

LAKEHEAD UNIVERSITY

Department of Biology

Internal Brief on the Master of Science (Biology) Program
(for internal review)

March 26, 2009

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Executive Summary

This document summarizes the last 7 years of performance of the Lakehead University Biology MSc Program. It is intended for internal review by our colleagues, and demonstrates the strong leadership position the program has attained within the university. Biological science plays a central role in the understanding of global warming, medicine, the drive towards the “bio-economy”, and ultimately the evolution of life on Earth. In this respect our Biology programs (undergraduate and graduate) are truly “flagship” program for the evolution of our own institution. Some pathways toward sustained success of Biology and our university are outlined.

Introduction

The Department of Biology offers one graduate program, leading to the degree of Master of Science in Biology. Two additional interdisciplinary PhD programs (Forest Science and Biotechnology) to which a number of Biology faculty members contribute are not addressed in this brief. They are reviewed within different cycles of OCGS.

The Biology MSc program is one of the oldest graduate programs at Lakehead University. It provides students with training at an advanced level through thesis research, as well as participation in graduate level courses designed to further develop critical thinking, discipline-relevant knowledge and communication skills. The program traditionally prepares students for academic pursuits at the PhD and post-doctoral levels, as well as for highly specialized work in the government, industry and independent business. Our program aims to satisfy the intellectual curiosity of our students by allowing them to work alongside research faculty. The program also strengthens the students’ ability to communicate their knowledge (as teaching assistants) to undergraduates.

The program consists of: (a) research work culminating in a defended thesis (weighted at 3 FCE – full course equivalents) and thesis defense, and (b) four one-semester graduate courses (2 FCEs). One compulsory course Graduate Seminar (Biology 5010 - **now 5030 FA**)_deals specifically with science communication, research proposal preparation and current topics in Biology. A new optional course is being developed (**Biology 5031 WA**). Of the remaining three courses one can be at the fourth year undergraduate level. Individual student’s progress through the MSc program is monitored by a Graduate Student Supervisory committee chaired by the student’s supervisor, and consisting of at least two additional members one of whom is often from outside the department of Biology.

The Biology graduate program supervisory capacity has grown over the last seven years due to a new complement of contributing full-time faculty, as well as adjunct faculty who are included in the “core” MSc supervisory complement recognized by the Faculty of Graduate Studies. Of the 18 core faculty in 2002, four have retired or left the university. Currently, 24 core faculty members approved by the Faculty of Graduate Studies (created in 2005) can supervise MSc students. Accordingly, compared to the 30 MSc graduates in the previous review period (1995-2002), the department of Biology graduated 64 MSc students in the current reporting period (List 1, below).

Further details of the Biology MSc program are elaborated on in the following pages, pursuant to Items 1.B2.e and 1.B1.b (20) of the Lakehead University Academic Plan.

Critical Mass of Core Faculty

The expansion of core faculty supervising Biology MSc students is in part due to the success of Lakehead University in attracting funding for Endowed Chairs (three positions), and the establishment of Northern Ontario School of Medicine (NOSM) - Thunder Bay campus (four positions). Strategic partnership development with local institutions - Centre for Northern Ecosystem Research (CNFER) and Thunder Bay Health Sciences Centre Cancer Research Laboratory (CRL) provides additional three and two positions, respectively. Expansion of Lakehead University to Orillia campus and the establishment of the Biorefining Research Initiative may supply two additional core faculty in the future (applications to Graduate Studies Faculty by Drs. N. Kanavillil and R. Dekker are pending).

CARNEY Joseph, Assistant Professor, Invertebrate Zoology and Parasitology
HECNAR Stephen, Professor, Lower Vertebrate Zoology
HUGHES Janice, Associate Professor, Ornithology
LAW David, Associate Professor, Plant Molecular Biology
LEE Peter, Associate Professor, Limnology and Aquatic Plant Ecology
LEUNG Kam, Associate Professor, Microbiology
MALEK Ladislav, Professor, Plant Biochemistry
MALLIK Azim, Professor, Plant Ecology
MORRIS Douglas, Professor, Theoretical Ecology
PYLE Greg, Professor and Canada Research Chair (Tier 2), Aquatic Ecotoxicology
QIN Wensheng, Assistant Professor, Ontario Research Chair, Plant Molecular Biology
SCHRAFT Heidi, Associate Professor, former Canada Research Chair, Microbiology
WANG Rui, V.P. Research and Professor, Biopharmacology

Adjuncts

KHAPER Neelam, NOSM Adjunct, Human Toxicology
MACKERETH Robert, CNFER Adjunct, Aquatic Ecology
MATHESON Carney, Anthropology Adjunct, Human Genomics
REMPEL Robert, CNFER Adjunct, Ecology
RODGERS Art, CNFER Adjunct, Mammalogy
ROSS Brian, NOSM Adjunct, Human Toxicology
SUNTRES Zacharias, NOSM Adjunct, Human Toxicology
THING John, CRL Adjunct, Human Functional Genomics
ULANOVA Marina, NOSM Adjunct, Human Toxicology
VARNEY Tamara, Anthropology Adjunct, Analytical Anthropology
ZEHBEG Ingeborg, CRL Adjunct, Immunology

Teaching Effectiveness of Core Faculty

The objectives of the Biology graduate program are to prepare students intellectually for further academic pursuits or alternatively for fruitful professional careers based on their biology training. As shown below, most of our graduates, since the last periodic appraisal in 2002, have pursued higher academic training or found suitable careers based on their advanced training in Biology.

List 1. Current Activities of Lakehead University Biology MSc Students

Graduated 2008

BARNES, Rebecca. Medical student, McMaster University

BISWAS, Shekhar. Ph.D. student, University of Toronto

DAVEY, Lauren. Administrative Assistant and Research Coordinator, Biotechnology Research Program, Lakehead University

DeCARLO, Correne. Currently a research assistant in the psychology department at the University of Victoria; as of September 2009 will be starting a PhD in the clinical psychology program at University of Victoria

GODIN, Peter. Student, Lakehead University, Education Professional Year

GOOLD, Andrea. Environmental, Chemical, and Safety Technician, Ontario Power Generation, Atikokan Generating Station

HAWDON, Nicole. Research Assistant, Northern Ontario School of Medicine Research Lab, Lakehead University campus

KEPKA, Grzegorz. Research Technician, LUCAS and Biorefining Initiative, Lakehead University

MAKI, Miranda. PhD student, Biotechnology program, Lakehead University

OUELLET, Jacob. PhD candidate in Toxicology at the University of Saskatchewan

SIEGWART, Laura. In Newfoundland searching for a job/PhD position

SUTHERLAND, Lindsay. PhD candidate in Food and Nutrition Sciences, Univ. of Western Ontario

Graduated 2007

BERGLUND, Eric. Contract Biologist with Ministry of Natural Resources at the Science and Information Unit, Thunder Bay

BROOKES, David. Bioscience Officer, Armed Forces Canada

CARR, Natasha. Park Biologist, Wabakimi Provincial Park, Ontario Parks, Northwest Zone, Thunder Bay

CHOY, Nicholas. Technical Sales Representative, Aurora Biomed Inc., Vancouver

CUMMING, Andrew. Research Associate working for Cangene in Winnipeg

HAYTER, Shana. Initially worked for the Canadian Centre for DNA Barcoding; currently is employed in a crime lab in Florida

HENEY, Melanie. PhD candidate at Baylor College of Medicine, Texas

MARION, Travis. University of Ottawa School of Medicine

ROSA, Bruce. Lab Technician, Department of Biology, Lakehead University, entering Lakehead University PhD program in Biotechnology in 2009

ZELLER, Alex. Transportation Planner/Landscape Ecologist, Dillon Consulting, Ottawa

Graduated 2006

DEWAR, Nancy. Contract Biologist, Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources, Lakehead University campus

FARRELL, Lindsay. Pursuing PhD in Zoology at Simon Fraser University

IACHETTA, Lucia. PhD candidate, University of Western Ontario

INGRAM, Mary Kate. Environmental Department, Chalk River Laboratories, Chalk River Ontario

LAMERS, Ryan. PhD candidate, University of Central Florida; recipient of Canada Commonwealth Award

METCALFE, Brent. Fisheries Assessment Biologist with Ministry of Natural Resources at the Lake Simcoe Fisheries Assessment Unit

OATWAY, Michael. High school teacher, Peterborough

PARKER, Scott. Contract Biologist with the Lake Superior Management Unit, Thunder Bay

TALLON, Pamela. Research Lab Coordinator, Northern Ontario School of Medicine, Lakehead University campus

VERMEULEN, Natasha. Research Assistant, Northern Ontario School of Medicine, Lakehead University campus

Graduated 2005

LAMBERT, Kaylin. Environmental Department, Chalk River Laboratories, Chalk River ON

MATTHEWS, Donald. PhD candidate at GenNYSIS Center for Excellence in Cancer Genomics, State University of New York University at Albany

MURRAY, Carolyn. University of Ottawa Medical School

SANZO, Domenico. DVM candidate, University of Guelph

VANCOOK, Mark. Environment Program Rainy River First Nations; currently Lab Technician Canada Malting, Thunder Bay

VANDER WAL, Eric. Ph.D. candidate, Department of Biology, University of Saskatchewan

WALKER, Gregg. Vegetation Management Specialist, Mount Revelstoke and Glacier National Parks, Parks Canada Agency, Revelstoke, British Columbia, Canada Parks Canada

ZHOU, Yuchang (Grace) unknown

Graduated 2004

ABBOTT, Virginia. Research Assistant, Simon Fraser University

BEAULNE, Christine. Microbiology Lab Technician for Buckmans

HAAPA-AHO, Kristian. Research Technician, University of Washington

HILL, Steven. PhD student, University of Toronto

KARIM, Md. Nayeemul (Shuvo). PhD student, University of Northern British Columbia.

LAHTI, Arlene. Laboratory Manager, Molecular World, Inc., Thunder Bay

MOENTING, Alissa (EDWARDS). Ontario Ministry of Natural Resources, Sudbury, Provincial Parks

MOORE, Michael. Laboratory Technologist, Department of Biology, Lakehead University

STEWART, Katherine. PhD student, University of Northern British Columbia.

WADDINGTON, Lisa. PhD student, Food Science and Technology, Dalhousie University

Graduated 2003

BROWNE, Constance. Ph.D. candidate, Department of Biology, University of Alberta

CHIKOSKI, Jennifer. Biodiversity/Species at Risk Biologist, Ministry of Natural Resources, Thunder Bay District

CROUSE, John. Wildlife Biologist, Alaska Department of Fish & Game, Soldotna, Alaska

DEBRUYNE, Christine. November 2008 – PhD in Zoology from University of Canterbury, Christchurch, New Zealand

HILDEBRANDT, Curtis. Molecular World, Inc., Thunder Bay

JEFFERY, Rebecca. Regional Biologist, Government of Newfoundland and Labrador, Goose Bay, Labrador

MCINTOSH, Terese. PhD candidate, Department of Biology, Trent University

MUCHA, Jamie. Area Biologist with Timmins District Ministry of Natural Resources

ROBINSON, Jeffrey. Fish & Wildlife Technician, Ontario Ministry of Natural Resources, Centre for Northern Forest Ecosystem Research, Thunder Bay

WATTERWORTH, Leigh. Pastry chef, Guelph, Ontario

Graduated 2002

BLOOM, Robin. Research Scientist, Environment Canada, Edmonton.

CHALEN (BETTS), Laura. High school teacher

JUNNILA, Amy. PhD McGill University; Post Doctoral Fellow, Kuvim Centre, Hebrew University, Israel

LAMB, Eric. Finished a PhD at University of Alberta, an NSERC PDF and now Assistant Professor, Department of Soil Science, University of Saskatchewan

The above list demonstrates the diversity of intellectual and livelihood opportunities our graduates have enjoyed. These range from the pursuit of PhD degrees followed by academic appointments, to biology-based employment in industry or government. Few students have become teachers and only one has a job unrelated to their Biology training. Overall, the effort invested by our Department and supporting funding organizations/government into these individuals translates into a valuable long-term contribution to Canadian society. Most of these students have had a positive experience at Lakehead as evidenced by their ongoing contact with their former supervisors and colleagues.

Student Recruitment, Retention and Program Completion

Measures implemented since the previous Periodic Appraisal have greatly improved our program delivery as measured by reduced times to completion (Table 1). The following information summarizes individual student performance. We are gradually working toward program delivery improvements, which will bring average completion times as close to six semesters as possible.

Table 1. Registrations and Completions, by Entering Cohort

Entering Cohort (academic year)	Students registered	Students completing	Average Terms to completion	Standard deviation
2009				
2008	7			
2007	17			
In progress 2006	16	9 to date	6.33?	0.71?
2005	6	5	7.4	0.89
2004	13	11	8.36	2.29
2003	9	8	8.14	1.95
2002	14	10	8.10	2.33
2001	10	9	8.33	2.35

Student Intake

Fluctuating annual numbers of registrants are a function of several factors: (a) changing availability of the number of graduate teaching assistantships (GTAs), which to some extent is influenced by (b) periodic and unpredictable financial incentives from the provincial government. The last factor, (c) is the unpredictable nature of the funding of individual supervisors, who must make financial commitments to student projects with caution.

The annual pool of applicants into the program generally exceeds (by a factor of about 2) the financial ability of our core members to accept new students. Stipend supplements which make our GTA somewhat competitive with other institutions can use up a significant portion of a grant, lowering the amounts available for performance of the research project. Increased availability of internal scholarships, fellowships and bursaries would assist us in attracting additional highly qualified applicants.

Student Progress and Completion Times

New policies instituted by the university and adopted by our program have placed incentives on both, the supervisor and the student, to complete research projects and thesis preparation in a timely manner.

- (1) The part-time registration option was removed, as part-time students generally showed lower commitment to research, resulting in correspondingly longer completion times.
- (2) Adherence to departmental regulations and safeguards have traditionally ensured good progress through MSc projects. Exceptions do exist, though. The department is participating in the development of institutional policies which will ensure that supervisors and students adhere to established and new protocols and regulations.
- (3) The requirement to pay registration fees beyond the expected six semester time period also accelerated thesis work progress over the last three years. Enough flexibility and allowances exists to permit students whose theses were submitted for review and final examination in a timely manner to complete the process slightly into the seventh semester, without the need for re-registration and fee payment.
- (4) Students needing the seventh term to complete are usually able to make arrangements with their supervisor for additional salary support or find outside financial support.
- (5) Institution-wide policies for time extensions or leaves of absence beyond the seventh term have been implemented. Applications for these extensions are reviewed and only approved after thorough review of rationale for the request.

Table 2. MSc Program Withdrawals

Entering Cohort (academic year)	Students registered	Students NOT completing	Terms in program
2009			
2008	7		
2007	17		
In progress 2006	16	1 to date	7
2005	6	1	5
2004	13	2	3, 4
2003	9	1	8
2002	14	4	3, 3, 3, 10
2001	10	1	11

Based on Tables 1 and 2, only 11% of our entering students do not complete the program. Likely, two main reasons for withdrawal exist.

Firstly, students withdrawing after 3-5 semesters invariably are those accepted into medical or other professional studies. To minimize this eventuality, our core members scrutinize student intentions more carefully and insist on verbal commitment from the student to complete the MSc research project. This approach is supported by our local medical school, which will only consider applications from currently registered MSc students "armed" with a written consent from the MSc supervisor.

Secondly, students withdraw because they have lost interest in the project or are unwilling to switch to an alternative line of inquiry based on supervisory committee input. Most of these students put themselves in a position to accept salaried work elsewhere.

Core Faculty Research Intensity

All of the core faculty members listed above are active in research and delivery of the graduate program as per the faculty of Graduate Studies membership criteria. Evidence for this productivity is provided in the appended CVs. In summary, core faculty members published a total of **377** refereed articles, representing **11-fold** increase over the previous Appraisal period and received about **\$27 million** in funding over the last 7 years, representing a **7-fold** increase over the previous Appraisal period.

Table 3. Operating Research Funds by Source and Year

Year	Source			
	Granting Councils	Other Peer Adjudicated	Contracts	Others
2002	767,338	786,350	95,140	58,750
2003	517,458	902,050	164,140	135,750
2004	534,458	1,097,350	294,140	152,750
2005	1,180,553	2,646,130	362,000	148,714
2006	577,458	2,514,084	245,000	241,445
2007	1,060,901	1,658,368	14,000	93,500
2008	1,610,673	2,254,168	937,000	94,325
Totals	6,248,839	11,858,500	2,111,420	925,234

Sustainability

Currently all, except one, faculty members in the department are involved in the delivery of the MSc program. However, it needs to be pointed out that we are perhaps the smallest Biology department in the country. Despite this, most of the traditional areas of biology are represented: zoology, botany and microbiology. Deficiencies exist in important fields such as genetics, cell biology, behaviour, physiology and newly emerging disciplines such as bioinformatics. All core faculty members are externally funded and actively seeking/recruiting students to join their research group. As demonstrated in List 1, there is a steady demand for our graduates to pursue further PhD studies elsewhere and now also in Lakehead's PhD programs in Forestry and Biotechnology (the first transfers from our MSc to PhD program have taken place). There is also a growing demand for technical expertise in industrial and government

laboratories. These entities tend to prefer to hire students with training beyond the basic BSc level. There are no immediate (next seven years) retirements threatening our current staffing levels, although the premature passing of Dr. Peggy Tripp has left a significant gap in the teaching of genetics.

Interdisciplinarity

The MSc program in the Department of Biology is not interdisciplinary by design. We pride ourselves on working in the unique environment of the Boreal forest, and hence have opted for choosing only one unique descriptor for our “Field”, namely “Boreal Biology”. Within this common denominator, we attempt to offer as diverse a set of biology graduate courses and research projects as possible under our circumstances and staffing levels. We achieve this in part by involving well-qualified supervisors (PhD level) from other organizations in Thunder Bay. Historically, the Center for Northern Forest Ecosystem Research has contributed significantly. More recently, four individuals from Northern Ontario School of Medicine (Thunder Bay campus) and two researchers at Regional Cancer Care unit of the Thunder Bay Regional Health Sciences Centre serve as adjuncts within the Department of Biology and are core graduate faculty members. The Department of Anthropology has historically contributed expertise in DNA analysis, which was further enhanced by a second adjunct with expertise in heavy isotope analysis of biological materials. Faculty members from many other departments (Chemistry, Geography, Forestry) contribute by serving on graduate advisory committees and such collaborations often result in joint publications.

Future direction

As the MSc in Biology has clearly been able to attract many graduate students, perhaps future faculty hiring could be geared toward filling existing institutional gaps by biology-focused joint appointments within cognate departments such as Anthropology, Chemistry, Physics, Geology and Geography. This would maintain the historically egalitarian approach to distributing faculty appointments equitably among departments. Yet, this approach would ensure a steady influx of students interested in key issues facing our society. Many such issues can be resolved by the improved understanding of biology, including human biology. Nevertheless, it would be desirable to maintain the majority of core advisory faculty within one administrative unit, namely the Department of Biology.

Part II – CVs of individual core faculty members in a separate document