities and interviews is attached as Appendix I. The following items were provided about two weeks prior to the site visit:

1994 Internal Review of the Department of Chemistry;
Tentative schedule for the site visit;
Terms of Reference for the Chemistry Review Committee;
Senate Guidelines for External Reviews of Academic Units;
Simon Fraser University 1993-1994 Calendar; and
Excerpts from the Simon Fraser University Graduate Studies Fact Book.

Complete curriculum vitae of all faculty members were available upon arrival at the hotel in Vancouver. The following items were provided at the June 27 breakfast meeting with Dr. John Munro (Vice-President, Academic), Dr. Bruce Clayman (Acting Vice-President, Research and Dean of Graduate Studies) and Dr. Colin Jones (Dean of Science):

Six fact sheets on the Faculty of Science;
Faculty of Science Who's Who; and
Simon Fraser University Graduate Studies Fact Book.

Additional written information was provided by the Chair of Chemistry, the Academic Vice-President, the Dean of Graduate Studies, the Dean of Science, and by individuals during the visit. Such material included:

Challenge 2001, The President's Strategic Plan, February 1991;
Simon Fraser University Fact Book, 14th edition, May 1994;
Graduate Studies Handbook, August 1992;
Memorandum from the Dean of Science on a proposal to establish a graduate programme in Molecular Biology and Biochemistry, June 1994;
Course and Instructor Evaluation form;
Teaching Assistant Evaluation form;
Operating Budget Application of the Department of Chemistry for 1991-92, 1992-93 and 1993-94;
Year-end analysis of the Operating Budget for the five most recent fiscal years;
Research funding of the faculty members;
List of Departmental personnel as of May 1994;
List of TRIUMF/SFU personnel for 1993-94; and
Lists of the current graduate students, postdoctoral fellows and research associates, including their sources of support.

II. OVERVIEW OF SIMON FRASER UNIVERSITY

Construction of Simon Fraser University began in the Spring of 1964 and eighteen months later in September 1965 the University opened its doors to 2500 students. The development of Simon Fraser University has been strongly shaped by its mandate to deliver programs in the liberal arts, education and the basic sciences, while adopting innovative approaches to higher education. Tutorial-based instruction was adopted from the start and continues to be used extensively. The trimester system was chosen to more fully utilize the University's resources throughout the year, although the greater complexity and higher costs to instructional delivery were recognized at the outset by the provincial government. This system has enabled Simon Fraser University to develop a very successful Co-operative Education program in a broad range of academic disciplines. From its inception, there has been a strong emphasis on accessibility, as reflected by the growth of credit and non-credit continuing education programs, a strong commitment to distance education, and a relatively large proportion of mature students.

Simon Fraser University has been one of the fastest growing universities in Canada in recent years. Throughout its relatively short history full-time enrolment has increased at an average rate in excess of 6% per annum, while many of the older universities have had increases of 1% or less. The rapid growth of Simon Fraser University is not surprising given its location near the geographical centre of Canada's fastest growing urban area and the fact that undergraduate enrolment at the University of British Columbia has been frozen for several years. The enrolment pressure would have been even greater if the Province of British Columbia had not developed in the 1960s and 1970s an extensive system of community colleges whose academic programs were until recently restricted to first- and second-year university level classes. In 1993/94 full-time equivalent enrolment at Simon Fraser University was 13,708, while the number of faculty members was 607 on September 1, 1993. This corresponds to a student/faculty ratio of 22.6 which is the highest in British Columbia and one of the highest in the country. Of course, a careful analysis of student/faculty ratios must take into consideration the mix of undergraduate, graduate and professional programs offered.

III. OVERVIEW OF THE DEPARTMENT OF CHEMISTRY

The Department has 30 full-time faculty members including Professor Chow who retires September 1, 1994 and Professor Jones who is the current Dean of Science. In terms of subdisciplines, there are 6 biochemists, 5 inorganic, 3 nuclear, 7 organic and 9 physical chemists. These labels do not recognize, however, the broad and interdisciplinary interests of some faculty members. The Department's first analytical chemist, Dr. George Agnes, will arrive in 1995. There are 6 instructors, 2 of whom are part-time, 7 teaching technicians, 3 of whom are part-time, 3 administrative staff, 1 of whom is the supervisor of NMR services, 3 research technicians, 1 of whom is not funded by the Faculty of Science budget, and 3 secretaries. The Faculty of Science operates electronics, glassblowing and machine shops with 5, 2, and 5 technical support staff, respectively. These shops serve all departments in the Faculty of Science.

The Department offers a broad range of undergraduate programs and has a strong commitment to undergraduate teaching. The facilities in biochemistry and organic chemistry are especially good, while those in the other areas of chemistry have received much less attention and are less up-to-date. Curriculum revision is an on-going process, but there is an immediate need for further changes in upper-division lecture and laboratory courses in analytical, inorganic, organic and physical chemistry.

Despite the short history of the University, the Department has built up a fairly large graduate program with about 60 students enrolled in M.Sc. and Ph.D. programs. Typically about 60% of the graduate students are enrolled in the Ph.D. program. The most pressing needs are to improve both the administration of the graduate program and the quality of the graduate students. Constructive steps to address the concerns raised in this report should reduce the average completion time for the M.Sc. degree by 4 semesters. Similarly the completion time for the Ph.D. degree should be reduced by 3 semesters. The current completion times are much too long.

The Department is well supported in terms of the complement of professors, and overstaffed, in the view of some external reviewers, with respect to instructors and support staff. There is a need to improve the administrative procedures and to develop a more collegial approach to decision making. Also, some groups have abdicated their responsibilities to others and therefore corrective measures are necessary.

Research funding has been increasing at a very impressive rate of 15% per year during the past decade. This has been achieved as a consequence of many excellent appointments during the past six years, plus the willingness of faculty members to seek out nontraditional sources of funding and to engage in interdisciplinary research.

The Department has been receiving good financial support from the central administration, but there is a strong case for renovation of some teaching laboratories and for the provision of more office space. The undergraduate program would be strengthened by providing space for a resource centre.

The future of the Department is bright. With nearly half of the professors retiring in the next decade, there is an excellent opportunity to build upon present strengths and to recruit new faculty members in carefully chosen branches of chemistry. While the achievements of the first three decades of the Department have been noteworthy, the potential for the next decade is even greater. The key ingredient will be strong leadership within the Department and within the administration of Simon Fraser University.

IV. UNDERGRADUATE TEACHING AND CURRICULUM

A. Degree Programs

The Department of Chemistry at Simon Fraser University offers a broad range of undergraduate academic programs: the Major (120 semester hours) and Honors (132 semester hours) programs with specialization in biochemistry, chemistry or chemical physics. These correspond to four-year degrees at universities which do not use the trimester system. Students may choose to pursue these degrees within the Co-operative Education program which includes 4 work semesters in addition to the 8 academic semesters. All programs include a core of courses in all major fields of chemistry and courses in mathematics, physics and computing science. The Department also offers Minors in Environmental Chemistry and Nuclear Science.

The number of B.Sc. graduates in chemistry, including the 0 to 2 students per year in the Chemical Physics stream, has been about 20 to 25 per year during the past five years. During the same period about 25 B.Sc. degrees in biochemistry have been awarded each year. The number of Honors graduates in both chemistry and biochemistry is typically in the range of 0 to 2 per year. The number of B.Sc. graduates is about double that of the early 1980s when the total number of chemistry and biochemistry graduates was about 20 to 25 per year.

B. 100-Series Courses

Although the term "year" does not apply to the trimester system, the 100-series courses correspond to what are traditionally called first-year courses in Canadian universities. All courses are one semester in length; separate course numbers are given to laboratory courses. Students in the Major and Honors programs must take the following sequence of general chemistry courses which correspond in content to a full year of general chemistry at other universities:

- CHEM 102-3 General Chemistry I
- CHEM 103-3 General Chemistry II
- CHEM 115-2 General Chemistry Laboratory I
- CHEM 118-2 General Chemistry Laboratory II

Most science students take CHEM 102 and 115 in their first semester and CHEM 103 and 118 in their second semester for a total of 10 semester hours. A few years ago the Department removed CHEM 103 and 118 as prerequisites for the first course in organic chemistry. Thus, it is possible for students to take CHEM 150-3 Organic Chemistry I and CHEM 155-2 Organic Chemistry Laboratory I after completion of one semester of general chemistry. This flexibility is attractive for students in programs for which an introduction to organic chemistry is a greater priority than an introduction to chemical equilibria, thermodynamics and the other topics covered in CHEM 103. The minority of chemistry students who choose to take the first semester of organic chemistry immediately after the first semester of general chemistry must complete the general chemistry courses in later semesters. Some students have taken CHEM 103 and 150

concurrently, but this is not always possible since the two courses are often scheduled at the same time. One consequence of this system is that it is possible for students to take all the courses in organic chemistry before completing the 200-level courses in analytical, inorganic and physical chemistry.

In our discussions with several groups and a few individuals we learned about several concerns with respect to the general chemistry program. Even though Simon Fraser operates on a trimester system and students can enter the University at the beginning of any of the three semesters, September is the most popular choice. It is becoming increasingly more difficult for the Department to meet the demand for CHEM 115 lab places in the Fall semester. The Department has responded to the pressure in the CHEM 115 lab (capacity of 60 students per session) by putting the overflow in the lab that houses CHEM 106 and 118 (capacity of 36 students). Further changes are required, however, in order to handle the increased enrolments forecast by the central administration. As described in the *1994 Internal Review*, several options for increasing the CHEM 115 enrolment have been considered and one possibility, the so-called "wet/dry" format, is being tested in the Summer semester prior to implementation in the Fall of 1994. With the new format the capacity of the lab will be effectively doubled because the students will conduct lab experiments every second week. In alternate weeks the students will do prelab preparations, carry out computer analyses of experimental data, and attend demonstrations relevant to the lecture material. Elimination of prelab lectures from the beginning of the four-hour laboratory slot will partially offset the loss of time in the laboratory, while the introduction of several new activities in the "dry" part of the program will enrich the students' experience in other ways. We encourage the use of computers in the analysis of data but **not** as a substitute for carrying out experiments. Hands-on activities are critical for science students and for fostering an appreciation of science in others.

The present computer facilities are inadequate for full implementation of the new format. The computer room adjacent to the large general chemistry laboratory was originally set up for the graduate students, but is also used for upper-level courses. It is too cramped and has too few workstations and microcomputers to be able to handle the large number of students in CHEM 115 in the Fall semester.

The possibility of restricting enrolments in laboratory courses appears to have been eliminated because it is contrary to the President's Strategic Plan which projects a FTE enrolment of 20,000 students at the turn of the century. As an alternative, we suggest that the Department investigate the possibility of setting up more student locker space in or near the general chemistry laboratories.

In drawing up our recommendations with respect to the 100-series courses we have kept a number of facts in mind. As in all Canadian universities, a high percentage of chemistry enrolments are in service courses: 91% of student enrolments in chemistry were in the 100- and 200-series service courses during the 1992-93 academic year. Chemistry is a key prerequisite for the study of many disciplines. Clearly, general chemistry courses must meet the needs of non-chemistry students and at the same time provide a sound base for students who will go on

to take a degree in chemistry. The general chemistry laboratory is essentially unchanged since it opened and should be renovated. There is a strong will within the Department to redesign the general chemistry laboratory to allow for the introduction of new experiments.

RECOMMENDATION 1. In view of the relevance of general chemistry to the study of many disciplines in the Faculties of Science and Applied Science, and the fact that chemistry is an experimental science, the University should make the renovation and modernization of the general chemistry laboratory one of its highest priorities.

RECOMMENDATION 2. The Department must provide adequate computer facilities before fully implementing the new laboratory program in CHEM 115.

RECOMMENDATION 3. The revision of the general chemistry lecture and laboratory program should be an on-going process that is coordinated by a General Chemistry Coordinator.

The communication skills of some teaching assistants were raised in our discussions about general chemistry and, to a lesser extent, some more advanced classes. We think all teaching assistants should be required to pass an oral comprehension exam before being allowed to be a teaching assistant.

RECOMMENDATION 4. The Department should introduce procedures to insure that all teaching assistants, especially those in 100-series chemistry laboratory courses, have acceptable communication skills.

The coordination of lecture and laboratory material is a perennial problem in chemistry courses. The situation is exacerbated when the lecture and its related laboratory course are the responsibility of two different individuals. Improved synchronization of lecture and laboratory courses could be achieved by the active participation of the professor of each lecture course in the corresponding laboratory course.

RECOMMENDATION 5. Insofar as possible, lecture and laboratory courses at all levels should be synchronized. The same faculty member should be responsible for the lecture and associated laboratory course.

C. Higher-Level Courses

The Department offers a broad range of chemistry and biochemistry courses. It is clear that the Department has a strong commitment to undergraduate teaching and that curriculum revision is

a dynamic process.

1. Biochemistry

The Biochemistry program is a joint effort of the six biochemists in the Department of Chemistry and seven members of the Department of Biological Sciences. The courses were recently restructured to reflect the rapid advances in biochemistry and molecular biology during the last decade. With new laboratories in the South Sciences Building, adequate space to handle a substantial increase in enrolment, and several new appointments in recent years, the Department is well-positioned to offer a strong undergraduate Biochemistry program well into the next century.

2. Organic Chemistry

With the retirement of Professor Chow in August 1994, the organic chemistry group will be reduced to a teaching complement of six professors. This is the minimum number required to teach a full range of undergraduate courses in organic chemistry and to offer a minimal number of graduate courses.

The first two organic chemistry laboratory courses (CHEM 155-2 and 255-2) are held in a spacious laboratory in the new South Sciences Building. This laboratory is well equipped and should be able to handle an increase in enrolment of 50% or more. Micro-scale experiments were introduced into CHEM 155 and 255 about four years ago and have led to substantial savings in the cost of chemicals. Unfortunately the laboratory portion of the third organic chemistry course (CHEM 357-3) is held in the "old" Chemistry wing of the Science Complex and is, therefore physically separated from the main organic chemistry teaching laboratory.

The organic chemistry courses were last reviewed in 1988. There appears to be no need to carry out any major revision of the first two semesters of organic chemistry. The most pressing needs are the introduction of an intermediate organic chemistry course at the 300-level, and an advanced course in synthesis.

RECOMMENDATION 6. The Department should improve its offerings in upper-level organic chemistry by introducing a new 300-level organic chemistry course and by developing a 400-level integrated laboratory course in which the students synthesize target compounds and then characterize their products by spectroscopic techniques.

3. Inorganic Chemistry

The inorganic chemistry group consists of five professors which is a sufficient number to teach

a full range of undergraduate courses and a limited number of graduate courses in inorganic chemistry, while contributing to the teaching of general chemistry. This conclusion is based on the assumption that 300- and higher-series courses are only offered once per academic year. The ability of the inorganic group to meet its obligations has been constrained, however, by the lack of analytical chemists to teach the analytical chemistry courses.

The inorganic chemistry curriculum was reviewed in 1990 and CHEM 331-3 Practical Aspects of Inorganic Chemistry was introduced in 1992-93. This course was added in order to satisfy the Canadian Society for Chemistry requirement that an accredited program must, as a minimum, include two semesters of both lectures and laboratory work in inorganic chemistry. Prior to the introduction of CHEM 331-3, students in the Major and Honors programs were required to take only one semester of laboratory work (CHEM 336-2) and two semesters of lectures (CHEM 232-3 and 332-3) in inorganic chemistry.

Although the new curriculum meets the CSC requirements for accreditation, it is unfortunate that most students do not gain practical laboratory experience in inorganic chemistry until their fifth or later semester. This situation could be rectified by combining CHEM 232-3 and 331-3 into a new three-semester-hour course which would have the same distribution of hours (2-0-4) as CHEM 218-3 Introduction to Analytical Chemistry. The new course could be listed in the *Calendar* as CHEM 23X-3 Introduction to Inorganic Chemistry and would include portions of the material covered in the current CHEM 232-3, 331-3 and 332-3. Two new courses CHEM 33Y-3 Chemistry of the Nontransition Elements (or Chemistry of the Main Group Elements) and CHEM 33Z-3 Chemistry of the Transition Metals could be introduced. CHEM 33Y-3 and 33Z-3 would be offered only once per year in different semesters and CHEM 23X-3 would be the only prerequisite. The two new 300-series courses could have a (3-0-3) distribution of hours. The students would receive credit for nine semester-hours for the three inorganic chemistry courses listed as required courses in chemistry (50 and 58 semester hours, respectively, for the Major and Honors programs). The total distribution of hours would be eight hours of lectures and ten hours of laboratory work. With the present system the students receive credit for eleven semester hours on the basis of eight hours of lectures, two hours of tutorials and eight hours of laboratory work. Of course, the accreditation requirements would be satisfied if the students took CHEM 23X-3 and either 33Y-3 or 33Z-3. Honours Chemistry graduates from most Canadian universities receive the equivalent of CHEM 23X-3, 33Y-3 and 33Z-3.

Although the Department has given some thought to the matter of accreditation, an application has not been filed with the Canadian Society for Chemistry.

RECOMMENDATION 7.

The Department should revise its inorganic chemistry curriculum in order to introduce students to laboratory work in inorganic chemistry in the 200-series courses.

Our interviews left us with the impression that the inorganic chemistry teaching laboratory has received much less attention than some other laboratories, despite the fact that it has a dedicated laboratory instructor for the 300- and 400-level courses. The inorganic chemistry teaching

laboratory has been moved a few times and has received much less funding for new instrumentation than the organic and biochemistry teaching laboratories. Among the most urgent needs are facilities for handling air-sensitive materials.

RECOMMENDATION 8. The Department should establish an order of priority for requests for teaching equipment to insure that all areas of the undergraduate curriculum have comparable facilities.

4. Physical Chemistry

The physical chemistry group of nine professors is the largest and most diversified group in the Department. Their teaching commitments include general chemistry, a core of three physical chemistry courses (thermodynamics, quantum chemistry and statistical thermodynamics), three advanced classes (kinetics, molecular spectroscopy and electrochemistry) and two special topics courses in physical and theoretical chemistry.

Within the last five years the physical chemists have developed experiments based on FT-NMR and scanning tunnelling microscopy. A third new experiment based on laser flash photolysis is planned. These developments have led to a partial updating of the physical chemistry laboratory. More extensive changes are envisaged as a result of a review of the content and order of the physical chemistry courses. The current proposal is to replace the current core program (CHEM 261-3, 361-3 and 362-3) by two new courses (CHEM 262 Introduction to Quantum Chemistry and CHEM 364 Chemical Thermodynamics). The other physical chemistry courses would be CHEM 363 Kinetics and Mechanism, CHEM 462 Molecular Spectroscopy, CHEM 465 Electrochemistry and CHEM 469 Selected Topics. Additional topics would be incorporated into new interdisciplinary courses (CHEM 381 Introduction to Spectroscopy, CHEM 382 Chemical Bonding and CHEM 383 Materials Chemistry). There is no agreement on which of the new courses should be the third core class for a Major in Chemistry, but some favour making CHEM 363 a required class.

We have doubts concerning the practicality of teaching quantum chemistry in a 200-level course. Nevertheless, we think the physical chemists and the Department should proceed to revise the physical chemistry curriculum.

RECOMMENDATION 9. The physical chemists should continue with their curriculum revision and, after extensive consultation, bring forward their proposal for adoption by the Department.

RECOMMENDATION 10. The physical chemistry teaching laboratory should be modernized.

5. Nuclear Science

The nuclear chemistry group consists of three professors including Dr. Colin Jones who is the current Dean of Science. This group teaches some of the courses offered in the Nuclear Science Minor program. Additional courses are taught by the Department of Physics. The Nuclear Science Minor program has historically low enrolments and is evidently unique to Simon Fraser University. The history of nuclear chemistry in the Department goes back to the founding of the University.

6. Analytical and Environmental Chemistry

The Department offers several analytical chemistry courses. CHEM 218-3 Introduction to Analytical Chemistry and CHEM 316-3 Introductory Instrumental Analysis are core courses for the Major in Chemistry. These lecture/laboratory courses satisfy the analytical chemistry requirement for accreditation by the Canadian Society for Chemistry. The Department also offers CHEM 415-3 Selected Topics in Analytical Chemistry and CHEM 417-3 Advanced Instrumental Analysis. Both of these courses concentrate on instrumental methods.

The analytical chemistry courses have been taught by a senior laboratory instructor and a member of the inorganic chemistry group. As a first step to establishing an analytical and environmental chemistry group, the Department has just appointed its first analytical chemistry professor, Dr. George Agnes, who will arrive in 1995.

A new Environmental Chemistry Minor Program for which CHEM 371-3 Chemistry of the Aqueous Environment and CHEM 372-3 Chemistry of the Atmospheric Environment are required classes has recently been approved by the Faculty of Science. It is our understanding that this new program was introduced before the required faculty members and facilities were in place.

RECOMMENDATION 11. The Department must provide sufficient personnel with expertise in analytical chemistry to maintain a high standard in its analytical chemistry courses and to introduce the new Environmental Chemistry Minor Program.

RECOMMENDATION 12. The analytical chemistry teaching laboratory must be updated with new equipment to provide contemporary facilities for the analytical and environmental chemistry laboratory courses.

7. General Recommendations

The following recommendations are made in the spirit of suggesting ways in which a good undergraduate program can become even better. Implementation of these recommendations will benefit the Department as a whole.

RECOMMENDATION 13. In order to support academic excellence and foster a stronger sense of community among the undergraduates the Department should establish a resource center where the students can study and work on assignments between classes.

RECOMMENDATION 14. Courses which are not offered regularly should be deleted from the *Calendar*. The Department should publish a list of its courses and the semesters in which they are expected to be offered.

RECOMMENDATION 15. The Department should review its curriculum and the scheduling of courses with respect to prerequisites and resolve scheduling problems where two or more advanced courses are held at the same time.

V. GRADUATE TEACHING AND CURRICULUM

A. Degree Programs and Requirements

The Department of Chemistry offers programs leading to the M.Sc. and Ph.D. degrees. The minimum requirement for the M.Sc. degree consists of 12 semester hours of graduate courses, including the two seminar courses CHEM 801-3 and CHEM 805-4. In the former the students present seminars based on assigned papers from the recent literature, while in the latter they present a seminar based on their thesis research projects. The remaining 5 semester hours are obtained by taking two formal lecture courses. If the two seminar courses are considered to be equivalent to two formal lecture courses, then the course requirements for the M.Sc. degree are comparable to the national average. A thesis describing original research must be submitted and defended in order to complete the requirements for the M.Sc. degree.

The minimum requirement for the Ph.D. degree for students entering with a B.Sc. degree or equivalent is 20 semester hours. Ph.D. candidates must take CHEM 801-3, 802-3 (a second semester of CHEM 801-3) and 806-4 (the Ph.D. research seminar). The remaining 10 semester hours are obtained by taking formal lecture courses. Students entering the Ph.D. program with an M.Sc. degree are required to take 12 semester hours of graduate courses, including CHEM 802-3 and 806-4. These formal requirements are similar to those in other Canadian chemistry departments. A thesis describing new and significant results must be presented and defended to satisfy the requirements for the Ph.D. degree. The standards are maintained by internal and external examiners for Ph.D. theses.

The Department has recently approved a new stream for biochemistry M.Sc. and Ph.D. students which allows them to take seminar courses which are aimed more toward the biological side of biochemistry. This has alleviated the problem of having two very distinct groups of graduate students in the chemistry seminar courses. Another new initiative is the introduction of a Co-Op program for M.Sc. graduates whereby M.Sc. graduates undertake an eight-month approved work

term immediately after completion of their M.Sc. thesis. University approval is expected, but has not yet been obtained.

B. Enrolment and Completion Data

The graduate program has grown by about one third during the past five years to about 60 students. As of June 27, 1994, Departmental records show 20 and 37 students in the M.Sc. and Ph.D. programs, respectively. The Fall 1993 figures were 26 and 35, respectively. The total number of graduate students will likely exceed 60 when the new graduate students arrive for the Fall semester. An average of about ten graduate degrees per year were conferred during the period 1989-93, with a slight majority being Ph.D. degrees. The number of graduate degrees conferred is likely to rise to 12 or more per year during the next few years and the trend toward the Ph.D. degree will likely continue.

During the last four years M.Sc. candidates have averaged 10 semesters (3.3 years) for completion of their programs. The median of 9 semesters is only slightly better and still unacceptably long. The Department should review its policies with respect to the admission and financial support of graduate students in order to substantially reduce the time required to complete the M.Sc. degree. Our suggestions are described in the following sections.

RECOMMENDATION 16. The Department should implement policies which will reduce the average time for completion of the M.Sc. degree to two years without reducing the standards.

Ph.D. candidates have averaged 16 semesters (5.3 years) in the program during the past four years. This is an improvement of about one semester from the data supplied by the Dean of Graduate Studies for students completing the program between 1985 and 1993. There is however room for further improvement.

RECOMMENDATION 17. The Department should implement policies which will reduce the average time for completion of the Ph.D. degree to less than 4.5 years without reducing the standards.

C. Quality of Graduate Students

Simon Fraser University has established a large graduate program in Chemistry, but the quality of the graduate students is not as high as it should be. This is all too apparent from the low number of NSERC Postgraduate Scholarships which have been held in the Department. With a graduate enrolment of about 60, the Department should have a minimum of ten NSERC and MRC scholars. Given the number of faculty members with international reputations for their research achievements, we think this goal is achievable, if the majority of the recommendations contained in this report are implemented. Increasing the number of NSERC and MRC scholars will improve the quality of the graduate students and help to reduce the average time required to complete the Ph.D. degree. It must be stated that we recognize that there are excellent

graduate students in the program and that many former graduates have won prestigious postdoctoral fellowships and been awarded highly competitive positions.

We were not supplied with details on the universities from which graduate students received their undergraduate degrees, but it is our understanding that the program is very dependent on the B.Sc. graduating class at Simon Fraser University and visa students for the majority of the 12 to 15 students who enter the graduate program each year. The Department should be attracting more students with Honours degrees from other Canadian universities. It is not sufficient to recruit in the usual ways by, for example, placing advertisements in Canadian Chemical News. The Department must develop a recruitment program to attract excellent graduate students.

RECOMMENDATION 18. The Department should implement a program to recruit graduate students by sending faculty members to visit Canadian universities, especially non-Ph.D. granting institutions and those with strong Honours Chemistry programs.

The quality of the graduate program is very dependent on the admission procedures and standards. In some universities the decision to accept a student is made by a graduate studies committee which is composed of about five professors whose research interests represent the full spectrum within the department. This approach insures that high standards are maintained and that decisions are made with the best interests of the department in mind. Of course, a student cannot be accepted unless there is at least one potential supervisor who is prepared to make a financial commitment to the student.

RECOMMENDATION 19. The Graduate Studies Committee should review its admission procedures and standards with a view to insuring that only highly qualified students are admitted to the graduate program.

D. Financial Support of Graduate Students

Graduate student support is derived from three principal sources: research grants of the supervisors (60%), teaching assistantship funds (30%) and scholarships (10%). As noted above the third source is low relative to that in many of the more mature graduate programs in chemistry, but on the other hand the teaching assistantship budget is better than that at many Canadian universities. In our discussions we became concerned that the Department policies with respect to the support of graduate students are either not known to everybody or not clearly established. Given the importance of funding to the graduate program and to the well being of individual research groups, we recommend that the Department and its Graduate Studies Committee establish clear policies that are known to all faculty members and the graduate students and that these policies be applied in a fair and uniform method.

RECOMMENDATION 20. Departmental support, in the form of teaching assistantships and scholarships towards the annual student stipend, should be for a maximum of two years for M.Sc. students and four years for Ph.D. students. Beyond these time limits all support should be at the discretion of the supervisor and should come entirely from the research grants of the supervisor. The supervisor should contribute to the stipend every year.

RECOMMENDATION 21. All graduate students, including scholarship holders, should be teaching assistants for a minimum of two semesters.

E. Seminar Courses

The Department revised its course requirements a few years ago and substituted seminar courses for some of the formal lecture course requirements. This change has been positively received. There is, however, some concern that CHEM 805-4 (M.Sc. Research Seminar) is prolonging the time in the program. We found that there is strong support for the seminar program, but we were very concerned to learn that the students have not been receiving written feedback on their performance.

RECOMMENDATION 22. The seminar courses CHEM 801-3 and 805-4 should be retained as requirements for the M.Sc. degree. CHEM 805-4 should be taken as early as possible and no later than in the fourth semester of the M.Sc. program.

RECOMMENDATION 23. Graduate students should receive written feedback in relation to their grades in seminar courses.

F. Administration of the Graduate Program

A number of matters came to our attention in our interviews which have led to a few additional recommendations. For example, we were told by the Graduate Studies Committee that the transfer from the M.Sc. program to the Ph.D. program is based solely on the grade-point average in course work. We recognize that CHEM 805-4 M.Sc. Research Seminar is taken by all M.Sc. students and that this course involves a critical evaluation of written and oral research projects. Nonetheless, the major requirement for the Ph.D. degree is original research and the presentation and defence of a thesis embodying new and significant results. Consequently, we strongly recommend that research promise be taken into account when considering requests for transfer to the Ph.D. program.

RECOMMENDATION 24. A request to transfer from the M.Sc. program to the Ph.D. program should be evaluated by the Graduate Studies Committee on the basis of research promise and grade-point average in course work and must have the support of the applicant's supervisory committee.

RECOMMENDATION 25. The Graduate Studies Committee should provide leadership to the Department in the development and administration of Departmental policies with respect to teaching assistantships, scholarships and all matters pertaining to the graduate program.

RECOMMENDATION 26. The Graduate Studies Committee should prepare a handbook for graduate students which would complement the one prepared by the Dean of Graduate Studies and contain details pertinent to the M.Sc. and Ph.D programs in Chemistry. The handbook should be updated as required by changes in procedures and regulations.

RECOMMENDATION 27. The Graduate Studies Committee should monitor the availability of graduate courses and the frequency at which courses are offered. The schedule of graduate courses for each year should be announced prior to the beginning of the Fall semester. Any course which has not been offered for three consecutive years should be removed from the *Calendar*.

RECOMMENDATION 28. The Graduate Studies Committee should meet at regular intervals and more frequently as circumstances require. Procedural details on how decisions are made should be widely known in the Department.

VI. ADMINISTRATIVE STRUCTURE

The Department is headed by a Chair (currently Dr. A.C. Oehlschlager) who reports to the Dean of Science. The Chair is normally appointed to a five-year term and is assisted by an Associate Chair (currently Dr. R.G. Korteling), a Departmental Assistant and a Laboratory Coordinator. The Department has a well-established committee structure with the Appointments, Tenure, Undergraduate Studies and Graduate Studies Committees being the key committees. A number of special advisory committees and coordinators carry out important functions within

the Department, advise the Chair, and help to develop Departmental policies. In principle, the committee structure described in Appendix II of the *1994 Internal Review* is appropriate.

In 1992 the Laboratory Co-ordinator position was split into two positions with one retaining the same title and the other becoming known as the Departmental Assistant. The latter position corresponds closely to that of the Administrative Officer in other universities with responsibility for the operation of the general office, administration of departmental accounts, and processing of the appointments of teaching and research assistants. The Laboratory Co-ordinator supervises technical support staff in the teaching laboratories and Departmental research facilities. The daily operation, including safety and security, of the Department are also responsibilities of the Laboratory Co-ordinator. We were told that the Laboratory Co-ordinator is the primary person whom students consult for advice on their programs, transfer credits and letters of permission. Academic advising has become a major time-consuming activity even though it is not in the official job description. We think this is inappropriate and that academic advising should be done by the professors. We further suggest that the job descriptions and responsibilities of the Departmental Assistant and Laboratory Co-ordinator should be reviewed.

RECOMMENDATION 29. In view of the diversity of the students and their programs, the Department through its Undergraduate Studies Committee should develop better mechanisms for advising students. The principal advising on chemistry courses and programs should be done by the academic staff.

RECOMMENDATION 30. The job descriptions and responsibilities of the Laboratory Co-ordinator and Departmental Assistant should be reviewed. The Departmental Assistant should be in charge of all support staff with the the Laboratory Co-ordinator reporting to the Departmental Assistant on all technical support staff in the teaching laboratories.

Removing academic advising and related matters from the job description of the Laboratory Co-ordinator would allow more time for the supervision of support staff and the general operation of the Department. Safety has not received as much attention as is required by current regulations.

RECOMMENDATION 31. The Department must adhere to all safety and WHMIS regulations.

RECOMMENDATION 32. Laboratory instructors and technicians should take safety and first-aid courses on a regular basis. The Department should organize in the Fall semester a session on laboratory safety which would be compulsory for all new graduate students.

RECOMMENDATION 33. The Department should maintain an up-to-date inventory of chemicals and radioactive materials in laboratories and Departmental facilities.

VII. FACULTY

A. Professors

The professors typically teach one lecture course and give lower division tutorials in two of three semesters per year. This load is comparable to that in research-intensive universities, but less than that in universities with small graduate programs. Without specific details on the courses taught and the number of contact hours for each professor for the past three years it is impossible to make a more quantitative judgment of the appropriateness of the number of professors for the workload. In terms of the total number of students taught, the faculty complement appears to be somewhat higher than that at universities of comparable size. However, two factors must be kept in mind: the trimester system requires a higher faculty complement and 20% of the professors are biochemists; also biochemists generally have lighter teaching loads in Canadian universities than chemists. On balance we think the number of professors is appropriate for the Department's undergraduate and graduate programs.

B. Laboratory Instructors

In addition to professors holding tenured or tenure-track positions, the Department has four full-time and two part-time laboratory instructors. These faculty members have no research responsibilities and are responsible for essentially all lower-level, and many upper-level, laboratory courses. They design the courses and assign the grades. They are required to be present during every semester, but they can be granted a development seminar (one in nine semesters) in which they have no teaching duties. The teaching loads of the instructors are lighter during the summer semester. Given the existing and anticipated enrolments in laboratory courses in the next five to seven years, and by comparison with other programs serving a comparable number of students and laboratories, two of the external reviewers think that some reduction of the number of laboratory instructors is in order.

VIII. SUPPORT STAFF

A. Secretaries

The Department has three secretaries, one of whom serves as the secretary to the Chair, the other two in the general office. One secretary handles all matters pertaining to graduate students. The Department had a fourth secretary until the Spring of 1994. We understand that this position could be filled if there is sufficient demand for secretarial services in the general office. We were concerned to hear that job descriptions and personal evaluations are not carried out on a regular basis and that there is no extra remuneration for technical typing and other responsibilities which require more than basic secretarial training.

B. Teaching Technicians

The Department has seven technicians, three of whom are part-time (50%), assigned to teaching laboratories. We were concerned to learn that there have been cases where the laboratory instructor did not familiarize the teaching technician with a new piece of equipment prior to its installation in the teaching laboratory. The *1994 Internal Review* suggests that the teaching technicians and the laboratory instructors "are universally regarded as a very burdened group." This statement is not supported by the experience of two of the reviewers. Indeed, the number of teaching technicians is significantly larger than justified on the basis of existing and expected enrolments in laboratory courses. As in the case of the laboratory instructors, we have not included an explicit recommendation. However, two of the external reviewers suggest that the total number of laboratory instructors and teaching technicians should be reduced by at least four.

C. Research Technicians

The Department has three research technicians, one of whom is not funded by the Faculty of Science. In addition there is the NMR Supervisor who is classified in the May 12, 1994 listing of Departmental personnel as being both part of the administrative staff and a research position. The nature of the NMR Supervisor's position is complicated further by the fact that he holds an NSERC Research Grant.

D. Faculty of Science Technical Staff

The Faculty of Science electronics, glassblowing and machine shops were scarcely mentioned in our interviews. The five electronics technicians and the two glassblowers appear to be able to meet the needs of the Department of Chemistry. As stated in the *1994 Internal Review*, the five machinists are unable to keep up with the demand. The introduction of nominal charges may help to alleviate the pressure on the machine shop. Departmental budgets should be increased to pay for shop charges arising from the work carried out in support of the

undergraduate teaching program. Shop charges for research purposes must not be at a level which would impact negatively upon research productivity.

RECOMMENDATION 34. The Department should review the job description and evaluate the performance of every member of the support staff on an annual basis.

RECOMMENDATION 35. The Department must impress upon the administration of the University that the job classifications and salaries of all support staff should be consistent with their qualifications and responsibilities.

IX. RESEARCH AND EXTERNAL FUNDING

As a consequence of many excellent appointments during the past six years, external grants and contracts to Chemistry faculty have grown at an impressive rate of 15% per year during the past decade. With 21 NSERC Operating Grants (including the one held by Dr. Tracey) in 1992-93, the fraction of faculty members holding individual NSERC grants exceeds the national average for chemistry, while size of the average grant is close the average for chemistry. Many members of the Department have been very successful in obtaining funds from new NSERC programs and non-NSERC sources. This success is due to the willingness and ability of faculty members to engage in interdisciplinary research. The potential for growth from non-NSERC sources exceeds that from NSERC sources but faculty members would be wise to maintain a strong base of NSERC funds while pursuing other sources of funding. The Department has been very successful in obtaining funding for research and therefore we do not have any specific recommendations.

X. SPACE

The Department claims to be currently operating with a 11% shortfall in research space and a 41% shortfall in office space. We cannot corroborate or challenge these figures because we do not have sufficient information and we did not tour all the facilities in the Department. On the basis of the current distribution of graduate students and postdoctoral fellows among the research groups we suggest, however, that some reallocation of research space is possible. The shortage of office space is a more serious matter which must be addressed by the administration of the University.

RECOMMENDATION 36. The Department should pursue its goal to provide well-vented office/study space for graduate students which is physically separated from research laboratories in which there is a risk of being overexposed to toxic and to carcinogenic substances.

According to the *1994 Internal Review* the Space Committee meets only rarely to settle space

issues not resolvable by the Chair. We think a more collegial approach would be to refer all requests for office and laboratory space to the Space Committee which would then make its recommendation to the Chair. With the large number of retirements and new appointments during the next ten years, it will become increasingly more critical for the Department to develop effective policies and procedures.

RECOMMENDATION 37. All requests for office and laboratory space should be referred to the Space Committee which should function as an advisory committee to the Chair.

RECOMMENDATION 38. Retired professors should be provided with space as long as they have external funding for their research.

XI. RESOURCES AND FACILITIES

A. Equipment

The Department is very well equipped for research in many of the fields in which there is major strength. This is due to the success of the faculty members in the NSERC equipment competitions and to the strong institutional support. The 600 MHz NMR is a prime example. With an NSERC Major Equipment Grant of \$562,325 as leverage, the University contributed about \$400,000 to allow an upgrade from the original proposal for a 500 MHz. Institutional support of this magnitude is unknown in many universities of a comparable size.

As noted above, the Department has excellent teaching equipment in some areas and deficiencies in other areas. The Department has sufficient discretionary funds, or at least access to equipment funds, that it should be possible to make a significant improvement during the next two or three years.

B. Library

We did not tour the library and apart from learning that the 1994 acquisitions budget for chemistry is \$300,000 we were given no details on the library resources. This is down by 20% from the budget one year earlier. Even with this cut, the library budget for chemistry acquisitions is better than that at many universities of a comparable size. Virtually every library has had to cope with similar cuts in recent years. No examples of undue hardship were brought to our attention. Fortunately the very extensive library collection at UBC is only 20 km away.

C. Central Services

No problems with central computing or administrative services were brought to our attention. In the case of computing facilities we have addressed the inadequacies of the facilities for teaching in an earlier section. Several workstations have been purchased to meet the needs of researchers.

XII. BUDGET

The Operating Budget of the Department of Chemistry in 1993 was only 6% higher than it was in 1983 according to the *1994 Internal Review*. Given the substantial increases in enrolments (4% per year) during that period and the even greater rate of increase (6%) in the cost of chemicals and equipment, it is clear that the Department does not have the operating funds that it is accustomed to receiving. Nevertheless, it appears that there are very few recoveries. This is indicative of a healthier operating budget than that at many other universities. We were told that all faculty members receive free photocopying irrespective of the purpose. In many universities, it is standard practice to require faculty members to pay for any photocopying that is not for teaching. Such policies have been adopted by departments in order to deal with budget cuts. Other common measures are to require faculty members to pay for long-distance calls, out-going facsimile messages and courier expenses. There is very little evidence to suggest that the Department is facing such hardships. However, given that the Operating Budget may not return in real terms to the levels of the early 1980s, the Department should consider the matter of recoveries and user fees.

RECOMMENDATION 39. The Department should develop a set of policies with respect to recoveries.

RECOMMENDATION 40. The Department should develop a policy on user fees for Departmental facilities which is to be implemented as circumstances warrant.

XIII. INSTITUTE OF MOLECULAR BIOLOGY AND BIOCHEMISTRY

The Institute of Molecular Biology and Biochemistry was established in 1987. The primary purpose was to promote basic research in molecular biology and biochemistry and to coordinate graduate programs in the two disciplines. Three new positions in the Department of Chemistry (Borgford, Sen and Scott) and three new positions in the Department of Biological Sciences (Brandhorst, Price and Boone) were created with funding from the provincial Funds for Excellence in Education Program. This brought the total membership in the Institute to 13, with six in Chemistry and seven in Biological Sciences. Subsequently the undergraduate program in biochemistry was revised and a new program was implemented in the Fall of 1993. This

coincided with the opening of the new South Sciences Building, funding for which might not have been obtained without the graduate teaching research programs of the Institute.

More recently the Institute has brought forward a proposal for the establishment of a graduate program in Molecular Biology and Biochemistry which will be offered by both the Departments of Biological Sciences and of Chemistry as a stream within their respective graduate programs. A new program of courses will be offered to service molecular biology and biochemistry (MBB) students in both Biological Sciences and Chemistry. Degree requirements will be specified in terms of these courses. Applications for graduate studies will be screened and forwarded to the Graduate Studies Committee (GSC) for admission into the appropriate Department. The MBB Graduate Programme Committee (GPC) will strike supervisory committees for ratification by the GSC of the appropriate Department. Ranked lists of MBB students for scholarships and fellowships will be forwarded by the MBB GPC to the appropriate GSC for consideration along with other graduate students. The MBB graduate students will enjoy all the benefits and privileges of being a student in their Department.

With the new graduate program, a new building, a critical mass of faculty members in both molecular biology and biochemistry, and strong support from the University, the Institute is well positioned to attract highly qualified graduate students and postdoctoral fellows. This is an area in which Simon Fraser University has an opportunity to build an even stronger centre of excellence. Several of the people we interviewed suggested that it was inevitable that IMBB would become a separate Department, but at the same time they indicated that they would prefer to have the biochemists remain in the Department. There are very beneficial interactions between the biochemists and the organic chemists. This would likely be weakened if the biochemists became part of a separate department. There are also reservations about teaching assistantships for biochemistry students if they were not members of the Department of Chemistry.

We met with and interviewed the Director of IMBB, the Chemistry faculty members who are members of IMBB, and the Chair of Biological Sciences. We were left with the impression that the goals and wishes of the concerned parties are not far apart and that on the whole, there is strong support for maintaining the current Departmental affiliations. Much of the perception that breaking away to form a new Department is the only solution stems from a lack of communication among all parties. In particular, the Director is not always properly informed about decisions made by the individual Chairs that have an impact on the Institute. In addition, several of the individuals we interviewed alluded to "personality conflicts" that could only be addressed by forming a new Department. The Institute and two Departments must analyze the issues that are critical to the future directions of molecular biology and biochemistry at Simon Fraser University and make their decisions and plans accordingly. Issues of personality can then be dealt with in the context of a coherent plan.

We are convinced that the right choice is to maintain the Institute. If the Departments of Chemistry and Biological Sciences are prepared to work with the Institute for the common good, then the Institute will succeed. Communications between all parties must however improve.

RECOMMENDATION 41. We recommend that the present relationship between the Department of Chemistry and the Institute of Molecular Biology and Biochemistry be maintained.

RECOMMENDATION 42. The Director of the Institute of Molecular Biology and Biochemistry should attend all Departmental meetings in the Departments of Chemistry and Biological Sciences.

XIV. FUTURE DIRECTIONS

The Department of Chemistry must identify the areas in which it will concentrate. With fourteen faculty members expected to retire in the next ten years, there is a tremendous opportunity to build on present strengths and to enter into new fields. Clearly, we favour maintaining the strength in biochemistry and organic chemistry. This gives the Department a strong basis for interdisciplinary research and a unique advantage over many other universities in the competition for the best graduate students.

What new directions should the Department embark upon that may carve a special niche for Simon Fraser University in the academic scene of British Columbia? It is indicated in the *1994 Internal Review* that the appointment and impending arrival of Dr. Agnes is expected to spearhead developments in the area of analytical chemistry. A single individual in an analytical division cannot be expected to carry the load with respect to teaching and research in the same way that the teaching and research duties are discharged by a half dozen members in other divisions. We suggested informally during the site visit that a viable division needs to have at least three faculty members. A balanced analytical group should include appointments of recognized analytical chemists in the three areas of separations, electroanalysis and spectrochemical analysis.

When the subject of the desirability of additional analytical appointments was raised we sometimes received comments to the effect that individual faculty members should not be constrained by labels. Nevertheless, while an interdisciplinary point of view has validity, for the foreseeable future most chemists will call themselves by the traditional labels "analytical", "inorganic", "organic", "physical" and so on.

It is reasonable to expect analytical appointees to interact with and to collaborate with colleagues in other divisions. As indicated the first analytical chemistry professor may well focus on environmental studies and collaborate with others in such studies. It seems unlikely that other analytical chemists would or should necessarily have a similar environmental focus. The search for analytical faculty members should not be constrained by a requirement that they be hyphenated analytical chemists such as "analytical-environmental", "bio-analytical", etc. The broader perspective should be retained for analytical appointees in the same manner that it is for those in other divisions.

RECOMMENDATION 43. In order to establish a viable analytical division of three professors, the Department should develop a plan to appoint two additional analytical chemists to its faculty during the next three to five years.

In its attempts to develop a long-range plan the Department should build upon the current strengths in inorganic and physical chemistry. Given that the Department of Physics at Simon Fraser University has by choice concentrated on condensed matter physics, it would appear to be appropriate to explore the opportunities for developing an interdisciplinary approach to materials science.

The Department has had a small but unique nuclear chemistry program since the founding of the University. The long-range planning process should consider the maintenance of this established niche by means of future appointments.

RECOMMENDATION 44. The Department of Chemistry should develop a long-range plan for future appointments. The plan should build upon existing strengths and identify opportunities for establishing strong groups in fields which are important to the future of British Columbia.

The Department has successfully recruited women for its faculty. However, all recent appointments have been in biochemistry, a discipline in which women are better represented than in chemistry. The biochemists do not teach lower-level courses and, therefore, the undergraduate students do not have any female role models in chemistry. In addition women are over-represented in Departmental support positions such as teaching technicians and laboratory instructors. This sends a signal to female chemistry students that these are the positions to which they must aspire.

RECOMMENDATION 45. The Department should vigorously recruit excellent female scientists for future appointments.

Chemistry

27 - 29 June, 1994
Site visit of Review Committee

Monday, 27 June, 1994

Meeting with John Munro, Colin Jones, Bruce Clayman, Alison Watt	8:00-9:00	DUC
Meeting of committee members	9:00-9:15	DUC
Meeting with Chair, Cam Oehlschlager and tour of Department	9:30-10:30	C8039
Meeting with Undergraduate Studies Committee	10:45-11:45	C8039
Meeting with Chair, DUGSC, Ralph Korteling	12:00-1:15	DUC
Meeting with undergraduate students	1:30-2:15	C8039
Meeting with Inorganic group	2:30-3:30	C8039
Meeting with Director, Institute of Molecular Biology & Biochemistry, Bruce Brandhorst	3:30-4:00	C8039
Meeting with Dean of Science, Colin Jones	4:15-5:15	P9452
Reception with members of the Department	5:30-6:30	C8039

Tuesday, 28 June, 1994

Meeting with technical staff	8:30-9:15	C8039
Meeting with Graduate Studies Committee	9:30-10:30	C8039
Meeting with graduate students	10:45-11:45	C8039
Lunch with Chair, DGSC, Steven Holdcroft	12:00-1:15	DUC
Meeting with Physical group	1:30-2:30	C8039
Meeting with Organic group	2:30-3:15	C8039
Meeting with Joe Chow	3:15-3:30	C8039
Meeting with Nuclear group	3:30-4:15	C8039
Meeting with Bruce Clayman	4:30-5:15	C8039
Meeting with Brian McKeown, Chair, Biological Sciences	5:15-6:00	C8039

Wednesday, 29 June, 1994

Meeting with DA and Laboratory Coordinator	8:30-9:00	C8039
Meeting with support staff	9:00-9:30	C8039
Meeting with Biochemistry group	9:45-10:45	C8039
Meeting with General Chemistry group	10:45-11:30	C8039
Meeting with Lab Instructors	11:30-12:15	C8039
Open Lunch in Department	12:30-1:30	C8039
Wrap up meeting of committee	1:45-2:45	C8039
Meeting with Cam Oehlschlager	3:00-3:45	C8039
Meeting with John Munro, Colin Jones, Bruce Clayman, Alison Watt	4:00-4:45	PCR

PCR - President's Conference Room

DUC - Diamond University Club

C8039 - Chemistry Seminar Room

P9452 - Office of the Dean of Science

7HW

SIMON FRASER UNIVERSITY
Department of Chemistry

Memorandum

To: J. Munro, VP Academic

From: R. Korteling, Chair

Date: February 13, 1995

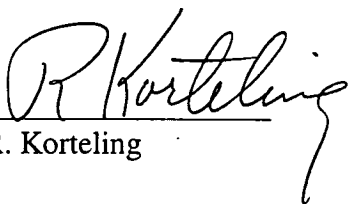
Re: External Review of Chemistry

File: ..chair\dept\rev94\fnlmem95.vp



The Chemistry Department has finished its review of the External Review Document generated by the External Reviewers of the Department. The enclosed Departmental Response explains the process the Department used to evaluate the External Review Document and the Department's response to it. Although prepared by the Chair, the department as a whole had input to all sections and reviewed the contents section by section at Departmental Meetings.

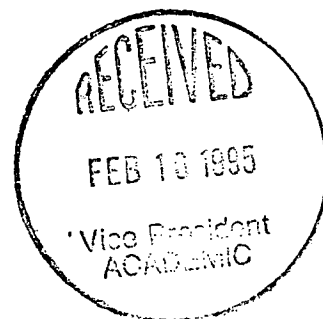
If there are further questions that need to be addressed, please let me know.


R. Korteling

RGK:ps

cc: C.H.W. Jones, Dean of Science

**Simon Fraser University
Department of Chemistry**



**Departmental Response
to the
Recommendations
from the
External Review of the Department
held
June, 1994**

Prepared by
R. Korteling, Chair
February 13, 1995

Summary

The Department has considered the report of the External Reviewers and responded to their recommendations in detail. In general, the Department is in agreement with the suggestions that have been made and had identified many of them as items which the Department wished to implement when resources were available. There were some recommendations which the Department does not think would improve its ability to provide the best possible chemical education and foster the best possible research program. The difference in opinion may be due to the very special nature of our trimester system with which all of the External Reviewers were not totally familiar. These items have been identified.

Many of the recommendations dealt with changes which would require substantial financial and Faculty of Science resources. The Department cannot implement these recommendations unless the University provides the necessary means or the Department can acquire the resources externally. The Department will vigorously pursue all avenues to acquire the needed resources however it is an unfortunate state of affairs when departments find it necessary to also seek external funding to mount an effective undergraduate teaching program in addition to seeking the normal external support for the research and graduate programs.

The report of the External Reviewers seems to have been written very much in the spirit of making a good department better and the Department is responding in a like manner.

Introduction

The Chemistry Department is in the final stages of a departmental external review process. This review was initiated in late 1993 with an internal review where all members of the Department had the opportunity for input to the Internal Review Document. This Document was submitted to the University and sent by them to an External Review Committee formed by the University.

The members of the External Review Committee were:

Dr. Howard Alper
Department of Chemistry
University of Ottawa

Dr. Russell Boyd - Chair
Department of Chemistry
Dalhousie University

Dr. Walter Harris
Department of Chemistry
University of Alberta

Dr. Rachel Klevit
Department of Biochemistry
University of Washington

Dr. Manfred Mackauer - Internal Member
Department of Biological Sciences
Simon Fraser University

The External Review Committee visited the Chemistry Department for three full days on June 27 to 29, 1994. At that time they met with all groups within the Department including both graduate and undergraduate students. They also met with the other Chairs in the Faculty of Science and senior members of the Administration.

In due course, the Committee submitted their report to the University and the Chemistry Department received it in late September, 1994.

The Department has now considered the report and the recommendations which the External Review Committee made. These recommendations cover all aspects of the Departmental activities. The Department has generated its response by requesting the various appropriate Departmental Committees to discuss the relevant recommendations and produce draft responses for inclusion in a final document. This document was discussed by the faculty and senior support staff of the Department in meetings held for that purpose. This final document is the result of these deliberations and represents the consensus of those who participated.

What follows is the Departmental response to each of the recommendations made by the External Review Committee as well as some general comments. The response is organized and labeled to follow the flow of the External Review Report.

Section IV Undergraduate Teaching and Curriculum

The External Reviewers concentrated on the undergraduate program. They divided their discussion into several sections according to subject. In regard to the general chemistry 100 level courses they noted that, similar to all Canadian Universities, a high percentage of chemistry enrollments are in these service courses. Furthermore, these courses are key prerequisites for the study of many disciplines; chemistry is a central subject for science and related disciplines. As such, these courses must meet the need of non-chemistry students and at the same time provide a sound base for students pursuing a chemistry degree.

They had specific recommendations for course changes in some of the specialty areas of chemistry. The department is in general agreement with these suggestions and had already noted that improvements were needed. In fact, the Department is currently reviewing its total undergraduate program with the aim of revitalizing and modernizing its offering.

The External Reviewers did not identify any serious flaws in the program and seemed to be suggesting ways to make a good program better.

Recommendation 1

The general chemistry laboratories are held in rooms designed in the 60's for 60's chemical education. Chemistry has changed considerably since then with a major shift from test tubes to computer controlled electronic instrumentation. It is time for the modern student to be exposed to modern chemistry. An important step in this direction is to renovate and modernize the general chemistry laboratories. The Department has put this forward as a high priority in the past and now will endeavor to make it a high priority for the University as the External Reviewers recommend.

Recommendation 2

Partly to start the process identified in Recommendation 1 and partly to respond to enrollment pressures, the Department sought funding from the Provincial MSTL Innovation Fund and was granted funds to incorporate computers into the first general chemistry laboratory course. Unfortunately the Department does not now have space to house adequate computer facilities and it is trying to cope with totally inadequate computer resources as identified by the External Reviewers. The Department has submitted a request for renovation funds which would allow it to convert some of its general office and seminar room area into computer laboratories. Although the Department is reluctant to convert these highly used areas, it feels it has no choice

meet its teaching responsibilities. The Department is hopeful that the funds will be made available in the next fiscal year.

Recommendation 3

The Department is reviewing its total undergraduate program with an aim to modernizing and revitalizing its offering. Part of this review involves a revision of the general chemistry program. In fact, the general chemistry program has been reviewed several times in the last few years, mainly under the direction of the Undergraduate Studies Committee. What has not been done well in the past but which will be done in the future is to make sure that the lecture and laboratory components are viewed as a whole. Since many faculty are involved in teaching the program, it is likely that the coordination for this process will remain with the Undergraduate Studies Committee or a subcommittee charged with maintaining the program rather than with an individual.

Recommendation 4

In the past the Department had a significant number of graduate students who had poor English communication skills and it was a difficult problem to utilize them in the undergraduate teaching program. More recently the numbers have decreased and the problem is less severe. Nevertheless, there still are a few cases where the communication between a TA and students is a problem. The Department tries to place these TAs in less demanding situations and in extreme cases, withholds teaching assistantships until the graduate student's English proficiency reaches acceptable levels. The Department will continue to monitor this potential problem.

Recommendation 5

With the separation of the lecture and laboratory components into two different courses, the synchronization between the two has been a perennial problem. Due to the workload involved, it is unreasonable for one faculty member to be responsible for both in most lower level courses. However, some faculty members have been very effective in interacting with the laboratory instructor associated with the accompanying laboratory course without being in charge of the course. The Department, through its Undergraduate Studies Committee, will encourage this interaction in all cases and take steps to enforce appropriate synchronization if problems arise.

Recommendations 6, 7, 9 and 10

These recommendations deal with improvements to upper level courses in specific areas. The Department is currently undertaking a review of its total undergraduate program as mentioned above. These concerns of the External Reviewers will be addressed in detail in that review.

The Department is in general agreement with what the External Reviewers have suggested. Steps have already been taken to address the need to modernize the physical chemistry teaching laboratory, and with suitable support from the University it should be completed in the next few years. The changes in the courses will be developed over the next few months with the aim of submitting the new program in the fall of 95 to the University for approval and implementation in the 96-3 semester.

Recommendation 8

The Department has been upgrading and modernizing its teaching laboratories over the past few years. Some still require conversion, but it is a high priority of the Department to complete the task. The Department has followed the recommendation to establish an order of priority by trying to address the most pressing needs first. Henceforth the Department will use the Undergraduate Studies Committee as a vehicle to prioritize this process.

Recommendation 11

A few years ago, the Department revitalized its analytical courses and created a series of environmental courses. At that time a minor in environmental chemistry was instituted. These courses are only now being incorporated into the teaching program of the Department. The delay was due to the lack of faculty to mount the courses. A new appointee in analytical chemistry will be joining the Department in the Spring of 1995. The Department had also identified the need for a second appointment to teach the environmental chemistry courses. It is only now that the possibility exists to add this second member and the Department has given its highest priority to the addition of a person able to teach in that program. Further appointments in the area will be made as the University provides positions, hopefully in the next 3 to 5 years.

Recommendation 12

The Department invested heavily in new analytical equipment a few years ago. Additional instrumentation is needed and the Department is seeking funding from within and external to the University. The Undergraduate Studies Committee will help prioritize the need in this area relative to that in other laboratories. It is unfortunate that the Department must seek external funding to adequately support this important component of the undergraduate teaching program.

Recommendation 13

The Department provides the undergraduate student union with some office space. Unfortunately this is inadequate to satisfy the needs of the students but the Department is faced with a severe space shortage. The Department is currently studying its space utilization but it is unlikely that additional space can be found for the resource center even though the Department

feels that it is a worthwhile cause. Perhaps this is an item that should be addressed at the Faculty or University level.

Recommendation 14

The Department does plan its chemistry course offerings at least one year in advance and this is published by the Registrar. The scheduling of the biochemistry courses, which are not under the direct control of the Department, is going through a transition with the implementation of the new biochemistry program. Once the course offerings of this program are stabilized, their scheduling will also be published at least one year in advance.

Courses which are not offered regularly are identified by the registrar and deleted by the Department when warranted.

Recommendation 15

The Department does adhere to a block schedule for courses within the Faculty of Science. Unfortunately, the flexibility of the trimester system makes it almost impossible to avoid some clashes, especially when students get out of phase.

Section V Graduate Teaching and Curriculum

The reviewers considered the graduate program in some detail. They found that the formal requirements are similar to those in other Canadian chemistry departments. They were, however, concerned with the length of time to complete degree programs - especially the M.Sc. degree.

They noted the relatively low number of NSERC Postgraduate Scholarships holders in the Department and drew the conclusion that the quality of the graduate students was not as high as it should be. However, they did comment that there were a number of faculty members with international reputations for their research achievements and concluded that it should be possible to increase the number of Postgraduate Scholarship holders to a number above 10. At the same time they did recognize that there are excellent graduate students in the program and that many former graduates have won prestigious awards.

These and other concerns which they identified led the reviewers to come forward with 13 specific recommendations dealing with the graduate program. The Departmental Graduate Studies Committee has discussed these recommendations and has formed responses to them. In a few instances there seems to have been a misunderstanding of the details of the program by the reviewers leading to recommended actions which are already Departmental practices.

Recommendation 16 & 17

The Graduate Studies Committee agrees that the Department should strive to have students complete their M.Sc. or Ph.D. programs in 2.0 and 4.5 years, respectively. However, there are reasons for the current excessive length of these programs, in particular, the small number of scholarships available to our students. This requires students to TA for eight months of the year, and some TAs are considered far too onerous. The consensus was that it would be extremely difficult to implement a "hard-line" policy to reduce residence time in the program. However, the committee agreed to be pro-active, in this regard, by reviewing individual cases which appear to be heading towards residence times in excess of those indicated above. It is anticipated that the Graduate Studies Committee would meet with the student and supervisory committee, and make appropriate recommendations.

Recommendation 18

In response to this recommendation the Graduate Studies Committee now includes a Recruitment Officer. The Graduate Studies Committee has several new strategies for recruitment: following up on potentially high quality students who request application materials; obtaining a list of NSERC postgraduate scholarship holders and encouraging them to apply to SFU; having a strong faculty presence at Canadian Society of Chemistry meetings, particularly the undergraduate poster session; sending a representative to lecture to, and meet with, undergraduates at non-Ph.D. granting universities.

Recommendation 19

The Graduate Studies Committee will oversee admissions through the combined efforts of the Admissions and Recruitment officers. Applications which require further deliberation will be brought to the Graduate Studies Committee.

Recommendation 20

The Graduate Studies Committee disagrees with the recommendation that TA stipends be awarded for only 2 and 4 years for M.Sc. and Ph.D. students, respectively. The Department's TA allocation varies substantially from year to year. The Department often has difficulty in finding a quota of suitably qualified TAs. In semesters where the Department requires a large number of TAs, it would be demoralizing to the students of current good standing to be denied a TAs while non-students are brought in to perform the necessary duties. In addition, the University's contract with the TSSU forbids such a practice.

It is currently the practice that supervisors contribute at least 1/3 of the student's annual stipend.

Recommendation 21

The Graduate Studies Committee agrees that a TAship is beneficial to the student's education. The Graduate Studies Committee will recommend that all graduate students should have TA's for a minimum of one semester.

Recommendation 22

The Department is considering the rescheduling of CHEM 801/802 and CHEM 805/806 to help students complete their programs in a timely fashion.

Recommendation 23

The Graduate Studies Committee agrees that students should get written feedback in relation to their seminar courses. This proposal has already been implemented in 94-3.

Recommendation 24

The External Review Committee either misunderstood, or was misinformed, regarding transfer from the M.Sc. to Ph.D. program. It has always been Departmental policy to base transfer on research promise, grade-point average, and recommendation by the student's supervisory committee.

Recommendation 25

In the past, the Graduate Studies Committee, or a representative of that committee, has been actively involved in TA assignments in consultation with the Chair of the Department. The Graduate Studies Committee continues to be pro-active in regard to development and administration of Departmental policies concerning the graduate program.

Recommendation 26

The Department is currently preparing an updated document for entering graduate students which highlights pertinent details and scholarships.

Recommendation 27

The Graduate Studies Committee agrees that it should monitor course requirements, and has done so in the past. Offerings are, of course, at the discretion of the Departmental Chair, and are

subject to available faculty. At any one time, some faculty are on sabbatical or research leave and are therefore not available to teach specific graduate courses related to their expertise. In this regard, the Graduate Studies Committee recommends that courses which have not been offered for three years should not be removed from the calendar since they are likely to be offered in the future.

Recommendation 28

It is the current practice of the Graduate Studies Committee to meet on a regular basis. The Graduate Studies Committee believes that procedural details on how decisions are made by the Graduate Studies Committee are widely known to the Department.

Section VI Administrative Structure

The reviewers felt that the committee structure of the Department was appropriate in principle. They did, however, recommend that the job descriptions of the Laboratory Coordinator and the Departmental Assistant be reviewed. They were particularly concerned that academic advice was currently the responsibility of the Laboratory Coordinator rather than a faculty member. It is ironic that the Department had been exceptional among departments in the University in that in the past faculty were responsible for all academic advising.

The reviewers were also concerned with some safety issues and recommended that the Department ensure that safe practices be followed. The Department does take safety seriously and has mechanisms in place to teach safe practices and identify unsafe situations. However, it is ultimately the responsibility of the faculty member in charge of a laboratory to make sure the laboratory is a safe environment.

Recommendation 29

All of the academic advising has been done by faculty members in the Department until this year when the advising of chemistry students was taken over by the Laboratory Coordinator. The present advisor, although not a faculty member, does hold a science Ph.D. degree and is well versed in undergraduate science programs. There is no reason to think that any faculty member is better suited for the task. A biochemistry faculty member is the academic advisor for the biochemistry students.

Recommendation 30

The job descriptions and responsibilities of the Laboratory Coordinator and the Departmental Assistant have been discussed on several occasions with the incumbents. The reason for the recommendation that the Departmental Assistant should be in charge of all support staff and that

the Laboratory Coordinator report to the Departmental Assistant on all technical support staff in the teaching laboratories is not clear. It seems that the reviewers are suggesting a theoretical structure which does not fit our situation or take into account the individuals involved. The Departmental Assistant has a background in finance which makes her ideally suited to handle the Departmental finances whereas the technical background of the Laboratory Coordinator makes him well suited to the task of supervising the technical aspects of the Department. The Department does not have any plans to change the present arrangement.

Recommendation 31

The Department has a Safety Committee which routinely conducts safety inspections and requires adherence to all safety and WHMIS regulations. The Chair of the Departmental Committee is a member of the Faculty of Science Safety Committee and as such is required to act at the departmental level upon any regulations or rulings that may be made by the Faculty Committee. Unfortunately, present University policies do not provide enforcement mechanisms for the Department or Faculty Safety Committees short of requesting the external WCB to close a laboratory. The Department does endeavor to bring its powers of persuasion to rectify violations. This practice is generally effective and the Departmental record is good.

Recommendation 32

The Department has given a laboratory safety course to incoming graduate students each Fall semester since 1992 and feels that this is an important component in a student's program. However, at present there is no way to make attendance compulsory. The Department will investigate ways to ensure that all students do attend in the future. First-aid is a component of these courses. Special first-aid courses are given by the Red Cross at SFU and some of our technical staff have taken them. The Department encourages its members to take these courses but does not require it. Fortunately, the University provides a 24 hour service by a direct phone line to Traffic and Security, where a fully qualified Industrial First Aid Attendant is on duty. Response time is about ten minutes.

Recommendation 33

The Department does require up-to-date inventories of chemicals and radioactive materials in laboratories and Departmental facilities. There are few problems with maintaining the radioactive inventory since the number of items is relatively small and the University provides a two person radiation protection office which happens to be located within the Department. Unfortunately, maintaining the chemical inventory is more difficult since there are approximately 20,000 items in the Departmental inventory and most of them are perceived by the users as being harmless and therefore a low priority safety issue. Again enforcement mechanisms are a problem short of laboratory closures by the external WCB. Intermediate actions need to be developed to enforce compliance which may involve changes to University policies.

Section VII Faculty

Although the reviewers made no recommendations in regard to the faculty, they did comment that the number of faculty was appropriate for the Department's undergraduate and graduate programs. However, two of the reviewers did think that the number of laboratory instructors was more than needed. The Department has considered this comment and has come to the conclusion that the comment may have come from a lack of knowledge of how our trimester teaching programs differs from the normal year program found at most Universities. This issue is discussed more fully in the next section along with the technical support staff associated with the laboratory program.

Section VIII Support Staff

In this section some of the reviewers saw fit to identify what they perceived as a surplus of technical support in the teaching laboratories. The Department has discussed this issue at some length and feels that the reviewers did not completely understand the different mode of operating teaching laboratories in this department as opposed to that commonly practiced at other institutions. The Chemistry Department has historically placed great emphasis on the laboratory component of the student's chemical training. For this and other reasons, it has separated out the laboratory component as separate courses where greater emphasis on experimental skills can be taught. Most other institutions conduct laboratories as part of the corresponding lecture course and often regard them as a necessary condition to pass the course but with little impact on the final grade. As a consequence, the importance and attention placed on this aspect of their education is often minimized by the student.

Our laboratory courses require a much greater repetitive teaching involvement by the laboratory instructors in small sections of students than at most other institutions. For example, in the 94-3 semester the laboratory course CHEM 115 was given to about 600 students broken into 10 laboratory sections. For each section a separate 30 to 45 minute lab lecture is given to cover the principles of the laboratory experiment and to demonstrate the techniques required to perform the experiment. Then once the students are working on their experiments, the presence of a responsible person for safety considerations is mandatory. This teaching is ideally suited to those faculty who do not have research responsibilities and therefore can spend the time with the students.

The laboratory instructors also provide a continuity and consistency to a laboratory course which is very difficult to accomplish with the trimester system and concomitant course offerings. (We give the same course 3 times a year whereas most 1 year institutions offer the course once a year.) This is not to say that these laboratory courses should be turned over to be run solely by laboratory instructors. In fact, we have found that the most successful laboratories are those where faculty giving the lecture courses are involved in the evolution of the laboratory course with the laboratory instructor and this is encouraged.

The question whether there are too many laboratory technicians involved in mounting the laboratories must include the physical layout of the teaching laboratories as well as the responsibilities of the technicians. Many institutions have a laboratory arrangement where one central dispensary can service several laboratories with inherent efficiencies. Unfortunately that is not the case in this Department. Any future building plan would include such considerations but until then the Department is faced with existing facilities. In addition, some of the technical support is used to prepare and assist in lecture demonstrations. Without this help few lecturers would find the time to include this instructive component to their lecture course presentations.

Although the Department is currently reviewing the technical staff responsibilities with an aim to improving the match between Departmental needs and current staff, there is little hope that significant savings can be made in total staffing levels. The Department strongly feels that had all the reviewers fully appreciated the differences between our teaching needs and perhaps those of their own institutions, the reviewers would not have come to the conclusion that there seemed to be an excess of support for the teaching laboratories.

Recommendation 34

The Chair and senior administrative staff of the Department are currently reviewing the job descriptions of the Departmental staff with the aim of better matching the current needs of the Department and the capabilities of the individuals. The hope is that with some relatively small changes in staff responsibilities, the match can be improved and changes in the Departmental needs can be accommodated. The staff will be consulted in this review and their cooperation will be sought. As this review comes to a close, new job descriptions will be generated which will form the basis of performance evaluations. The formal aspects of the evaluations will be governed by University policy.

Recommendation 35

The Department will continue to make every effort to convince the University that the job classifications and salaries of all support staff should be consistent with their qualifications and responsibilities. The past Departmental efforts in this regard have not been successful. Hopefully, the University will be more receptive to taking a more flexible position in the future.

Section IX Research and External Funding

The reviewers were generally impressed with the level of external funding for research programs. They did mention that faculty would be wise to maintain a strong base of NSERC funding while pursuing other sources. The members of the Department are aware of that bit of good advice and strive to comply.

Section X Space

The reviewers were not in a position to independently assess the space needs of the Department. They did, however, address the claimed shortage of office space and suggested that it was a serious matter which must be addressed by the administration of the University. They were specifically concerned with the safety of having graduate students, as well as others, using laboratory space as offices where they are overtly exposed to toxic and carcinogenic substances.

Recommendation 36

The Departmental Space Committee is in full agreement with the recommendation to provide office space for graduate students outside of the research laboratory. Unfortunately, adequate office space does not exist within the Department to accommodate all of these students. The Department has repeatedly requested additional space for this purpose but has not been successful. The Department will again try to convince the University that this is an urgent matter and that some suggestions for renovating currently unused areas would help relieve this problem.

Recommendation 37

The Department has recently reconstituted the Space Committee and charged it with several responsibilities including those suggested by the external reviewers. It will be the practice of the Department in the future to seek advice from this committee on space matters.

Recommendation 38

The Department has provided office and research space to those retired professors who wished to continue to work after retirement. The amount and quality of the space is determined by the limitations the Department faces at the time and the use these faculty make of the space. It is the general practice of the Department that space will be provided to retired faculty but not to the serious detriment of existing faculty needs. The Space Committee will review these requests and recommend a course of action to the Chair.

Section XI Resources and Facilities

The reviewers were impressed with the equipment in many of the research laboratories and the success the Department has had in NSERC equipment competitions. They did mention that the support of the teaching laboratories seemed to be uneven and suggest that the Department make improvements where needed. This issue has been addressed in Recommendation 8. In general, the Department has been trying to revise its teaching laboratories and is in a multi-year program to update and improve all of them. With the support of University resources, it will continue with the task.

The reviewers found no problems with either the library or computing services except with the need to increase the computers made available for undergraduate instruction. The Department is in the midst of trying to increase its computer laboratory facilities within the strict space limitations it faces.

Section XII Budget

The External Reviewers seem to have formed the impression that the Department is not facing financial hardships. It is a well known fact that all universities are struggling to cope with shrinking budgets to service increasing numbers of students. It is also well known that some other regions of the country have been under greater strain than BC. However, this is not a reason to reduce everyone to the same inadequate lowest funding level.

Unfortunately, the reviewers seem to have also gained the wrong impression that the Department does not recover many costs from the faculty such as photocopying, long-distance phone calls, facsimile messages and courier expenses. This false impression seems to have led them to conclude that the Department is not experiencing financial difficulties. The fact is that the Department is currently recovering essentially all of the costs of consumables, including the above list, used in research even though it does not yet charge for departmental research facilities for sound pedagogical reasons. It has even shrunk its secretarial staff to the lowest level within the Faculty of Science for budgetary reasons. It also is faced with the difficult problem of mounting new teaching laboratories without adequate funding for the required instrumentation. The temporary solution has been to borrow equipment from BCIT and apply for external funding. Nevertheless, the Department is again forced to review its charging practices in light of increased financial pressures and will come forward with a comprehensive plan to charge for all non teaching supplies and services.

Recommendation 39 and 40

The Department has struck a special committee to look at the question of cost recoveries and user fees for Departmental facilities. This committee is trying to formulate a comprehensive and equitable plan to address these issues. Subject to Departmental acceptance, the plan will be implemented as soon as possible and definitely by the beginning of the new fiscal year.

Section XIII Institute of Molecular Biology and Biochemistry

The Institute of Molecular Biology and Biochemistry evolved from a joint program started by the Departments of Chemistry and Biological Sciences in the early years of the University. The Chemistry Department has always been a supporter of the Institute and the corresponding undergraduate Biochemistry Program. It will continue to nurture it within the Department and when the time is right, if the members wish, support it as a separate department. In the mean

the biochemists within the Department are valued colleagues and are treated as equal members of the Department with all the same rights and responsibilities as any other member of the Department.

Recommendation 41

The Chemistry Department has supported and encouraged the biochemistry program from its inception. Collaborative research programs have developed between the biochemists and other members of the Department. This close contact is viewed by the Department as highly desirable and the Department would not want to initiate any action which would diminish this relationship. The Department is in agreement with the recommendation that the present relationship between the Department of Chemistry and the Institute of Molecular Biology and Biochemistry be maintained.

Recommendation 42

The relationships amongst the three parties involved in the Institute of Molecular Biology and Biochemistry are complex. The Chemistry Department is anxious to continue the interactions as amicably and productively as possible. It currently invites the Biochemistry Undergraduate Program Committee to identify one of their members to be an observer on the Chemistry Department's Undergraduate Committee. A chemistry member of the IMBB is a full member of the Chemistry Graduate Studies Committee. Members of the IMBB, who are also members of the Chemistry Department, are included in the membership of various other Departmental Committees. If the Director of the Institute of Molecular Biology and Biochemistry feels that his presence at Department of Chemistry meetings would aid cooperation between the Chemistry Department and the IMBB, the Department would welcome him as an observer at all of its meetings.

Section XIV Future Directions

The Department is in the midst of formulating a future academic plan for the current Faculty of Science planning exercise. This is an ongoing effort which will address the future role of the Chemistry Department in the Faculty of Science and the evolving University. The fact that a major fraction of the existing faculty will retire within the next 10 years, is both a challenge and an opportunity to direct the Department into new areas that better meet the needs of future students.

Recommendation 43

The Department had identified the area of analytical and environmental chemistry as a high priority. It has been trying to make an appointment in these areas for some time. These are currently highly competitive fields and it is difficult to locate suitable candidates. Fortunately, the

currently highly competitive fields and it is difficult to locate suitable candidates. Fortunately, the Department has recently been able to attract a highly qualified analytical chemist who will be joining the Department in the Spring of 1995. The Department had always recognized that further appointments would be needed to make this a strong segment of the Department, and will make every effort to make additional appointments within its ability to convince the University to allocate such positions.

Recommendation 44

The Department is currently in the midst of developing a long range academic plan for submission to the Faculty of Science. As part of these discussions, it will address the issues identified by the Review Committee.

Recommendation 45

The Department has always tried to attract excellent female scientists for appointments. Two out of the 4 recent appointments in Biochemistry are female. Unfortunately, the pool of qualified candidates in the other areas of chemistry is smaller. As a consequence, only 4 out of 97 and 7 out of 51 applicants for recent searches in physical and analytical chemistry respectively were female. In these cases the appointees were male. The Department will continue to make every effort to attract suitable female candidates in all future searches.

Conclusion

The Department is in agreement with the majority of the recommendations brought forward by the external reviewers and was, in fact, in the process of addressing many of them. Some solutions will require University support such as additional space and financial resources. Some will be easily implemented within the Department's activities and resources. In either case, the Department has taken the position that it will make every effort to implement these recommendations.

There are a few recommendations which the Department feels should not be implemented. The difference in opinion between the Department and the reviewers is believed to be mainly the result of the significant differences between the operation of our trimester system and course structure and the conventional year system and course structure found at most other universities. The recommendations could be understood in the latter context and perhaps the reviewers were not fully aware of the differences. In addition, it seems that the reviewers were not fully aware of some details or misinterpreted statements made by individuals.

In total, the external review process has been both a timely and generally productive exercise. Starting over a year ago, there have been periods of intense activity and periods of waiting for events to occur where more reflective thought could be brought to bear on the subject. It has

forced the Department to consider its present condition and initiate planning for the future with a clearer understanding of the conditions we face. This planning is continuing with a goal of producing a future academic plan for the Department in the next few months.