Report of the Academic Program Review Panel
for the
Department of Biochemistry
Memorial University of Newfoundland

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Summary of Academic Review Panel Procedures

The members of the Review Panel met with Dr. Grant Gardner (Associate Vice President [Academic]) and Dr. Mark Abrahams (Dean of Science) on the evening of April 1, 2009. The meeting was also attended by Kim Myrick, the APR coordinator. We discussed the Academic Review process in general and the Dean provided some background on the Biochemistry Department (hereafter referred to as the Department). There was discussion of priorities and of the commitment to following up panel recommendations.

During the subsequent two days, the Review Panel members met with:

1. The Head of Biochemistry on two occasions.

2. Departmental staff including information technology support, administrative and secretarial support, purchasing and receiving staff for the combined Psychology, Biology and Biochemistry Stores and members of the teaching support staff for laboratory course instruction.

3. The departmental Graduate Studies Committee.

4. Twelve Graduate students from the Biochemistry and Food Sciences degree programs at both the MSc and PhD levels.

5. A group of six Faculty members concerned with the nutrition/metabolism program.

6. A group of five Faculty members concerned with other areas of the biochemistry program.

7. Two Faculty members concerned with the food science program.

8. One Faculty member concerned with the nutrition curriculum.

9. A representative from Distance Education and Learning Technology to discuss the results of exit interviews with Biochemistry Undergraduates.

10. The departmental Undergraduate Studies Committee.

11. Fifteen Undergraduate students from both Honors and General programs in Nutrition and Biochemistry.

12. The Dean of Medicine.

13. The Heads of Mathematics, Psychology, Physics and Physical Oceanography, Biology and Chemistry.

14. Seventeen Faculty members on research foci, initiatives and renewal.

In addition, the Review Panel had lunch with the Department Head and two Canada Research Chairs from the Department. They were given tours of the Biotechnology Building and of the fourth and first floor Science Building space occupied by Biochemistry. On April 13 the Review Panel had a conference call with the Dean of Graduate Studies.

The Panel appreciated the helpful attitude and cooperation of the groups and individuals with whom it met and conferred. We were also grateful for the support provided by Kim Myrick, the Review Coordinator, and Lorraine Kenny of CIAP.

The Department of Biochemistry

1.0 Leadership

The Review Panel was impressed with the work of the current Head in laying the groundwork for addressing many of the challenges the Department faces. His genuine concern for the Department and his efforts to be fair to all in difficult circumstances were evident to the Panel. Departmental committees have been actively generating plans for renewal of both undergraduate and graduate curricula. A Departmental Vision Statement has been articulated to help enhance the focus of the Department. The exit survey strategy to monitor strengths and weaknesses of the undergraduate program was seen as innovative. The allocation of staff resources to address issues raised by earlier reviews was noteworthy. The self study plan was comprehensive, including a large array of comparative statistics, and was very helpful to the Panel.

Critically, the Department is now at a junction where a new Head will need to be appointed. This is such a key position for the health and well-being of the Department that the Panel's recommendation in this regard is its strongest.

Biochemistry is a research intensive department, with faculty members recognized nationally and internationally for their research. However, the Department has a longstanding history of fragmentation and is presently composed of a heterogeneous group of individuals with highly disparate aims and capacities. While the contributions of the current Head are strongly acknowledged, it is Panel's unanimous opinion that the next Head be external to the Department. An external head is a necessity at this time owing to what the Panel views as a lack of any obvious candidates within the current complement who could reasonably be expected to reroute the collective mentality towards a positive and collegial direction and away from the longstanding ill will which has continued unbridled in the unit. A new Head should not only have strong leadership skills, but should also be an active and successful researcher in an area that complements research strength(s) in the Department. Leadership skills are paramount. Further, the Faculty of Science should be prepared to support a new Head in such a way (e.g., research support, as well as an administrative stipend) that an excellent candidate can be recruited and retained.

Recommendation 1.0: The Science Faculty should initiate a search process, according to the University's Policies and Procedures for the Appointment of Administrators, such that an external Head with a strong research profile is in place when the term of the current Head ends.

2.0 Faculty Research and Scholarship

As noted above, the Department is considered a research intensive unit. The prior 1998 APR report observed that it might be difficult to maintain the level of research productivity if teaching

loads increased, but also noted that teaching loads in the Department were relatively light in comparison to other departments in the Faculty of Science. The solution suggested at that time was that the Department endeavour to increase the number of faculty supported by external salaries. Indeed, the Department was successful in this regard, recruiting two Canada Research Chairs and another faculty member who has received support from the CIHR New Investigator program.

However, compared to the situation in 1998, both the amount of external funding (considering primarily operating funding) to the Department and the number of funded faculty has decreased. While the total amount of funding awarded to the Department (data provided in the Self Study Report) is comparable to similarly sized departments, the number of faculty holding operating awards is less than in comparable departments nationally. As of Mar 31, 2008, 10 FT faculty (out of 18 FT) held external funding according to the information provided. Currently (April, 2009, CIHR and NSERC Funded Research Database), 8 of the 17 FT faculty hold funding as PIs from these external agencies; the 2 jointly appointed faculty also hold external funding. This percentage may represent the barrier to growth in research capacity and graduate student numbers (see section on Graduate Studies). It should also be noted that that the Department has had success in the past in obtaining infrastructure awards (CFI, ACOA) which have provided much of the large equipment integral for the emerging strengths in the Department.

The current granting climate may make it difficult for those who lose funding (particularly from CIHR) in these increasingly competitive times to continue their research uninterrupted. The prior APR report recommended that the Department "aggressively seek funding from the CFI and the MRC/CIHR Regional Partnership program". Certainly, these avenues have been actively exploited by the department over the past 10 yrs, but even these are becoming limited (due primarily to institutional 'envelopes' for funding).

Another option is for faculty members to engage in more collaborative applications, which the Panel acknowledges is likely easier for some than others. Some members of the Department have had some success in this regard, and it may be that there are untapped opportunities for more such applications. Other options could include partnerships with various industrial (biotechnology, pharmaceutical companies). However, this funding problem is not unique to the Department of Biochemistry, and it would be useful for the Faculty of Science or the University to explore a program to provide some amount of bridging funding, or to actively assist faculty members in finding potential partners for funding.

The Department today has expertise in a number of different areas including metabolism, nutritional and food chemistry, structural biochemistry of proteins, lipids and carbohydrates, membrane functions, developmental biology and molecular biology. Past hiring decisions, which were intended to diversify the department in numerous directions but were stunted in the long term by a lack of significant overall growth, generated a heterogeneous group seemingly unable to enjoy any common purpose. While the area of Nutrition / Metabolism stands out as the exception, the remainder of the Department lacks coherence in its scientific directions.

The stated goal in the Biochemistry Vision Statement "is to develop research and teaching themes that bridge the Department's current core areas of expertise and allow it to move into the

future". This Vision Statement put forward by the Department in 2007 (although the Panel understands that this was not unanimous) attempted to define two general themes which could serve to provide foci for future growth by capitalizing upon existing strengths and providing a framework for interactions between existing research and that represented by two new positions. These two areas were 1) Development and Health, and 2) Membranes and Molecular Interactions. There are currently two faculty positions being advertised that fall within these general categories: one is in the area of Gene Expression and the other in Metabolic Biochemistry.

The goal of these two strategic themes is to develop new collaborations or interactions and to promote an interdisciplinary approach to research in these two major foci which would include issues of applied health research, as well as advancing the basic biochemical understanding of membranes and macromolecular interactions (e.g., lipids, proteins, protein-lipids, protein-DNA, etc). This framework would also provide support for ongoing collaborations within the Department and with other units in the University. The APR Panel strongly endorses this approach.

However, some of the issues identified in prior reports have not been fully resolved. The continuing rift among faculty in the three main disciplinary areas historically represented in the Department, biochemistry, nutrition and food science, does not bode well for future growth. Faculty members should be encouraged to look past historical divisions and to use their considerable (and multiple) strengths to position the Department as an active research unit with a view to making the most of the emerging opportunities in applied health issues and technological advances in biochemistry and biophysical chemistry. Having a strong research environment can only enhance both the undergraduate and graduate programs. The intent is not necessarily for the Department to reinvent itself, but rather for faculty to recognize that all members can contribute to making the Department an exciting place known for its research and teaching.

Strategic faculty renewal is the main avenue for refocusing the Department and solving its longstanding problems. This renewal would encompass the appointment of scientists to the currently advertised positions, the appointment of a new head external to the Department, replacement of any staff attrition or retirement, and possibly taking advantage of opportunities for joint appointments with costs shared with the Faculty of Medicine. The Department should be commended for its strength in metabolic biochemistry and nutritional research, for which it is known nationally and abroad. This is a logical and appropriate research focus for continued development. However, the Department must also develop, and recruit towards, a secondary complementary area. "Membranes and molecular interactions" or "membrane proteins" has emerged in recent planning exercises. Future recruitment (including the 2 currently advertised positions) should attempt to maximize (i) interactions within and outside the Department (including the Faculty of Medicine, where joint appointments to leverage research activity might be possible), and (ii) complementary technical expertise to enhance both research and teaching needs (e.g., enzymology, proteomics). New hires (although already in progress) should be made with a view to successful applicants having the ability to create sustainable research programs in addition to being able to interact with and/or complement existing research.

Recommendation 2.1: The Department should develop a five year plan of careful new hiring within a vision defined by strategic advantage for excellence in research and teaching of biochemistry and nutrition/metabolism, around a constrained number of research themes as noted above.

3.0 Undergraduate program

The Department's current undergraduate Majors and Honors programs are in the areas of Biochemistry and Nutrition. A total of 200-250 students are served by the undergraduate programs, all years combined, of which the distribution of the intake in the recent past is ~ 55% nutrition, 45% biochemistry. There are no restrictions on the number of students accepted into either program and the academic quality of the students is very good. Courses offered by the Department are also an integral part of the other programs including Biology, Chemistry, Neurosciences, Kinesiology, Pharmacy, Medicine and Nursing. Joint Honors programs are available with Cell Biology, Chemistry, Physics and Psychology.

Between the time of the inception of the Department, when only a single undergraduate degree (Biochemistry) was offered and the present time, the Department went through a phase of differentiation of their undergraduate offerings, and a subsequent contraction and elimination of many of these options, which included food science and dietetics. Food, nutrition, metabolism / biochemistry and health represent a continuum of related subjects. Universities across Canada have Departments which span at least some of this range. For example, it is not unusual to find university departments spanning food and nutrition or biochemistry metabolism and human health, but MUN would appear to be the only example in Canada which ever envisaged encompassing the whole range. This differentiation of the Department of Biochemistry might have been driven by optimism for growth of the unit and by the fact that students in competing institutions across the country are able to obtain undergraduate degrees in biochemistry, nutrition, food science and to obtain qualification as Registered Dietitians. However MUN Biochemistry is a small unit compared to most Departments of Biochemistry, Nutrition and Food Science across the country and is clearly insufficient in number to be able to offer programs in all of these areas. The elimination of food science and dietetics from MUN undergraduate program offerings is a prudent and appropriate decision and concordant with the idea of developing more constrained areas of focus.

The current programs in Biochemistry and Nutrition remain strong and independently viable, and the quality of the programs and of the students is a major strength of the Department. The Review Panel met with a group of undergraduate students representing both programs who expressed enthusiasm and general satisfaction with both the programs and the quality of the instruction therein. These students were both committed to the programs and articulate in their expression of the qualities of the programs. These remarks are borne out by the results of formal course evaluations and exit surveys, and described in the self-study report. Overall students like the programs; a particular respect for Dr. Mulligan was expressed.

A variety of ongoing and new issues pertaining to the undergraduate program was identified by the APR Panel. These are a synthesis of issues raised within the self-study report, the 1998

review of academic programs, the exit surveys, and meetings with students, staff and the Undergraduate Program Committee.

Students, Faculty and members of the Undergraduate Program Committee were aware of a series of issues related to the undergraduate curricula. Some of these issues include: is the program consistent with similar programs across the country? How is the balance of basic core material versus elective material and content related to new / emerging topics? Is the structure and flow of courses logical, and does it build consistently throughout the successive years? Is the practicum relevant and well – integrated? Many of the identified issues are perennial for all such programs, but it is of great importance that there is a means of dealing effectively with these issues on an ongoing basis and that implementation of change not get bogged down in process or unduly influenced by personal issues or Department history / politics. Curriculum review has been conducted and the Undergraduate Program Committee has labored to produce proposals for revisions to the programs and is in their second iteration of responding to comments from the academic staff on these proposals. The Panel agreed with the Undergraduate Program Committee that their preferred options for new course programming (selection 3A in Biochemistry and 2B in Nutrition) were clear improvements on the current prescriptions. Issues to be considered in program restructuring include:

- Lack of specific content in early years of the programs. Biochemistry content begins in 1st term of 2nd year and specific Nutrition content begins in 2nd term of 2nd year. This issue is endemic in similar programs across the country owing to the weight of relevant background in the early years.
- Frequent repetition of content amongst courses (raised in a 2005 exit survey, 1998 APR and by current students). Specific topics mentioned at this review : protein modeling and protein synthesis.
- Consistency with programs across the country. This topic has been the subject of formal review by the Undergraduate Program Committee, but it is noted that "requirements" in undergraduate nutrition programs across the country do not necessarily include as extensive physical chemistry, analytical chemistry, biochemistry or food science as mandated at MUN and these may be dictates of history more than anything. For example, neither physics nor food chemistry are subjects included in most Nutrition programs and not subjects mandated by Dietitians of Canada for Nutrition programs used to train Registered Dietitians. By contrast, most Nutrition programs usually include one course of introductory food science. Adjustments in these domain areas would bring MUN Nutrition programs in line with other programs nationally and help create much-needed flexibility.
- There would seem to be room for constructive interactions with the Department of Biology. There is currently course overlap or even redundancy with biology offerings especially in the areas of cell biology and genetics. These overlaps require rationalization. Biology has recently mounted a course in Biotechnology offered as a 3-week block in intersession and cooperation around this content area and others (such as metabolomics, nutrigenomics) may be in the mutual advantage of both Departments.
- A number of specific issues pertaining to the Honors program were raised. It is of note that not all Honors students in Biochemistry and Nutrition are supervised within

the Department of Biochemistry, making the means by which these projects are supervised and standardized important across Departmental boundaries. The extension of Honors projects into a thesis-based MSc program and whether that constituted "double dipping" was discussed.

Recommendation 3.1: The Department should develop and support a plan for implementing the recommendations of the Undergraduate Program Committee for the ongoing upgrading of the curriculum, in a timely fashion.

The career paths of former graduates appear to be relatively well documented. However, the dissemination of information about career opportunities to prospective or continuing students is limited. This was noted in the 1998 review, and appears not to have been addressed specifically in the meantime. The Department web site lacks specific career –related information, and the current undergraduate students stressed the importance of having career information early in the program. The Department was seen to be absent from Faculty or University – wide career days / information sessions and also to lack their own career information dissemination within the programs. Many students are motivated by the perception that a Biochemistry degree stands them in good stead to obtain admission to Medicine, and there may be implications of increased medical school intake for graduates of the current programs. Those students either not interested or unsuccessful in their bid to enter Medicine have a high interest in career advice, including the possibility of graduate studies and research. A perception by students that some Faculty members are unapproachable with regard to summer student research opportunities and career information may be a reflection of the fact that academic staff has been disappointed by students who fail to follow through on a commitment to complete an MSc research project when they are admitted to Medical school. The Academic Program Manager to be appointed may be able to take responsibility for developing career advice planning for students with these varied interests.

Recommendation 3.2: The Department should develop a plan for the dissemination of career information to students considering applying for, and currently in, their academic programs.

Both undergraduate and Honors students feel at a disadvantage in their scientific communications skills (i.e. scientific talks, oral examinations, effective Powerpoint and poster presentations, scientific writing) and expressed a need to learn these throughout their programs. Honors students felt particularly under-prepared for the written and oral components of their Honors dissertation. Faculty echoed the expectation that effective communication be part of every element of the program. Positive comments were made by students about one undergraduate course that integrates writing and speaking skills, however this was an isolated example.

Recommendation 3.3: The Department should develop a plan for the integration of communication skills (written and oral) merged into undergraduate course content, throughout all years of the program.

The frequency and quality of laboratory experiences throughout the programs is a persistent issue, which was raised in the 2005 exit survey, 1998 APR and by current students. Specific

concerns are the coordination of laboratory content with course material, the lack of nutrition laboratory content (i.e, none of the nutrition courses have a laboratory component) and laboratory components comprised of non-laboratory exercises or demonstrations. The Department should consider consolidating laboratory experiences into longer sessions (number of consecutive hours in the laboratory per session) or, better, the creation of laboratory courses with attention to the relevance of laboratory content in terms of applicability in future workplaces and leading – edge technologies. It may be useful to explore the possibility of sharing advanced laboratories with related Departments such as Biology. While not a part of formal courses, a lack of availability of summer student placements in research laboratories within the Department (as well as Honors research placements) was noted by students. Co-op placements are not presently a part of any of the programs and it is currently unknown as to whether sufficient placements would be available to make a co-op program viable; this merits evaluation.

Recommendation 3.4: The Department should develop a plan for the ongoing improvement of quality of laboratory experiences throughout the programs.

The Department currently offers a very limited course selection at the senior undergraduate level. This problem is especially acute in nutrition, for which there is no elective nutrition content and students in the program simply take all available nutrition courses to complete their degrees. While nutrition and biochemistry are the existing areas of concentration in the Department, neither program is served by a diversified pool of course options. Lack of coverage during administrative and sabbatical leaves results in courses being cancelled and further narrows choices. Critical mass of academic staff is an ongoing issue in both programs and consistent with the recommendation to develop more constrained areas of focus, the Department will need to maintain a clear view of the undergraduate program enhancement in these two areas. New hiring in the Faculty of Medicine in areas of Nutrition &Health may offer some chance to increase the scope of undergraduate course content areas.

Recommendation 3.5: The Department should develop the number and diversity of courses within senior undergraduate content areas of nutrition and biochemistry, with specific attention to making strategic use of new faculty appointments in the Department of Biochemistry, in the Faculty of Medicine and by cooperation with other institutions

Students and staff agree that the Joint Honors programs effectively constitute 2 full degrees since neither of the participating Departments typically capitulate any of their usual degree requirements. This lack of rationalization of requirements mitigates against easy completion of the joint programs, and this may be exacerbated by a University policy which allows no more than 3 anomalies (i.e. a substitution of required material) in any Honors program. The Faculty of Science should develop an overarching policy pertaining to the minimum and maximum course requirements for Joint Honors programs.

Recommendation 3.6: The Faculty of Science should institute a review of Joint Honors programs.

4.0 Graduate Education

The Biochemistry Department offers two separate graduate (M.Sc. and Ph.D) programs, Biochemistry and Food Science, which respectively account for about 75% and 25% of the total graduate student complement. Combined enrolment in these programs over the past decade has remained relatively stable with a total of 25-30 students in a given year, or an average of ~1.5 students per faculty member. However, this disguises the fact that most graduate students are training in a relatively small number of well-funded laboratories, and increasing competition for research funding at the national level, faculty demographics, and ongoing divisions among faculty over the future direction of the Department raise serious concerns about the stability and critical mass of its graduate programs in the coming years. Memorial University aims to double graduate student enrolment as part of its strategic plan, and the Review Panel (and others interviewed) felt that the Biochemistry Department is unlikely to be able to meet this challenge unless it takes steps to increase research funding through focusing on key areas of strength, while at the same time enhancing graduate student recruitment, support and mentorship.

Previous Departmental reviews have recommended termination of the Food Science program, or at least its consolidation with related programs elsewhere in the University. The 1998 review noted the incongruity of offering undergraduate degrees in Nutrition while providing graduate training in Food Science, and concluded that the latter program "has a very narrow focus" and is "difficult to justify....with three research-active faculty." These issues have become even more pronounced in the last decade: at present there are only two faculty members (one nearing retirement age) contributing to active graduate training in Food Science. Even the most active faculty member involved admitted that this program, which trains primarily international students, will likely terminate when he retires. While the Review Panel respects the dedication and perseverance of these faculty members, there is little justification for maintaining Food Science as a separate program in the current environment. In the interim, its policies (e.g. comprehensive exam format) should at least be aligned with the majority of graduate students in the Department to maximize student interactions and to facilitate participation of faculty on exam committees.

The majority of the Biochemistry graduate students are supervised by faculty in the metabolism and nutrition group, which met separately with the Review Panel to propose a new interdisciplinary graduate program in Nutrition (or Nutritional Sciences). There is considerable rationale for this concept given the traditional strength of this group and the potential participation of several other researchers, mainly in the Faculty of Medicine, with related research interests. On the other hand, introduction of a separate interdisciplinary graduate program at this time would seriously threaten the survival of the existing Biochemistry graduate program. Indeed, should the latter cease to exist, there is no clear home in other graduate programs for many of the students who would be displaced. As there is currently a single and effective Graduate Advisory Committee, and many of the graduate policies are already common across the Department, a compromise would be to create "streams" within the existing Biochemistry degree program, at least until such time that the rest of the Department can coalesce under a separate focus (e.g. membranes) with the help of further recruitment.

The Review Panel met with the Graduate Advisory Committee and separately with a dozen graduate students in the Biochemistry and Food Science programs. We were very impressed with the enthusiasm and commitment of these students who, despite lingering divisions among the faculty, expressed a sense of identity and allegiance to the Department as a whole. Recent initiatives by the Department Head and the Graduate Advisory Committee have reviewed and strengthened graduate policies and procedures that should benefit *all* graduate students within the Department. Examples include positive changes to the comprehensive exam format for the Biochemistry students and inclusion of graduate students on appropriate Departmental committees. Many of the policies are in line with those in other biochemistry departments, including admission procedures and mechanisms for transfer to the PhD program. In short, the Department is going in the right direction in terms of many of its graduate educational initiatives, and the Review Panel feels it would be premature to fracture this solid program base. It should be possible to build on this foundation to maintain and expand a critical mass of graduate students in the Department, while at the same allowing some degree of specialization that could ultimately lead to full interdisciplinary programs.

Recommendation 4.1: Under the direction of the Graduate Advisory Committee, the Department should harmonize its graduate policies and procedures under a single graduate program in Biochemistry, while considering the creation of a specialization stream in Nutritional Sciences, to be so designated on the diploma. As recommended in earlier reviews, the Food Science program should be discontinued; a specialization stream in Biochemistry/Food Science could be considered until such time as students are no longer accepted into this program.

Graduate students receive a guaranteed minimum stipend that is consistent with graduate programs elsewhere in Canada, given the cost of living and the relatively low tuition fees at M.U.N. We heard no specific complaints from graduate students about their level of financial support. Students also have an opportunity to receive extra remuneration as teaching assistants or lab demonstrators, although some faculty expressed concern that there should be a limit to the amount of such work students can assume, as this takes time from their research. This is a complex issue as it also relates to the need for TA positions in undergraduate programs (laws of "supply/demand"), but a limit of two positions per term would seem a reasonable compromise. The Review Panel commends the policy of distributing available School of Graduate Studies funding to graduate student stipends for two (for M.Sc.) or four (Ph.D.) year periods. These funds appear to be equitably shared among research supervisors and significantly alleviate the requirement for grant support of students.

The Dean of Graduate Studies commented that Biochemistry graduate students are generally highly regarded (M.U.N students enter with an average undergraduate grade of 76%), but also noted that the Department could take better advantage of available graduate scholarships as well as web support to enhance recruitment efforts. Attrition of Ph.D. students is not a major issue (only one of 15 Ph.D. students have dropped out since 1996), but is considerably higher among M.Sc. students (10 of 45 students have left over the same period). The Review Panel heard that a major contributing factor was premature acceptance of M.Sc. students into medical school, i.e. after only one year in the program. Although not committing to changes in medical admissions policies, the Dean of Medicine was supportive of efforts to resolve this situation, noting that

medical students with a background in research at the M.Sc. level are more likely to become valuable clinical researchers later in their careers.

One factor in M.Sc. attrition could be the average length of time to completion of the degree (34 months for Biochemistry M.Sc. students), which exceeds the norm of two years at many other institutions. This suggests that students are not being encouraged or allowed to write up their projects within a timely fashion, despite the two-year cap on stipend subsidies. While there may be several reasons for this, the Review Panel noted that student supervisory committees are only required once a year. The Department should institute bi-annual committee meetings, including one held within a month or so of the start of the program to set expectations. One idea that is being considered by the Department is to allow M.Sc. students entering from the B.Sc. Honors stream to use their 4th year research project results as part of their M.Sc. work, presumably to allow completion after one year and increase completion rates for students accepted into medicine. The Review Panel was not supportive of this idea, which would devalue the M.Sc. by "double counting" the Honours project.

Recommendation 4.2: The Department should work towards decreasing the time to completion of the M.Sc. degree to two years as the norm. Instituting more frequent (bi-annual) supervisory committee meetings would help accomplish this. At the same time, the Faculty of Medicine should be encouraged to alter its admission policies to avoid acceptance of graduate students that have only finished one year in the M.Sc. program, so that students can complete their degree.

M.Sc. students in Biochemistry and Food Science are expected to take two graduate courses, which is typical of many graduate programs across Canada. However, one complaint heard from both faculty and students was the lack of graduate courses available: although 26 courses are listed in the Calendar there are only four graduate courses available in each graduate program, and these are offered on a two-year rotating cycle (i.e. one Biochemistry and one Food Science course per term). While the Department does accept for credit relevant courses given by other Departments such as Chemistry and Biology, imaginative mechanisms to provide additional and more varied course options should be explored. The cross listing of graduate and 4th year undergraduate courses is one option, but this is discouraged by the School of Graduate Studies. However, it might be possible to combine aspects of these courses on a "modular" basis, with clearly delineated additional components required for the graduate students (e.g. a mentored teaching experience on selected topics in the course). Other options include offering shorter and more focused graduate courses (e.g. six weeks, or 1.5 credit hours), which would also be more attractive for research-active faculty to provide. Another possibility (perhaps to be explored with the School of Graduate Studies) would be to give credit for intensive courses or workshops taken at other institutions. In any case, graduate students should be allowed maximum flexibility in selection of their courses, in keeping with their varied backgrounds and the broad diversity of research across the Department.

Recommendation 4.3: The Department should consider options to increase the selection and rigour of its graduate course offerings, for example through shared courses with other departments, more focused shorter courses, or recognition of short courses/workshops provided at other universities.

The Department Head and Graduate Advisory Committee are considering a new mandatory "skills-based" graduate course for all first year students, to develop literature review, presentation, and writing abilities. The Review Panel was highly supportive of this idea, one that would not only enhance the above skills, but also allow each cohort of new graduate students from different research groups to meet and interact with each other. This course should not replace the requirement for two standard courses as part of the program. Ideas to enhance the value of this experience might include additional components such as poster presentation, and symposium-style presentations around a central theme at the end of the course (perhaps with a small budget and external speaker selected by the students). Ideally, this course should include participation by multiple faculty members, who would assume responsibility for different components.

Recommendation 4.4: The Department should initiate a mandatory "skills-based course" for all first year graduate students that would include instruction in scientific writing, poster and seminar presentation. This should include participation by multiple faculty members and be provided with a small budget, perhaps to invite an external speaker and/or culminate in an annual symposium with student presentations.

Seminars and journal clubs also present opportunities to enhance presentation and communication skills, increase scientific interactions, and generally enhance the intellectual energy of a department. Although the current Departmental seminar series provides an opportunity for faculty, students and visiting speakers to present research results, low attendance has apparently been an issue. One idea to enhance seminar attendance and add value would be to introduce a standardized evaluation form so that supervisory committee members can provide constructive feedback immediately following a graduate student presentation, i.e. this would become part of their role on the student's committee. A variation of this concept would be to have graduate students prepare short written summaries or critiques of seminars by faculty and external speakers; this could be a component of the core course described above. Every attempt should also be made to advertise upcoming seminars beyond the Department, not just through mailed notices and the Department web page, but also by actively contacting colleagues with interests related to the weekly topic. In any event, faculty must lead by example and weekly seminar attendance should be a priority. Sometimes beer and pizza is a good incentive.

Journal clubs are excellent forums for enhancing presentation skills, keeping up-to-date with recent developments, and building interactions and collaborations in a research area. Currently, only the nutrition/metabolism group holds a regular journal club. The Review Panel encourages graduate students and postdoctoral fellows in emerging areas of research focus within the Department (e.g. membranes), or in research areas with a critical mass in other Departments (e.g. molecular biology), to consider initiating new journal clubs that would include both trainees and faculty. Depending on the numbers involved, these sessions could be held monthly or more frequently, and they would give students a sense of responsibility and leadership over an aspect of their graduate education, especially if appropriate space is made available (see below).

Recommendation 4.5: The Department should attempt to re-invigorate its Departmental seminar series through enhanced faculty and student participation. In

addition, graduate students should be encouraged to initiate new journal club(s) in emerging thematic areas, or in areas of common interest with researchers in other units such as Biology, Chemistry and the Faculty of Medicine.

While the above recommendations should lead to increased interactions among graduate students, and between students and faculty, additional steps could be taken to enhance communication and information flow to students. One of the top concerns expressed by the graduate students was the lack of suitable space and opportunities for social interaction; their existing room is not adequate for more than a few students at a time. Given that sufficient underutilized laboratory space appears to be available in the Science Building, the Review Panel was supportive of minor renovations to provide a larger meeting room for graduate students. At least 300 sq. ft. would be adequate for independent study outside of the lab, small journal clubs, and social events. For their part, the graduate students should be encouraged to form a society, with a presence on (or link to) the Department website, as apparently exists in other departments in the Faculty of Science. Finally, the Department should consider holding an annual Research Day, with a mixer to follow; such an event held a few years ago was greatly appreciated by the students interviewed, but this has not happened since.

One of the most pervasive complaints the Review Panel heard was about the state of its "virtual" space: the Department website. While some of the basic elements are there, the Biochemistry website is considerably out-of-date both with respect to its visual appeal and its content. A quick search revealed several dead links and many faculty pages that just list research interests in point form, without links to CVs, publications, lab personnel, etc. There is no notice of upcoming seminars or celebration of recent honors and awards in the Department. A separate Graduate section exists with names (and some e-mail addresses) of students, but this could be enhanced significantly to include student profiles, discussion groups, and access to important program documents such as the comprehensive exam procedure in PDF format. Increasingly, websites (and newer utilities such as Facebook) are becoming major recruitment tools. We learned that resources are available from the School of Graduate Studies to upgrade websites, but the Department needs to take some creative initiative by forming an ad-hoc website committee, including faculty and student representatives and the Department technician. The committee's mandate should include identification of an ongoing mechanism for content management of the website.

Recommendation 4.6: To improve interactions and communications among graduate students, the Department is encouraged to identify and renovate an adequate room for activities such as graduate students meetings, social events and journal clubs.

Recommendation 4.7: The Department is urged to form an ad-hoc website committee with faculty and student representation, with the goal of improving and updating factual content, providing current events information, enhancing visual appeal, and supporting recruitment efforts.

5.0 Staff

The Panel was impressed with the quality of staffing of all components of the Department. The improvement in computer and information technology support initiated by the Department since the 1998 review is commended. The Department is fortunate to have a talented and dedicated technician who is responsible for IT support as well as general equipment repair, thereby reducing overall costs for maintenance.

The current addition of a Program Manager position was recognized as a positive step in enhancing the undergraduate experience through the early provision of information related to career opportunities and increased curriculum counselling and oversight. The Panel also suggests that the Program Manager take responsibility for updating both Departmental and Faculty websites in order to provide clearer information about research opportunities in the Department, as well as to provide information on career opportunities, program options and formal information related to Honors thesis preparation. The Panel recommends such an individual chair an ad hoc committee to overhaul the departmental website.

The Panel recommends that the Life Sciences Store be administered directly from the Office of the Dean of Science. It is not appropriate for a service supporting three Life Science departments to be administered and budgeted from a single member department. The increased workload of the Life Sciences stores, a direct function of the increased oversight required by safety and other new regulatory demands, merits a re-examination of the level of staffing or method of delivery of services to make the workload manageable. The model of the Medicine Faculty, in which all research faculty members have ordering and receiving responsibilities, might be considered to distribute workload and authority more equitably. If the Faculty of Science prefers the present consolidation of these functions to improve oversight then an additional staff member is warranted.

Recommendation 5.1: The Program Manager position should include responsibility for updating and maintaining an informative and helpful Departmental website.

Recommendation 5.2: The Life Sciences Store should be directly administered from the Dean of Science's office and consideration should be given to streamlining procedures or to recruiting an additional staff member.

6.0 Space and Infrastructure

The Department's space is primarily distributed in three wings of the Science building and the newer Biotechnology building. The square footage available to the Department appeared adequate to present needs including the foreseeable new hires. Given the availability of space the Panel felt strongly, as recommended by the 1998 review report, that a larger common room for graduate students in which to meet and socialize away from their individual laboratories should be arranged, possibly through renovations. The present small space in the Biotechnology building does not meet that need. As noted in Recommendation 4.6 above, the provision of a common space would facilitate integration and cohesion among the graduate students pursuing differing specializations and would contribute to a stronger program identity.

Despite the adequacy of the quantitative space allocation for the department, some space the Panel viewed was dilapidated and in acute need of redesign and modernization. The Panel anticipates that redesign of space to meet the needs of new faculty will partially address these shortcomings. Space of one faculty member in the newer Biotechnology Building suffered from a leaky roof and there were issues with climate control. Such conditions should be addressed in a timely manner.

It is assumed that eventual replacement of the older Science building in which Life Science departments and the majority of the Biochemistry department is housed has been recognized as a priority. In that eventuality, consolidating Biochemistry space into a common section of the building will enhance and facilitate collegial and collaborative interaction. The current distribution of space militates against such interaction. The location of offices removed from laboratories is also undesirable.

Because of the importance of space development and space considerations to facilitate the active research programs of new and existing faculty and to enhance the cohesiveness of the department, the Panel recommends that a space and infrastructure planning committee be struck. Such a committee could also be proactively involved in organizing equipment grant applications and space renewal. An issue to be reviewed is the allocation of space and laboratory facilities for research active retiring faculty.

Recommendation 6.1: A Space and Infrastructure Committee should be formed to optimize space allocation and to promote equipment grant applications.

Recommendation 6.2: Deficiencies in presently available space be addressed by the Faculty of Science in a timely manner. In the design of new Biochemistry space, attention should be given to spatial consolidation of all elements of the Department.

Summary of Recommendations

Recommendation 1.0: The Faculty of Science should initiate a search process, according to the University's Policies and Procedures for the Appointment of Administrators, such that an external Head with a strong research profile is in place when the term of the current Head ends.

Recommendation 2.1: The Department should develop a five year plan of careful new hiring within a vision defined by strategic advantage for excellence in research and teaching of biochemistry and nutrition/metabolism, around a constrained number of research themes as noted above.

Recommendation 3.1: The Department should develop and support a plan for implementing the recommendations of the Undergraduate Program Committee for the ongoing upgrading of the curriculum, in a timely fashion.

Recommendation 3.2: The Department should develop a plan for the dissemination of career information to students considering applying for and currently in their academic programs.

Recommendation 3.3: The Department should develop a plan for the integration of communication skills (written and oral) merged into undergraduate course content, throughout all years of the program.

Recommendation 3.4: The Department should develop a plan for the ongoing improvement of quality of laboratory experiences throughout the programs.

Recommendation 3.5: The Department should develop the number and diversity of courses within senior undergraduate content areas of nutrition and biochemistry, with specific attention to making strategic use of new faculty appointments in the Department of Biochemistry, in the Faculty of Medicine and by cooperation with other institutions

Recommendation 3.6: The Faculty of Science should institute a review of Joint Honors programs.

Recommendation 4.1: Under the direction of the Graduate Advisory Committee, the Department should harmonize its graduate policies and procedures under a single graduate program in Biochemistry, while considering the creation of a specialization stream in Nutritional Sciences, to be so designated on the diploma. As recommended in earlier reviews, the Food Science program should be discontinued; a specialization stream in Biochemistry/Food Science could be considered until such time as students are no longer accepted into this program.

Recommendation 4.2: The Department should work towards decreasing the time to completion of the M.Sc. degree to two years as the norm. Instituting more frequent (bi-annual) supervisory committee meetings would help accomplish this. At the same time, the Faculty of Medicine should be encouraged to alter its admission policies to avoid acceptance of graduate students that have only finished one year in the M.Sc. program, so that students can complete their degree.

Recommendation 4.3: The Department should consider options to increase the selection and rigour of its graduate course offerings, for example through shared courses with other departments, more focused shorter courses, or recognition of short courses/workshops provided at other universities.

Recommendation 4.4: The Department should initiate a mandatory "skills-based course" for all first year graduate students that would include instruction in scientific writing, poster and seminar presentation. This should include participation by multiple faculty members and be provided with a small budget, perhaps to invite an external speaker and/or culminate in an annual symposium with student presentations.

Recommendation 4.5: The Department should attempt to re-invigorate its Departmental seminar series through enhanced faculty and student participation. In addition, graduate students should be encouraged to initiate new journal club(s) in emerging thematic areas, or in areas of common interest with researchers in other units such as Biology, Chemistry and the Faculty of Medicine.

Recommendation 4.6: To improve interactions and communications among graduate students, the Department is encouraged to identify and renovate an adequate room for activities such as graduate students meetings, social events and journal clubs.

Recommendation 4.7: The Department is urged to form an ad-hoc website committee with faculty and student representation, with the goal of improving and updating factual content, providing current events information, enhancing visual appeal, and supporting recruitment efforts.

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Recommendation 6.1: A Space and Infrastructure Committee should be formed to optimize space allocation and to promote equipment grant applications.

Recommendation 6.2: Deficiencies in presently available space be addressed by the Faculty of Science in a timely manner. In the design of new Biochemistry space, attention should be given to spatial consolidation of all elements of the Department.