

Faculty of Science

Draft



Academic Plan 2007-2011

December 21, 2006

Draft



Western
Science

The University of Western Ontario

**Faculty of Science Academic Plan
for four-year period 2007-2011
Dec.21, 2006**

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SUMMARY

This Academic Plan (2007-11) is the second four-year plan created by the Faculty of Science. The previous Plan (2003-07) has been largely implemented and has guided the creation of a Faculty that is healthy, robust, and in a position to become one of the top Faculties of Science in the G13 group of Canadian universities.

The vision for the Faculty after the next four-year cycle is twofold:

- 1) The Faculty would be, or would be on threshold of becoming, the destination of choice for science education in Canada.
- 2) The Faculty would be the Canadian or world leader in selected research areas and would be emerging as a leader in other areas.

This vision is entirely consistent with, and supportive of, the University goal of providing the best student experience at a research intensive university in Canada. Student experience and research intensity are two themes that weigh heavily in the University's new Strategic Plan, "Engaging the Future"

The Faculty has identified seven primary objectives that are consistent with achieving the vision. These primary objectives are the lenses through which we focus our efforts to achieve the vision described above.

- (1) Establish national reputation as a learning intensive Faculty
- (2) Increase research intensity

- (3) Develop a robust research strategy that fosters discovery while enabling agile responses to needs of society
- (4) Graduates distinguished by differential training in communications skills, career skills, & appropriate technical skills
- (5) Proactive recruitment and career development strategies
- (6) Facilities & infrastructure that enhance research, learning, and recruitment
- (7) Enhanced external relations

The current four-year plan introduces a myriad of new initiatives and programs; establishes graduate enrolment growth as a priority; raises the level of stewardship over undergraduate education, research, and human resources; provides for reviews of selected programs; enhances existing programs that merit further investment; addresses deficiencies in modes of operation or delivery of services; and addresses the need for effective management of academic space for the Faculty. The remainder of the summary is presented in the context of major themes that strongly influenced the content of the Academic Plan and priorities over the next four years.

Graduate expansion

This is a key area for the 2007-11 four-year cycle. The focus is on accelerated growth of the domestic cohort in Years 1 and 2 with continued growth at a reduced rate and with a return to the normal mix of domestic and international students in Years 3 and 4. Research assistant and teaching assistant funding requests to support incremental growth of the domestic cohort are top priorities. Concomitantly, a suite of new

project-based interdisciplinary Masters programs will be developed and accredited; several of these are expected to be available for the 2007-08 academic year.

Improved counseling services for students

Enhanced and expanded counseling will be available to undergraduate and graduate students. The academic counseling service provided by the Faculty of Science to undergraduates will undergo an external review, an additional Academic Counselor position will be created, and an additional Assistant Dean recruited at the beginning of Year 1 to manage the delivery of this service. The renewed counseling operation will focus on customer service and strive to provide the best counseling experience on campus. A Career Counselor position will be inaugurated in Year 2. This will be the first such position in Career Services unit in the Faculty of Science. The counselor will provide career consulting and training for both undergraduates and graduate students.

Professional skills development for undergraduate and graduate students

An intentional and systematic approach will be taken to skills development, replacing the current laissez-fair approach that yields highly variable student exposure to skills development opportunities and awareness of their importance. Professional skills includes specific technical skills, general scientific skills, the “soft” skills, and career skills. The first step is a thorough skills inventory of the undergraduate and graduate curricula at a departmental level and an assessment of students’ perceptions and needs. The second step is deployment of a comprehensive skills development initiative that is a blend of Faculty-wide services and programs combined with integration of skills training across the curriculum and discipline-specific skills courses at the Departmental level.

Stewardship of undergraduate science education

The key element in the best student experience is a pedagogically-sound, progressive undergraduate curriculum that balances content delivery, intellectual development, experiential learning and skills training, and is delivered in manner that promotes learning through engagement. To achieve and maintain

this requires ongoing, proactive stewardship. A cornerstone of the stewardship will be the Dean’s Advisory Committee on Science Education which is to be formed before Year 1. It will have a broad mandate that is described in the Undergraduate Education Section of the Academic Plan. An Interdisciplinary Curriculum Committee will be formed to provide



governance and steering for modules and programs that involve more than one Department. In addition, the mandate and operation of the Educational Policy Committee will be reviewed.

Teacher development

A Teaching Development Coordinator will be hired (seconded) to the Faculty Office on a part-time basis. Initially the incumbent will focus on teaching & learning in large enrolment 1st and 2nd year courses, with duties later expanding to upper year courses and to enhanced teacher training for Teaching Assistants. A new program to provide accelerated professional development for junior academic faculty (tenure-track & limited-term) will be created during the 2006-07 academic year with the intention of launching it in 2007-08. This program will focus on teaching skills and practice and on scholarship in teaching & learning.

Stewardship of faculty and staff complements

The most valuable component of the Faculty is the people who create, deliver, or support its educational and outreach programs, and who undertake or support the research enterprise. Stewardship of this resource is crucial for the success of the Faculty and of the

individual staff and faculty, yet has historically been ad hoc and often neglected. Various initiatives, programs, and policies focusing on professional development, career progression, recruitment, and retention are described in Section C. An overall stewardship consideration is finding the right overall size of the Faculty complement and the right balance between faculty and staff positions. The number and distribution of requested base-budget faculty and staff positions reflects this aspect of stewardship.

Stewardship of research enterprise

The way research is carried out and the way research activity is organized has evolved considerably in the last decade and this evolution is continuing unabated. Single principal investigator research remains foundational but as research intensity, capacity, and funding increase, a larger proportion of research is collaborative and/or targeted to a particular research theme or major project, many of which are interdisciplinary. There is a growing number of



research clusters (small informal groups), institutes, centres, and shared major facilities in the Faculty of Science. In addition, the Faculty has five overarching research themes that were introduced in the previous four-year plan. Cohesive management, long-term planning, and vision are required in order to steer such a collective research enterprise. Current organizational and governance structures were not designed to provide this stewardship and need to be revamped. As a first step, an external review of each of the five Faculty themes is being undertaken in 2006-07; the recommendations emanating from these reviews will guide the next steps.

Corporate/Industrial Relations

Corporate and industrial relations are currently not at a level commensurate with a top tier Faculty of Science. Two major initiatives designed to deepen and broaden connections with industry in a relatively short timeframe will be undertaken in Year 1. First is the formation the Western Science Corporate Council which will consist primarily of ~ 20 leaders/decision makers from a broad range of corporate and industrial sectors aligned with academic programs and research within the Faculty of Science (see Sec. I). Second is the creation of new position to foster and assist technology transfer based on research in the Faculty of Science: A Technology Transfer Officer will be hired (contractual) in Year 1 and embedded at the departmental level. This is as a pilot project and a joint venture with Industry Liaison.

Space Management

The Faculty's space needs will grow progressively during the four-year planning period. It appears that the amount of additional space needed at the end of the four-year cycle will be of the same order of magnitude as the additional space needed at the beginning of the cycle, despite the anticipated acquisition of space at various points during the cycle. Sound space management is essential to ensure the efficient and appropriate use of available space. This Academic Plan provides a set of space management principles (Sec. G) that will guide allocations to Departments and other recognized units. Departments will be required to develop and approve their own space management principles and policy by the end of 2006-07.

A. PREAMBLE/INTRODUCTION

This Academic Plan (2007-11) is the second four-year plan created by the Faculty of Science. The previous Plan (2003-07) has been largely implemented and has guided the creation of a Faculty that is healthy, robust, and in a position to become one of the top Faculties of Science in the G13 group of Canadian universities.

The current version has been prepared by the Dean's Office in conjunction with preparation of the four-year Budget Plan (BP), and informed by departmental and unit plans that were submitted to the Dean in mid-October. The Academic Plan (AP) will be further developed as follows: There will be a consultative, iterative process involving the departments and ancillary units to further develop and refine the Faculty's AP in the winter of 2007. The AP will be further reviewed and updated in the summer of 2007 in preparation for the annual budget update in the fall of 2007.

The current four-year plan introduces a myriad of new initiatives and programs; establishes graduate enrolment growth as a priority; raises the level of stewardship over undergraduate education, research, and human resources; provides for reviews of selected programs; enhances existing programs that merit further investment; addresses deficiencies in modes of operation or delivery of services; and addresses the need for effective management of academic space for the Faculty.

The following major themes strongly influenced the content of the Academic Plan and priorities over the next four years.

- ◇ Graduate expansion
- ◇ Improved counseling services
- ◇ Professional skills development for students
- ◇ Stewardship of undergraduate science education
- ◇ Teacher development
- ◇ Stewardship of faculty and staff complements
- ◇ Stewardship of research enterprise
- ◇ Corporate/Industrial relations
- ◇ Space management

Explicit actions are clearly identified within each section of the document. Those with budget

implications have generated funding requests in the four-year Budget Plan. In the budget document, funding proposals (UPIF, PASF, etc.) and statements of investment of Faculty resources refer to the relevant section(s) of the Academic Plan. More detailed linkage to the new University Strategic Plan, "Engaging the Future" will be made in the next version in order to reveal fully the synergies with elements of the Faculty AP.



The Faculty of Science consists of eight core Departments, distributed among three groupings: (1) the Physical Sciences (Chemistry, Earth Sciences, Physics and Astronomy), (2) the Mathematical Sciences (Applied Mathematics, Computer Science, Mathematics, Statistical and Actuarial Sciences) and (3) Biology. In addition, the Faculty of Science and the Schulich School of Medicine and Dentistry formally share the delivery of the undergraduate program in the basic medical sciences. The Faculty is thus cross-affiliated with the six departments that comprise the Basic Medical Sciences in Schulich.

B. VISION & OBJECTIVES FOR THE FACULTY:

Vision for Faculty of Science

The vision is twofold:

- 1) The Faculty would be, or would be on threshold of becoming, the destination of choice for science education in Canada.
- 2) The Faculty would be the Canadian or world leader in selected research areas and would be emerging as a leader in other areas.

This vision is entirely consistent with, and supportive of, the University goal of providing the best student experience at a research intensive university in Canada. Student experience and research intensity are two themes that weigh heavily in the University's new Strategic Plan, "Engaging the Future"

The role of the vision statement is to provide a destination that we seek to attain. Becoming the destination of choice for science education and a world leader in selected research areas are lofty goals, ones that are intrinsically difficult, perhaps impossible, to measure quantitatively. But if we do not strive for them then we assuredly will not get there. The length of the path to these goals and the pace with which we can move along the path are not known at the outset. This will make the journey interesting, exciting and, at times, unpredictable. The journey may not be complete by the end of this four-year plan in 2011 but can enthusiastically be continued in the next planning cycle.

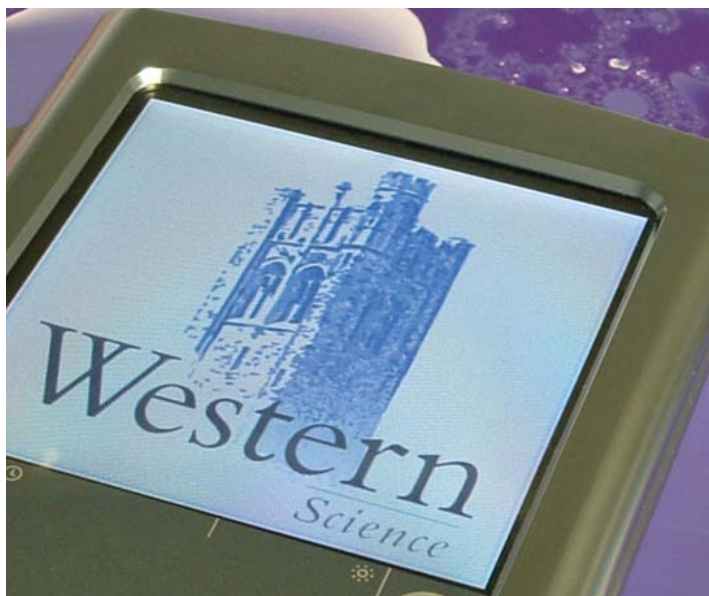
Objectives

The Faculty has identified seven primary objectives that are consistent with achieving the vision.

All elements of the AP support one or more of these objectives.

- (1) Establish national reputation as a learning intensive Faculty
- (2) Increase research intensity
- (3) Develop a robust research strategy that fosters discovery while enabling agile responses to needs of society
- (4) Graduates distinguished by differential training in communications skills, career skills, & appropriate technical skill.
- (5) Proactive recruitment and career development strategies
- (6) Facilities & infrastructure that enhance research, learning, and recruitment
- (7) Enhanced external relations

These primary objectives are the lenses through which we focus our efforts to achieve the vision described above.



C. ACADEMIC STAFF & SUPPORT STAFF

Tenure-track/tenured academic staff (faculty)

There were 53 new tenure-track or tenured faculty appointments under the previous four-year Academic Plan (includes all positions released for advertising in 2006-07). This represents 29% of the current tenure-track/tenured faculty complement of 182 (at Oct. 2006). This is a relatively high rate of faculty renewal and now faculty complements are approaching the historical levels experienced before the drastic cuts to university budgets in the mid-1990s. It is anticipated that the rate of establishment of incremental positions will decrease over the next four years due to completion of population of the few remaining CRCs, shift in emphasis to rapid and substantial graduate growth, and limits on the available physical space. The Faculty and its Departments are thus planning for relatively modest growth of the faculty complement over the next 4 years. The emphasis will be on increasing the productivity and effectiveness of the existing complement in terms of teaching, supervision, and research activity.

New positions that are funded initially from external sources and awarded on a competitive basis provide a low-cost, high-quality approach to enhancing the faculty complement when internal university funds are being preferentially directed elsewhere. The NSERC Industrial Research Chair (IRC) program creates a new position at no cost to the University for a period of five years. If an existing faculty member assumes the IRC, a new junior position will be created. The IRC program has been under utilized at most universities, including Western. It will be exploited wherever the subject area of the proposed chair fits with Faculty and Departmental plans and a sponsoring company can be found. The NSERC University Faculty Award (UFA) program provides junior faculty positions for females and other designated groups that are funded at about a 40% level by NSERC for the first five years. The Faculty will continue to exploit the UFA program to create new positions at 60 cents on the dollar and to continue to increase the number of female faculty members.

The current recruiting environment in Canada for junior tenure-track faculty is highly competitive. A key element of an effective recruitment strategy in the

sciences is startup funding that is competitive with cognate Departments at the G13 universities. The average or typical startup package in the Faculty is low in comparison with the primary rival departments (e.g., Toronto, UBC, Alberta, McGill, Queen's), situation that is exacerbated by the expectation that the 20% match for a CFI LOF grant is to come from this source after the fact. In addition there can be, and have been, wide variations in the startup amount provided to new faculty in a given Department. Such variations are not usually based on differing needs but instead on the availability of unassigned monies in departmental coffers at the time the startup grant is arranged. Enabling newly recruited tenure-track faculty to launch active, adequately funded research programs very soon (within first few months) after arrival at UWO has numerous benefits to the researcher, the Department, and the Faculty. The vast majority of newly recruited junior faculty arrive at Western without having submitted a NSERC DG application or a CFI LOF application.



The typical current pattern is the following: The appointee arrives in summer and submits a NSERC DG application in the fall with funding decision in March of the following year, leaving the appointee without external research funds for up to 9 months. The CFL LOF application is usually submitted during the first year of the appointment (sometimes later) and most are successful. However these funds, which provide essential research infrastructure and equipment, are thus not available until the second year of appointment. The delay in obtaining the NSERC DG and the CFI LOF is major impediment to the development of an independent, fully functioning

research program. In addition it depresses research performance indicators such as grant dollars and graduate students per researcher and overall publication counts. Beginning in the 2007-08, appointees to junior positions will be required to prepare tentative CFI LOF budgets as part of the employment negotiation process. In this way, the approximate amount of the 20% CFI match can be incorporated in the startup grant budget, providing the opportunity to ensure that the non-CFI-match portion of the startup is adequate to cover the standard initial expenses. New junior appointees will also be strongly encouraged to submit NSERC DG and CFI LOF applications before commencing their appointment. Concomitantly, Departments will be encouraged to advance the recruiting cycle so finish negotiations with new faculty in the summer or early fall thus permitting a NSERC DG application to be submitted in the fall. A stable and adequate source of funding is required to achieve competitive startup grants that also allow for a sizeable CFI LOF match. To this end a PASF application will be made for funds to match Faculty-department contributions to startup packages over the next two years. This includes startup for limited-term spousal appointees (see below).

Inter-university and university-industry mobility of faculty has never been as preponderant as it is now. In order to retain outstanding faculty in whom the University has made a substantial investment and from whom it has received enormous benefit, it is necessary for Chairs and the Dean's Office to be proactive and to find flexible solutions that recognize the unique features of each retention case. Retention activity occurs on an annual basis and inevitably requires fiscal resources. A UPIF request will be made in order to establish a retention budget that anticipates the cost of this activity.

Limited-term academic staff

There are increasing numbers due to: (i) rise in number of spousal appointments, the majority of which are limited-term (usually 5 years) and have the same workload profile as a tenure-track appointee; and (ii) in the past 4 years, many departments choosing to hire one or more full-time teaching faculty to deliver important aspects of their undergraduate programming, e.g., laboratory teaching and large enrolment introductory courses. It is likely that this

trend will continue. Career development for limited-term faculty is easily overlooked in the current system but is important for the individual and the Dept. and the Faculty. Ongoing stewardship is required to optimize the benefit of such positions to the incumbents and the University. Primary considerations are career and professional development.

For those appointed into tenure-track-like positions, efforts must be made to ensure that they develop as teachers and independent researchers so that they are competitive for tenure-track positions at the end of the term. Among other considerations, such appointees require some startup funding to enable a timely launch of their research program. Those hired into teaching positions are typically outstanding instructors who carry a teaching load that is often approximately double the normal departmental load. For such faculty members, considerations include varying their teaching assignments over time to avoid burnout, arranging for some form of short-term leave, and fostering their participation in the scholarship of teaching & learning in lieu of scientific research activities.

Support staff

Support staff includes administrative staff, teaching support staff (e.g., laboratory technologist), technical support staff (e.g., computer support, electronics technician, machinist, stores keeper), and research support staff for major communal instrumentation or shared facilities. It is anticipated that the number of support staff will increase modestly during the next four years in response to recently increased academic staff complement and a steadily rising graduate population. New base-budget positions will be driven by need and the ability to fund the position based on new revenues associated with the increased research activity, increased enrolments, or a shift in priorities. Requests for new-base budget staff positions will be thoroughly vetted with a view to viability over the anticipated occupancy time of the position by an incumbent. A full job description will be required as part of the application procedure for a new position in a Department.

The majority of current support staff positions are funded through departmental budgets and Departments thus play a major role in determining

the overall competencies, skill sets, job functions, and job reallocations of the support staff cohort. The Faculty and its Departments, in consultation with Human Resources, will seek to upgrade the entry-level qualifications for selected staff positions. Faculty and its Departments will provide stewardship of support staff and staff positions as follows:

(a) update job descriptions on a regular basis to reflect actual job function;

(b) transform positions to fill new needs when original position has become obsolete;

(c) facilitate the establishment and maintenance of staff networks for the sharing of best practices for like-positions in the various Depts. & units; and

(d) provide for in-service training/re-training; foster participation in professional development courses/programs; support enrolment in post-secondary or graduate programs.

Professional development for new faculty

A new program to provide accelerated professional development for academic faculty (tenure-track & limited-term) will be created during the 2006-07 academic year with the intention of launching it in 2007-08. The program is intended for faculty members who are new to the professoriate but will be open to all. It is anticipated that the vast majority of participants will be the cohort of 1st year faculty in Science. The course would cover a wide variety of topics (see list below) and all aspects of an academic job description in the areas of research, supervision, classroom teaching, service, outreach, etc., with a focus on teaching, learning, and mentoring. Some components or modules would consist of faculty workshops, training, and courses already offered at Western. An advisory committee, to be constituted by the Dean in January 2007, will be charged with designing the program. In terms of time commitment and workload, the program will be the equivalent of a half-course or a quarter-course, depending on the program design. First year faculty will be expected to participate in the sense that they will be given teaching relief according to the weight assigned to this program by the advisory committee. Dept. Chairs would then be requested to adjust teaching assignments for 1st

year faculty accordingly and would be compensated by Faculty Office for any sessional hires required to cover the teaching shortfall created by this program. Topics to be included in the professional development program include:

- management & administrative aspects of teaching
- scholarship of teaching & learning
- graduate and postdoctoral supervision
- development and management of a research operation
- effective preparation of grant applications
- mentorship (in which you are the one being mentored)
- maintaining a CV and teaching dossier
- support mechanisms for (new) faculty
- work-life balance

The cost of this program will be carried by the Faculty Office as a pilot project in Year 1, and if continued, a UPIF or PASF application will be made in Year 2.

Women in Science Initiatives

(1) Postgraduate and Faculty Women in the Faculty of Science

This program was initiated in 2004 by the Dean's appointment of a coordinator to lead the Faculty's efforts in implementing the recommendations of a 2004 symposium on the title topic. The first two years of the initiative focused on decreasing the isolation of the women in the Faculty by creating opportunities for them to meet informally at least twice a year. A work-life balance website was created for the Faculty webpage and the NSERC "Becoming Leaders" handbook for women in science has successfully been disseminated to new women faculty members and graduate students each year. The initiative has been received well by the women in the Faculty. Accordingly, the program for postgraduate and faculty women in science will continue and the coordinator has been renewed for a second term. A steering committee was formed in the fall of 2006 and includes a graduate student, a postdoctoral fellow and a tenured faculty member. The goal is to further develop initiatives aimed at supporting career development of women faculty, post-doctoral fellows and graduate students.

As articulated in the new Strategic Plan “Engaging the Future”, the recruitment and retention of both female graduate students and faculty, as well as their career development is of primary importance to the University. This creates an ideal environment for enhancement and growth of the Faculty’s initiative for postgraduate and faculty women. Over the next four years, the program will build on the foundations established in 2004-2006. Starting in 2007 a yearly lecture will be initiated, bringing a prominent woman scientist from the academy, government or industry as role models to promote participation and retention of women in science careers. This would also expose the entire campus community to prominent women scientists. The lecture would be the highlight of an event celebrating of the year’s achievements by women faculty and post-graduate students. By 2009 the speaker series would become integrated with the Faculty’s proposed yearly visiting scholar program through which a prominent scientist would be brought to campus to work with faculty and graduate students through seminars, lectures and discussions. Beginning in 2007 it is proposed to create a yearly special edition of the Science Flashpoint newsletter devoted to Women in Science, as well as a section in the Alumni newsletter to include announcements of upcoming events, special award applications for women, award recipients, historical achievements (e.g., the Helen Battle story of 2005 newsletter). Finally, we propose phasing in over the 4yr period beginning in 2007, Faculty travel awards to fund female postdoctoral fellows (particularly) and graduate students to present their work at scholarly meetings. Two awards would be available in 2007-08 (one at each level) increasing to 3 in 2009-10 and 4 in 2010-11. The Faculty will fund the 2007-08 awards after which a PASF or UPIF application may be made.

(2) Measures to improve gender balance in faculty complement

The gender balance has improved significantly over the last four years. The fraction of full-time female faculty has increased from 12.8% in 2003-2004 to 17.4% in 2006-07. Of 3 NSERC Industrial Chairs/ Associate Chairs and 16 CRCs, 2 and 4 are held by female faculty members, respectively. Five female faculty have been awarded NSERC UFAs in the past 4 years and three UFA applications were submitted

in October 2006. The future use of UFA program will be a priority for Faculty and access to this program has been increased by NSERC’s decision to allow applications from faculty in the 1st year of their appointment. Recruitment of female faculty will be further supported by the University policy of providing 50% of non-externally funded salary in 1st year of appointment.



Actions:

C.1 Professional development course
 - ad hoc committee (formed by the Dean) to design course in 2006-07.
 - inaugural offering in 2007-08 academic year as a pilot project
 - cost: Faculty Office responsible for salaries of any sessionals required by Depts. to cover teaching release associated with new faculty participation in the course.
 - budget implications: estimate teaching replacement for buy-out of ¼-course equivalent for 10 new faculty at \$3750 per ¼ -course = \$37,500.
 Year 1: funding for any incremental teaching replacement costs from FoS
 Years 2-4: if program continued, then seek UPIF to cover sessional teaching, using any Year 1 FoS funding as a match

C.2 Retention & recruitment fund
 Ancillary recruitment costs: 1/3 or 2/3 share of spousal appointments
 Retention costs: salary market adjustments; share of spousal appointment for existing faculty; limited-term research support for existing faculty.
 Years 1, 2, 3 and 4: PASF

C.3 Startup fund for new faculty
 Years 1,2 & 3: UPIF application for partial coverage of anticipated start up funding across the Faculty for hires with start dates in 2007-08, 2008-09 and 2009-10; remaining amounts to be divided equally between Departments and the Faculty Office.

D. UNDERGRADUATE EDUCATION

(1) Undergraduate programs

(i) Modules

With the recent introduction of the new modular format of undergraduate programs, the range of academic pathways available to students in the Faculty of Science has increased significantly. There will be regular monitoring of enrolments to measure level of student demand and periodic reviewing of content to ensure appropriate coverage of subject matter and sound pedagogy. As appropriate, modules which have experienced low acceptance by students may be discontinued or revised. Modules that have unsuitable or outdated content or whose composition prevents program accreditation, program certification, or the pursuit of advanced studies in the subject area will be revised accordingly. Departments will also be encouraged to develop new modules in response to the developments in science, in response to knowledge and expertise required in the industrial, corporate, health care, educational, or government sectors. Faculty of Science modules that are interdisciplinary in the sense that they are comprised of courses from several Departments within the Faculty of Science or involve courses from other Faculties will be overseen by a new Interdisciplinary Curriculum Committee to be established by the Dean. Currently, there is no administrative structure to provide systematic, ongoing, intentional oversight of interdisciplinary modules. (Current and proposed interdisciplinary modules in the Faculty of Science are listed in Sec.H on Interdisciplinarity.)

Term-by-term oversight, monitoring, and management of modules will be provided by Departmental Curriculum Committees (or equivalent), the (nascent) Interdisciplinary Curriculum Committee, and the Faculty Educational Policy Committee. Periodic general reviews of modules currently occur as part of the Chair selection process every five years and, if applicable, program accreditation by an external body (varies from Department to Department). Existing reviews will be supplemented by University-mandated program review that will occur on a seven-year cycle beginning in 2007-08.

Particular attention will be paid to developing modules

and promoting career options that are attractive to students not admitted to the BSc program at the end of year 1 in the Faculty of Science. This cohort is approximately the same size as the cohort accepted into year 2. The vast majority of this cohort will never be admitted to the BSc program. (It is anticipated that there will be only 20-25 available spaces in the BSc program for year 3 students and there will be no longer be any entry for year 4 students.) The objective is to discourage students from intentionally “shadowing” BSc modules in years 2 and 3, to assist them in identifying a range of career options that provide future flexibility and possibly alternate routes to a given career sector, and to encourage them to select from an array of Science modules commensurate with their subject area preferences and intellectual abilities. Such considerations will form part of the mandate of a Dean’s Advisory Committee on Science Education. A related issue to be addressed by this committee is the impact on academic and professional career progression and the pedagogical implications of (a limited number of) major modules that are devoid of 3rd and 4th year courses.

(ii) Degree programs

BSc programs:

A complete compilation of old and new (module-based) degree programs is provided in Appendix 1. The old programs will disappear soon – last graduation is October 2008 – with the possible exception of the various Concurrent/Combined Programs with Professional Programs. The simplified degree structure associated with the modular system places academic stewardship at the modular level instead of at the degree program level as in the past. Such stewardship is described in the subsection immediately above.

BSc programs:

The BSc program was started in 2001 as a joint venture between the then Faculty of Medicine & Dentistry and the Faculty of Science. It is designed to provide students training in the basic medical sciences. In April of 2005, an agreement was signed between the Dean of the Schulich School of Medicine & Dentistry and the Acting Dean of the Faculty of Science describing the basic features for the operation of the program. This Memorandum of Understanding is currently in revision to reflect changes in the program in the last two years (see below).



The program is administered jointly by the Associate Dean, BMSUE, Schulich School of Medicine & Dentistry, and the Associate Dean, Academic, Faculty of Science. Students who are interested in this program normally enter the Biological & Medical Sciences First Year entry program and in second year declare a BMSc degree stream and identify a BMSc module (see below). In years 1 & 2, students are enrolled in the Faculty of Science and in years 3 & 4 in the Schulich School of Medicine & Dentistry.

The original Memorandum of Understanding has resulted in a number of undesirable outcomes in terms of academics and counselling. In response, the Dean of Science and the Associate Deans (Academic from FoS and BMSUE from Schulich) have begun the task of reworking this document in an effort to improve the BMSc program. The first major change, involving the adjudication of students applying for entry into the BMSc program, has the full support of Dr. Roma Harris, Vice-Provost Academic Programs and Students.

These academic changes can be summarized as follows:

1) The 1.0 Physics requirement can be completed by the end of Year 2

This change will allow students in first year to sample other offerings in the Faculty of Science. Currently students are required to complete Physics in first year, leading to restrictive course selection.

2) Only 3.0 principal courses (Biology, Chemistry, Math) will be used in calculating the ranking average for progression of ~330 to 370 students into Year 2 BMSc degrees.

Students will gain entry into the BMSc program at the end of year 1 based on the average of these three courses. In the past, Physics was also required for the ranking average.

3) The average on 3.0, 200-level modular courses (foundation courses) will be used to rank students and populate BMSc modules in Year 3. Students who did not perform well in first year will be given a second chance to enter the BMSc program. Students not performing well in second year will not be able to proceed in the BMSc program. Approximately 330 to 370 students will be admitted into Year 3.

4) Only students admitted to Year 3 of BMSc degrees will be able to complete a BMSc degree (i.e. lock-in/lock-out after Year 2)

Currently students in Year 3 of a BSc degree are invited to shadow the BMSc offerings in the hope that they can bump a student out of the BMSc program as they enter 4th year. This leads to undue stress for both groups. Beginning in 2007-08, students entering the BMSc program in Year 3 will graduate with a BMSc degree, as long as they meet the minimum requirements. Students not admitted to the BMSc program after Year 2 will not be able to register in the BMSc at a later date.

The second major change to the Memorandum of Agreement involves the counselling of BMSc and BSc students. This issue is addressed, in detail, in the Counselling section below.

(iii) Scholar's Electives (SE) Program

Science, along with the Basic Medical Sciences, is involved with the (new) SE Program. Students in this program have access to supervised individual research courses in 2nd (SE 020y) and 3rd years (SE 303E and 304E). For 2006-07, 17 year-one students (from 140 applicants) were selected for SE 020y. Assignment to mentors has proved more difficult than for previous years, especially for the Basic Medical Sciences, who already mentored most of the SE 020y students last year, and are mentoring most of the SE 303E students this year. The administrative consequence is that these assignments were not yet quite complete as of mid-November, 2006. On the upside, it looks as if more of the SE 020y mentors will be in Science in 2006-7.

Our experience so far suggests that the estimate of 20 willing mentors being available for SE 020y students in Science/Basic Medical Sciences (for a total of 60 students in SE 020y, SE 303E and SE 304E, once steady state is reached) may have been too optimistic, and a smaller number of SE 020y students may will have to be selected for 2007-8 (or a limit put on the enrollment in SE 303E/304E in any year). Many faculty members appear to be unengaged, uninformed, or unwilling to be involved in the mentorship aspect of the Scholar's Elective program. The reasons for the paucity of mentors are unknown; this situation will be reviewed and assessed by the Dean's Advisory Committee on Science Education.

(2) Enrolments

(a) BSc/BMSc enrollments

Appendix 2 displays year-by-year Science and BMSc enrolments (actual to 2005-06, then projected) for academic years 2006-07 to 2010-11, as given at the January, 2006, SUEPP/SCUP Meeting. The first-year entry into Science/Biological and Medical Sciences is flatlined. Therefore if first-year enrollment reaches/maintains the target, the principal variable affecting Science vs. BMSc enrollments will be the level at which the Basic Medical Science Depts wish to cap their enrollments. The proposal is that second-year entry will be restricted to no more than 370/year, which exceeds the SUEPP/SCUP projection of 600 for the total enrollment in the BMSc program in years 3 and 4 of the BMSc (the years when students count as Schulich students rather than Science students).

(b) Undergraduate cross-Faculty enrollment patterns/trends

Figures from the 2006 Databook suggest a slow decline in cross-unit enrollments over the period 2003-4 to 2005-6. The reason for this is unclear, so it is difficult to make a prediction of future trends.

(c) Summer Registrations

Data from the 2006 Databook show that total enrollment numbers vary irregularly, so that no trend is discernable.

(3) Student Experience

Counselling Service

The Faculty of Science provides academic program

counseling services to BSc and BMSc students. This service is housed in the Dean's Office in the Western Science Centre. At the core of the counseling service are five academic counselors who provide good one-on-one counseling for students. The quality of the student experience once a student has arrived at a counsellor's office is not at issue. There are, however, overall operational and structural shortcomings in the organization of the operation and the current set of five counsellors are overloaded (overall student to counselor ratio is too high, particularly for BMSc students). As a result, the Science counseling operation has received widespread criticism from students and senior administrators alike. It has a reputation for not being customer-service oriented. Negative student experiences include exceptionally long-wait times to see an academic counselor, extended unavailability of a counselor with the requisite expertise, and rather limited number of hours during which counselors are available for drop-in or pre-booked appointments.

A top priority for year 1 of the plan is to remedy the root causes in order to improve the level of service and to begin the long process of repairing the damaged reputation of the Science counseling operation. The objective is to provide the best student counseling experience at Western. To this end three initiatives are being undertaken. First, a thorough review of every aspect of the current counseling operation will be performed by two external reviewers. These reviewers have not yet been identified but they will be Associate Deans Studies or Academic (or equivalent) at other Ontario Universities that have student populations and programming similar to science at Western. The review will result in a set of recommendations to the Dean. Second, a new position of Assistant Dean Studies has been created. A primary role of the incumbent will be to provide management, leadership, and visioning for the counseling operation. This position will be filled after the report of the external reviewers is received. Third, a 6th counselor will be added as soon as possible; this position will be jointly funded by Science and Schulich and ongoing support will be requested in a year 1 UPIF.

Career Services

The career services operation has blossomed during the previous (2003-07) four-year planning period. Its purpose is to inform students about career options,

provide career skills training, provide work experience to selected students, and link interested students with potential employment sectors and employers. It is run by two staff members housed in the Faculty Office: a Manager and an Employer Relations Officer. There are two primary programs: Science Internship Program and Science Career Development. The Internship program has become increasingly popular: the number of student placements increased from 33 in 1999-00 to 53 in 2005-06; the placement rate in 2005-06 was 50% with approximately 1/3 of all UWO undergraduate interns being Science students. Demand for this program is expected to continue. The growth-limiting step is finding the industrial placements. The yield rate is relatively low, i.e., the number of industries agreeing to create an intern position is a relatively small fraction of those approached. Thus program expansion requires that the Employer Relations Officer spend more time seeking intern positions. This is already a full-time portfolio for the Employment Relations Officer and a significant expansion of the Internship Program will likely necessitate additional personnel (up to 0.5 full-time equivalent). The Career Development program is multi-faceted. It consists of a variety of events including workshops, career expositions by guest speakers, career/networking fairs, preparation of CVs and resumes, interview training, mock interviews, job-hunting skills, and post-employment career development. Some of these activities are discipline specific and others are aimed at the general student population in BSc and BMSc programs.



Two major enhancements to the career services available to students are envisioned in the timeframe of this Academic Plan.

(i) Career Counsellor position

This is a new position for the Career Services unit in Science. It is to be jointly funded by Western's Career Services and Science. The incumbent will most likely be a counselling professional, hired with the assistance of Western's Career Services, and would work in Science full-time. Currently, individual career counselling within the Faculty of Science is limited by availability of qualified personnel (currently only the Manager is qualified to provide career counselling and she has many competing duties and roles). Addition of a Career Counsellor would significantly expand the capacity for individual counselling, as well as workshops targeted at additional/specialized programming, and would also allow formal student assessments to be carried out (something not done now, because no one is licensed). It is anticipated that this shared position would lead to improved communication with Western's Career Services. The funding request for the Science portion (50%) of the salary will be made in a UPIF application.

(ii) Career Services for graduate students

It is anticipated that there will be ~640 graduate students in Science by the end of this four-year plan. This represents an increase of 64% from the 2002-03 enrolment of 390. The fraction of the graduate student cohort entering the workforce or pursuing an additional graduate degree after the MSc or PhD will increase significantly since the number pursuing academic careers is expected to remain more or less constant. In addition, some of the incremental enrolment growth will be due to an increased number of, and participation in, course-based MSc degree programs designed to provide professional qualifications for entry into specific industrial or corporate sectors. All of this strongly suggests that there is a developing need for career services for graduate students in Science. These services would be an extension of the services currently provided to undergraduates (with suitable modifications) and would form part of a professional development initiative for graduate students that is described in Sec. E. This initiative will be developed in Year 2 for implementation in Years 3 and 4. The workload implications for Career Services unit are unclear at this time and will be addressed in Academic Plan and Budget Plan updates.

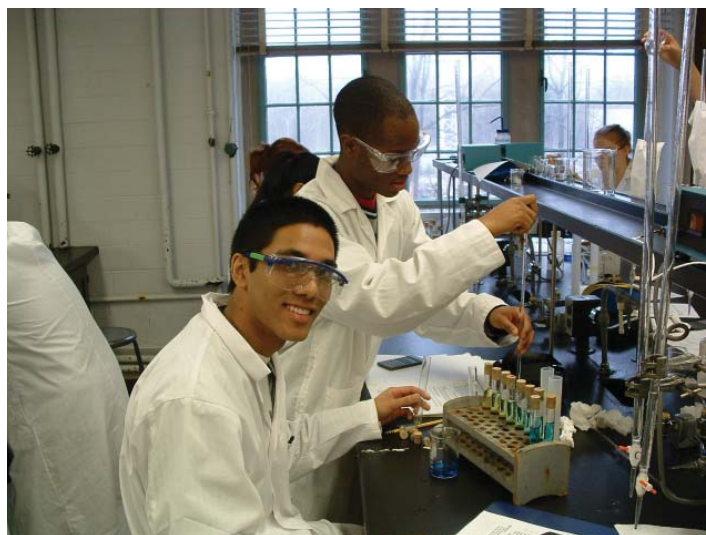
Teaching Development Coordinator

The Faculty of Science recognizes the importance of effective classroom instruction and meaningful evaluation of student learning on student engagement, student outcomes, and the student perceptions of science. This is particularly important in the context of large enrolment/large lecture courses in 1st and 2nd year where students are making the transition from high-school style learning modalities to university-style modalities. To improve the course experience for students and instructors, the Faculty will create the position of Teaching Development Coordinator to be filled on a part-time basis by a science faculty member with suitable expertise and track-record in teacher development and the scholarship of teaching & learning. It is anticipated that the incumbent would be affiliated with the Teaching Support Centre and also be active as a course instructor for one or more courses offered by a Department or Departments in the Faculty of Science. The Coordinator would be an ex officio member of the Dean's Advisory Committee on Science Education. A 20% appointment (one day per week) is anticipated in Year 1 which will be regarded as a pilot project. Assuming success in Year 1, it is anticipated that the position will be expanded to 40% in Year 2 or 3 and to 50% by Year 4. The focus will be on 1st year courses and instructors in Year 1, systematically expanding to 2nd year courses and instructors, and to teaching assistants beyond Year 1. A UPIF application may be made in Year 2 or a subsequent year depending on success of the pilot and cost of filling the position.

Student technical and career skills

Training in technical and so-called "soft" skills adds value to a student's degree and acquisition of these skills provides life-long benefit to our students. An incremental investment in such training has enormous impact on the "marketability" of a science graduate: employers value technical and soft skills highly and use them to differentiate among job applicants from different universities. Skills training can be improved within undergraduate science programs with a modest incremental investment of resources and by refocusing a small fraction of the overall instructional effort. A goal in the four-year timeframe of this Plan is the systematic development of a skills "strand" to the undergraduate curricula in Science. This strand needs to be comprehensive and integrated

into the curriculum. The skills in question include: communications (oral & written), presentations, technical skills relevant to discipline, scientific literacy, professional ethics, academic integrity, research methodology, information technologies, etc. The first step is a course-by-course inventory of skills currently covered in each Department (Biology has already done this and will be used as a model for other Depts.) followed by an assessment of gaps, strengths, weaknesses. A career skills inventory (actual vs. desired) will be undertaken by the Faculty of Science Career Services unit. Part of the mandate of the Dean's Advisory Committee on Science Education will be to provide recommendations for systematic, coherent skills training via some combination of integration into existing curriculum and dedicated course/fraction of a course at departmental and/or Faculty level.



Science Students Council (SSC)

The SSC is an important contributor to the fabric of student life and to the student experience in Science. Ongoing support from the Dean's Office contributes to effective operation of the Council and empowers the SSC Executive. Regular meetings between the Dean and the President and occasional meetings of the Dean with the Executive have been instituted and will continue. The Faculty has provided the SSC office with a new computer and access to a dedicated, permanent email account for 2006-07, neither of which was available in the previous academic year. The current SSC office is substandard by any standards and is in an invisible location. Appropriate space in a better location is called for in the Faculty's four-year space plan (attached). The President of the SSC will be invited to be an ex officio member of the

new Western Science Corporate Council (See Sec. I) and a SSC representative (possibly the SSC VP Academic) will be a member of the Dean's Advisory Committee on Science Education.

Actions:

D.1 Interdisciplinary Curriculum Committee

- to be formed by the Dean by January 2007 and commence operations by Feb.2007
- module areas to be assessed include: Materials Science (first), Environmental Science (next), and then others
- budget implications: none

D.2 Educational Policy Committee

- Dean and Associate Dean group to review mandate, operation, and structure in winter term 2007
- goal is to have this committee providing leadership and steering on curriculum/program development, degree objectives & outcomes, etc.
- budget implications: none

D.3 Dean's Advisory Committee on Science Education.

- to be formed by the Dean by January 2007 and commence operations by Feb.2007
- mandate includes:
 - Attractive, alternate programming for cohort not admitted to BMSc program at end of 1st year studies in Science
 - Years 1-4 skills inventory in each Department (Biology has already done this and will be used as a model for other Depts.); assessment of gaps, strengths, weaknesses; and recommendations for intentional skills development via some combination of integration into existing curriculum and dedicated course/fraction of a course at departmental and/or Faculty level
 - Assessment of student experience & engagement in large enrollment 1st and 2nd year Science courses; and recommendations thereupon
 - Assessment of modules having no, or very few, upper year courses
 - Consequences of modular approach on admissibility to grad school and transition from undergrad to grad studies
- budget implications: none

D.4 External review of Science counseling operation

- Dean & Assoc. Deans to establish mandate for

review & select reviewers

- site visit in Jan. 07
- anticipate report by Feb.07
- budget implications: \$4K (estimate) for travel & honoraria from Faculty funds

D.5 Assistant Dean Studies

- position has been created by the Dean in consultation with Associate Dean group
- to be filled after external review of counseling operation
- term of appointment: one year, renewable for a second year subject if mutually agreeable.
- Year 2 UPIF for ongoing stipend, with Year 1 from FoS funds as pilot project.
- budget implications: \$4K stipend for seconded faculty member; negotiated stipend for emeritus faculty member in Year 1.

D.6 Additional Academic Counsellor

- Year 1 UPIF, jointly submitted by Science & Schulich
- if not funded in year 1, then re-apply in year 2 and fund from discretionary monies in year 1 (50% of salary)
- begin hiring process after external review and after Assistant Dean Studies appointed
- budget implications: 50% of salary up to May 1, 2007 and possibly 50% of salary for 07-08 if Year 1 UPIF unsuccessful

D.7 Teaching Development Coordinator

- advertise position (internally) in winter 2007
- incumbent in place by May 1, 2007
- budget implications: stipend or teaching buyout; estimate at cost of sessional for one half-course to one full-course equivalent for Year 1 from discretionary monies \$7,500 to \$15,000); if program successful, apply for UPIF for 40-50% position in Year 2.

D.8 Career Counsellor position

- Year 2 UPIF submitted by Science & Western's Career Services
- if UPIF not funded in Year 2 or deferred to Year 3, may use discretionary funds in Science budget to implement for Year 2 on a trial basis.

E. GRADUATE EDUCATION

E.1 Programs

The foundation of graduate education in the Faculty of Science is a set of core, discipline-specific programs augmented by a growing number of interdisciplinary programs, some intra-Faculty and others inter-Faculty. All programs must be accredited by the Ontario Council on Graduate Studies (OCGS) by way of a rigorous review process on a seven-year cycle. In the fall of 2006, the Faculty of Science began a self-imposed external review of its five over-arching Research Themes (to be completed June 2007). In alignment with Commitment 3.4 of the University's new Strategic Plan Engaging the Future 2006, part of this process necessarily involves a review of graduate education in each research theme and all of the structures that support the vitality of our graduate programs.

E.1.1 *Established Core Programs*

The Faculty of Science has 10 well-established, core graduate programs offering both MSc and PhD degrees in which the majority of its graduate students are enrolled:

- Applied Mathematics
- Astronomy
- Biology
- Chemistry
- Computer Science
- Geology
- Geophysics
- Mathematics
- Physics
- Statistics and Actuarial Sciences

Except for the Astronomy and Physics programs and the Geology and Geophysics programs, which are administered through the Department of Physics and Astronomy and the Department of Earth Sciences, respectively, all programs are housed in Departments bearing the same name as the program. These programs provide students with expertise and skills in the traditional disciplines. No major changes in the thrust or structure of these programs are anticipated over the 4-year timeframe of this Academic Plan. Program improvements or enhancements are

anticipated and would normally emanate from OCGS review recommendations, from external reviews of the Departments as required with a change in Chair, or from informal internal review/self-study.

E.1.2. *Established Interdisciplinary Programs*

Current inter-disciplinary graduate programs involving Departments and researchers in the Faculty of Science are:

- Theoretical Physics (MSc and PhD)
- Scientific Computing (MSc and PhD)
- Environmental Science (MSc and PhD)

E.1.3. *New Interdisciplinary Programs in Preparation*

The number of such programs has grown slowly but steadily in the last decade with growth poised to accelerate in the 4-year timeframe of this Plan. This growth is the result of early promotion by universities, governments, and funding agencies followed by the ground-breaking recognition in academia that inter-disciplinarity is a powerful paradigm for identifying innovative research projects and solving problems that are not amenable to effective solution via a single-discipline approach. As a result of concerted efforts during the last 4-year cycle to expand into inter-disciplinary areas where existing or emerging faculty and other research resources made sense to do so, and consistent with Commitment 6.2 of Making Choices 2001:

6.2 Develop new graduate programs in areas of research strength, with special emphasis on PhD degrees and programs in interdisciplinary areas;

the following four new programs are in an advanced stage of development (formal or informal proposal exists):

- Bioinformatics (MSc and PhD)
- Collaborative Program in Environment and Sustainability (MSc and PhD (formerly Environmental Science) plus course-work MSc)
- Collaborative Program in Planetary Science (MSc and PhD)
- Collaborative Program in Financial Mathematics (course-work MSc, PhD)

Each is at a different stage of development, e.g.,

Environment and Sustainability has been submitted to OCGS and Bioinformatics is undergoing final internal development, and the other two are undergoing initial internal development. It is expected that most of these programs will be accredited by December 2007, with Environment and Sustainability expected to be approved by September 2007.

There are two other new programs that are currently in the formative stages:

- Materials Science (MSc and PhD)
- Geophysics (course-work MSc)

E.2. Graduate Enrolment Growth and Program Expansion

The overlap of intense efforts of graduate program expansion, backed by additional fiscal resources at the provincial level and within Western provide a rare, perhaps unique, opportunity to reach the twin goals of increasing the research intensity in the Faculty of Science and of producing more citizens with graduate degrees. The former is a key objective in the Faculty of Science 2007-11 Academic Plan and the University's new Strategic Plan Engaging the Future 2006, while the latter objective is a major thrust in higher education of the Government of Ontario. The Faculty of Science whole-heartedly embraces this initiative. The increased level of research activity and productivity promulgated by a significantly increased cohort of graduate students will eventually translate into increased research funding, publications, patents, tech transfer, and research profile.

E.2.1. Enrolment Trends and Targets

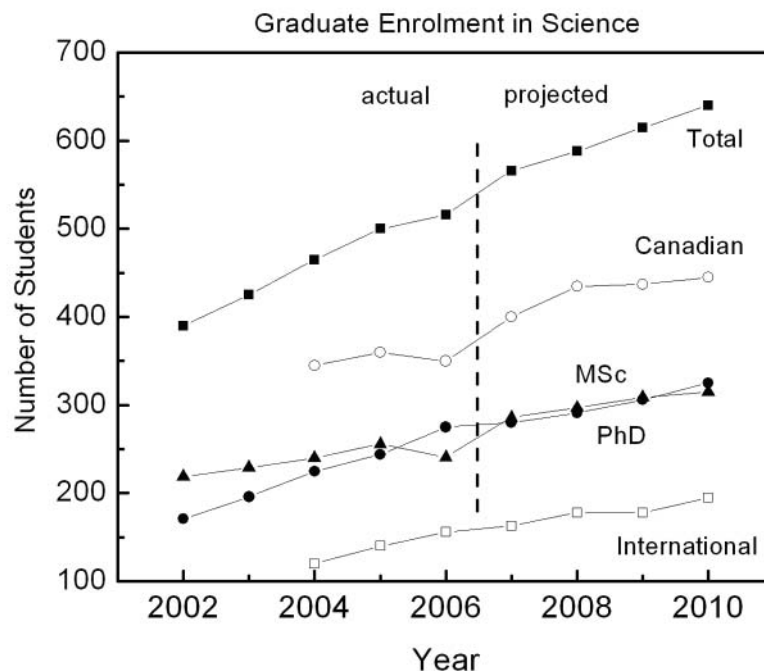
In order to set the context of graduate enrolment targets for the Faculty of Science, it is important to lay out the recent historical trend from which we intend to launch our plans for enrolment growth over the next 4-years. In Making Choices, Commitment 6 specifically addressed plans for growth in graduate programs:

6. Western will expand its graduate programs in areas of high quality. Our University community will:

6.1 Carry out the plans approved by Senate for a substantial increase in graduate enrolment over the next five years;

Within this context, the Faculty of Science has increased its graduate student enrolment by 45% from 185 MSc and 172 PhD students in 2000-01 to 241 MSc and 275 PhD students in 2006-07. Western's commitment to graduate enrolment growth pre-dated and was aligned with the main recommendation of

the 2003 report of the Council of Ontario Universities task force entitled Advancing Ontario's Economy Through Advanced Degrees, which was chaired by Western's President. The report called for a doubling of graduate enrolment in Ontario universities over a ten year



period beginning in 2002-03. The growth in graduate enrolment of 32% achieved in the Faculty of Science since this baseline year is proportionately consistent with the recommendation of doubling the number of graduate students by the year 2012-2013.

Western's *Engaging the Future* reaffirms the university's commitment to the objective of increasing

graduate enrolment as enunciated in the following excerpt :

3. Western is committed to providing Canada's best graduate student experience.

The University will:

3.1 Double the number of PhD students and significantly increase Masters-level students at Western from the base-line of 2000-01 by 2010-11, and continue a strong rate of graduate expansion thereafter.

The Faculty of Science is exactly on the trajectory of a steady growth for a doubling of PhD students (i.e. growth of 10% of 2000-01 baseline per year) as the number of PhD registrants has grown by 60%. The increase in MSc registrants has also been significant (30%) since 2000-01. The Faculty of Science aims to achieve a graduate enrolment complement that reflects a ratio of graduate students per tenured/tenure-track faculty member of 3.5:1, an increase over the current ratio of 2.8:1. (The projected and current ratios are based on an anticipated steady-state faculty complement of approximately 182 which has been the number of faculty, within + 2, for the past 4 years.) A plan to achieve a target of approximately 640 graduate students by 2010-11 is shown in the graph below. In the first phase of our four-year plan, our sights are set on domestic students in concert with the goals of the Reaching Higher plan of the Ontario provincial government. This plan also encourages growth in international students which will continue be an important component of our overall graduate student complement, especially in the latter phase of our 4 year plan.

E.2.2. Current Funding Environment

The minimum annual stipend support for a doctoral student is set in Western's Doctoral Funding Guarantee and is tuition plus \$12,000, amounting to \$17,248 for 2006-07. Graduate stipends for doctoral students in the Faculty of Science vary from a minimum of \$18,000 to \$22,000 depending on the program. Most programs extend this minimum to their MSc students as well. The funding package

for students without major external scholarships (such as NSERC, OGS, OGSST) is comprised of the following three components with their stated sources: i) Graduate Teaching Assistantship (GTA) valued at \$10,264 (2006-07) which is mainly supplied by the Faculty of Science; some programs use Departmental funds or the Graduate Student Scholarship and Training Fund (GSSTF) allocation to the program from the Faculty of Graduate Studies; ii) Western Graduate Research Scholarship (WGRS) from GSSTF funds valued at \$3350 per domestic student and \$9650 per international student (increases to \$3550 and \$9850, respectively, beginning 2006-07; the Faculty of Graduate Studies allocates \$3900 per domestic student and \$10,200 per international student but the Faculty of Science withholds \$350 per student for selective redistribution as discussed later). (iii) Graduate Research Assistantships (GRA) make up the balance of the student stipend support package and are paid by the supervisor from her/his research grant. The amounts vary but for an average of \$18,500 per student per year in the faculty of Science, the GRA is valued at \$4,500 (and as much as \$8,000 in some programs).



E.2.3. Jumping Hurdles : Stimulation of Graduate Enrolment Growth

The barrier to graduate enrolment growth does not appear to be, or to have been, supervisory capacity. Surveys of supervisors carried out by Graduate Chairs in the Science Departments have revealed that a majority of faculty have a strong interest in taking on more graduate students and have sufficiently diversified and successful research programs to spawn new projects for additional students. This is reassuring since arguments that Science at Western does not have the supervisory capacity to expand graduate enrolment would be at odds with the fact that Faculties of

Science (or equivalent) at some of the G13 comparator universities already have higher steady-state graduate student to faculty ratios.

The evidence for the current excess supervisory capacity is consistent with the following. The Faculty of Science holds back \$350 per fundable student of each program's GSSTF allocation to generate a pool of funds of ~\$140,000 annually to distribute differentially Special Support Awards each valued at \$7000 to students of supervisors who otherwise would not be able to take on the student because of financial constraints. In addition to these holdback funds, supplementary funding for the 'bench sciences' has been allocated to the Faculty of Science from Central Administration. Together, these currently fund 24 equal-valued awards suggesting that supervisory capacity is available, but funds for supporting graduate student growth are limited.

One possible barrier is high undergraduate teaching loads in the Science Departments at Western compared to sister Departments in the G13. This is not the case for the majority of the eight Departments but has been clearly identified as a problem for two Departments. Steps are being taken by the Chairs of these two units to systematically reduce the teaching loads for tenured/tenure-track faculty over the course of the next four years. Informal surveys of researchers who supervise more than one or two students and who have a very active research program, combined with discussions with Chairs and Graduate Chairs have revealed the largest barrier to graduate enrolment growth is funding of the graduate student stipend package. The current largest barrier is the lack of research funds to bear the cost of GRAs associated with additional graduate students. A concomitant barrier that has been emerging as the graduate population in Science grew by 32% in the last 4 years is that the demand for GTAs (which provides almost two-thirds of the minimum funding package) at the undergraduate level has outstripped the available supply of funded GTA positions. Some Departments have created additional GTA positions at considerable expense from their own budgets on an ad hoc basis (e.g. in 2006-07 Chemistry; Physics and Astronomy, and Earth Sciences self-funded 25.4%, 21.4%, and 13.6%, respectively of their total GTA budgets). This is a practice that is not sustainable. In addition,

structural deficits still linger from the transition to the new FGS funding formula and the GSSTF is increasingly used to fund GTAs (as much as 53% in some programs!) instead of being applied to the intended scholarship WGRS. The shortage of base-funded GTA positions will only be exacerbated over the next four years as the graduate population grows by an anticipated 125 students and the undergraduate enrolment is expected to remain fixed (Commitment 2.1 of *Engaging the Future*: "Maintain its current target of 4,350 undergraduates per year for the next decade."). The current allocation of GTAs on the basis of pedagogical need will have to be revisited if each incoming graduate student is to be supported by a GTA. It may be time to consider a new set of priorities in the GTA allocation criteria which incorporates the need for graduate support through a GTA. This can only lead to the concomitant benefit of enhancing the undergraduate experience through a reduction in the ratio of undergraduate students to GTAs.

To address these barriers, the Faculty is making base-budget requests for GRA and GTA support in its 4-year Budget Plan. A UPIF application for GRA support for incremental domestic students will be made in Years 1 to 4. This UPIF builds on the GEF incentive plan announced by the Provost in October 2006 for incremental domestic students. It complements existing graduate growth funding for the bench sciences provided by the Central Administration and issued in the form of a limited number of \$7000 scholarships designed to cover the cost of the typical GRA in Science. A series of UPIF applications for GTAs will also be made in each of Years 1 to 4 until an equilibrium state is achieved whereby all fundable graduate students have a full GTA. The requested GTA positions will be tied to the pedagogical needs of delivery of undergraduate courses, improving student engagement, enhancing the undergraduate educational experience (Commitment 2 in *Engaging the Future*), and enhancing the graduate student experience (Commitment 3 in *Engaging the Future*) by providing fertile training grounds for teaching.

E.3 Professional Development for Graduate Students

As part of our training of graduate students, and to prepare them for the best post-graduate experience, the Faculty of Science will work closely with Career Services to encourage an extension of the programs and infrastructure currently in place for undergraduate students for application to graduate students. Various possibilities exist in the areas of skill inventory and enhancement of those skills and development of other professional skills needed to attract potential employers. For example, there is a Faculty-wide need for enhancement of writing skills for the professional arena. Many graduate students have already availed themselves of the Effective Writing Program offered by the Student Development Centre (SDC). Expansion of these efforts, and in particular, the design of tailored workshops for science graduate students is already underway. Discussions have begun with SDC to formulate a plan for our international graduate students to benefit from the new SDC hire in language instruction (she will offer pronunciation workshops for foreign language students). This will provide longer term benefits related to employability for our international graduate students and provide immediate benefits for our undergraduate students who are served by these graduate students as their GTAs. This will be part of a larger program to offer in-house teaching assistant training that will couple the current TA Training Program offered by FGS with a more directed Science Teaching Assistant Program (STAT) - with an acronym that underscores the urgency with which we view this need.

E.4 Actions

E.4.1 OCGS Accreditation of New Graduate Programs

Accreditation by OCGS for the following new programs in Science is anticipated before December 2007: Environment and Sustainability (MSc and PhD; and course-based MSc) and Bioinformatics (MSc and PhD), Planetary Science (MSc and PhD), and Financial Mathematics (course-based MSc, and PhD).

The Environment and Sustainability program is a Collaborative Graduate Program that builds on the highly successful program in Environmental Science. The inter-disciplinary nature of studies relating

to Environment and Sustainability has fostered participation by 22 core faculty members across 4 Faculties (Science, Social Sciences, Schulich School of Medicine and Dentistry, and Engineering). It is anticipated that the introduction of the course-based MSc will attract many students who wish to obtain a 1 year graduate degree before embarking on a career as an environmental professional. Although not a thesis-based program, the summer work term and project emanating from this work term of the course-work MSc program will serve as a testing ground for the students who wish to pursue a thesis-based PhD. The Dean and Assistant Dean of Science have provided support in the proposal development stage. Further supports in launching the approved program will come in the form of facilitating assignment of course instructors selected from the faculty complement in Science. This will involve discussions with Chairs and providing compensation to participating Departments to hire sessional replacements. It is anticipated that such arrangements will be necessary for the first 2-3 years. In addition, use of the Science Internship Program infrastructure and assignment of Career Services personnel to find work-study placements for the 3rd term of this MSc program is anticipated as a critical step to ensuring employment opportunities are identified and exploited. The Faculty of Science anticipates hiring a part-time assistant to support the current Career Services staff.

The proposal for a graduate program in Bioinformatics (MSc and PhD) will be based in the Faculty of Science but have participation from Schulich and Engineering. This could be the first approved program in Bioinformatics in Canada and as such has great potential to be a major attractor for graduate students in this emerging area. Informatics is an emerging sub-discipline in the Medical Sciences and presents the opportunity of broadening the informatics theme to embrace Bioinformatics and Medical Informatics and create a truly inter-Faculty program. To this end a joint faculty appointment between Science and Schulich is proposed for Year 3 to be funded by a joint UPIF award.

A proposal for a Collaborative Program in Planetary Science has already been drafted. Overlain on the current MSc and PhD programs in Physics, Astronomy, Geology, and Geophysics, the proposed collaborative program has the potential to be unique in

Canada since no other graduate program in the area of planetary science exists.

A proposal for a Collaborative Program in Financial Mathematics is being prepared and is expected to be submitted by the end of December 2006. Existing MSc and PhD graduate programs in Applied Mathematics and in Statistics and Actuarial Sciences will provide the foundation. Opportunities exist for inter-Faculty involvement in the proposed program in Financial Mathematics from Social Sciences (Economics) and the Richard Ivey School of Business.

Advertisement of these proposed programs following submission to OCGS as “pending approval” will be an important component of our graduate student recruitment campaign and to reach our new normal in research activity in the Faculty of Science.

E.4.2 Base-Budget Increases for Graduate Research Assistantships

Graduate enrolment growth is central to the Academic Plan of the Faculty of Science over the next 4 years. The pivotal components to this plan involve growth in space, student support, and research funding (especially in the bench sciences) combined with new faculty hires who are forming their research groups. Recent and in-progress faculty appointments provide a key capacity building step for the growth of graduate enrolment in Science. Space improvement and expansion resulting from both on-going and planned renovations as well as new building construction (Materials Science Addition) will address much of the space issues accompanying graduate growth. Another pivotal component is Graduate Research Assistant (GRA) support. Additional stipend support will be needed to support enrolment growth.

The Faculty of Science will encourage graduate growth by augmenting the new base funding that is available for incremental domestic graduate students announced by Central Administration (memo from Provost, October 23, 2006). The Faculty of Science plans to implement a funding package (from funds obtained through UPIF proposals and GEF and ECF funding) for incremental domestic students, irrespective of the student’s degree program, that will supply a total annual amount of \$17,694. This exceeds Western’s Doctoral Funding Guarantee. This

funding for incremental domestic students will enable faculty supervisors to achieve the research momentum necessary to augment their research grant funding over the next cycle of the typical operating grant of 3-5 years.

E.4.3 Base-Budget Increases for Graduate Teaching Assistantships

Graduate Teaching Assistantships (GTA) assigned to undergraduate programs in Science are currently funded mainly through Faculty of Science allocations. Graduate enrolment has increased by 32% in the Faculty of Science since 2002-03 (some programs such as Physics and Astronomy, as well as Mathematics have more than doubled; Geology and Geophysics have grown by 70%) and despite the availability of graduates to serve as GTAs and the need in the undergraduate programs, there are insufficient GTA resources. Consequently, 5 of 8 Departments currently use a large percentage of their internal discretionary funds to bridge the GTA shortfall (e.g. in 2006-07 Chemistry 25.4%; Physics and Astronomy 21.4%; Earth Sciences 13.6%). In addition, structural deficits still linger from the transition to the new FGS funding formula and the GSSTF is increasingly used for GTAs instead of being applied to the intended scholarship WGRS.

There are pedagogical needs for extra GTAs ranging from the effects of the BMSc program and the parallel modules that these students can take in Biology, to the significant changes in the practice and teaching of Applied Mathematics that have occurred in the past few years. The re-establishment of Help Centres in other departments is needed to engage students in an open and informal atmosphere. All of these call for additional GTAs to engage undergraduate students and provide the best learning experience. The Faculty of Science will request a systematic base-budget infusion of GTAs in each of the next 4 years to support the undergraduate teaching needs of the Departments as well as to provide much-needed financial support for the increase in graduate student enrolment.

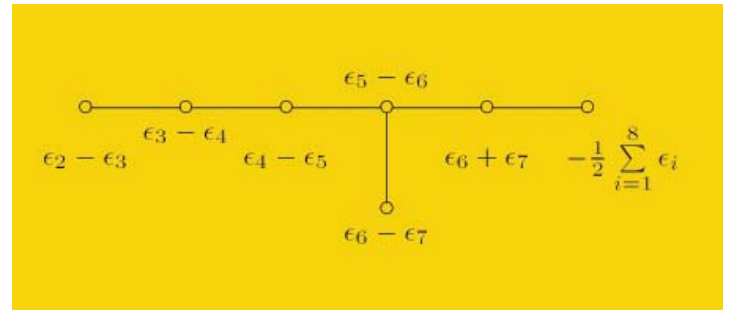
F. RESEARCH

Research in the Faculty of Science ranges from fundamental to applied, is theoretical, experimental, or computational in nature, and spans a broad spectrum of subject matter. The core research mission of the Faculty is to conduct discovery-oriented research that advances the particular fields of study, while providing global leadership in selected areas. The research vision of the Faculty is to become an international leader selected research areas. Two primary supporting objectives are to increase the research intensity, and to expand the proportion of research activity devoted to collaborative and/or interdisciplinary research. Initiatives intended to initiate and accelerate progress towards these objectives are described under various headings below. The major emphasis on graduate enrolment growth leading up to the Nov. 2007 graduate head count means that some initiatives have been deferred until Years 2 or 3 of the Plan. In addition, the scheduled reviews of the five Faculty of Science Research themes in 2006-07 preclude presentation of a complete research development plan at this time. A revised research plan will appear in the Academic Plan update preceding the Year 2 Budget Plan submission.

Research personnel

A major thrust of the Faculty's research enterprise is the training of highly qualified personnel. This next generation of researchers includes undergraduate students, graduate students and postdoctoral fellows. The ongoing drive by Western to double the graduate population in this decade will likely be the single largest contributor to increased research intensity. To maintain a larger graduate cohort requires development of a larger annual pool of potential applicants to graduate school. It thus becomes important to engage more undergraduates in research activities. This means more summer research positions and ensuring that all qualified undergraduates have the opportunity to undertake a senior research project. Increased participation in the latter is limited by course-design, scheduling, and possibly lab space but not by funding. Solutions to such barriers are best found at the departmental level. Summer research opportunities are generally limited by funding. Students who carry (most of) their own funding can usually find a summer placement. The Faculty of Science will apply for a UPIF to establish a set of summer undergraduate research assistantships to

be awarded on a competitive basis across the Faculty. More graduate students also mean more individuals with PhD degrees. It is anticipated that the demand for postdoctoral positions will increase. The research environment and research intensity will benefit directly and immediately from the increased recruitment of outstanding postdoctoral scholars, some of whom will form the next generation of professors. The historical and current number of postdoctoral fellows in the Faculty is relatively low, particularly compared to major research intensive universities in the U.S. and Europe. This is partly due to the research funding paradigm at Canadian universities. The Faculty of Science will apply for a UPIF in successive years of the Academic Plan in order to establish systematically a set of Postdoctoral Fellowships (two-year tenure) to be awarded in a cross-Faculty competition.



Applied research

Discovery-oriented research remains a core mission in the present Academic Plan. Complementing discovery-oriented research, and broadening its impact, is applied research that is, by nature, agile in its response to the immediate needs of society and industry, and amenable to commercial development via patents, licensing, or spin-off companies. The synergy between these two types of research is palpable, particularly when both occur in a given research group. One does not need to choose one type of research to the exclusion of the other. Currently the tangible measures of applied research (patents, licenses, spin-offs) indicate that the tech transfer side of applied research is significantly under-developed compared to such activities in sister Faculties or science departments at the primary comparator group (Toronto, UBC, Alberta, Queen's, McGill). In order to promote this aspect of applied research, a technology transfer officer, reporting to Industry Liaison but funded initially by Science, will be hired in the winter or early spring of 2007. The incumbent will be "embedded" in the core depart-

ments by virtue of an office in the Faculty of Science precinct and a mandate to talk to researchers on a daily basis. This will be a pilot project in Year 1 for which funding will be provided from the Faculty allotment of research contract overhead funds, possibly supplemented by a contribution from the VP Research. If the pilot is successful, the position will become permanent in which case UPIF funding would be sought in Year 2 or Industry Liaison would assume the salary. Synergies and collaboration with Career Services personnel are expected in the area of placements of the Internship Program.

Organization of research enterprise

The majority of research is performed under the individual investigator model, a situation that is expected to continue to provide the backbone of the research enterprise in the Faculty. However, the proportion of research done collaboratively has increased steadily over the last decade, a trend that is also expected to continue. Such collaborations most often involve two principal investigators and occasionally more. Occasional collaborations are formed to work on a particular research project whereas sustained collaborations are formed when there is a common research program. Collaborative research is equally valued whether it is intra-disciplinary or inter-disciplinary. A sign of a well-developed collaborative research program is joint supervision of graduate students who are given the opportunity to develop multidisciplinary expertise. The ongoing expansion of the graduate cohort is expected to provide much of the research capacity required to undertake more multi-investigator research.

In order to create an environment that encourages faculty to participate in collaborative research and to undertake joint supervision of graduate students, there must be support and recognition from Chairs and the Dean. In particular, Chairs and the Dean must not discount collaborative research in annual performance evaluations and the annual review of tenure-track faculty, respectively (and faculty should supply a clear description of their contributions to such research). The Dean must ensure that collaborative research is fairly and thoroughly assessed in the promotion and tenure process. A perennial sticking point is the application of traditional formulas to assign fiscal resources and supervisory credit to Departments for faculty involved in intra- or inter-Faculty collaborative research.

Current schemes are seen by many as a disincentive to collaboration and joint supervision. The Core Chairs group (Dean, Associate Deans group, and Chairs) will attempt to find a mutually agreeable new approach in the winter term 2007.

There are various ways in which collaborative, interdisciplinary research is organized on a scale larger than a team of principal investigators working on a particular project program. Two or more groups of collaborators may identify a common theme that embraces their collaborative projects and create an informal research group or cluster. Current examples of clusters are Biomedical Physics, Financial Mathematics, Interface Science Western, and potentially Mathematical Biology. Informal groups that achieve critical mass and prove to be sustainable may be formally recognized as a group, centre, or institute. Formally recognized units have a Director and a budget, some of which may be supplied by the Faculty Office. Currently, the following units are formally recognized by the Faculty of Science:

- Centre for Chemical Physics (CCP)
- Environmental Research Western (ERW)
- Planetary Science
- Surface Science Western (SSW)
- Western Institute for Nanomaterials Science (WINS)

Since informal group formation and requests for formal recognition is ideally a “bottom up” process, it is not possible nor wise to speculate on what additional units might appear during the four-year plan. Requests will be handled on a case-by-case basis. Existing formally recognized units will be assessed periodically for relevance, productivity in research output and supervision, contribution to graduate programming, value added to the research enterprise, and research leadership. Those not meeting expectations in a sufficient number of categories will be phased out or combined with other units.

The Faculty of Science is home to three stand-alone major research facilities: the Nanofabrication Laboratory (housed in P&A Building), Sharcnet (housed in Western Science Centre and ancillary buildings, and the Biotron (new building and NCB). Each was

created on the basis of substantial CFI/OIT funding. Each has a Director, support staff, and a management structure. Each facility is expected to be self-sustaining in the long term via cost recovery through some combination of user fees, external grants, and corporate sponsorship. The Biotron is a joint venture with the University of Guelph. Sharcnet is a consortium of 18 Ontario universities and colleges with Western as the lead institution. No new stand-alone facilities are anticipated during the 2007-11 period covered by this Plan.

In its 2003-07 Academic Plan the Faculty of Science first identified strategic research themes that would guide the allocation of faculty and staff positions, inform the development of graduate and undergraduate programming, and set priorities for large-scale thematic CFI applications and interdisciplinary initiatives. The themes transcend departmental and research unit boundaries. They are areas in which the Faculty intends to build, or enhance existing, research expertise and capacity. The current themes are:

- Computational Science
- Environment & Ecology
- Genetics & Evolution
- Materials Science
- Stellar Science (Planets & Stars)

The previous Academic Plan called for a review of these themes near the end of the mandate of that plan. Accordingly, a formal review of each theme is being undertaken in the 2006-07 academic year. A team of 2-3 external reviewers for each theme is being selected by the Associate Dean Research in consultation with ad hoc stakeholder groups. The reports will provide an assessment of the themes plus advice and recommendations to the Dean. It is anticipated that all reports will be available by June 2007. As a result of these reports and subsequent consultations within the Faculty, there are various possible outcomes which will be reported in the Year 2 update to the Academic Plan.

Research partnerships with external organizations

Individual researchers in all departments of the Faculty are involved in numerous external research collaborations, both nation and international, often on

an informal basis. Apart from these, some significant research partnerships that will be of ongoing importance to the Faculty are mentioned briefly below.

Institute for Catastrophic Loss Reduction (ICLR)

This is already partnered with Western; it is currently housed in Westminster but is seeking a home Faculty. It has been mutually agreed that Science is a natural home and thus ICLR will be included in Science's space planning and given office space in the Science precinct in order to facilitate interactions. Current collaborations with the Earth Sciences Department have led directly to the NSERC IRC for Kristy Tiampo and indirectly to the recruitment of Gail Atkinson (CRC Tier 1 applied for). Future collaborations are anticipated to broaden to other areas in science (e.g.; atmospheric and environmental sciences).

Partnership with the University of Guelph for the Biotron

The Biotron project, with the new building at Western due for completion early in 2007, involves an ongoing collaboration with the University of Guelph

SHARCNET consortium of universities and colleges

SHARCNET is a consortium of numerous partner institutions from universities, colleges and industry in a "cluster of clusters" of high performance computers, linked by advanced fibre optics.

Perimeter Institute

Western has developed, mainly through the Departments of Applied Mathematics and Mathematics, strong links to the Perimeter Institute for Theoretical Physics. These include joint appointments and adjunct appointments for faculty members, as well as collaborative research projects. There is now a strong graduate student involvement, which should prove beneficial in future graduate student recruitment.

Fields Institute

The institutional membership of the Fields Institute for research in mathematical science has been beneficial to four of our Departments (Applied Mathematics, Mathematics, Computer Science, and Statistics & Actuarial Sciences). Utilization of the support programs for putting on workshops and

seminars has been strong.

Ontario Photonics Consortium (OPC)

This ORDCF-funded project involves a partnership with McMaster University, Waterloo University, the University of Toronto, and industry. There is strong linkage to the operations of the Nanofabrication Lab and other work involving photonic band-gap materials.

Canadian Light Source

Several faculty members, particularly in Chemistry (e.g., Mike Bancroft, T-K Sham), continue to play a strong role in the Canadian Light Source (Canada's National Synchrotron Research facility) in Saskatchewan.

International research

The development of definitive, Faculty-wide programs that enable sustainable research efforts involving international partners has not yet occurred and remains both a challenge and an opportunity for the Faculty of Science. More effort will be devoted to this area in the current Academic Plan. A primary goal will be to establish a well-defined, formal collaborative arrangement involving graduate students and research with one foreign partner institution. It is recognized that formal arrangements are preceded by extensive exploratory discussions, exchange visits, and trial collaborative research projects by individual faculty in order to build a relationship to the point where an agreement can be undertaken at the institutional level. Thus a parallel objective over the next four years is creation of new links with international researchers and their Departments and the exploitation of selected existing links between an individual researcher in the Faculty and their colleague(s) at a foreign institution.

The current state of affairs in international research is more a result of happenstance than planning. At the Department level it usually consists of connections with international researchers established independently by individual faculty members and often involves exchange visits of principal investigators with the occasional short-term graduate student exchange. At the Faculty level, the dominant feature is the relatively large cohort of international graduate students (29% of MSc and 35% of PhD students in 2006-07). An increasing number of faculty members has a country of

origin other than Canada, many having obtained some or all of their formal education in countries other than Canada. This cohort of faculty is ideally positioned to provide links to international researchers and indeed many have already done so. One way to create new links with foreign researchers is to establish a Faculty of Science Visiting Scholar Program. Funds to host outstanding scholars for periods from several weeks to one term would be awarded to Departments in an annual competition. Preference would be given to scholars from outside Canada and the United States. Scholars would be expected to undertake or already be undertaking collaborative research with faculty at Western, to contribute to the teaching of graduate courses where possible, and participate in the academic life of the host Department. A UPIF application will be submitted by the Faculty of Science for this initiative. A natural outgrowth from the roots of research collaboration developed through this initiative would be the formalization of a graduate student exchange program for both research and curricular purposes. The development of graduate courses, perhaps most practically in the compressed format that short courses offer, will be pursued both at UWO and at international partner institutions. This will require administrative aid by the Faculty of Graduate Studies to facilitate the process of foreign course accreditation for Faculty of Science graduate programs as well as financial aid to visit foreign universities initially in order to develop curricular structures and procedures and then on a continuing basis to fund graduate student exchange visits. To launch such an initiative, use would be made of last year's successful PASF request for "Support for Internationalization Projects" and the internal International Curriculum Fund, through which funds will be sought. Base budget funds will be requested in the second half of the 4 year plan via a UPIF application to fund a limited number of graduate student exchange visits.

Some initiatives recently undertaken to establish formal partnerships / joint degrees with European universities have focused on Germany and France and include the following. The Associate Dean Research visited the University of Karlsruhe and the University of Konstanz in July 2006. These visits were partly in connection with the existing Ontario-Baden-Württemberg exchange program, which is well established but under funded from the Ontario government side. A delegation from B-W had visited Western in 2005

so the recent visit was a follow-up. Although Science receives a good proportion of the exchange students from Germany under this program, there is less participation by Western science students going to B-W universities. This is one of the issues discussed during the visit, but another purpose was to explore setting up bilateral exchanges and/or joint graduate degree schemes with Karlsruhe and Konstanz in particular. During the visit in July 2006 it was established that the Faculties of Science at each of these two universities constitute an interesting match with our Faculty of Science in several key areas (e.g., nanotechnology and materials science, environmental science; chemistry). These possibilities are still being actively developed. A separate initiative involves the Université Joseph Fourier in Grenoble, where there are identified strengths in areas of materials, biomaterials and nanotechnology. In November 2005 the Rector of UJF, who is himself a nanomaterials scientist, visited Western with several of his senior colleagues. There is a follow-up visit by a Western delegation, including our Associate Dean Research, to UJF scheduled to take place in December 2006.

Stewardship of grant and award applications

The Faculty of Science proposes to take some new steps, as well as strengthening current practices, concerning the timely preparation and vetting of grants and awards. Specifically, we shall

- continue to emphasize the Departmental responsibility to ensure that all grant applications are vetted by at least two internal readers. Additional attention and additional readers will be necessary for NSERC applications by junior faculty, and applications should be prepared allowing sufficient time for this process.
- work to establish Faculty policy that, as far as possible, all new faculty arrive with their NSERC Discovery Grant and CFI Leaders Opportunity Fund applications already submitted or prepared. The aim is to have the funding decision typically known either before arrival or as soon as possible thereafter. In most cases these will be funded and the junior researcher “hits the ground running”. Associated with this policy is some advance knowledge of a CFI LOF budget and hence the amount of 20% match, so that the match can be worked into the startup package.

- continue to pre-identify and cultivate nominees for major external awards (Early Researchers Awards, Steacie Fellowships, Premier’s Discovery Awards, Royal Society of Canada, national society awards, etc.). There is awareness and proactivity within the Dean’s Office (through the Associate Dean Research) but the Dean and Associate Dean Research will continue to push Chairs/Departmental Awards Committees to engage in this activity.

Actions:

F.1 UPIF for FoS undergraduate summer research awards

Funding is requested in 2008-09 to increase research participation by summer students. This may serve as a tool to promote graduate recruitment.

F.2 UPIF for FoS Postdoctoral Fellowships

Starting with funding requested for 2008-2009 we propose to build up a modest program of PDF positions in the Faculty with the purpose of raising the research intensity and to broaden the research interactions for the graduate students in the host department.

F.3 New approach to assignment of resources and credits for inter-departmental collaborative research

A series of discussion among the Core Chairs group (Dean, Associate Dean group, and Chairs) is proposed to take place in winter 2007. There are no budget implications to carry out the process but some impact on Departmental budgets is anticipated and possibly on the Faculty budget in cases of inter-Faculty revenue sharing.

F.4 Review of the five research themes

These will be reviewed one-by-one by external consultants. A site visit for the Materials and Biomaterials theme has already occurred in October 2006 and we await report. The other four themes will be reviewed in Winter/Spring 2007, so we expect to have all five reports by about June 2007. There are some budget implications, with the estimated cost of the 5 reviews being $5 \times \$6K = \$30K$ from Faculty discretionary funds.

F.5 UPIF for FoS Visiting Scholar Program

Funds are requested starting in 2009-10 to introduced a Faculty-based program for the purposes of strengthening research and linked to internationalization.

G. SPACE

Space Planning Principles

- The allocation of existing space assigned to the Faculty of Science and the acquisition of new space will be guided by the following principles which are either commensurate with, or essentially identical to, space planning principles enumerated in the Campus Master Plan (Nov. 2006 draft):

- Incremental space: The Faculty will request that space newly assigned to the Faculty be contiguous with existing assigned space to enable the continued development of the a community of science at Western and provide a consolidated science precinct

- Relocation within existing buildings: During expansion and/or major renovation of physical space assigned to the Faculty, opportunities to realign the Faculty's activities will arise. When presented with such opportunities, the following principles should serve as guides:

- wherever possible, the space assigned to a Department should be contained in a single building

- when it is impossible to confine a Department's space allocation to a single building the relocation of academic units/groups should be based on proximity to similar units/groups and should promote interdisciplinarity and collaboration.

- Non-academic units and non-academic use of space: The academic uses of space assigned to the Faculty in the campus core take priority. A non-academic unit may be moved out of core academic space in the Science precinct when it is feasible to do so, i.e., when suitable alternate space is available and the relocation would not severely disadvantage the unit. Non-academic uses of space (e.g. long-term storage) will be discouraged and alternative arrangements vigorously pursued.

- Assessing Space Needs: New/incremental space should be targeted towards programs/areas with the greatest needs. The need for additional space should be directly linked to Faculty and Department Academic Plans and to Research Unit Operational Plans. The assessment of space needs should be guided by an analysis of actual space compared to required space according to standards for space allocation applied across the Ontario university system.

- Design of Space: It is important that newly created space (new construction or renovation) is

designed in a manner that is flexible and easily adaptable to the constantly-changing University environment. In addition, it is important that the design of space include the appropriate provisions for common or gathering space that would allow for informal interaction/collaboration among students, faculty, and staff.

- Faculty Management of Space: Decisions on the use of space allocated to the Faculty, including its reassignment, are taken under the Dean's authority, in consultation with Chairs and Directors, as appropriate.

- Departmental Space Management: Each Department will develop a set of space management principles to ensure efficient, adaptable use of its space and a fair, transparent process for the assignment and reassignment of space under its control. Departments will develop these principles in consultation with the Dean and Associate Dean Administration. Departmental principles will consist of a set of a generic principles supplemented by specific principles arising from discipline-specific considerations and any special circumstances.



Major objectives and priorities during four-year plan

- 1) Acquire additional academic space to accommodate office and laboratory requirements generated by planned incremental growth in the number of faculty members and graduate students. The Faculty of Science will apply for the space to be vacated in the Natural Science Building after ITS moves to a new location.

2) Create additional academic space to accommodate office and laboratory requirements generated by planned incremental growth in the number of faculty members and graduate students. The Faculty of Science supports the relocation of SSW to the Research Park. The Director of SSW has agreed to this move. This will free up most of the basement level of the Western Science Centre.

3) The incorporation of adequate communal and interdisciplinary space in the Physics & Astronomy renovation project.

4) The consolidation of several Departments that are currently spread across several buildings into a single building.

Four-year Space Management Plan

A preliminary draft of a detailed plan has been prepared and is undergoing revision. It is anticipated that the Space Management Plan will be released in the spring of 2007.

Actions:

G.1 Chairs, Dean, and Associate Dean Administration develop space management principles for all 8 Departments in winter 2007.

G.2 Apply for space in Natural Science Centre in upcoming space “auction”

G.3 Dean to work with Provost, VP research, Dan Sinai, Director of research Park, and Director of SSW to pave way for moving SSW to Research Park.

H. INTERDISCIPLINARITY

Interdisciplinarity can have different meanings in different contexts. Here it means bringing knowledge, perspectives, expertise, and skills from different disciplines to bear on an undergraduate program, a graduate program, or a research project, program, or theme. In the vast majority of cases it entails two or more principal investigators from different units teaching or carrying out research in collaboration. Interdisciplinary studies and research have been identified as priorities in the University's Strategic Plan. Interdisciplinarity is an emergent theme in the Faculty of Science. The current status of interdisciplinarity in undergraduate and graduate education and in research is summarized immediately below. This is followed by a summary of initiatives and principles in this Academic Plan that have an implicit or explicit interdisciplinary component. The plans for development of interdisciplinarity contained in this inaugural version of the four-year Academic Plan are intentionally modest and based largely on current and recent initiatives. A substantially more developed and focussed approach to interdisciplinarity will be presented in the Year 2 update to this Plan. It is anticipated the update will contain a proposal or proposals for a major initiative to be funded by the new Interdisciplinary Development Initiatives Program.

Summary of current status of Interdisciplinarity in Science

Some current examples of interdisciplinarity, together with some that are still at the planning stage, are:

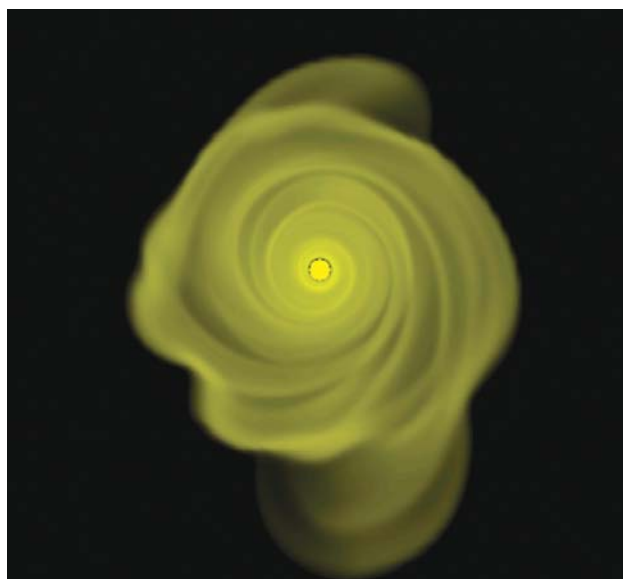
(i) Undergraduate programs

- *Medical Physics program*, involving Physics & Astronomy with Medical Biophysics and Robarts.
- *Planetary Sciences program*, involving Physics & Astronomy and Earth Sciences
- *Materials Science program*, based in Physics & Astronomy but also involving Chemistry and Earth Sciences. There will also be a Materials Science Building with shared labs.
- *5 Year B.Sc. Honours Mathematical Sciences and Bachelor of Education*, involving Applied Mathematics, Mathematics, Computing Science, Statistics & Actuarial Sciences, Faculty of Education.
- *Environmental Sciences courses* (existing

courses), involving Earth Sciences, Biology, Physics & Astronomy, and Chemistry.

- *Proposed School of the Environment and Sustainability*, which would have the Faculty of Science as its natural home but would also include Engineering and Social Science (plus some involvement from almost all other Faculties and some affiliate Colleges).
- *Service Mathematics and/or Statistics courses*, of which there are several taught by Applied Mathematics, Mathematics, and Statistics to other Science departments and other Faculties (Engineering, Social Science, etc.).
- *Chemistry and Biochemistry*, involving joint courses in their departmental programs.
- *Theoretical Physics program*, involving Applied Mathematics and Physics & Astronomy.
- *Bioinformatics studies*, involving joint course offerings being developed between Biology, Computer Science and Biochemistry.
- *Liberal Studies courses*, which are being developed by Earth Sciences and Chemistry [as part of "*Liberal Studies: Culture, Science and Society*" with the Faculties of Arts and Humanities, Social Science, Fine Arts and Music].

In addition to the above specific options, there is scope to explore the introduction of various innovative "make your own" interdisciplinary degree programs by taking advantage of the module system for undergraduate courses.



(ii) Graduate programs

- *Joint Theoretical Physics program*, involving Applied Mathematics and Physics & Astronomy.
- *Scientific Computing program*, involving Applied Mathematics, Computer Science, Statistics & Actuarial Sciences, Physics & Astronomy, and Chemistry.
- *Environmental Sciences program*, involving Biology, Earth Sciences, Physics & Astronomy, Chemistry, Engineering.
- *Materials Science program (planned)*, involving Chemistry, Physics & Astronomy, Earth Sciences, Biology, and Applied Mathematics (and maybe Engineering).
- *Planetary Sciences program (planned)*, involving Physics & Astronomy and Earth Sciences.
- *Bioinformatics courses (planned)*, involving Computer Science and Biochemistry.
- *Linguistics M.A. program* (in Faculty of Arts and Humanities) – Computer Science participation is planned.

(iii) Research

The Faculty of Science has five identified research themes. These were not chosen along departmental lines, but instead each one of them is an interdisciplinary area. They are (indicating the main departments involved and links to other Faculties):

- *Materials and Biomaterials* – Physics & Astronomy, Chemistry, Earth Sciences, plus Engineering.
- *Computational Sciences* – Computer Science, Mathematics, Applied Mathematics, Statistics & Actuarial Sciences.
- *Functional Genomics and Evolution* – Biology, Chemistry, Applied Mathematics, Computing, plus Schulich School.
- *Environmental Science and Ecology* – Earth Sciences, Biology, Chemistry, Statistics & Actuarial Sciences, plus Engineering.
- *Planets and Stars* – Physics & Astronomy, Earth Sciences.

Some of the formalized research units that are intrinsically interdisciplinary are:

- Centre for Chemical Physics (CCP).

- Environmental Research Western (ERW).
- Western Institute for Nanomaterials Research (WINS).
- Interface Science Western (ISW).
- Surface Science Western (SSW).
- Nanofabrication Laboratory.
- Biotron
- SHARCNET Computing Facility/Network.
- Institute for Catastrophic Loss Reduction (ICLR).
- Planetary Science Group.

External units with which Science is associated and which promote interdisciplinary research include:

- *Fields Institute for Mathematics* – Mathematics, Applied Mathematics, Statistics & Actuarial Sciences, Computing Science.
- *Perimeter Institute for Theoretical Physics* – Mathematics, Applied Mathematics, Physics & Astronomy.
- *National Research Council* (in Ottawa and locally at IMTI) – Several departments (often through adjunct appointments).
- *Canadian Light Source (Synchrotron Facility)* – Earth Sciences, Chemistry.

There are numerous informal research groupings of an interdisciplinary nature, e.g.,

- *Biomedical Physics* – Physics & Astronomy, Biology, Medical Biophysics, Robarts, Lawson, London Regional Cancer Centre.
- *Mathematical Biology* – Applied Mathematics, Biology.
- *Theoretical Physics* – Physics & Astronomy, Applied Mathematics, Mathematics.
- *Bioinformatics* – Biology, Computer Science, Schulich School.
- *Financial Mathematics* – Applied Mathematics, Statistics and Actuarial Sciences, Ivey Business School.

I. EXTERNAL RELATIONS

External relations in a university setting is broad and diverse. For the Faculty of Science it includes:

- Alumni relations
- Corporate relations
- Government relations
- Media relations
- Fundraising and sponsorships
- Outreach to students and the public
- Relations with other Faculties at UWO and their constituent units
- Relations with other universities and cognate Faculties
- Relations with cognate professional organizations
- Raising the profile and promoting signature features

At the central administrative level, most Canadian universities, and all of the G10 (G13) universities have recognized the importance of external relations and have established a comprehensive strategy backed by programs and personnel. At the Faculty level, the importance of external relations is typically recognized but comprehensive strategies are usually not established and implementation of external relations activities is usually well developed in some selected areas but under-developed in others. At the level of the constituent units of a Faculty, recognition and implementation are typically less developed than at the Faculty level and there is usually a very wide variation in engagement in external relations, with some units having no track-record in this area and no stated plans to do so in the near future. The Faculty of Science is no exception to this typical scenario.



During the past 7-8 years, there has been substantial development in selected areas of external relations, in particular embedding of a Development Officer in the Faculty, addition of a Communications Officer/ Science Writer, addition of an Outreach Coordinator, addition of Internship Program, establishment of Science External Advisory Council. However, much remains to be done to establish an external relations program that is active in all the areas listed above, that is integrated into core activities, and that is embraced by Departments and personnel in the Faculty. The twin goals of this four-year plan in the external relations sphere are:

- 1) take the external relations to the next level by developing a comprehensive program that is coherent and integrated;
- 2) promote and facilitate increased departmental involvement in a (broader) range of external relations activities.

Two major initiatives are described immediately below. There will be numerous initiatives at the Faculty level within the existing external relations infrastructure; these are not described here. In addition, the Dean will begin the process of increasing Departmental activity in external relations in Year 1 of the Academic Plan via consultations with Chairs.

(i) Formation of Western Science Corporate Council (WSCC)

The external membership of this Council will consist primarily of leaders/decision makers from a broad range of corporate and industrial sectors aligned with academic programs and research within the Faculty of Science. Allowance will be made for strategic appointments from the government sector and of exceptional individuals. At steady state it will have about 20 external members and 5-10 internal members. The Corporate Council will replace the existing Science External Advisory Council. It is anticipated that the first meeting of the new Council will occur in the Fall of 2007, with recruitment occurring in the first half of 2007. The WSCC will provide advice to the Dean on a wide range of topics relevant to activities within the Faculty, engaging as necessary in studies and/or surveys in order to inform itself of qualitative and quantitative aspects of Faculty activities. Council members will be expected to

contribute to academic programs in numerous ways, e.g. guest lectures, career talks, interviewers for mock interviews of students, identification research areas/ engagement of researchers of interest to the company they represent. Companies represented on the WSCC will be expected to support relevant research programs whenever possible, to sponsor selected events and activities in the Faculty, to provide internship placements for Science students whenever feasible, and to promote Science Western. A list of potential member corporations will be formed by melding extensive number existing corporate/industrial contacts developed by the Internship Program, the Development Officer, Surface Science Western, and individual researchers.

(ii) External Relations Manager

This is a new position whose purpose would be to implement the objectives delineated in this part of the Academic Plan and coordinate the ever-broadening spectrum of external relations activities at the Faculty level. In particular, the Manager would develop a comprehensive external relations program, play a lead role in the administration and recruiting for the Corporate Council, optimize the deployment of ongoing programs, and find synergies and efficiencies among personnel engaged in external relations at the Faculty and Departmental levels. It is anticipated that the Manager would devote about 50% of her/his time to the management portfolio and the remaining time to one or two specific portfolios under the external relations umbrella, e.g., career services, development, alumni relations. Ideally this position would be in place for Year 2 of the Plan (2008-09) and funded by a UPIF but could be delayed to Year 3 depending on funding for the position and/or success in recruiting a suitable first incumbent. A detailed job description and a more detailed UPIF proposal will be developed for the Year 2 update of the Faculty Academic Plan and Budget Plan. Given the possibility of a 50-50 split with another portfolio in the external relations area, it is premature to submit a proposal for base-funding at this point.

Actions:

I.1 Form Western Science Corporate Council

- create terms of reference by Dec. 2006 (Dean, Development Officer, Chair of SEAC)
- vet terms within Faculty of Science and with VP

External

- assemble list of sectors to be represented on Council and list corporations and contacts within sectors in January 2007
- recruit membership for WSCC (February to August 2007)
- hold first meeting in Fall of 2007.

I.2 Manager of External Relations

- new staff position to oversee, manage, and promote external relations activities in Faculty of Science
- to be funded by UPIF and inaugurated in Year 2 (08-09) or Year 3 (09-10)
- detailed job description and UPIF text to be prepared for Year 2 update to plan

J. PERFORMANCE INDICATORS AND COMPARATIVE ASSESSMENTS

Increasingly the provincial and federal governments, and universities themselves are employing performance indicators, benchmarks, and comparative assessments to identify and exploit strengths, to identify and address weaknesses, and to inform the selective allocations of resources. Potential students (and their parents) are increasingly influenced by such data in the selection of a post-secondary institution. The reputation and profile of a university among the general public and the media is increasingly tied to these measures. At the central administrative level, universities have devoted time and effort to the systematic development of indicators and assessments, and with considerable success: There is now a plethora of useful data and comparisons to suitably chosen sister universities (within Canada it usually the so-called G10 group (now G13) for Western). Universities are now beginning to agree on sharing of common data and making that data publicly available (e.g., the Common University Data Ontario (CUDO) website). Within Western, most data, performance indicators, and benchmarks are, or can be, available at the Faculty level. Far less well developed is the availability and analysis of data that would enable the comparison of a particular Faculty at one university with the same Faculty, or a cognate set of Departments, at other Canadian universities. The ability to make comparative assessments of the same or similar Departments across Canada is highly variable across the disciplines represented within a Faculty since it depends on the existence of a coordinating body (usually a council of Chairs) that maintains a central database.

A goal of this four-year planning cycle is to identify, compile, and track a suite of performance indicators and benchmarks appropriate to a Faculty of Science and to make meaningful comparative assessments to other Faculties of Science (or equivalent unit) at the G13 universities. In parallel, Departments will be first encouraged, and later required, to identify suitable indicators for their discipline and to make comparative assessments to their sister Departments in the G13 and across Ontario. This initiative will be directed by a standing committee on Performance Indicators and Comparative Assessments (PICA). The Committee will be composed of faculty representing

the mathematical, physical, life, and basic medical sciences; it will be chaired by an Associate Dean and report to the Dean. The PICA Committee will be formed in winter 2007. Its early mandate will be to identify indicators, benchmarks, and comparators appropriate to the Faculty of Science and enabling a balanced evaluation of undergraduate programs, graduate programs, and research. Included in this early mandate is the requirement (expressed in Sec. D.6 of the 2007-11 Planning Guidelines) to identify five Science-specific, quality-based benchmarks to complement the currently available centrally-generated indicators. The Committee is expected to provide a recommended set of indicators and comparators by Sept. 2007 for inclusion in the Year 2 updates to the Academic Plan and Budget Plan.

APPENDIX 1: Degree Programs, Faculty of Science and BMSc

Old Programs

Three-Year BA Degrees, with an approved Area of Concentration, are offered in:

- Computer Science
- Geology
- Mathematics

BSc (Human Ecology) and BA (Human Ecology) programs in Family Studies and in Foods and Nutrition are offered jointly by the University and Brescia University College.

Three-Year BSc Degrees are available in:

- Applied Mathematics
- Applied Mathematics and Computer Science
- Biochemistry and Chemistry
- Biology
- Biology and Environmental Science
- Chemistry
- Chemistry and Environmental Science
- Chemistry and Geology
- Computer Science
- Environmental Science
- Geology
- Geology and Environmental Science
- Geophysics
- Mathematics
- Mathematics and Computer Science
- Mathematics and Statistics
- Physics
- Physiology and Psychology
- Statistics
- Statistics and Computer Science
- Statistics and Environmental Science

Four-Year General BA Degrees are available in:

- Computer Science and MIT

Four-Year General BSc Degrees are available in:

- Biology
- Computer Science
- Computer Science with Software Engineering Specialization

- Geology
- Geophysics

Four-Year BA Degrees are available in the following Honors Programs:

- Actuarial Science
- Actuarial Science and Mathematics
- Actuarial Science and Statistics
- Actuarial Science with Economics
- Computer Science and MIT
- Mathematics
- Mathematics and Statistics
- Mathematics with Economics
- Statistics
- Statistics with Economics

(A 4-Year Honors BA is available in Philosophy and Mathematics.

Four-Year BSc Degrees are available in the following Honors Programs:

- Actuarial Science
- Actuarial Science and Computer Science
- Actuarial Science and Mathematics
- Actuarial Science and Statistics
- Applied Mathematics
- Applied Mathematics and Computer Science
- Applied Mathematics and Geophysics (Environmental Modelling)
- Applied Mathematics and Statistics
- Applied Mathematics and Statistics in Environmetrics
- Applied Quantitative Information Technology
- Astronomy
- Astronomy and Geophysics (Planetary Science)
- Biochemistry and Chemistry
- Biology
- Biology and Geology
- Biology with Environmental Science
- Biophysics
- Cell Biology
- Chemistry
- Chemistry and Economics
- Chemistry with Environmental Science
- Computer Science
- Computer Science and Statistics
- Computer Science with Economics

- Computer Science with Mathematics
- Computer Science with Philosophy
- Computer Science with Psychology
- Computer Science with Software Engineering Specialization
- Ecology and Evolution
- Genetics
- Geology
- Geology with Environmental Science
- Geophysics
- Mathematics
- Mathematics and Computer Science
- Mathematics and Statistics
- Mathematics with Computer Science
- Medical Physics
- Physics
- Physics and Geophysics (Atmospheric Physics)
- Physics and Computer Science
- Physiology and Psychology
- Plant Biochemistry and Molecular Biology
- Plant Sciences
- Science of Materials
- Statistics
- Toxicology with Environmental Science
- Zoology

A Four-Year General BSc Degree is available in:

- Medical Sciences

Four-Year BSc Degrees are available in the following Honors Programs:

- Biochemistry
- Biophysics
- Medical Sciences
- Microbiology and Immunology
- Pharmacology and Toxicology
- Physiology

A Five-Year BSc Honors and Concurrent BEd Degree Program is available in:

- Mathematical Sciences

A Five-Year BSc and Concurrent HBA Degree Program is available in:

- Medical Sciences

A Six-Year BSc Honors and Concurrent LLB Degree Program is available in:

- Honors Computer Science/LLB

New (NAC) Programs

The Faculty of Science offers modules which lead to the following degrees:

Honors Bachelor of Science (Four-Year) 20.0 required courses.

Honors Bachelor of Arts (Four-Year) 20.0 required courses.

Bachelor of Science (Four-Year) 20.0 required courses.

Bachelor of Arts (Four-Year) 20.0 required courses.

Bachelor of Science (Three-Year) 15.0 required courses.

Bachelor of Arts (Three-Year) 15.0 required courses.

The Faculty of Science and the Schulich School of Medicine and Dentistry jointly offer the following BSc degrees:

Honors Bachelor of Medical Science (Four-Year) 20.0 required courses.

Bachelor of Medical Science (Four-Year) 20.0 required courses.

The following degrees are not necessarily offered in the modular format.

A Five-Year BSc Honors and Concurrent BEd Degree Program is available in:

Mathematical Sciences

A Five-Year BSc Honors and Combined HBA Degree Program is available in:

Honors Specialization in Medical Sciences

A Five-Year BSc and Concurrent HBA Degree Program is available in:

Honors BSc/HBA

A Six-Year BSc Honors and Concurrent LLB Degree Program is available in:

Honors Computer Science/LLB

BSc (Human Ecology) and BA (Human Ecology) programs in Family Studies and in Foods and Nutrition are offered jointly by the University and Brescia University College.

Expected Evolution

All of the old programs will disappear very soon – last graduation, September 2008 – with the possible exception of the various Concurrent/Combined Programs with Professional Programs.

APPENDIX 2: Science/BMSc Enrolments

First Year (when all students Biological and Medical Sciences students are in the FoS)*							
2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11
1306	1220	1169	1150 (proj)	1150 (proj)	1150 (proj)	1150 (proj)	1150 (proj)
Year 2 (when all students are in the FoS)&,**							
1142	1457	1254					
Year 3&,**							
886	716	759					
Year 4&							
428	477	478					
Total Science*							
3844	3966	3758	3820 (proj)	3903 (proj)	3841 (proj)	3827 (proj)	3824 (proj)
BMSc							
Year 3&,\$							
103	202	257					
Year 4&,\$							
16	51	127					
Total BMSc (in Schulich)*							
222	455	851	815 (proj)	600 (proj)	600 (proj)	600 (proj)	600 (proj)
Summer&,#							
1601	1263	1335					
Cross-Unit Enrollments (Fall/Winter) &,#							
10003.5	9983.5	9538.5					
Cross-Unit Enrollment (Summer) &,#							
694.5	599.5	623.0					

* Actual and Projected; from Exhibit I, SUEPP/SCUP Meeting, Jan 12, 2006

** 3-Year and 4-Year enrollments combined

& from Databook 2006

Including Summer Learning by Distance

\$ Registered in Schulich