Cyclical Review of the Biology Department

Final Assessment Report

Submitted August 29, 2012 by Dr. Paul Jessop, Dean of Science, in consultation with Deborah MacLatchy, Vice-President: Academic & Provost and Dr. Pat Rogers, Associate Vice-President, Teaching & Learning

Part 1: Synthesis of Review Documents

Summary of Self-Study

This was the third periodic review of the Biology program at Wilfrid Laurier, the last one being in 2003. Since the last review the Department has grown substantially from 10 faculty members to 16. Over that same period the total enrolment in our programs has increased from 249 in 2002/03 prior to the double cohort to 551 in 2010/11. Of those, the greatest change has been in the number of students in Honours programs, which increased from 161 in 2002/03 to 545. This shift is a result of the phasing out by the University of General degrees with a declared major. In 2007 we added an MSc program, and in 2008/09 we undertook a major overhaul of our program requirements and course offerings. The Department is supported by eight persons in the equivalent of 6.62 full-time staff positions.

At the undergraduate level we offer five BSc programs: a single major and four double majors (with Chemistry, Mathematics, Physical Geography, and Psychology). We offer two BA programs: a single major and a B.A. in combination with another major. In addition to our major offerings we offer a Biology minor, and we participate with Geography in offering the Environmental Science Option.

In January 2008 we conducted a major overhaul of our undergraduate course offerings and program requirements, with the new curriculum fully implemented in 2009. Under the revised program students take a common core of 8 0.5-Cr Biology courses in their first and second year. At the third and fourth year level students have the option of following one of three streams, each of which includes a number of core and specialty courses as well as electives from the other streams. The streams were designed to match the core research areas of the faculty members in the Department and comprise the following: Stream A—Cell, Molecular and Microbial Biology, and Genetics; Stream B—Biodiversity, Evolution and Ecology; Stream C—Physiology and Toxicology.

Our faculty strive for teaching excellence and this is reflected in the positive feedback we receive from our students as well as from the many nominations and awards that our instructors have gathered over the years. Over the 16 academic terms from Fall 2003 to Winter 2011 the overall average score on teaching evaluations for faculty members in Biology was greater than or equal to the Faculty of Science average in nine terms. In five of the remaining seven terms the difference between the Faculty average and the Department average was less than 0.25. Since 2001, three part-time faculty members, two full-time faculty members, and one graduate teaching assistant have won awards for teaching excellence.

The physical, financial and human resources that support our programs have not kept up with the growth in student numbers and faculty members. We teach labs in four rooms that came into service in the mid-1990s each ranging in capacity from 24 to 36. In order to meet the demand for courses constrained by the availability of lab space, we have begun offering some

courses in both the Fall and Winter terms, and we are contemplating offering some of the most popular courses in the Spring term. Lecture sections are somewhat less constrained; however, even here we run up against occupancy limits once rooms have been assigned by the Registrar's Office, and overall capacity is limited by the number of rooms and time slots available for labs.

In addition to the space limitations imposed by classroom sizes, we face further space limitations for storage of specimens and equipment. The Laurier Herbarium, which comprises research and teaching specimens is housed in the Laurier Science Research Centre (LSRC). Until 2011, our animal archive was housed in a separate facility in the LSRC. However, to make space available for new research labs to accommodate recent hires to the Department, the collection was moved and is now temporarily stored in a number of locations in the Science Building and the LSRC. The departmental greenhouse is currently located at the St. Michael's property on the north side of University Ave.; however, it will need to be dismantled and moved once construction is underway on the new Global Innovation Exchange building.

As new faculty members have been hired new research labs have had to be constructed to meet their needs. Instrument rooms and storage spaces have been renovated over the years to accommodate the increasing demand for lab space, but in recent years the number of options for adding new labs has dwindled. New faculty also require office space, and here again we are at the limits of what is available with recent hires.

Budgetary restrictions have meant that, in 2010, we were forced to replace the lab component of our first year courses with tutorials. This decision was not made lightly; however, it allowed us to preserve the quality of the labs in our senior courses. The increased enrolments in lab courses has meant that the cost of consumables to support the labs has gone up. Furthermore, the increased wear and tear on equipment leads to a more frequent need for maintenance and replacement.

Through the growth in our faculty complement that we have experienced since 2009, the Department of Biology finally has the critical mass to provide a well balanced Biology program in all three teaching and research streams, emphasizing the integrative nature of Biology. Each stream has a minimum of 3 core faculty and 5 to 6 faculty with overlapping research interests.

A survey of alumni satisfaction, presented to Senate in 2009, revealed that Biology graduates reported the highest satisfaction of all University programs for the education and training they received while at Laurier. A survey of current students revealed similar positive indicators of satisfaction, however there is a general sense of dissatisfaction with program changes that have resulted from budgetary constraints, in particular the loss of labs from 100-level courses.

As we look forward we are planning a number of initiatives to enhance our programs. These include a mentoring program that would pair incoming students with faculty members, whom they could consult for assistance throughout their program of study; a series of bi-weekly

guest lectures in first year courses delivered by faculty members on the topic of their research integrated within the content of the courses; and a mid-term self assessment during the fall term of year one that would allow students to gain a realistic understanding of their performance and would tie back into the mentoring program. In addition to these initiatives at the undergraduate level, we have submitted a letter of intent to launch a joint PhD program with the Department of Chemistry in 2013. This program will have a number of benefits for Department as a whole: it will increase the research productivity of the faculty members; it will provide a source of peer mentors for students in our MSc program; and it will provide an additional source of graduate TAs for our undergraduate courses, an important element of high impact learning practices.

Summary of External Reviewers' Report and Recommendations

The internal reviewer of the program was Dr. Stephen Perry, Chair of the Department of Kinesiology & Physical Education. The external reviewer was Dr. James Kieffer, Professor in the Department of Biology at the University of New Brunswick.

The external reviewers' report was generally very favourable. The reviewers praised the Biology undergraduate program for providing a well-rounded education to its students and developing in them an in-depth understanding of organisms, and their form, function and interactions. They commented on the strength of the program's professors, their active research programs, their use of innovative teaching methods and their commitment to outreach activities. They felt that the opportunities for undergraduates to be involved in research projects are a particular strength of the program. They praised the dedication and skill of the support staff in Biology. The problems identified by the reviewers were almost all problems linked to the rapid growth in recent years. The final paragraph in their report's executive summary nicely sums up their most significant findings:

One of the major issues within the Biology program is the large course enrolments, which have increased substantially over the past few years. Several new faculty members have been added to the department, but support for the program is lacking in other areas. In particular, the numbers of laboratory instructors, coordinators and administrative staff need to increase substantially to effectively support the rapid growth in student numbers. Also, laboratory equipment should be upgraded to match the needs of students entering the biological sciences. More laboratory space is required to ensure that the biology student experience at Laurier continues to be positive. Emphasis should be placed on increasing the numbers of student labs, particularly at the first year level. Lastly, administration should fully support the addition of a Ph.D. program in biology- this would ensure that Biology and Laurier can be competitive at the National and International levels.

The reviewers had nine specific recommendations:

Recommendation #1: Laboratory exercises should be returned to first year courses. Due to budget cuts, replacing all tutorials with labs could be challenging. One possible avenue for consideration would be to have laboratories for biology majors; non-majors would continue to take the tutorial sessions. Finding adequate laboratory space for the numerous sections required will continue to be problematic. A potential solution could be to convert some existing space on the biology floor into undergraduate labs—this would require collaboration with the Dean's office to find additional space for technician offices and/or faculty research laboratories.

A more cost effective method to achieve a similar result could be to consider splitting the laboratory and lecture course for the 1st year courses. In this way, priority for the lab would be given to biology majors.

Recommendation #2: The labs are assisted by what appears to be highly skilled and dedicated technicians and coordinators, who appear to be overworked! Realizing funding restraints, perhaps a plan could be implemented to acquire an *additional* academic staff position to address some of these concerns.

Recommendation #3: *Undergraduate lab equipment:* One concern was the lack of functioning equipment and some equipment that is outdated. This concern was echoed by the laboratory staff. Again realizing funding restraints, funds are required to ensure functioning equipment exists and that the student experience can be enhanced by access to updated equipment. In particular, lab computers should be upgraded.

Recommendation #4: Student growth has continued over the past few years. However, this growth has put an enormous strain on human resources. For example, with added numbers is the added time to advise students and manage files. The biology office is supported by two (1 full/1 part time) administrative assistants. Their greatest concern is being overworked, and faculty and staff agreed that additional support is needed. This individual could have the responsibility to help manage the growing graduate program.

Recommendation #5: Stream coordinators/ lab technicians. Biology labs are the hub of most biology programs; Laurier biology has streamlined many of its courses (three streams exist). These courses/streams require technical support to organize, coordinate and deliver labs. With the addition of labs and the large student enrolments, additional resources are required. Priority should be given for additional support staff for labs- in particular, a dedicated technician for the first year courses. Funds should also be provided to support additional IA mentorships within the department. These undergraduate students play a significant role in mentoring other

undergraduate students in the laboratories.

Recommendation #6: Entry level requirements for admission into the biology undergraduate program should be raised to help offset the large enrolment issues. Thus, increasing the entry level grade point by 3-5% would reduce the number of students who would be eligible to enroll in biology programs. In addition, some effort should be made to tighten the restrictions for students to take upper level courses (i.e., set additional pre-requisite requirements).

Recommendation #7: Graduate student teaching experience: while most graduate students are eager to gain experience teaching/assisting undergraduate labs, some concern (from faculty and graduate students) centres around the role of the TA in the lab and the discrepancy between students' workloads among labs. Consideration has to be given to "what is the role of graduate students in the lab" and "what are the expectations of the graduate student". There appears to be some disconnect between graduate student expectations and faculty expectations. Thus, the Chair should discuss with the faculty members methods to make the graduate student teaching experience more satisfying and efficient. Thus, there needs to be a better balance between graduate student learning and faculty needs.

Recommendation #8:* Due to large enrolments in the undergraduate program, additional support staff are required. In particular, an additional staff position to support the work of the biology office; and an additional biology technician to support the biology lab offerings. As noted above, a designated person to support 1st year laboratories is recommended.

Recommendation # 9:* Storage space: storage space is at a premium. However, it was clear from our visit that adequate storage space (for equipment, supplies) is not available.

* In the reviewers report, recommendations 8 and 9 were numbered 1 and 2 in a separate grouping under the heading of "Staff members."

Summary of the Department's Response

In its response, the Biology Department agreed with most of the observations made by the external reviewers and welcomed their recommendations. The departmental response emphasized what they felt to be the most pressing issues and attempted to prioritize the reviewers' recommendations in the context of the finite financial resources likely to be available over the next few years.

The departmental response reiterated the problems associated with the large enrolment increases in Biology courses over the last few years, with an emphasis on the impact this is

having on undergraduate laboratories. They particularly lamented the loss of labs in first year biology courses, which was necessitated in 2010 due to budget constraints, and urged the reinstatement of first year labs for Biology majors, if not for all students taking Biology courses.

They stressed the difficulties posed by the fact that, on average, the performance of Biology majors in 100-level math courses is poor. The seriousness of this is captured in the shocking statistic that fully 65% of Biology students continuing into the second year of their studies will have to retake some or all of Year 1 math. Difficulties with math are a major contributor to the larger problem of low completion rates and long time to completion among Biology majors. To address these issues, the department is recommending its own version of the external reviewers' recommendation #6 that admission requirements for the program be raised. Fortunately, because of growing demand for entry into Biology, it appears that this can be done without a substantial drop in enrolment.

To address increased demand and also to facilitate the recovery of students who fall behind in one or two courses, the Department has started to offer selected courses in both Fall and Winter terms and to repeat courses during the Spring/Summer terms. This trend will likely continue.

The Department agreed with the reviewers that the initiative to establish a joint Biology and Chemistry PhD program is central to the continuing success of both our undergraduate and MSc programs. They comment that "an enhanced research culture is the key for high quality programs at all levels. We are eager to have the PhD program approved."

The departmental response concludes with point-by-point responses to the nine specific recommendations from the external reviewers. These will be incorporated into the implementation plan below.

Part 2: Executive Response

Identification of Program Strengths

Laurier's undergraduate program in Biology is very strong. It provides students with a well-rounded education in the biological sciences and prepares them well for employment or further studies in graduate school or professional programs. It makes use of a variety of teaching styles and provides practical experience through hands-on laboratory learning, field trips and opportunities to be engaged in research projects. The Biology Department has a strong cohort of research active faculty members who are committed to undergraduate education. This includes several talented new Assistant Professors who have been hired in the last few years. The Department is also fortunate to have dedicated support staff, in both the office and the

laboratories, who are critically important to the success of the program.

Opportunities for Program Improvement and Enhancement

The popularity of biology among university applicants presents an opportunity that is not shared by all programs. Popularity has led to a very rapid increase in the numbers of Biology majors in recent years as well as an increase in service teaching of students enrolled in related disciplines, principally Kinesiology, Health Sciences and Chemistry. The rapid growth has given rise to a number of the problems discussed in the departmental self-study and the external reviewers' report. These problems are being addressed through the hiring of additional faculty and staff, but more still needs to be done. Rather than allowing the program to continue to grow at its current pace, we have an opportunity to increase admission requirements while holding enrolments more or less constant. Higher entrance requirements, with particular attention paid to mathematics preparation, are likely to be the most effective means of addressing problems of high attrition rates and long times to completion.

Although the graduate program was not formally part of the review, it is widely agreed that the Biology Department has developed the research strength needed to support a PhD program and that the proposed new PhD in Biological and Chemical Sciences is an important new opportunity that should be supported.

There are a number of specific opportunities for improvement listed in the reviewers' report that will require increased resources. Since resources are finite, these will need to be prioritized. We will also need to examine the appropriateness of the overall resource allocation to Biology in comparison to Faculty of Science and university-wide norms. The Integrated Planning and Resource Management review that will take place in the coming year will help address this important question.

a. Prioritization of Recommendations Approved for Implementation

The reviewers' recommendations are discussed below in order of their priority with regard to the timing of implementation, not in order of importance. The most substantial recommendations require new resources and cannot all be implemented immediately.

Recommendation #6 – Raising entry level requirements: This has the highest priority and actually took place for September 2012 admissions. The minimum entering average was increased from 74 to 76%. For 2013 admissions, we will consider raising the minimum average still higher or requiring specific minimum grades in individual mathematics courses or the Special Science average.

Recommendation #7 – Clarify and make more uniform the workload expectations of graduate TAs: This will address a significant irritant among graduate students and should be done at the beginning of the Fall 2012 session.

Recommendation #3 – Upgrade undergraduate lab equipment: In 2011-12 a new mechanism was put in place for ongoing renewal of undergraduate laboratory equipment in the Faculty of Science. A Science Teaching Equipment Renewal Fund (STERF) was established and made available an initial amount of $374,000 and an ongoing annual amount of $90,000. Biology made use of these funds for some relatively small purchases during the past year and will continue to have access to this fund in the future.

Recommendation #9 – Storage space: The Dean's office will work with the Biology Department to identify appropriate storage space. Space is a major problem all across campus and storage space cannot be given the highest priority in terms of how convenient the location is.

Recommendations #2, 4, 5 & 8 – additional staff positions: The reviewers recommend the following new staff positions:

- an additional lab technician,
- an additional administrative assistant in the department office
- additional undergraduate Instructional Assistant (IA) positions,
- an additional laboratory coordinator (referred to as an "academic staff position" in recommendation #2),
- a new lab technician dedicated to reintroduced level 1 labs.

It is recognized that the recent growth in the Biology Department's enrolments has necessitated increases in both the faculty and staff complements. Two new faculty were hired in 2010 and four more in 2011. An additional lab technician was hired in 2011. Subsequent to the external reviewers' report, funding was approved to convert the half-time Administrative Assistant position to full time and to hire another new lab technician. Thus the first two of the five staffing recommendations above have already been addressed. The third (IA support) will be addressed in the coming academic year, as course requirements and teaching budgets permit. The fourth and fifth are tied to the recommended reinstatement of laboratories in first year Biology, which is discussed below.

Recommendation #1 – Reinstate laboratories in first year Biology courses: It was with a great deal of reluctance that the first year laboratories were discontinued in 2010 and replaced with tutorials. This was necessitated by budget cuts. The financial pressures on the Faculty of Science have eased only slightly since 2010 and estimates for 2013 and beyond are not encouraging. It may not be possible to implement this recommendation in the near future. Not only money, but lab space is in short supply. The increased enrolments in upper year Biology courses have increased the number of lab sections being offered in the currently available lab space. In addition, it is our hope that enrolments in upper years will increase further as raising the entry requirements improves program retention. But this will serve to exacerbate upper year lab space problems. Ideally, reinstated first year labs would be located in their own dedicated space. Such space is envisioned for a new Science Building, but that is a few years away.

Part 3: Implementation Plan

Recommendation to be Implemented	Responsibility for Implementation	Implementation Date	Additional Notes
Raise entry level requirements	Department Chair, Associate Dean: Student Services, Registrar	2013	First steps were taken in 2012
Clarify graduate TA expectations	Biology Department Graduate Advisor	September 2012	
Upgrade teaching lab equipment	Department Chair, Associate Dean: Priorities &Planning	Ongoing	STERF budget is primary funding source
Find more storage space	Department Chair, FoS Admin Manager	2012-13 academic year	
Hire additional lab technician	Dean	Summer 2012	Done
Hire additional administrative asst.	Dean	Summer 2012	0.5 FTE increase only
Increase IA support	Department Chair, Dean	2012-13 academic year	As required to mount courses
Reinstate first year labs	Department Chair, Dean	Uncertain	Feasibility must be carefully considered in the context of

			available space and funding