

*PROPOSAL*

*Master of Biotechnology (M. Biotech)*

*University of Toronto at Mississauga (UTM)*

*Department of Botany*

*Department of Chemistry*

*Department Zoology*

April 15, 1999

*School of Graduate Studies  
Proposal for a New Course - Division III*

Department: Botany/Chemistry/Zoology

Date: March 1999

If you are proposing a *new* graduate program course, please use this form. It will be photocopied and sent to the Executive Committee for approval exactly as submitted.

***COURSE NUMBER WITH IDENTIFIER, LENGTH (eg. ABC 1223Y, A, B, L, F, S or H),  
TITLE, AND DESCRIPTION OF COURSE:***

*BTC 1600H - Seminar in Biosciences/Biotechnology (and BTC 1601H for second year of student's program)*

*This course will meet once per week during the fall and winter terms for 1 to 2 hours, and will involve student presentations, presentations from University scientists and presentations by speakers from industry and other academic institutions. All students registered in the Program will be expected to attend all seminars in each of their 2 years and to participate in discussions of the topics that are presented during their residency in the Program. Each student will provide at least 1 formal presentation. The course is to be coordinated by a rotation through the faculty members associated with the Program. It is expected that all Program scientists will participate on a regular basis. The topics presented in this course will range from scientific (latest technologies and research) to business oriented issues (e.g. market strategies for biotechnology products, government regulations, intellectual property, ethics, etc.)*

*Marking Scheme: CR/NCR (requiring weekly sign-in, participation in discussions, one presentation)*

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURERS IF OTHER THAN  
THE INSTRUCTOR/COORDINATOR:***

*Coordination: 4 members of the teaching staff of the Program (annual rotation)*

***PREREQUISITES, IF ANY:*** *Enrolment in the Master of Biotechnology Program, completion of BTC 1701H, BTC 1702H and BTC 2000H*

***ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:***

*SEMINAR IN BIOTECH*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Seminar program funding is available as budget line item, and responsibilities are shared to reduce the load on any one faculty member.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*All participants in the Program are linked by the seminar course during academic and industrial terms.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*Possibly, by special arrangement. The prerequisites are intended to set limitation, but no serious resource issues are anticipated by having this course open.*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*Consultation with representatives of the Faculty of Medicine, and the Faculty of Applied Science and Engineering, has not identified the existence of a similar program.*

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**COURSE NUMBER WITH IDENTIFIER, LENGTH (eg. ABC 1223Y, A, B, L, F, S or H), TITLE, AND DESCRIPTION OF COURSE:**

*BTC 1701H - Genetics and Molecular Biology Laboratory*

*This laboratory is intended to provide students with hands-on experience in work with nucleic acids. The experience will focus on the use of advanced equipment and techniques, and will include experiments that are imported from recent research work that has been done in the laboratories at UTM. Industrially and commercially relevant issues of requirements for record keeping, accreditation issues, and ISO 9000 certification will be explored. This will be an intensive 6-week course, operating every day of the week for 8 hours a day. The experiments can be completed in 5 weeks, and the timelines provide for opportunity to repeat work and for instruction, discussion and team work. Students will complete some experiments individually, and some experiments will require students to work in teams. Two teaching assistants and a technician will be on hand at all times while the laboratory is in operation.*

**Topics:**

*Nucleic Acid manipulation - Isolation of plasmid, phage and eukaryotic DNAs; Isolation of RNA; chromatographic methods : 3 Days*

*DNA Cloning and Nucleic Acid Hybridization - Digestion of DNAs with restriction endonucleases; Handling of cloning vectors; DNA ligation and construction of recombinant DNA molecules in plasmids and phages; Transformation, cloning, selection and recovering cloned DNA; Thermodynamics and kinetics of DNA-DNA hybridization, RNA-DNA hybridization, PNA-DNA hybridization; Diagnostic hybridization kits, gene chips and bioinformatics for yeast : 10 Days.*

*The Polymerase Chain Reaction - Amplification of a known gene sequence from a cloned gene in a plasmid and/or from a cDNA library: selection and synthesis of primers; Subcloning of PCR product into a protein expression vector (e.g. pET); Transformation and restriction analysis to confirm cloning : 4 Days*

*Molecular Mutagenesis - Deletion of C- and or N-terminal sequences using restriction digests and recloning and/or PCR using internal primers; Site-directed mutagenesis using*

*single stranded DNA and /or PCR; gene knockouts and replacements for yeast : 5 Days*

*DNA Sequencing and Sequence Analysis - Confirmation of mutants ; Entering of sequence information into a software program that generates restriction maps, reading frames, amino acid sequence; Introduction of how to access GenBank, SwissProt : 3 Days*

**MARKING SCHEME:**

<i>Laboratory Notebook Evaluation:</i>	<i>15%</i>
<i>Formal Laboratory Reports:</i>	<i>25%</i>
<i>Performance Evaluations:</i>	<i>30%</i>
<i>Oral exams:</i>	<i>30%</i>

**INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:**

*Anderson, Horgen, Krull, Westwood, TBA (Geneticist), TBA (Biotechnology)*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program.*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*GEN AND MOL BIOL LAB*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Supplies and TA funding are available in new base budget. New equipment resources are available from joint industry-University funding. Technicians are available in reassignment.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*This course provides hands-on experience in practical applications of a major area of biotechnology and is an important breadth component.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

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***COURSE NUMBER WITH IDENTIFIER, LENGTH (eg. ABC 1223Y, A, B, L, F, S or H), TITLE, AND DESCRIPTION OF COURSE:***

*BTC 1702H - Protein Chemistry Laboratory*

*This laboratory is intended to provide students with hands-on experience in work with proteins and peptides. The experience will focus on the use of advanced equipment and techniques, and will include experiments that are of research interest. Industrially and commercially relevant issues of requirements for record keeping, accreditation issues, and ISO 9000 certification will be explored. This will be an intensive 6-week course, operating every day of the week for 8 hours a day. The experiments can be completed in 5 weeks, and the timelines provide for opportunity to repeat work and for instruction, discussion and team work. Students will complete some experiments individually, and some experiments will require students to work in teams. Two teaching assistants and a technician will be on hand at all times while the laboratory is in operation.*

**Topics:**

*Overexpression of a cloned protein; latest chromatographic techniques in protein purification (affinity chromatography, including column preparation); isolation/structure determination using small model peptides (2-dimensional nmr examples, ESI-MS) : 10 Days*

*Protein modification - (crosslinking; construction of an amperometric glucose biosensor by molecular wiring), surface immobilization, immunoassay construction : 3 Days*

*Hands on peptide synthesis, sequence analysis, structural modelling using Silicon Graphics Inc. work stations and molecular graphics software : 7 Days*

*Screening inhibitors of enzymes of clinical significance (e.g. phosphotyrosine phosphatase), advanced spectroscopic techniques and radioisotopes for kinetics : 5 Days*

**MARKING SCHEME:**

<i>Laboratory Notebook Evaluation:</i>	15%
<i>Formal Laboratory Reports:</i>	25%
<i>Performance Evaluations:</i>	30%
<i>Oral exams:</i>	30%

**INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:**

*Krull, Lange, Macdonald, O'Day, Reed, Taylor, TBA (Biotechnology 2)*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program.*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*PROTEIN CHEM LAB*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Supplies and TA funding are available in new base budget. New equipment resources are available from joint industry-university funding. Technicians are available by reassignment.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*This course provides hands-on experience in practical applications of a major area of biotechnology and is an important breadth component.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*No – this is an advanced laboratory of specialized focus for M. Biotech. students.*

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*BTC 1801H - Biological Controls and Production of Natural Products (26L, 26T)*

*This course will focus on the exploration and understanding of biological controls of plants, animals, and insects, and the laboratory and industrial production of control agents in both small and large scale. Various lecturers from academia and a few guests from industry will participate. Students will work in teams, and each team will present topics twice as oral presentations during tutorial hours. Lecture topics will include:*

*Biological Controls (13 hours);*

*Chemistry and function of some natural controls such as pheromones and hormones  
Chemistry and function of some synthetic controls such as neural toxins and pesticides  
Chemistry of anticancer plant products*

*Production of Natural Products (13 hours):*

*Modern approaches to the production of plant-derived anticancer, antimetabolic agents  
Small versus large scale production strategies from cultured cells (e.g. Taxol)  
Engineered expression; selective resistance, selective toxicity*

***MARKING SCHEME:***

<i>Participation/discussion:</i>	<i>10%</i>
<i>Term Research Proposal:</i>	<i>30%</i>
<i>Oral Presentations:</i>	<i>2 X 15%</i>
<i>Exam:</i>	<i>30%</i>

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:***

*Cummins (Coordinator), faculty from the Division of Science:*

*Cummins - plant physiology  
Dicosmo - large scales production  
Fleming - neurotransduction, signalling  
Horgen - fungi, Dutch Elm, engineered expression  
Lange - insects and insecticides  
Macdonald - chemistry production  
O'Day - signal transduction*



*TBA (Geneticist) - engineered expression  
Westwood - heat shock, protein expression*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program, completion of BTC 1701H, BTC 1702H and BTC 2000H*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*BIO CONT & NAT PROD*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Contributions to lectures have been offered by faculty on all 3 campuses; there is expertise among the faculty listed in the Program proposed.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*Breadth lecture course which will cover fundamentals as well as the most recent developments and concepts in the field.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No -- prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*This is a specialized course that covers issues related to plants, animals, medical applications and industrial practices. While there is overlap of some of the content in this proposed course with a number of other courses, we are unaware of any similar course as described here in its entirety.*

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*BTC 1802H - Biotechnology in Agriculture (26L,26T)*

*This course will focus on the exploration and understanding of biotechnology as applied to agricultural interest. Various lecturers from academia and a few guests from industry will participate. Students will work in teams, and each team will present a topic once as an oral presentation during tutorial hours. A series of field excursions to agri-biotechnology enterprises in the local geographic vicinity will take place as part of the tutorial activities.*

*Lecture topics will include:*

*Traditional approaches to plant breeding, cultivar, and livestock improvement : 5 hours*

*Molecular approaches to breeding, cultivar and livestock improvement : 16 hours*

*Transgenic plants and livestock*

*Genomics and its importance in agri-biotechnology*

*Molecular approaches to plant pathology*

*Nutraceuticals – plant biotechnology and pharmaceutically important products*

*Plant and animal cell cultures and biotechnology*

*Cloning of animals and implications to agriculture*

*The Public and genetically engineered agricultural products : 3 hours*

*Projections for the future : 2 hours*

**MARKING SCHEME:**

*Participation/discussion: 10%*

*Term Research Proposal: 30%*

*Oral Presentation: 20%*

*Exam: 40%*

**INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:**

*Horgen (Coordinator), faculty from the Division of Science:*

*Anderson - fungi cloning*

*Dicosmo - fermentation processes, cultures*

*Espie - single celled plants*

*Horgen - fungi, transgenics*

*TBA (Biotechnology) - nutraceuticals*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program, completion of BTC 1701H, BTC 1702H and BTC 2000H*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*BIOTECH IN AGRI*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Contributions to lectures have been offered by faculty on all three campuses; there is expertise among the faculty listed in the Program proposal. Some funding for field trips will be provided.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*Breadth lecture course which will cover fundamentals as well as most recent developments and concepts in the field.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*This is a specialized course for the M. Biotech. program which covers a blend of fundamental science and industrial practices. We are unaware of significant overlap with other courses.*

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*BTC 1803H - Biotechnology in Medicine (26L,26T)*

*This course will focus on exploration and understanding of biotechnology as applied to areas of medical interest. Various lecturers from academia and a few guests from industry will participate. Students will work in teams, and each team will present topics twice as oral presentations during tutorial hours. Lecture topics will include consideration of what is required to move from the lab bench to the marketplace, and will more specifically focus on:*

*The Molecular Basis of Disease (8 hours):*

*Cancer; origins, propagation, molecular processes*

*AIDS; the immune system and system regulation, viral interactions and consequences,  
molecular processes*

*Biotechnology and the Detection of Disease (6 hours):*

*PCR amplification and genetic markers*

*DNA chip technologies and biosensors*

*Immunoassay methods, ELISA kits, single molecule detection*

*Biotechnology and Therapies (12 hours):*

*Gene therapies and delivery methods*

*Implants of devices and tissues*

*Tissue engineering*

***MARKING SCHEME:***

*Participation/discussion: 10%*

*Term Research Proposal: 30%*

*Oral Presentations: 2 X 15%*

*Exam: 30%*

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN  
THE INSTRUCTOR/COORDINATOR:***

*Westwood (Coordinator), and faculty from the Division of Science:*

*Anderson - pathogenic fungi; drug resistance*  
*Bonner - the Human Genome Project*  
*Code - magnetic resonance imaging*  
*Fleming - neuro chemicals, pathways, networks*  
*Krull - biosensors, DNA Chips, ELISA*  
*Macdonald - liposome drug delivery*  
*O'Day - signalling*  
*Reed - medical basis of disease*  
*Schneider - sensory implants*  
*Westwood - AIDS, cancer*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program, completion of BTC 1701H, BTC 1702H, and BTC 2000H*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*BIOTECH IN MED*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Contributions of guest lectures have been offered by a number of pharma industries; there is expertise among the faculty listed in the Program proposal.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*Breadth lecture course will cover fundamentals as well as most recent developments and concepts in the field.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*There is some overlap of topics in this course with a number of courses within the Faculty of Medicine, and the Faculty of Applied Science and Engineering. We are unaware of any course that combines the 3 major topics that have been identified herein, although other courses may separately cover some or all of these individual topics. The intention of this course is to provide integration of concepts, and to provide a focus on biotechnology and its practical applications for students in the M. Biotech. program.*

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*BTC 1900Y - Placement Project in Biosciences/Biotechnology (and BTC 1901Y, 1902Y for subsequent placement credits).*

*These projects may be of an interdisciplinary nature and should use a number of different approaches to address topics. Students must complete the placement project which provides up to 3 credits. Each credit is based on 3 to 4 months of full-time participation in our internship. It is presumed that students may spend some time in each of the labs and businesses of the scientists which make up their placement committee to learn all of the techniques needed to complete the project. Each student will have to find an appropriate placement (supervisory) committee and project. Students will get some feeling of their specific research area from the course work, and from a research day when faculty members and industrial partners present an overview of the activities going on in their laboratories and the techniques that they are using. These projects will not be as involved as a regular M.Sc. thesis, but depending on the project, could result in a publishable work or industrial report. At the end of the project, the student must present a seminar and write up the work in the form of an acceptable journal article or detailed industrial report.*

**MARKING SCHEME:**

<i>Performance evaluations (by Placement Committee):</i>	50%
<i>Oral Presentation:</i>	20%
<i>Report:</i>	30%

**INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:**

*Interdisciplinary placement (supervisory) committees of 2-4 faculty and/or industrial scientists will design work placement projects for full-time students and professional experience equivalents for part-time students. All faculty and businesses participating in the Program will be available for placement projects.*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program, completion of BTC 1701H, 1702H, 1801H, 1802H, 1803H and 2000H.*

*ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:*

*BIOTECH PLACEMENT*

*INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:*

*Placement opportunities with faculty and industry have been secured, and sets by conservative estimates the number of students accepted to the Program.*

*BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:*

*This course represents an Ainternship@ element of learning, which is considered as fundamental to application of the academic course work.*

*IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:*

*No – prerequisite limitations*

*DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:*

*We are not aware of any similar course in the area of biotechnology.*

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*BTC 2000H - Organizational Skills (0.25 credit; 13L,13T)*

*This short course (3 weeks) is intended to be the introduction to how a workplace is structured. It will allow students to explore various structures to learn about issues of cooperativity, teamwork, leadership and goal-orientation. The major points that will be addressed include:*

*Basic people management skills: working in teams and multidisciplinary groups; working across organizational boundaries (intra- and inter-organizational) : 10 hours*

*Common approaches to organization of management, staff, research labs, and sales as used by industries associated with biotechnology will be explored : 10 hours*

*This course will be used to define and organize groups of students who will work as a team to complete the subsequent laboratory modules. This course will serve as a platform for identification of leadership skills by the students, and will provide the first opportunity for a team-approach to problem solving which results in a grade (teams will present during tutorial hours). Oral presentation skills will be refined with the assistance of professional instruction and use of video for personal critiques: 3 Days*

***MARKING SCHEME:***

<i>Participation/discussion:</i>	<i>20%</i>
<i>Written Team Report:</i>	<i>40%</i>
<i>Team Presentation:</i>	<i>40%</i>

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:***

*Gunz / Wensley (Coordinators)*

*Industry participants: Cathy Bright (Astra) - personnel*

*Kevin Fehr (Glaxo Wellcome) - technologies, external affairs*

*Olive James (Connaught) - production*

*Bill Laidlaw (Glaxo Wellcome) - government affairs*

*Ravi Ramachandran (Novartis) - research manager*

*Barry Saville (Perkin-Elmer) - instrumentation/lab design*

*Jim Stewart (Guelph U.) - agrobiotech. business*



*PREREQUISITES, IF ANY: Enrolment in the Master of Biotechnology Program.*

*ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:*

*ORGANIZATION SKILLS*

*INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:*

*Arrangements with the Faculty of Management and Division of Social Science at UTM have been made for delivery of this course.*

*BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:*

*An introductory course completed at the beginning of the curriculum of the Program to acclimatize a student to the relationships which will be encountered in laboratory courses and the internship course.*

*IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:*

*No – prerequisite limitations*

*DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:*

*While such courses exist in the Faculty of Management, this new course is being designed to serve the specific needs and interests of students in the M. Biotech. program, and will also serve to organize student teams which will proceed to the laboratory courses.*

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*BTC 2001H - Science, Technology, Organizations and Society (0.75 credit; 39L,13T)*

*This course will provide an examination of the role and impact of technologically-focused organizations in the development of modern economies, from the European Industrial Revolution to present-day private, quasi-governmental and governmental global organizations. There will be a focus on biotechnology. Course material will also include general approaches to achieve social and technological forecasting. Attention will also be paid to broader issues raised by the commercialization of biotechnology, for example ethics, environmentalism, lifecycle economics and sustainable growth. The role of government in the development and regulation of technologically-focused organizations will be highlighted.*

*Lectures will be delivered by members of the Faculty of Management, the Division of Social Science, and guest lectures will be provided by members of biotechnology and pharmaceutical firms. Teams of students will be expected to research a specific area of impact of biotechnology and detail the commercial and social consequences in an oral presentation and a term paper. Each student will be expected to prepare a commercialization methodology proposal which concentrates on use of learned methods to determine how to evaluate a market, the investment that is required, availability of personnel and intellectual property, availability of government support, financial return tracking, and social/ethical consequences.*

***MARKING SCHEME:***

<i>Participation/discussion:</i>	<i>10%</i>
<i>Team presentation:</i>	<i>20%</i>
<i>Team Term Paper:</i>	<i>20%</i>
<i>Commercialization Proposal:</i>	<i>20%</i>
<i>Exam:</i>	<i>30%</i>

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN THE INSTRUCTOR/COORDINATOR:***

*Gunz / Wensley (Coordinators), and members of the Division of Social Science (Friedmann, Gad, Wolfe):*

*Industrial participants:* Murray Brown (Astra) - government affairs  
 Chad Gubala (Headmasters Inc.) - globalization  
 Connie Hearty (Guelph U.) - agriculture innovation  
 Cathy Lee (U of T) - medical innovations  
 Peter Lea (Skye PharmaTech) - inventions  
 Michael Levy (Glaxo Wellcome) - medical discovery  
 Gerry McDole (Astra) - economics, investments  
 Murray McLaughlin (Ont. Agri-Food) - business  
 development  
 Ron Nowlan (Hatch) - technology management  
 David Phipps (Innovations Foundation) - biotech.  
 management

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**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*SCI TECH ORG & SOC*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Arrangements with the Faculty of Management and the Division of Social Science at UTM have been made for delivery of this course.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*A fundamental component of understanding the structure of business and commercialization of technology.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*While such courses exist in the Faculty of Management, this new course is being designed to serve the specific needs and interests of students in the M. Biotech. program, and is distinctly different on this basis.*

*School of Graduate Studies  
Proposal for a New Course - Division III*

Department: Botany/Chemistry/Zoology

Date: March 1999

If you are proposing a new graduate program course, please use this form. It will be photocopied and sent to the Executive Committee for approval exactly as submitted.

***COURSE NUMBER WITH IDENTIFIER, LENGTH (eg. ABC 1223Y, A, B, L, F, S or H),  
TITLE, AND DESCRIPTION OF COURSE:***

*BTC 2002Y - Management of Innovation (52L, 13T)*

*This course is intended to connect together the science components and the practical experience components of the M. Biotech. program. The course will focus on the managerial and entrepreneurial issues that are associated with the process of taking a new biotechnology to the marketplace.*

*Topics to be covered include:*

*The lifecycle of biotechnology and pharmaceutical development  
Strategic planning, the economics of innovation (including evaluation methodologies)  
Marketing science-based products  
Protection of intellectual property  
The organization and financing of innovation, including SME issues, the stock market and investors for capitalization*

*Students will be expected to work in a team to propose a business plan for commercialization of an assigned product.*

***MARKING SCHEME:***

<i>Participation/discussion:</i>	<i>10%</i>
<i>Team presentation:</i>	<i>20%</i>
<i>Commercialization Proposal:</i>	<i>40%</i>
<i>Exam:</i>	<i>30%</i>

***INSTRUCTOR/COURSE COORDINATOR, INCLUDING LECTURES IF OTHER THAN  
THE INSTRUCTOR/COORDINATOR:***

*Gunz /Wensley (coordinators), faculty in the Division of Science (Horgen, Krull),  
personnel from University of Toronto Research Services (Peter Munche, Monique  
McNaughton), and the Innovations Foundation (David Phipps), the Intellectual Property  
Unit of Allelix Inc.*

*Other participants: Cathy Bright (Astra) - personnel management  
Kevin Fehr (Glaxo Wellcome) - research investment  
Connie Hearty (Guelph U.) - networking, government leveraging  
Peter Lea (Skve PharmaTech) - intellectual property*

*Mike McIntyre (Fac. Management) - business plans*  
*Alison Paprica (Astra) - academic/industry linkages*  
*Ravi Ramchandran (Novartis) - new technology trend tracking*  
*John Switzer (American Management Systems) - software and high tech.*  
*Joe Tedesco (Key Molecular Products) - small business entrepreneurs*  
*Andre Uddin (Merrill-Lynch) - investment*

**PREREQUISITES, IF ANY:** *Enrolment in the Master of Biotechnology Program, completion of all units of BTC 1900Y/1901Y/1902Y.*

**ABBREVIATED COURSE TITLE (NOT MORE THAN 20 CHARACTERS AND SPACES:**

*MGMT OF INNOVAT*

**INDICATE ANY RESOURCE IMPLICATIONS AND HOW THEY HAVE BEEN RESOLVED:**

*Arrangements with the Faculty of Management and the Division of Social Science at UTM have been made for delivery of this course. Other units within and beyond the University have agreed to provide specific guest presentations related to their expertise.*

**BRIEFLY DESCRIBE HOW THE COURSE FITS INTO YOUR GRADUATE PROGRAM:**

*A finishing course intended to tie together the academic and placement courses from the perspective of management and business.*

**IS THIS COURSE LIKELY TO BE CROSS-LISTED BY ANOTHER UNIT? IF SO, PLEASE INDICATE:**

*No – prerequisite limitations*

**DOES THIS COURSE OVERLAP SIGNIFICANTLY WITH ANY OTHER(S) IN YOUR OWN OR ANOTHER DEPARTMENT? IF SO, PLEASE GIVE THE NAMES OF THE RELEVANT UNITS OR INSTRUCTORS WHO HAVE BEEN CONSULTED:**

*While such courses exist in the Faculty of Management, this new course is being designed to serve the specific needs and interests of students in the M. Biotech. program, and is distinctly different on this basis.*

### *Additional Courses*

*In order to make up the 8 full course requirement, up to one full credit may be obtained from other graduate courses at the University of Toronto or another Ontario University. The Program Director would assist the student to plan and select such courses.*

*At the University of Toronto at Mississauga, the following relevant graduate courses are available:*

<i>CHM 1007H</i>	<i>Topics in Neurochemistry</i>
<i>CHM 1152H</i>	<i>Chemical Sensors and Biosensors</i>
<i>STA 1001H</i>	<i>Applied Regression Analysis</i>
<i>STA 1003H</i>	<i>Sample Survey Theory and Its Application</i>
<i>STA 1004H</i>	<i>Introduction to Experimental Design</i>
<i>STA 1005H</i>	<i>Applied Multivariate Analysis</i>
<i>ZOO 1501H</i>	<i>The Biology of Signal Transduction</i>

*Additional options exist among undergraduate 400 level half courses which might serve as a major component of a course with a graduate level designation. They include:*

<i>BIO 452</i>	<i>Advanced Topics in Cell Biology</i>
<i>BIO 475</i>	<i>Modern Approaches to Biotechnology</i>
<i>BIO 477</i>	<i>Molecular Biology of Gene Expression and Cancer</i>

*Examples of suitable Graduate Courses at the St. George Campus of the University include:*

<i>Biochemistry</i>	<i>BCH 1421H</i>	<i>Protein Structure and Function</i>
	<i>BCH 1422H</i>	<i>Cell Surface Biochemistry</i>
	<i>JBB 1425H</i>	<i>Biophysical Methods</i>
	<i>BCH 1430H</i>	<i>Nucleic Acid Biochemistry</i>
	<i>JBZ 1420H</i>	<i>Regulation of Gene Expression</i>
	<i>JBZ 1450H</i>	<i>Molecular Genetics of Selected Eukaryotes</i>
	<i>JBI 1428H</i>	<i>Molecular Immunology</i>
<i>Botany</i>	<i>BOT 1421H</i>	<i>Plant Physiology</i>
	<i>BOT 1460H</i>	<i>Plant Molecular Genetics</i>
<i>Chemical Engineering</i>	<i>CHE 1332H</i>	<i>Tissue Engineering</i>
	<i>JTC 1331H</i>	<i>Biomaterials Science</i>
<i>Clinical Biochemistry</i>	<i>LMP 1407H</i>	<i>From Bench to Bedside: Design, Measurement and Analysis for Clinical Investigations</i>
	<i>LMP 1505Y</i>	<i>Analytical Clinical Chemistry: Basic Principles</i>
	<i>LMP 1510H</i>	<i>Molecular Biological Aspects of Analytical Biochemistry</i>
<i>Immunology</i>	<i>IMM 1430H</i>	<i>Advanced Immunology</i>
<i>Medical</i>	<i>MBP 1010H</i>	<i>Quantitative Biology-Statistical Methods</i>

*Microbiology*    *MPL 2111L*    *Methods in Microbiology*

*Molecular and Medical Genetics*    *MSC 1020H*    *Molecular Approaches to Health and Disease*

*Pharmacology*    *PCL 1001Y*    *General Pharmacology*  
                       *PCL 1004Y*    *Clinical Pharmacology*  
                       *PCL 1015H*    *Drug and Toxicant Metabolism*

*Pharmacy*            *PHM 1111H*    *Pharmacy Administration: Management, Evaluation and Research*

*Other courses that are relevant to a student's program may be approved by the Program Director.*

## 5. OUTCOMES

### 5.4. Enrolment Projections

<i>Year</i>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
	20	45	50	50	50	50