

**Report of the Academic Program Review Committee
For the Department of Chemistry
Memorial University of Newfoundland**

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1) Introduction

On the first evening (March 10th, 2010) the academic program review (APR) panel met with the Dean of Science Dr. Mark Abrahams, the Dean of Graduate Studies Dr. Noreen Golfman, Associate VP (Academic) Dr. Doreen Neville and Kim Myrick from the Centre for Institutional Analysis and Planning in order to discuss the general procedure of the APR. During the following two days (March 11th and 12th, 2010) the APR committee was given a tour of the Department of Chemistry (herein simply called the *Department*) and met with various individuals and groups as follows:

Day One

- Dr. Peter Pickup (Department Head)
- Staff Members
- Graduate Studies Committee
- Departmental Head and Deputy Heads (lunch)
- Graduate Students
- Undergraduate Studies Committee
- Undergraduate Students
- Dr. Noreen Golfman (Dean of Graduate Studies)
- Organic Group
- David Miller (Director of CREAT)

Day Two

- Inorganic Group
- Inorganic/Analytical Group
- Computational Group
- Dr. Fisher (Associate Dean of Engineering)
- Dr. Mulligan (Biochem Head)
- Dr. de Young (Physics Head) and Dr. Hanchar (Earth Sci. Head)
- All Faculty
- Dr. Mark Abrahams (Dean of Sci.)
- All Faculty and Staff
- Dr. Peter Pickup (Department Head)

From our discussions with these groups the APR Panel was able to identify clear issues of concern which, along with our recommendations are discussed within the text of this report. A summary of the recommendations is also provided at the end of this document.

The APR Panel would like to acknowledge the enthusiasm and overall cordial reception offered by the members of the Department who, along with a well laid out agenda made the review process seamless and almost effortless. The APR Panel would also like to praise Kim Myrick from the Centre for Institutional Analysis and Planning for her professionalism while dealing with the overall planning of this process.

2) Undergraduate Studies

Undergraduate enrollments in the Department have increased overall since 2003 with a small decrease in first-year enrollments since 2005. The chemistry programs at MUN are accredited by the Canadian Society for Chemistry and therefore meet or exceed minimum program expectations. However, the delivery and administration of first-year courses (i.e. CHEM 1010, 1011, 1031, 1050, & 1051) is inefficient and warrants review by the Department. In particular it came to our attention that some of the first year courses have no assignments and that students are evaluated entirely based on tests. When assignments

are given they are often corrected by hand. Although there are some faculty members using web-based teaching aids this practice is far too uncommon. The department is recommended to investigate modern computer based or web based teaching resource tools for administering and marking assignments. Because of the magnitude of the first year courses and the need for consistency it is also recommended that the department assign an individual to oversee the running and organization of the first year courses. It was also brought to our attention that the instructors of first year courses play very little role in the laboratory part of the course. Although the panel recognizes that designated laboratory staff do an excellent job at running and administering the laboratories, it is ultimately the responsibility of the instructor to ensure a continuity between the course lectures and the laboratory experiments. We recommend that instructors of first year courses increase their presence in the laboratories in order to help students make the connection between class material and their laboratory sessions. It was also brought to our attention that due to limited TA fellowships faculty teaching classes with less than 100 students are often not assigned a TA for marking assignments. The use of web based teaching resource tools for administering and marking assignments would also greatly benefit such cases.

Through discussions with students and other departmental heads, it was brought to the attention of the APR committee that many joint programs are poorly organized and as a consequence require over four years on the part of students to complete. Further discussions with departmental heads indicate that improved communication between departments within the Faculty of Science may make the completion of joint programs within a four-year period possible.

There were a number of comments from students and faculty regarding the quantity and quality of teaching space and in particular the lack of classroom space that is fully equipped with multimedia technology¹ such as those continuously being retrofitted to existing classrooms across the campus. Such space will enable faculty members to develop innovative teaching methods especially those requiring the use of computers and specialized software therein. Also see section 8.1

A major concern is the lack of modern state-of-the-art undergraduate laboratory facilities. The antiquated and inadequate facilities that currently exist are gradually being dealt with such as a ca. \$2 million renovation of the organic teaching laboratory. Whereas this renovation addresses perhaps the most urgent need there are a number of other chronic and critical deficiencies within the Department that warrant a more timely resolution. These include the first-year undergraduate laboratories and the physical chemistry laboratories. The one time infusion of funds of the order of \$600,000 directed towards equipment in the teaching laboratories is a welcomed response to the obvious need for the update of old and non-working instrumentation and acquisition of new modern instruments. Based on our investigation and consultation with the Department Head the following are pressing items that should be resolved in a timely manner:

¹ Typical multimedia centers consist of a unit at the head of the classroom which houses a computer, a visual presenter and a controller that communicates with an overhead projector. Total cost for purchase and installation of multimedia centers is between \$15,000 and \$20,000.

Rooms C-5001 and C-5010: These spaces are used of teaching CHEM 2210, 2301, 2302, 3100, and 3211. Because of the heavy use of these spaces the renovation of these rooms is a high priority to the Department. Some of the issues needed for these rooms are increased fume hood space and new benches with ventilation. It is recommended that these renovations be designed by a laboratory design specialist to help rearrange the layout of the rooms in order to maximize the use of space and include changes that will allow for a storage area for sensitive equipment and chemical.

Rooms C-2016, C-2025 and C-3046: First year laboratories need additional and/or larger fumehoods (safety issue) and require to be remodeled to allow a computer and monitor at each experimental station.

Rooms C-2023, C-3044, C-4025: Stockrooms require 60 inch fumehoods for employee safety.

Room C3041: Renovations of this laboratory for 2nd and 3rd year Physical Chemistry courses require new chairs, stools, tables and benches. Again we suggest that a design specialist be consulted to plan the renovations of all labs to make the best possible use of the available space.

There is also a need for all labs to have solvent and acid/base storage cabinets, and upgrades for eyewashes and safety showers.

It is clear that the current state of the facilities in this Department is due to years of neglect. It should be understood that once these renovations are made the Department will develop and new approach for maintaining its facilities. In order to allow this we recommend that an annual budget line item for maintenance and capital equipment be provided for the undergraduate teaching laboratories.

The APR Panel wishes to make the following recommendations related to undergraduate studies:

Recommendation 1: Renovate and modernize undergraduate teaching laboratories.

Recommendation 2: Institute an annual budget line item for maintenance and operation of undergraduate teaching facilities.

Recommendation 3: Increase the quantity and quality of classroom space with particular emphasis on equipping classrooms with a complete array of multimedia tools.

Recommendation 4: Incorporate technologically assisted and other innovative teaching methods such as online administration of assignments and video recording of lectures at the first-year level and initiate such activities for higher level courses.

Recommendation 5: Conduct a thorough review of first-year courses and appoint a first year coordinator from amongst those faculty members teaching these courses.

Recommendation 6: Improve communication with other departments to facilitate the completion of joint degree programs within four years.

Recommendation 7: Improve professor participation in the delivery of the laboratory component of courses to ensure connectivity with the lecture component.

3) Graduate Studies

The Department has doubled the number of graduate students in the M.Sc. and Ph.D. programs since 2004. This rapid increase is due to the strong financial support from the School of Graduate Studies (SGS), low tuition fees, the efforts of Memorial University to recruit international students, and a significant number of tenure-track appointments in the past decade. The APR Panel was told that the graduate program in Chemistry is very well administered and is one of the best run programs at Memorial.

The graduate students are generally content with the quality of the education they are receiving and with the level of financial support. Their main concerns are the availability of graduate courses, the handling of chemicals, and the low attendance at graduate seminars. The graduate students drew our attention to the problem of legacy chemicals associated with the previous occupants of some research laboratories. They see a need for better safety protocols including safety training and improvements in the regular safety inspections of the research laboratories. The graduate students are willing to take on more responsibility, beyond acting as teaching assistants and markers, in the delivery of the undergraduate programs. There is a major need for programs to guide students with respect to the preparation of curriculum vitae, the preparation of applications, and the preparation for interviews.

The APR Panel was surprised to learn that the Department has been operating under the assumption that the composition of the Supervisory Committees and Examining Committees of M.Sc. and Ph.D. students are required to be different. The APR Panel was informed that this policy is not strictly enforced by SGS. The APR Panel was also surprised to learn that M.Sc. theses are not publicly defended, as are Ph.D. theses. A public M.Sc. defense is an excellent method of judging the degree of understanding of a student well beyond what is indicated in the written thesis. Also a public defense is an excellent preparation for students for increasing their ability to give talks and provides a better training for those students that continue to a Ph.D. In particular, since public M.Sc. defenses are common in most institutions across Canada, not having them here places students that move to another institution for a Ph.D. at a disadvantage over their colleagues who would have gained this experience during their M.Sc. degree.

During the site visit the APR Panel requested statistics for completion times for recent M.Sc. and Ph.D. graduates. The Graduate Coordinator efficiently provided data for the 24 M.Sc. theses completed since 2003. The median time from the start date to the defense of the M.Sc. thesis is 29 months. Ideally, this number should be closer to 24.

For the 14 Ph.D. theses completed by students who entered the Ph.D. program directly since 2006, the median completion time is 53 months. Ideally, this number should be closer to 48. And finally, for the 15 Ph.D. theses completed by students who were admitted to the M.Sc. program and then transferred to the Ph.D. program, the median completion time is 57 months. Median, as opposed mean (average), times are recommended for the assessment of completion times.

On the basis of many interviews, the APR Panel is making seven recommendations that pertain directly to the graduate program.

Recommendation 8: The Department should review its policy with respect to the composition of M.Sc. and Ph.D. Supervisory and Examining Committees.

Recommendation 9: The Department is encouraged to require a public defense of M.Sc. theses.

Recommendation 10: The Department should regularly review the completion statistics of M.Sc. and Ph.D. graduates.

Recommendation 11: The Department should consult with the graduate students to consider possible ways to increase attendance at graduate seminars. One possibility is to implement a mandatory non-credit course obligating students to attend all departmental seminars.

Recommendation 12: The Department is encouraged to discuss with teaching assistants their role in the delivery of undergraduate courses.

Recommendation 13: The Department should organize an annual orientation day for all new graduate students.

Recommendation 14: The Department should work with the School of Graduate Studies to develop career mentorship programs for graduate students to help them with the preparation of curriculum vitae and applications and with preparation for an interview.

4) Research

The Department maintains a very active research program with 15 out of 16 of the permanent faculty (tenured/tenure-track) funded by NSERC and a large number of graduate students (approx. 80). Research productivity has significantly increased over the last decade with well over 300 publications and a strong citation record. The Department has also been very successful in receiving equipment grants from CFI and IRIF.

A significant fraction of this research aligns with the University's strategic research plan and the Department is in the process of developing its own research plan that will further

this coordination. The Department also maintains an active program of fundamental investigations.

The APR Panel is impressed with these research accomplishments and believes that the Department is managing this area well. It has one recommendation.

Recommendation 15: The Department should continue to develop its research plan as a living document and maintain its alignment with the University's strategic plan.

5) Service and Outreach

Members of the Department are actively involved in a wide variety of professional and service activities both inside and outside the University. The APR Panel commends the Department on these activities and feels no need to make any recommendations in this area.

6) Department as seen from Other University Units

The APR Panel met with the Heads of the Departments of Biochemistry, Earth Science and Physics and Physical Oceanography and the Associate Dean (Undergraduate Studies) of Engineering as well as the Deans of Science and Graduate Studies. The Panel found that the Department enjoys collegial relations with and is viewed well by these other groups. Other than Recommendation 7, there are no further recommendations in this area.

7) Faculty and Staff

The APR Panel had scheduled meetings with the Department's faculty and staff in both large and small group settings. Both groups expressed serious concerns with regards to the quality and quantity of space available to the Department and in particular the safety issues that follow from these problems; these issues are dealt with elsewhere in this report.

Both groups also felt that communications both within the Department and also to the Department from the University Administration could be improved. The APR Panel acknowledges that no communication system is perfect but also notes that the efficiency of any program can be improved with better communications. As specific concerns, the APR Panel heard that communications within the Department in certain areas are essentially by word-of-mouth with little or no official documentation. This includes the communication of a number of safety concerns. Many formal communications are disseminated by e-mail which is regarded as an acceptable form of documentation; however, some staff members have no access to e-mail in their workspace. The APR Panel noted a low level of Departmental representation on University wide committees and regarded participation on such committees as an opportunity to improve communications with the University Administration and other academic units.

These concerns aside, the APR Panel found that the staff was fairly content with their working conditions, while the faculty felt that they had insufficient time to properly perform all of the tasks expected of them.

The APR Panel has three recommendations in this area.

Recommendation 16: The Department should regularly review its communication procedures to ensure that they are operating in the most efficient way possible.

Recommendation 17: The University Administration should regularly review the way that it disseminates relevant information to individual faculty and staff members to help ensure that Departments can plan and make decisions in a fully informed way.

Recommendation 18: The Department should endeavour to increase faculty members' participation on University wide committees.

The Department currently has 5 full time science technicians and 14 laboratory instructors/assistants among which 4 are employed part time. The Department also employs an additional 5 instructional assistants on 4-8 month contracts yearly. In the two day visit we have learned that the support members are responsible for many tasks within the department:

- 1) Some members of the support staff are responsible (almost fully) for administering the undergraduate laboratories which include: coordinating activities, demonstrating the experiments, supervising the experiments, maintenance of equipment, marking reports, preparation of laboratory manuals, etc...
- 2) Marking assignments
- 3) Running tutorials
- 4) Manning the resource and help centers.

Although some of these duties are necessary for the daily operations of the department others could be re-evaluated. For example if the faculty were to use more computer based assignments it would alleviate much of the marking. Also, the tutorials provided by staff are given in small class rooms which require scheduling many tutorials for a given course. This could be avoided by giving the same tutorials in larger classrooms or amphitheatres. Lastly, the existence of two separate resource centers may also contribute to the problem. If the help center/resource center were combined into one room it may be possible to reduce the number personnel working at non-peak hours.

Although the APR committee was not given enough information to fully assess the need for such a large number of support staff it is our impression that the current number of support staff is large and that this number could be reduced by carefully reevaluating other aspects of the Department's operations.

Recommendation 19: Before any staff members are replaced, a thorough review should be carried out in order to assess the proper number of staff members for a department of this size. This review should compare the number of staff members of various Chemistry

Departments with similar student enrollments. This process should also attempt to assess the role of staff members in ensuring a high degree of quality of teaching.

The Department currently has 16 tenured/tenure-track faculty and three term appointments. It has plans for future hires with the immediate need being a computational chemist. In the near future it would also like to hire an analytical/physical chemist, while in the longer term plans to hire synthetic chemists who work on materials and sustainable processes.

These plans are well thought out and each of these hires would support the Departmental and University's strategic plans, complement current faculty interests and strengths, and support the growing graduate program. The APR Panel was told that the computational chemistry hire has been prioritized in order to support the existing interdisciplinary M.Sc. in Computational Science as well as the proposed B.Sc. in computational chemistry which the Department hopes to unveil in 2011. Given the critical space problems from which the Department suffers, computational and analytical/physical hires are practical as they would need less (if any) lab space with little or no access to fume hoods. The Department has identified space for these two initial hires but the hires in synthetic chemistry will not be possible until new space can be found or current faculty members retire.

In any department it is good to maintain a proper balance of the seniority level of the faculty. A department which is heavy with senior faculty is rich with experience but often lacks the drive for developing new ideas. Also such a department faces a problem when a large number of these senior members retire and are replaced with junior faculty. In such a case although the department may experience a surge of new initiatives, it may lack the experience upon which proper decisions often rely. Therefore in order to prevent this it is recommended that departments attempt to hire a new faculty member approximately every 3 years to ensure a proper distribution of faculty seniority.

The APR Panel endorses the Department's hiring plans and makes the following recommendations.

Recommendation 20: The Department should make an immediate hire in computational chemistry.

Recommendation 21: The Department should be granted further hires in the other identified areas when time and space allow. These should occur at a rate of not less than one every three years to ensure continuing renewal and a correct distribution of junior to senior faculty.

8) Facilities

During the two-day visit the APR panel was given a tour of the Department of Chemistry which included the main office, teaching and research labs dispersed throughout the Chemistry/Physics building, physical stores/chemical storage facilities and the help and

resource centers. In this section we will comment on each of these facilities.

8.1) Classroom Teaching Facilities

The quality of classrooms has already been discussed in Section 2. However, during our meeting with other university units it was made clear that others have, by their own initiative, renovated classrooms through various opportunities such as the Classroom Infrastructure Fund and the HRDC.

It is well established that the use of class demonstrations can increase student concept retention from 10% to 30% in a lecture setting. At Memorial University there are unfortunately many impediments to providing in-class demonstrations in the lecture halls required for large classes in introductory Chemistry (the same applies to all other physical and life sciences). The biggest impediment is the need to move equipment to various rooms across campus. For the case where demonstrations require chemicals, moving this equipment becomes impossible due to health and safety reasons.

Recommendation 22: The Department should consult with others in the University in order to be more proactive with regards to renovating classrooms.

Recommendation 23: The University requires large lecture rooms that are equipped with demonstration prep-rooms connected to the lecture area.

8.2) Support Rooms

The Department has two rooms dedicated to helping students. The first *help center* located in room C-2022 is dedicated to supporting students in CHEM 1010/1011 while the second *resource center*, located in room C-2012, is available for students with chemistry course and laboratory related content problems in first year, second year, and CHEM 3100. Both rooms, which are separated by a few meters, are small and often suffer from overcrowding leading to long wait times. Although both rooms have wireless internet access, there is only one computer (no printer) available for student use in the resource center (C-2012).

Recommendation 24: The Department needs to reevaluate the effectiveness of its help centers and expand the resources of these rooms.

8.3) Laboratory Teaching Facilities

See Section 2) Undergraduate Studies

8.4) Laboratory Research Facilities

During the two-day visit the panel was shown a selection of (not all) research laboratories. Although some of the research laboratories ranged from adequate to state-of-the-art, others were in a similar state as the undergraduate teaching laboratories - antiquated and inadequate. In some cases opportunities to fund necessary renovations have been missed. For example new faculty could have made use of CFI funds to

modernize their laboratories.

During our visit the APR panel was introduced to C-CART and CREAT. The panel was impressed by the concept of CREAT and commends the University for adopting this system. Although the members of the faculty were almost unanimously supportive of CREAT and C-CART, some faculty expressed frustrations with the way their CFI matching funds were provided on the condition that the acquired equipment be placed within the CREAT facilities. It is the opinion of this panel that the person/office who controls CFI matching funds should not be the same person in charge of CREAT. The current situation may represent a conflict of interest and not serve in the best interest of individual researchers. Also in discussing CFI funding, it was clear that some of the faculty hired in the last ten years were not aware of all the possible CFI eligible spending opportunities.

Recommendation 25: The Department should assist researchers to find funding to modernize their research facilities.

Recommendation 26: The University should reassess the method by which CFI matching funds are allocated.

Recommendation 27: The Department should provide better mentoring to new faculty members regarding existing and new funding opportunities.

8.5) Physical Stores/Storage Facilities

The storage facility located in the basement of the Chemistry/Physics building houses many organic, inorganic and toxic solvents which are distributed to users on an as needed basis. These solvents are kept and used in an uninsulated and unventilated room causing the fumes to accumulate without any chance of being dissipated. This is particularly hazardous in the summer when the temperature of the storage room increases causing an increase in fumes. Repeated exposure to these fumes is hazardous to the health and safety of the staff manning the stores. Also, some of these fumes are flammable which could represent a serious fire hazard. Some chemicals (i.e. acids and bases) are improperly stored; hence, proper instructions and training on proper storage should be made available to personnel working in this area. Some chemicals are also stored in a small uninsulated building outside the Chemistry/Physics building. This represents safety problems since some solutions may freeze when the temperature drops causing the containers to crack. When the chemicals thaw, the containers may leak creating the potential for a chemical spill which could result to bodily harm.

Recommendation 28: The many safety issues regarding the chemical storage facilities in the physical stores need to be addressed urgently.

8.6) Computer Facilities

The Department maintains a computer room on the fourth floor of the Chemistry/Physics building. The room is furnished with an appropriate number of computers though the APR Panel was informed that quite regularly not all of them are in working order. The

APR Panel was also informed that the wireless network is not yet available throughout the Department.

Staff members suggested that it would be very useful to have a computer in undergraduate laboratories. These could be used to monitor e-mail communications (see Section 7) as well as for checking student enrollment in laboratory sections. This would help eliminate future conflicts due to scheduling.

Recommendation 29: The Department should attempt to maintain the computers in the computer room and push to obtain wireless internet throughout the entire Chemistry/Physics building in a timely manner.

Recommendation 30: The Department should provide computers in the laboratories to improve communications, as well as help staff to better manage student enrollment and registration.

8.7) Graduate Student/Staff Offices

The Department is currently experiencing a severe space crisis as it attempts to expand its research program and student services. In order to deal with this some graduate students have been assigned desks in research laboratories. Although this has been a common practice for a number of years it is now understood that the location of desks within laboratories should be located away from areas such as fume hoods.

During our discussions with the staff it came to our attention that although each staff member is provided a desk, they are not each provided a computer. Since the staff members in this Department are involved with marking and student records, sharing computers may lead to a variety of problems due to file mismanagement. Also, with the every growing laws regarding privacy in the work place, sharing computers may lead to incidents where a person's privacy is violated.

Recommendation 31: The Department should reassess the space within the Department to provide a safe and appropriate location for desks for all graduate students.

Recommendation 32: The Department should provide a separate computer for each staff member.

8.8) Liquid helium/nitrogen facility

Memorial University has a liquid helium/nitrogen facility in the basement of the Chemistry/Physics building which is operated by the Department of Physics and Physical Oceanography. The Department stressed the importance of this facility to their research and teaching programs and commented that certain components of the system are quickly becoming outdated. Loss of this facility would constitute a large increase in expenses for certain departments and individual researchers and increases the chance of causing permanent damage to vital equipment with costs exceeding well over the million dollar range.

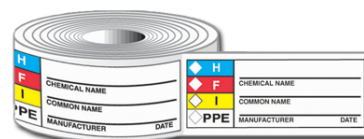
Recommendation 33: The University needs to be pro-active in ensuring that the liquid helium/nitrogen facility stays in continuous operation.

8.9) Health and Safety

During their visit the APR Panel noted several health and safety concerns with regards to the day-to-day operations of the Department. Some of these concerns have already been previously addressed in other sections of this report. We list here additional concerns which should be considered.

Although the Department of Health and Safety (Human Resources) within the University provides occupational health and safety training it was mentioned by staff and students that safety training should be provided more frequently and scheduled at times that are practical for all those concerned. It was further proposed that more specialized training courses be provided to address the specific needs of the Department. During these discussions it was also mentioned that the Department needs to adopt an evacuation strategy in case the Department needed to be evacuated in the absence of fire alarms. It was noted that fire drills were occurring at infrequent intervals which could lead to problems in the event that a real evacuation becomes necessary. In general, the Department, in conjunction with the University, urgently needs to develop universally applied safety protocols to address the issues noted in this document.

During meetings with several groups, the APR Panel was made aware of the existence of *legacy chemicals* which have lingered in the Department as laboratories were passed on from one user to the next. These legacy chemicals, which are more often than not unlabeled, represent a serious health and safety concern and need to be dealt with in a timely manner. Unlabeled chemicals represent a serious hazard in the work place. In the event that a person becomes injured as a result of physical contact with a chemical it is sometimes imperative to know what the chemical was in order to know how to treat the injury. It is the practice in some institutes to conduct weekly walk-through inspections by a safety committee in order to identify and deal with safety concerns in the work place and in particular unidentified chemicals. The use of readily available labels as shown here helps simplify the task of labeling chemicals and reduces the chance of serious injury. Also adopting a common chemical labeling scheme makes identifying chemicals easier.



Recommendation 34: The Department should work with the Department of Health and Safety to develop thorough training sessions for staff and TAs and ensure that these courses are delivered at convenient times.

Recommendation 35: The Department is encouraged to perform regular well-documented safety checks of all its facilities.

Recommendation 36: The Department should work with the Department of Health and Safety to develop a building evacuation strategy along with unannounced fire drills.

Recommendation 37: The Department should take immediate steps to dispose of *legacy chemicals* in a safe and environmentally responsible manner and adopt a new modernized chemical inventory system.

Recommendation 38: The Department should investigate various methods for laboratory users to quickly and easily identify chemicals in the lab and assign groups within the department to assure that the practice of chemical labeling is followed by performing weekly lab inspections.

Recommendation 39: The Department should initiate a new policy for dealing with laboratories when their designated use is changed in order to prevent the further build-up of legacy chemicals.

9) Summary of Panel Recommendations

We provide below the list of recommendations identified in the text of this report. In light of these recommendations the APR panel would like to make one further recommendation. It is clear that the Faculty of Science at Memorial University has seen tremendous growth in its research activities in both quantity and quality. The overall increase in funding from various sources such as NSERC, CIHR and CFI has allowed Departments to grow their research staff, graduate students numbers and equipment despite a crumbling infrastructure. Although the University provides funding for renovations on an *ad hoc* basis, this quick-fix solution is analogous to using a band-aid for patching a severed limb. If the University wants to capitalize on the success of its Science program, the APR panel strongly recommends that it build a new Science building.

Recommendation: Build a new Science building.
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Recommendation 1: Renovate and modernize undergraduate teaching laboratories.

Recommendation 2: Institute an annual budget line item for maintenance and operation of undergraduate teaching facilities.

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Recommendation 15: The Department should continue to develop its research plan as a living document and maintain its alignment with the University's strategic plan.

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Recommendation 22: The Department should consult with others in the University in order to be more proactive with regards to renovating classrooms.

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Recommendation 24: The Department needs to reevaluate the effectiveness of its help centers and expand the resources of these rooms.

Recommendation 25: The Department should assist researchers to find funding to modernize their research facilities.

Recommendation 26: The University should reassess the method by which CFI matching funds are allocated.

Recommendation 27: The Department should provide better mentoring to new faculty members regarding existing and new funding opportunities.

Recommendation 28: The many safety issues regarding the chemical storage facilities in the physical stores need to be addressed urgently.

Recommendation 29: The Department should attempt to maintain the computers in the computer room and push to obtain wireless internet throughout the entire Chemistry/Physics building in a timely manner.

Recommendation 30: The Department should provide computers in the laboratories to improve communications, as well as help staff to better manage student enrollment and registration.

Recommendation 31: The Department should reassess the space within the Department to provide a safe and appropriate location for desks for all graduate students.

Recommendation 32: The Department should provide a separate computer for each staff member.

Recommendation 33: The University needs to be pro-active in ensuring that the liquid helium/nitrogen facility stays in continuous operation.

Recommendation 34: The Department should work with the Department of Health and Safety to develop thorough training sessions for staff and TAs and ensure that these courses are delivered at convenient times.

Recommendation 35: The Department is encouraged to perform regular well-documented safety checks of all its facilities.

Recommendation 36: The Department should work with the Department of Health and Safety to develop a building evacuation strategy along with unannounced fire drills.

Recommendation 37: The Department should take immediate steps to dispose of *legacy chemicals* in a safe and environmentally responsible manner and adopt a new modernized chemical inventory system.

Recommendation 38: The Department should investigate various methods for laboratory users to quickly and easily identify chemicals in the lab and assign groups within the department to assure that the practice of chemical labeling is followed by performing weekly lab inspections.

Recommendation 39: The Department should initiate a new policy for dealing with laboratories when their designated use is changed in order to prevent the further build-up of legacy chemicals.