FACULTY OF ARTS AND SCIENCE
PROPOSED NEW AND DELETED PROGRAMS 2009-2010

NEW PROGRAMS

Department of Anthropology

Anthropology (Social/Cultural) (Arts program)

Major program:

(7 full courses or their equivalent including at least one at the 400 series course)

1. ANT 100Y Introduction of Anthropology
2. ANT 204H Anthropology of the Contemporary
3. ANT 370H Introduction to Anthropological Theory
4. Five additional Social-Cultural courses including at least one full course at the 400 level.

Academic Rationale:
The proposed major program has been developed in collaboration with students. It is modeled on the expectations and requirements of the existing specialist program but with the added recognition that students will combine this with other majors and/or minors. The required courses have been carefully selected to give students a foundational understanding of social and cultural anthropology. One of the key objectives of the new program is to ensure student exposure to at least one full course at the fourth year level. In addition, the program requirements will give students a more consistent training in the intellectual and practical skills important to this sub-discipline. It is anticipated that the slate of required courses will allow for a greater ease of cohort building among interested students.

This past year the social and cultural faculty of Anthropology conducted a strenuous review of course offerings. Several courses were deleted and a number of new courses were added reflecting the interests of new faculty to some extent and in an attempt to reflect the new research interests of others. In addition we halved several full year courses and renamed the halves to give students a clearer indication of the content. Utmost in our deliberations was the need to meet students' desire to be better informed of contemporary events as they unfold, to address concerns of cultural relativism, of ethics and new technologies and their implications.

Learning Outcomes:
Students are expected to develop:

1. capacity for critical thinking, intellectual rigour, engagement with complexity,
2. an appreciation of the breadth and depth of social and cultural anthropology and its centrality to understanding contemporary world concerns and developments.
3. skills and tools for critically analysing world issues.
4. competencies in the areas of critical and creative thinking, communication, information literacy and ethical reasoning.
5. a conversancy with inquiry based research through practice and communication.
6. a critical reading competency when working with quantitative data, understanding the politics of such data and the implications of what they might reveal or conceal.

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7. core skills through a greater emphasis in courses on

    - writing - structuring of more course requirements such as (creative) projects, essays, presentations.
    - communications – development of more opportunities for oral presentations, exchanges,
    - information literacy – development of discerning and critical use of various tools and technologies to locate, evaluate, assimilate and create reliable and meaningful information.
    - Quantitative analysis – through the development of study units in the second and fourth year courses on fieldwork research methods.

Degree Objectives:

a. Depth of Knowledge:

The proposed major program will require students to take three core courses (2FCE's) which will introduce students to the four field approach in anthropology through the re-tooled first year course. In subsequent years students will be required to take two courses that will expose them to anthropological methods and theory. Students will be required to select five courses (5 FCE's) with at least one FCE at the 400 level. The sequence of required courses is intended to expose majors to anthropological thought and its particular contribution to understanding social complexity in the contemporary world.

In their third year majors will be exposed to the main theoretical currents in anthropology (ANT 370H Introduction to Anthropological Theory), and by requiring them to take at least one (1FCE) full 400 series level course, the course alignments and specializations for the specialists will be equally available to majors. Thus we anticipate that majors will have a strong exposure to the various fields in anthropology, since at least 4.5 FCE's will be at the third year level.

We have worked on these requirements for the Majors with a view to setting out for them what they should know in terms of the breadth of the discipline and of course giving them an opportunity to develop a depth of study in at least two areas.

b. Competencies

i. Critical and Creative Thinking

Social and cultural anthropology is dedicated to developing critical and creative thinking. It is a discipline, which takes as its mandate a humanised, localised, ethically critical understanding of the human condition.

The ANT 204H Anthropology of the Contemporary foundational course will emphasise issues of timely relevance: war, AIDS, poverty, social and gender inequality, indigeneity, health and justice, development, colonialism, urbanism, within an overall framework of critical contemporary theory: of affect, post-structuralism, everyday ethics, deconstructionism and political economy. The course will require students to engage with ideas, diverse sources of knowledge and academic readings in ways designed to achieve greater depth of understanding. The course will emphasise writing projects intended to train students in the use of multiple modes of resources.

Critical analytical skills form a very important part of the syllabi of all our third and fourth year courses. Upper year courses have multiple essay requirements. Written assignments emphasize many of the objectives noted in the curriculum guidelines, such as the ability to read analytically, ability to synthesise arguments, to construct and pose hypotheses, to reason from the evidence, to theorise from the evidence, to question theoretical assumptions and to synthesise information in ways that are original or that have original potential.

Our courses across the board deal with the real-world and accordingly our students are asked to write essays that clearly engage with contemporary concerns be they to do with globalization or local and every day experiences of groups of peoples. We identify sophistication in argumentation,

capability of dealing with complexity, ethical analysis, and effective integration of the everyday with theory as key competencies within social and cultural anthropology.

Since our object of analysis is the contemporary human condition our subject is continually changing, re-forming, throwing up new combinations of ideas, new representations of reality, this all requires our students to become adept at extrapolating ideas from the new, to evaluate reasoning, identify misconceptions and misapplications of knowledge.

Acquiring an ethnographic understanding of history is a very important component of our discipline. Students are trained to develop a critical sensitivity to the multiple forms of history – official, local, oral, textual, normative and conjectured – and to see social events as created through geo-political contexts that can only be grasped by acquiring an appreciation of ethnographic history.

ii. Communication

All the required courses in the major program will have built in modules for developing literacy, numeracy and communicative skills. It is standard practice in our discipline for all classes to have major writing assignments. As students progress into upper years writing assignments, participation and presentations become key elements of instruction.

ANT 100Y is being re-tooled to include tutorials, several writing modules, a number of interactive projects with a view to exposing students to a more hands-on experience of anthropology as a four field discipline.

Our re-worked second year courses (ANT 204H ANT 210H) emphasise writing as the principal means of communicating ideas. ANT 204Y regularly has over 350 students enrolled. We have decided to offer Ant 204H Anthropology of the Contemporary in both terms. This will reduce the number of students taking the course in each term and hopefully this will work to enhance the possibilities for in-class discussions. Having a smaller class will also make it possible for group projects, oral presentations and other forms of communication to take place.

ANT 210H Craft of Anthropology has been capped to ensure a large seminar format with the possibility of in-class presentations, discussions and debates. The class focus is on training students in the craft of doing anthropology, exposing students to interview methods, participant observation, quantitative vs. qualitative methods of collecting data, the value of censuses and so on. It should be noted that one of the communicative skill that will be taught in this course is interviewing effectively. Students will be required to produce written work combining many of these data sources. The ability to organize diverse forms of data, learning to see patterns in daily interactions, structuring analyses and presenting the data in a cogent manner are all part of the course requirements.

In third and fourth year courses our writing and communication expectations are a question of degree. We clearly expect students to have basic writing and oral presentation skills to be in place, and these will be honed (progressively) in upper year courses. In the third and fourth level courses, writing projects are longer, more involved, more theoretical, better researched and better argued. There is more opportunity for group work, oral presentations, debates, and original research.

Our fourth year courses are all capped at between 20-25 students in order to support seminar format teaching and strong interaction between students and instructors. We have a yearly array of 15 half courses spread over the two terms, which will comfortably accommodate our new major students and continuing specialists.

iii. Information Literacy

All students in social and cultural programs are exposed, in increments, to a wide array of resources typically used in our field. These may be textual

- Books, bibliographies, archives, web pages, indexes, censuses, government documents, secondary sources, maps
  non-academic
- newspapers, magazines, popular media, internet, videos, film, comics, novels
  primary resources
- oral interviews, journals, letters, photographs, personal items, museum collections

All our courses require students to become familiar with some segment of the above forms of information, how to cite effectively and accurately, and the perils of plagiarism.

In ANT 100Y we will be introducing tutorial modules which will train students in the different ways of observing, thinking creatively and analyzing, perhaps by answering a series of questions on a film clip, or comparing advertisements from two different societies, or comparing a news item written as it appears in a national newspaper and a local paper.

In ANT 204H Anthropology of the Contemporary, information literacy will be further expanded encouraging students to expand their notion of a resource and to approach sources more critically. To that end students will be encouraged to evaluate (re)sources, the value of the information available, to be aware of underlying assumptions inherent in (re)sources and to synthesise arguments from various sources. That being said most written assignments will be library based. Second year papers will introduce students to anthropological argumentation, to the value of an anthropological approach, and to critical analysis.

We have introduced ANT 210H Craft of Social and Cultural Anthropology to expose students to the value of engaging - at the research and data collection level - with multiple forms of information both academic and non-academic from the purely observational (e.g. flaneur method) to informal participant observation, to experiential ethnographic method to formal interviews. The course is also intended to expose students to multiple forms of primary data: archival, textual, visual, internet based etc. and to train them in discerning valuable, legitimate data from plagiarized or unreliable data.

Our third year courses train students to collect and assess other forms of information (if relevant to their topic of study) supplemental to bibliographic sources. For example, increasingly our students use internet sources, accordingly, students are schooled in recognizing legitimate journal articles, from non-reviewed web-based information.

At the fourth year level we have an existing course ANT 444Y Research Methods in Social and Linguistic Anthropology which carries forward many of these objectives in a more comprehensive format. We have introduced a new course on Anthropology of Oral History and Narrative, ANT 464H, which will examine the multiple forms of oral evidence, its reliability and strategies for compilation and analysis of oral data.

All our existing third and fourth year level courses, to a lesser or greater degree, and where relevant incorporate the use of innovative resources as a means of accessing social contexts.

iv. Quantitative Reasoning

Social and cultural anthropology tends to favour longitudinal study, the collection of qualitative data and privileges the ideas and discourses of individuals and groups as a means of understanding meanings and values of a people. That being said, students need to know how to think about quantitative data, in the forms relevant to the field. Anthropologists do use censuses, surveys, formal interviews for collecting data, how this is assembled and the meanings imparted to basic statistical correlations need to be systematically studied.

Students will be exposed quantitative reasoning in ANT 204H. A number of fourth year courses have quantitative reasoning components and will require students to have some familiarity with the basic premises in quantitative analysis (ANT 444Y and ANT 445H). ANT 210H Craft of Anthropology is designed to introduce students to quantitative methods as one of an array of possible ethnographic tools: e.g. surveys, census materials, modeling and testing hypotheses. Students will be encouraged to use these methods with a critical understanding of the assumptions underlying some quantitative methods.

ANT 444Y Research Methods in Social and Linguistic Anthropology is a senior level course with more in-depth modules on the use of statistics in the social sciences, quantitative reasoning and on cultural and political assumptions potentially embedded in statistics. ANT 445H Science as Culture and Practice is a theoretically driven critical examination of science connected to wider social, political economic ideological and cultural contexts.

v. Social and Ethical Responsibility

As a discipline social and cultural anthropology is continuously and deeply engaged with social and ethical responsibility. It is a very strong commitment in our research, teaching and writing. As a discipline we tend to work with, but not exclusively, with groups that are marginalised, impoverished, lacking in power. Accordingly we have been very sensitive to the meaning of ethical responsibility across societies. Our professional associations have developed extensive guidelines for ethical research and writing, which we are committed to following. Our ethical standards and commitments in the field strongly inform our teaching methods forming significant parts of our course syllabi either overtly or implicitly. In our teaching there is a concerted interest in teaching students about ethically responsible behaviour in the field, ethical responsibility to our field informants, ethical engagement in modes of representation in our professional writing, and to the broader ethical issues of academic integrity.

Inherent in all the social and cultural anthropology courses in our program is a deep commitment to ethical understanding and the development of the same in students. Ethical and social responsibility is embedded in the topics of study and is an explicit requirement in the various writing assignments. While all anthropology courses have at their core a deep understanding of and pedagogical commitment to ethical reasoning and practice a number of courses examine ethics as a subject matter:

ANT 210H Craft of Anthropology
ANT 444Y Research Methods in Social and Linguistic Anthropology
ANT 358H Medical Anthropology and Social Justice
ANT 452H Anthropology and Human Rights
ANT 464H Anthropology of Oral History and Narrative

Students will learn the precepts of social and ethical thinking, ethical and responsible research, and ethical representation in writing. They will have the opportunity to develop more in depth awareness of ethical responsibility in the four above noted courses.

c. An Integrative, Inquiry-Based Activity

One of the reasons driving the proposed major program are a desire to create more courses in line with faculty research interests, to create courses that would enable greater faculty –student interaction and that would engage students in research more closely tied to faculty research interests. There is an emphasis on taking advantage of faculty expertise, in particular, through fourth year research seminars course offerings. Majors will be required to take a minimum of 1FCE at the fourth year level

Writing assignments and more extensive inquiry based essays will be required at the fourth year level. Fourth year courses are intentionally capped at 25 (a few are capped at 20) to ensure the possibility of intensive discussions and the 'creative synthesis of knowledge and methodological skills developed during their undergraduate education''. Final term papers are expected to be intensive investigations. We have found that quite often these papers become the basis for graduate research.

Estimated Enrolment: We project that the new major program in social and cultural anthropology will have an enrolment of 150-175 students.

Department of Chemistry

Synthetic and Catalytic Chemistry Specialist

(14 full courses or their equivalent)
Enrolment in this program requires completion of four courses; no minimum GPA required.

This program focuses on the fundamentals and practical aspects of modern synthetic organic and inorganic chemistry, and the understanding and applications of catalytic reactions. The program will prepare students for career paths as synthetic / discovery chemists, in the pharmaceutical,

biotechnology, biomedical, crop protection, materials and related sectors, or for academic research and teaching positions.

First Year: (CHM 151Y1 Chemistry: The Molecular Science strongly recommended)/(138H1 Introductory Organic Chemistry, 139H1 Chemistry: Physical Principles); MAT 135Y1 Calculus/137Y1 Calculus! ; (131H1 Introduction to Physics I, 132H1 Introduction to Physics II)/(151H1 Foundations of Physics I, 152H1 Foundations of Physics II)

Second and Higher Years:

1. BCH 210H1 Biochemistry I: Proteins, Lipids & Metabolism, CHM 217H1 Introduction to Analytical Chemistry, 225Y1 Introduction to Physical Chemistry/(220H1 Physical Chemistry for Life Sciences with minimum grade of B, 221H1 Physical Chemistry: The Molecular Viewpoint), 238Y1 Introduction to Inorganic Chemistry, 247H1 Introductory Organic Chemistry II/249H1 Organic Chemistry (CHM249H1 strongly recommended); MAT 235Y1 Calculus II/237Y1 Multivariable Calculus
2. CHM 317H1 Introduction to Instrumental Methods of Analysis, 338H1 Intermediate Inorganic Chemistry, 342H1 Modern Organic Syntesis, 343H1 Organic Synthesis Techniques, 347H1 Organic Chemistry of Biological Compounds, 348H1 Organic Reaction Mechanisms.
3. CHM 432H1 Organometallic Chemistry and Catalysis, 440H1 The Synthesis of Modern Pharmaceutical Agents, 441H1 Spectroscopic Analysis in Organic Chemistry, 443H1 Physical Organic Chemistry.
4. CHM499Y1 Introduction to Chemistry Research *and/or* CHM 398H0 Independent Experiential Study Project in areas relevant to the program (to be approved by the Department)
5. Further 300/400-series courses in CHM, including CHM 325H1 Introduction to Inorganic & Polymer Materials Chemistry, 328H1 Modern Physical Chemistry, 379H1 Biomolecular Chemistry, 416H1 Separation Science, 421H1 Chemical Kinetics & Dynamics, 434H1 Advanced Materials Chemistry, 437H1 Bioinorganic Chemistry, 438H1 Advanced Inorganic & Materials Chemistry Laboratory, 447H1 Bio-organic Chemistry and 479H1 Biological Chemistry to make a total of 14 full courses.

Academic Rationale:

Catalysis is revolutionizing the science, technology and art of chemical synthesis. Modern synthetic methods allow for the formation of many classes of molecules, in a manner that quite simply would not have been possible twenty, or even ten, years ago. For example, newly approved pharmaceuticals are not only being increasingly synthesized in bulk using catalytic reactions, but their discovery is often facilitated using catalysis at the earliest stages of the research and development programs. Such methods allow chemists to access molecules that range from simple bulk chemicals to complex bioactive natural products, and from high-tech materials, such as organic light emitting diodes, to new pharmaceuticals and crop protection compounds. Moreover, there is an increasing need for the development of new methods and catalysts that can be applied toward more efficient, cheaper and environmentally friendly syntheses than are possible with existing technologies. Indeed, the field of organic and inorganic synthesis is being transformed by advances in catalysis. For example, the 2005 and 2001 Nobel Prizes for Chemistry were awarded for developments in new metal catalyzed reactions. These advances represent a mere fraction of the possibilities for innovation and discovery in this field that will surely emerge in the future.

A new undergraduate program in the field of chemical synthesis and catalysis is both timely and relevant to the priorities of the Chemistry Dept., and will afford students with a clearly defined program of appropriate courses. The proposed program is quite distinct from the other Chemistry Specialist programs. The required courses will provide students with a laboratory intensive learning experience, and will include a requirement for upper level independent research. Such synthetically trained students are in high demand in the pharmaceutical, biotechnology, crop protection, materials and related discovery intensive sectors. For example, the training obtained in the area of synthesis and catalysis is considered to be the ideal preparation for entry into medicinal and process chemistry departments in pharma/biotech companies.

The field of synthetic chemistry is flourishing within the Chemistry Department. Direct faculty involvement in this field at the St. George Campus includes: Rob Batey, Jik Chin, Andy Dicks, Vy Dong, Mark Lautens, Doug McIntosh, Bob Morris, Stanislaw Skonieczny, Datong Song, Doug Stephan, Mark Taylor, Andrei Yudin. These faculty are very research active, with over 60 full-time researchers at the graduate and PDF level. The international recognition already achieved by our research faculty in the areas of synthesis and catalysis, will thus be translated into a new undergraduate program.

Learning Outcomes:

Students in this program will build upon the fundamentals of chemistry (structure, bonding, kinetics, thermodynamics) to specialize in the area of synthesis and catalysis. They will learn through a progression of intensive lecture and laboratory coursework. These courses will address the following questions:

What are the most important reactions for synthetic chemistry?
How do catalytic reactions operate?
How do we develop improved catalysts?
How are novel reactions discovered or invented?
Which analytical techniques and spectroscopic methods are relevant for preparative chemistry?
How can these methods be applied toward the synthesis of novel and structurally complex molecules?
How are synthetic laboratory experiments planned, research plans developed, and results and conclusions reported?

At the end of the program, students will have achieved competency in the following key areas, with both classroom and practical experience:

Structure, Bonding, Kinetics, Thermodynamics	Years 1-4
Synthetic Organic Chemistry	Years 1-4
Synthetic Inorganic Chemistry	Years 2-4
Reaction Mechanisms	Years 1-4
Catalysis and Catalytic Reactions	Years 2-4
Organometallic Reaction Mechanisms	Years 3-4
Spectroscopic and other Analytical Methods	Years 1-4
Purification Methods (preparative and analytical)	Years 1-4
Preparative Synthesis	Years 1-4
Applications toward Pharmaceutical Synthesis	Year 2-4

Throughout the program students will have the opportunity to develop practical laboratory, problem-solving, and independent creative thinking skills. Students enrolled in the program will be required to meet with a Program Coordinator at the end of each year to review progress, and outline their plans for future courses and research experiences. These meetings will provide an opportunity for faculty to identify areas for improvement for the student, to reiterate the interconnected nature of the required courses for the program, to discuss with the student career and graduate training opportunities, and to obtain feedback from the students on the program.

Degree Objectives:

a. Depth of Knowledge

Students will achieve depth of knowledge in the areas of synthesis (inorganic and organic) and catalysis. The course requirements include developing the necessary theoretical background, practical skills, research tools, critical problem solving abilities, and applied knowledge of synthesis and catalysis. A combination of lecture and laboratory based coursework is essential to achieve the depth of knowledge required for the program. In addition, students in the program will also be required to obtain upper level research experience. This program will be the ideal platform from which students can embark upon graduate studies and careers in academic and industrial research and development.

b. Competencies

i. Critical and Creative Thinking

This is a central theme of most of the required courses in the program. For example, the required courses will allow students to critically analyze existing synthetic methods and mechanistic problems. Students will be confronted with many problem-solving opportunities and be given the opportunity to develop creative solutions to such problems and apply them in the lab. These opportunities will be afforded formally through problems sets, oral/written reports, and the lab reports of the required courses. Over the course of the program the level of sophistication required of the students will increase.

ii. Communication

Throughout the four-year program, students will participate in several laboratory intensive courses, for which laboratory note-taking and written reports will be required. The laboratory component of the program will require that students develop their scientific literacy and writing skills. The required chemistry laboratory courses are offered evenly over the four years of the program. In first year, an introduction to chemistry is achieved in CHM151/(138H1, 139H1). In second year, students build upon their physical (225Y1/(220H1, 221H1)) and organic (247H1/249H1) laboratory skills, and are introduced to analytical (217H1) and inorganic labs (238Y1). In third year, intermediate/advanced labs in instrumental analysis (317H1), inorganic (338H1), and organic (343H1, 348H1) are offered. In fourth year, an advanced spectroscopy laborarotory (441H1) is required. Presentation of the results from labs is usually in written form. Students in CHM343H1 for example, are required to prepare their lab reports in a format suitable for publication in research journal. Finally, as a culmination of the program, student will obtain independent research experience (CHM 398H0 *and/or* CHM499Y1). These courses require the preparation of a written thesis, a formal oral presentation and informal presentations during research group meetings.

iii. Information Literacy

Students in the program will be required in all of the upper level courses to find and evaluate research information in academic journals, monographs, patents, databases and other web-based sources. The courses included in this program make extensive use of electronic journal and databases such as the Web of Science, SciFinder, Beilstein, etc. Experience and training in the use of these electronic resources is provided in several of the required courses, and is essential for the required independent research course(s). Formal lab reports and presentations will require properly researched and documented reference sources. Also, in addition to the use of standard software packages, students will obtain experience in the use of specialized chemical software such as ChemDraw, Gaussian, etc. All students graduating from the program will thus obtain substantial experience in the databases and software used by synthetic chemists.

iv. Quantitative Reasoning

Mathematics (MAT 135Y1/137Y1) in the first year is also a requirement of the program. In addition, many of the required courses in the program rely upon quantitative reasoning, both in a theoretical and practical sense. The design of synthetic experiments requires numerical reasoning and problem solving abilities. Students will also gain computational experience using advanced chemical modelling software such as Gaussian.

v. Social and Ethical Responsibility

Issues of social and ethical responsibility will be raised in several courses. Of particular importance are the end uses of the science described in the program, and the benefits to be obtained by improvements to, and advances in, synthetic and catalytic sciences. In the former area, the ultimate basis for much synthesis and catalysis is the development of new pharmaceuticals, and the advancement of other socially relevant goals. In the latter area, the chemical processes that students will learn in the program are more environmentally friendly than conventional processes. Issues of renewability of resources, cost/efficiency, safety, toxicity/environmental hazards are one of the principle driving forces for the development of new synthetic processes. These issues are introduced very early in the program (e.g., CHM249), but are addressed in more detail in later courses (e.g., CHM342, CHM343, CHM440). Issues of reporting experimental results and conclusions in an ethical manner (beyond an undergraduate degree) are discussed (e.g., CHM343). Misuses/problems of synthetic chemistry are also given as examples in the courses (e.g., the history of dioxin contamination from the Vietnam era to their recent use as poisons in Ukraine/Russia). Finally, in part for the reasons just given, “chemicals” and “chemistry” are usually viewed by the public in a negative manner. The disconnect between this perception and the aims

and goals of much synthetic chemistry which are generally considered to provide positive societal benefits are also discussed.

c. An Integrative, Inquiry-Based Activity
Students must take at least one of the courses listed below as a requirement for the program.

CHM398H0 Independent Experiential Study Project.
CHM499Y1 Introduction to Chemistry Research [260P]

These courses will provide students with upper level independent laboratory research experience, and allow them to conduct background literature searches, and present their results in written and oral formats.

Estimated Enrolment: 5-10 - An analysis of enrolment in existing chemistry specialist programs, and students undertaking 4th year research projects in this area suggests that this program will attract an enrolment level of approximate 5-10 students.

Department of English

Asian Literatures and Cultures – Joint Minor with National University of Singapore (NUS)

Four full courses or their equivalent, including ENG270Y Colonial and Postcolonial Writing or its equivalent and one other ENG full-course equivalent and two NUS full-course equivalents (NUS231H0 Singapore Film: Performance of Identity, NUS332H0 Singapore English-Language Theatre, NUS333H0 Studies in Southeast Asian Arts, NUS334H0 Southeast Asian Literatures in English, NUS338H0 South Asian Literatures in English, NUS339H0 Postcolonial Literatures in English, including at least one 300-series NUS full-course equivalent.

This humanities-based minor program represents a unique opportunity to study Asian Literatures and Cultures within a South Asian location. Students take core subjects at the first-year or second-year level in Toronto and then spend the fall semester of their second, third or fourth year at the National University of Singapore where they are enrolled in lecture courses.

Academic Rationale:
A term spent learning about Asian Literature and Cultures in a South Asian university promises to be a rewarding intellectual experience.

***Learning Outcomes*:**
The minor provides the opportunity for students to study Asian Literatures and Cultures intensively in a South Asian location. The students must first take their two preparatory courses at the University of Toronto, one of which is ENG270Y, which will give them a strong knowledge of postcolonial theory. They will then take two full-course equivalents in a single semester at the National University of Singapore. Our hope is that this program will allow students an intensive experience of learning about a literature in its social and geographical context.

Estimated Enrolment: 5 students go on exchange to the National University of Singapore, in the fall term of either their second, third or fourth year of study.

Department of Geography

Human Geography (Arts program)

The entry requirement for all Specialist programs is a CPGA of 2.5. The entry requirement for the Major program is a CGPA of 2.0, or 67% in 1.0 GGR FCE or two separate 0.5 FCE at the 100 and/or 200 level.

Number of courses	Courses	FCEs

Specialist		
A: Any 2	GGR100H1 Introduction to Physical Geography, 101H1 Ancient Civilizations and their Environments, 107H1 Environment, Food And People, 124H1 Urbanization, Contemporary Cities and Urban Life (or 1.0 other GGR courses with permission of Department)	1.0
B: Any 1 not used to satisfy A	GGR100H1 Introduction to Physical Geography, 101H1 Ancient Civilizations and their Environments, 201H1 Geomorphology, 203H1 Introduction to Climatology, 205H1 Introduction to Soil Science, 206H1Introduction to Hydrology	0.5
C: All 3	GGR270H1 Introduction to Analytical Methods, 271H1 Social Research Methods, 272H1 Geographic Information and Mapping	1.5
D: Any 1	GRR240H1 Historical Geography of North America, 246H1 Geography of Canada, 249H1 Contemporary Latin America, 254H1 Geography USA, 342H1The Changing Geography of Southeast Asia, 343H1 The Changing Geography of China, 344H1 Changing Geography of Russia and Ukraine	0.5
E: Any 1	Any 400 series course from Group E	0.5
F: Any 12 half courses or equivalent not used to satisfy E or D	Please see list below of Group E courses	6.0
Note: At least 4.0 FCEs must be 300/400 series courses. Of these, at least 1.0 FCE must be 400 series.		
Total		10.0
Major		
A: Any 2	GGR100H1 Introduction to Physical Geography, 101H1 Ancient Civilizations and their Environments, 107H1 Environment, Food And People, 124H1 Urbanization, Contemporary Cities and Urban Life (or 1.0 other GGR courses with permission of Department)	1.0
B: Any 1 not used to satisfy A	GGR100H1 Introduction to Physical Geography, 101H1 Ancient Civilizations and their Environments, 201H1 Geomorphology, 203H1 Introduction to Climatology, 205H1 Introduction to Soil Science, 206H1Introduction to Hydrology	0.5
C: All	GGR270H1 Introduction to Analytical Methods, 271H1 Social Research Methods	1.0
D: Any 1	GRR240H1 Historical Geography of North America, 246H1 Geography of Canada, 249H1 Contemporary Latin America, 254H1 Geography USA, 342H1The Changing Geography of Southeast Asia, 343H1 The Changing Geography of China, 344H1 Changing Geography of Russia and Ukraine	0.5
E: Any 1	Any 400 series course from Group E	0.5
F: Any 7 half courses or equivalent not used to satisfy E or D	Please see list below of Group E courses	3.5
Note: At least 2.0 FCEs must be 300/400 series courses. Of these, at least 0.5 must be 400 series.		
Total		7.0
	Minor	
A: Any 2	GGR100H1 Introduction to Physical Geography, 101H1 Ancient Civilizations and their Environments, 107H1 Environment, Food And People, 124H1 Urbanization, Contemporary Cities and Urban Life (or 1.0 other GGR courses with permission of Department)	1.0
	Three other higher level GGR/JAG/JFG/JGE/JGI/JUG social science or humanities courses, including at least 1.0 FCEs of 300/400-series courses	3.0
TOTAL		4.0

GROUP E Optional courses for Human Geography:
GGR216H1 Global Cities, 220H1 The Spatial Organization of Economic Activity, 221H1 New Economic Spaces, 222Y1 Perspectives on Environment, 240H1 Historical Geography of North America, 241H1 Historical Geographies of Urban Exclusion and Segregation, 246H1 Geography of Canada, 249H1 Contemporary Latin America, 252H1 Marketing Geography, 254H1 Geography USA, 256H1 Recreation and Tourism, 272H1 Geographic Information and Mapping I, 273H1 Geographic Information and Mapping II, 299Y1 Research Opportunity Program, 300H1 Special Topics in Geography, 314H1 Global Warming, 320H1 Geographies of Transnationalism, Migration and Gender, 323H1 Issues in Population Geography, 327H1 Geography and Gender, 328H1 Labour Geographies, 331H1 Resource and Environmental Theory, 332H1 Urban Waste Management, 334H1 Water Resource Management, 335H1 Business and Environmental Change, 336H1 Urban Historical Geography of North America, 338H1 Environmental Problems in Developing Countries, 339H1 Urban Geography, Planning and Political Processes, 342H1 The Changing Geography of Southeast Asia, 343H1 The Changing Geography of China, 358H1 Geography, Political Economy and Religion, 360H1 Culture, History and Landscape, 361H1 Understanding the Urban Landscape, 363H1 Critical Geographies: An Introduction to Radical Ideas on Space, Society and Culture, 366H1 Historical Toronto, 373H1 Advanced Geographic Information Systems, 391H1 Research Design, 416H1 Environmental Impact Assessment, 398/399H1 Independent Experiential Study Project, 400H1 Special Topics in Geography II, 418H1 Political Economy of Natural Resources, 421H1 History and Philosophy of Geography, 424H1 Transportation Geography and Planning, 431H1 Regional Dynamics, 439H1 Global Political Geography, 452H1 Space, Power, Geography: Understanding Spatiality, 457H1 Post War Suburbs, 458H1 Advanced Topics in Urban Geography, 462H1 GIS Research Project, 473H1 Cartographic Design, 491H1 Research Project, 492H1 Senior Practicum, 498H1/499H1 Independent Research I & II; JGI216H Urbanization and Global Change; JUG320H1 The Canadian Wilderness; JAG321H1 Aboriginal People and Environmental Issues in Canada, JGI346H1 The Urban Planning Process, 454H1 The Role of the Planner: Making a Difference; JFG470H1 Forest Management, 475H1 Emergency Response Systems Planning

Streams: Students may wish to choose courses from among one of more of the following streams if they want to concentrate in a particular area within Human Geography, while fulfilling the overall requirements given above:

Cultural and Historical Geography
Urban Geography
Social and Economic Geography
Political Geography
Geography of Canada
Environment
Planning

Academic Rationale:
The program is not a new program in the sense that it is a combination of two existing programs, Historical Cultural Geography and Urban, Economic and Social Geography with areas of concentration identified as possible (and flexible) streams within the Human Geography program. The proposed program includes areas of concentration that reflect the current menu of available courses.

Learning Outcomes:

Knowledge	Urbanization Historical context Theory of geographic thought Regions Globalization Nature/society

Skills	Research Communications – written and oral Critical reading Critical thinking Qualitative and quantitative analysis of data Knowledge production outside the classroom
Attitudes	Awareness Willingness to continue learning and applying knowledge to either create new knowledge or solve existing problems Willingness to engage different perspectives (and to respect other people's opinions) Connectedness and scope of different geographic processes and relations Responsible scholarship Enquiring approach Academic rigour/recognition of value of a methodical, patient approach Creative bursts Understanding/seeking underlying simple principles Recognition of potential errors (esp wrt predictions involving complex systems)

Degree Objectives:

a. Depth of Knowledge

The Human Geography degree program is designed to provide students with a deeper understanding of the world's human environments. Human Geography is a field that connects to and draws from a myriad of other disciplines across the social sciences and humanities. The curriculum for both specialists and majors is designed to provide students, during the first two years, with a broad introduction to various streams and critical issues in human geography. Depth of knowledge is attained by requiring a minimum number of 3rd and 4th year courses, in accordance with the Faculty requirements, and by identifying possible areas of concentration that incorporate courses up to and including 3rd or 4th year courses. Overall, a combination of lecture-based courses that include library research and extensive writing, as well as group and field-based course options, will allow students to gain a full sense of key concepts and methods in Human Geography. Students who graduate from this program will be well-positioned for careers in the public, private and voluntary sectors, and should they choose, to proceed on to graduate work in Geography or any number of related fields.

b. Competencies

i. Critical and Creative Thinking

Although one main purpose of the program is to teach students general concepts in Human Geography, critical and creative thinking is a crucial element in nearly every core course, and there is no way to single out individual courses that emphasize this over others. To take just one example, in GGR360 students are encouraged, through a set of three different writing assignments, to work critically with the idea of 'landscape' and its historical bases. Other courses, particularly at the 3rd and 4th-year levels, require students to critically read and synthesize secondary literature; create independent individual and group projects, often with a substantial problem-solving component; grapple with the ethical challenges at the core of primary and secondary research; and discuss issues and ideas of tremendous importance and complexity. Geographic thought, in sum, is inseparable from geographic practice, and across the curriculum *doing* geography is both a critical and creative exercise.

ii. Communication

The Human Geography program gives students the opportunity to develop both written and oral communication skills. All of the courses that are not purely technical courses have substantial writing requirements. These writing requirements take the form of either critical reviews of scientific papers, major term papers based on library and primary research, tutorials within some courses (i.e., GGR101) on specific writing skills, and requirements for essay-style answers on term tests and final exams. Several of our courses are involved in the Writing Initiatives for TAs (WIT) program (GGR101, 107, 241, 252). A number of courses, particularly at the 4th-year level, require students to provide questions and lead discussion on a respective week's readings, or to formally present original research or group work.

iii. Information Literacy
Human Geography students are expected to effectively access scholarly sources, and to critically reflect on and use popular sources. All students who graduate from this degree program will have, though various course experiences, basic training in finding, assessing, and employing information from various sources. The methodology courses, including GGR270 and 271, provide important training in the use of various forms of data, while writing-intensive courses will improve research skills that are the prerequisite for clear and reasoned assignments.

iv. Quantitative Reasoning
All GGR Specialists, Majors, and Minors are required to take a half course in statistics (GGR270). Human GGR Specialists and Majors require one Physical Geography course in addition to statistics.

v. Social and Ethical Responsibility
Human Geography – quite literally, our place in the world, and how we describe that world – is inseparable from questions of social and ethical responsibility. From a practical standpoint, GGR271 (required of all Human GGR and Environmental GGR Specialists and Majors) includes components related to ethical matters in research and concerning the practice of professional geographers. Other courses – on social inequality; transnationalism and migration; gender and labour; urban politics; and other topics – directly address questions of responsibility from conceptual and case-based perspectives. Still more courses, including GGR363 and 452, provide theoretical tools that work to destabilize conventional understandings of the social fabric. The optional field course will force students to step outside of university confines and confront environments that are often challenging or unfamiliar. Finally, opportunities for independent study provide upper-year students with an arena to explore places and topics of personal and political significance.

c. An Integrative, Inquiry-Based Activity
All of our fourth year courses satisfy all the conditions required to be considered an integrative, inquiry-based course, and we require a minimum of one (Majors) or two (Specialists) fourth year courses.

Estimated Enrolment: In specialists, majors and minors about 250

Asian Geographies (offered jointly with the National University of Singapore) (Social Science program)

The minor program represents a unique opportunity to study geography in a different cultural environment.

Minor Program: (4 full courses or their equivalent)

1. 2.0 FCEs (at UofT): 0.5 courses from GGR 100H Introduction to Physical Geography/101H Ancient Civilizations and their Environment/107H Environment, Food and People/124H Urbanization, Contemporary Cities and Urban Life; 1.5 other higher level GGR/JAG/JFG/JUG/JGI/JGE courses;
2. 2.0 FCEs (at NUS) (normally taken in second term of third year or fourth year) from: NUS250H0 Cities in Transition, NUS251H0 Southeast Asia, NUS252H0 Rice, Spice & Trees: Peasants in Southeast Asia, NUS253H0 Economy and Space, NUS254H0 Geographies of Social Life, NUS255H0 Cities and Urban Life in Southeast Asia, NUS256H0 Changing Landscape of Singapore, NUS350H0 Natural Resources: Policy and Practice, NUS351Y0 Field Studies in Geography: SE Asia, NUS352H0 East Asia, NUS353H0 Globalization and Asian Cities, NUS354H0 South Asia: Development, Issues, Debates
3. At least 1.0 FCE must be from courses at the 300/400 level at UofT or NUS

Academic Rationale:
The joint minor is an initiative of the Faculty of Arts and Science to allow students who take courses at the National University of Singapore to receive credit (grades) for those courses while pursuing the joint minor. The joint minor in Asian Geographies is an excellent fit in our unit for several reasons:
1. Many students attracted to Geography at the University of Toronto have interests in Asia and want

additional courses on Asia
2. Faculty in our department have long-standing research collaborations with faculty at NUS. The Chair of Geography at NUS is also a graduate of our department.
3. It is a priority for our department to offer programs that have requirements for knowledge of one or more regions of the world. Our new Human Geography and Environmental Geography programs have this requirement.

Learning Outcomes:
The 'knowledge' learning outcomes for the joint minor include knowledge of urbanization, regions, and globalization with a particular focus on Asia. The basic understanding of these knowledge areas will be obtained through courses taken at the University of Toronto while the specialized focus on Asia will be obtained at NUS. No methodological courses are required for the joint minor. Skills acquired by the student include: critical reading and writing skills associated with preparing essays in the upper level courses; adaptation to a different cultural setting, through living and studying in Singapore.

Estimated Enrolment: 3-5 to start; hopefully 10

Human Biology Programs

The proposed non-GPA-restricted Major programs will provide students in the very large Human Biology Major program (2,400 students) the opportunity to belong to a smaller learning community of like-interested students. This increased menu of Major programs will be particularly important to the ~1,000 students who enter our Major program in 2nd-year. It is a top priority request from our students and one that almost certainly leads to higher student satisfaction. The enrichment of the learning experience of our Human Biology Majors was a priority of our external review and the resultant Human Biology Academic Initiative Fund grant.

Environment and Health Major (8.0 FCE)

Non-GPA restricted.

First Year (2.5 FCE): BIO150Y1 Organisms in their Environment; CHM138H1 Introductory Organic Chemistry,139H1 Chemistry: Physical Principles; GGR100H1 Introduction to Physical Geogrpahy/101H1 Ancient Civilizations and their Environments GLG102H1 Earth Science/MAT135Y1 Calculus I/PHY131H1Introduction to Physics I /PSY100H1 Introductory Psychology

Higher Years:
1. 2.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism/CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Call and Developmental Biology; HMB265H1 General and Human Genetics/BIO260H1 Concepts in Genetics
2. 1.0 FCE: E&H core course JGE221Y1Interdisciplinary Perspectives on the Environment/ENV234Y1 Environmental Biology/ENV236Y1 Human Interactions with the Environment

300- & 400-level:
3. 0.5 FCE: E&H core course ENV341H1 Environment and Human Health
4. 1.0 FCE: PSL302Y1 Human Physiology
5. 0.5 FCE from E&H-relevant course
HMB302H1 Vertebrate Histology and Histopathology / 303H1 Global Health and Human Rights / 304H1 Biomedical Visualization / 305H1 Personalized Modern Science / 314H1 Laboratory in Human Biology / 322H1 Human Diseases in our Society / 397H1 Scientific Communication / 498Y1 Research Project in Global Health* / 499Y1 Research Project in Human Biology*; ANA300Y1 Human Anatomy and Histology / 301H1 Human Embryology, BCH311H1Biochemistry II: Nucleic Acids and Biologic Information Flow* / CSB349H1 Eukaryotic Gene Expression / PSL350H1 Mammalian Molecular Biology, BCH370H1 Laboratory Course in Biochemical Techniques, CHM310H1 Environmental Chemistry, CSB325H1 Endocrine Physiology / 327H1 Extracellular Matrix and Pathology / 328H1

Developmental Biology / 331H1 Advanced Cell Biology I: Cell Adhesion and Migration / 346H1 Neurobiology of Respiration / 347H1 Comparative Cellular Physiology / 350H1 Laboratory in Molecular Plant Biology / 351Y1 Introductory Virology, EEB318H1 Principles of Evolution / 319H1 Population Ecology / 321H1 Community Ecology* / 328H1 Physiological Ecology / 362H1 Introduction to Macroevolution / 375H1 Environmental Factors / 428H1 Global Change Ecology, ENV315H1 Chemical Analysis of Environmental Samples / 336H1 Ecology in Human-Dominated Environments / JGE347H1 Efficient Use of Energy / 348H1 Carbon-Free Energy, GGR303H1Climate-Biosphere Interactions / 305H1 Biogeography / 310H1 Cultural Biogeography / 409H1 Contaminants in the Environment, GLG351H1 Geochemical and Biological Regulation of Aqueous Systems / 450H1 Contaminant Fate and Transport in Subsurface Environments, IMM334Y1 Introductory Immunology, LMP301H1 Introduction to the Biochemistry of Human Disease / 363H1 Principles of Pathobiology, MGY377H1 Microbiology I: Bacteria, NFS382H1 Vitamin and Mineral Metabolism Throughout the Life Cycle* / 386H1 Food Chemistry / 488H1 Nutritional Toxicology*, PSL372H1 Mammalian Physiology Laboratory / 420H1 Reproduction I: Development and Function, PSY335H1 Environmental Psychology*

6. 0.5 FCE: E&H depth course JEH455H1 Current Issues in Environment and Health

*additional prerequisites required

Academic Rationale:

The Environment & Health (E&H) Major program aligns with our current E&H Specialist program (joint with Centre for the Environment). By offering priority enrolment into our E&H core and depth courses, it makes available more focused learning than is possible for students in our Human Biology Major program. As students improve their academic record, the availability of courses shared between the E&H Major and Specialist programs facilitates the E&H Major student's late-entrance into and completion of our aligned E&H Specialist Program. The availability of this new Major program targeted to the environment aligns with U of T's goal to promote this extremely important area of study.

Learning Outcomes:

In the fields of environment and health, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
  - Population, community & ecosystem environments
  - Humans impact on the environment
  - Impact of the environment on human populations
  - Human health & the environment
  - Scientific, medical, social, ethical, political & policy perspectives on environmental issues
- Describe specific techniques, and their application
  - Approaches to addressing environmental issues
  - Modelling sustainability
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives

a. Depth of Knowledge

Depth of knowledge is developed in this program by starting with broad areas of biology and chemistry, as well as geography, geology, mathematics, physics or psychology in 1st-year, and more specialized areas of life sciences more relevant to their program in 2nd and subsequent years.

In 2nd-year, students in this major gain comprehensive understanding of environment and health from all core course options: *JGE221Y1 Interdisciplinary Perspectives on the Environment*, *ENV234Y1 Environmental Biology*, and *ENV236Y1 Human Interactions with the Environment.* In JGE221Y1, students examine select environmental issues from social, ethical and biophysical perspectives. In ENV234Y1, students focus on elements from geology, systematics, soil science, and ecology to explore how humans alter environments. In ENV236Y1, students also study the impact of humans on the

environment as well as the role of the environment in shaping human behaviour. To provide more depth in four broad areas of science, students also take 200-level courses in *BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism*, introducing proteins, enzymes, membranes and metabolism or *CHM247H1 Introductory Organic Chemistry II*, studying reactions of organic compounds; *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; *BIO241H1 Cell and Developmental Biology,* focusing on the molecular aspects of cell and developmental biology; and *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis.

In 3rd-year, students study advanced subject material in specific areas of environment and health in their core course: *ENV341H1 Environment and Human Health.* In this case-based course, students apply basic principles and scientific knowledge to examine current environmental health issues from a health sciences perspective. They are required to demonstrate a command of increasingly advanced material in this 300-level course. In addition, students in the 3rd-year of this program also gain comprehensive knowledge of the functioning of the human body in *PSL302Y1 Human Physiology*. They are also required to choose a course from a large variety of 300- or 400-level science courses from Human Biology and departments in Arts & Science or Medicine (ANA, BCH, CHM, CSB, EEB, ENV, GGR, GLG, IMM, LMP, MGY, NFS, PSL, PSY) that probe increasingly advanced material in other environment- and health-related topics.

Students are required to take a 4th-year depth course (0.5 FCE) that uses scholarly material and research tools relevant to a specific topic in environment and health: *JEH455H1 Current Issues in Environment & Health*. Students explore a current and controversial case study from scientific, medical, political and policy perspectives. This year for example, the case is bisphenol A. This course includes development of a case based on a current environmental issue as well as participation in a public debate as part of the inquiry-based evaluation component.

In the field of environment and health, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. In one core 2nd-year H&E course, JGE221Y1, these skills are integral to the course. Students critique current environmental issues, and create solutions to these problems. In the 3rd-year core course and the 4th-year depth course, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (grant proposals and case studies); and presenting well-informed and well-evaluated arguments (verbal presentations and debates). Graduates of all our 4th-year courses would have successfully examined how the knowledge within specific areas of environment & health has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication

All students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. Our 3rd-year courses bridge between these advanced 4th-year requirements and the relatively minor but for many students intimidating 2nd-year communication skills. In the 2nd-year required HMB course HMB265H1, students write summaries and work every week in groups to present problems and their solutions. Exams require writing. In the 2nd-year environment courses, JGE221Y1 and ENV234Y1, students use advanced writing skills for the essay components of their evaluation.

Students have the option of taking courses that have a larger focus on communication:
HMB314H1 lab requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:
Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in our 2nd-year required course where students become familiar with using popular and scientific resources. These skills are developed at more advanced levels in the 2nd-year core courses. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In the 3rd-year core course, required information from scholarly sources and the length of each assignment are increased. By the 4th-year depth course, students are expected to effectively access and use scholarly sources, as well as critically use popular literature.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:
Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to the optional lab course.

v. Social and Ethical Responsibility:
All our graduates are expected to have internalized good ethical and social responsibility standards. *JGE221Y1 Interdisciplinary Perspectives on the Environment* was designed explicitly to raise these issues. In this course, students use social and ethical perspectives to examine environmental problems such as air pollution and climate change. In the core 3rd-year course that all E&H students take, *ENV341H1 Environment and Human Health,* social responsibility is integral to the course. Several case studies, such as the impact of the environment on children's health and the impact of urban sprawl on health, put social responsibility at the forefront. In the new course, *JEH455H1 Current Issues in Environment and Health* required in 4th-year, ethical and social perspectives were incorporated into the design. Expert guest lecturers from academia, municipal and provincial government, law associations, and the media raise social and ethical issues. Students then argue these issues in a public debate.

c. An Integrative, Inquiry-Based Activity
All our 4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. In the core 4th-year course specific to this program, JEH455H1, the assignments involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (case report) and verbal (debate) component.
In addition, students have other options for a second experience:
HMB314H1 laboratory course with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB499Y1 independent research project

Estimated Enrolment: 70 students; based on number of students applying to specialist program, current interest in the environment & health, and enrolment in JEH455H1.

Genes, Genetics and Biotechnology Major (8.0 FCE)

Non-GPA restricted.

First Year (2.5 FCE): BIO150Y1 Organisms in their Environment; CHM138H1 Introductory Organic Chemistry I, 139H1 Chemistry: Physical Principles; MAT135Y1 Calculus I/PHY131H1 Introduction to Physics I/PSY100H1Introductory Psychology

Higher Years:

1. 3.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism/CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Cell and Developmental Biology; HMB265H1 General and Human Genetics/BIO260H1 Concepts in Genetics; PSL302Y1Human Physiology/BIO251Y Biology of Plants and Micro-organisms/270H1 Animal Physiology I, 271H1 Animal Physiology II
2. 0.5 FCE: GGB core course HMB201H1 Introduction to Genes, Genetics and Biotechnology

300- & 400-level:

3. 0.5 FCE: GGB core course HMB301H1 Biotechnology/311H1 Laboratory in Genes, Genetics and Biotechnology/321H1 Topics in Genetics
4. 0.5 FCE: BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow/CSB349H1 Eukaryotic Gene Expression /PSL350H1 Mammalian Molecular Biology
5. 0.5 FCE from GGB relevant course
   HMB301H1 Biotechnology/304H1 Biomedical Visualization/305H1 Personalized Modern Science/311H1 Laboratory in Genes, Genetics and Biotechnology/314H1 Laboratory in Human Biology/321H1 Topics in Genetics/397H1 Scientific Communication/402H1 Bench to Bedside: translating lab research into clinical practice /421H1 Seminar in Genes, Genetics and Biotechnology/431H1 Biotechnology: Interface between Science & Industry/435H1 Selected Topics in Molecular Cell Biology/436H1 Human Fungal Interactions/441H1 Genetics of Human Disease/489H1 Advanced Laboratory in Human Biology/
   499Y1 Research Project in Human Biology; ANA300Y1 Human Anatomy and Histology/301H1 Human Embryology, BCB410H1 Applied Bioinformatics*, BCH370H1 Laboratory Course in Biochemical Techniques/422H1 Membrane Proteins: Structure and Function/426H1 Regulation of Signalling Pathways/440H1 Protein Biosynthesis/441H1 Bioinformatics/444H1 Protein Trafficking in the Secretory & Endocytic Pathways/445H1 Organelles and Cell Function/446H1 Cell Surface Dynamics, CSB325H1 Endocrine Physiology/327H1 Extracellular Matrix Biology and Pathology/328H1 Developmental Biology/331H1 Advanced Cell Biology I: Cell Adhesion and Migration/340H1 Plant Development/350H1 Laboratory in Molecular Plant Biology/351Y1 Introductory Virology/352H1 Bioinformatic Methods/353H1 Introduction to Plant-Microbe Interactions/428H1 Advanced Cell Biology II: Cell Polarity and Cytoskeletal Dynamics/429H1 Germ Cell Biology/435H1 Regulatory Networks and Systems in Molecular Biology/450H1 Plant Proteomics in Systems Biology/458H1 Epigenetics/459H1 Plant Molecular Biology and Biotechnology/460H1 Plant Signal Transduction/472H1 Computational Genomics and Bioinformatics/473H1 Chemical Genomics/474H1 Methods in Genomics and Proteomics/475H1 Plant Metabolomics, EEB303H1 Tropical Ecology and Evolution/318H1 Principles of Evolution/323H1 Evolutionary Genetics/331H1 Introduction to the Fungi/362H1 Introduction to Macroevolution/460H1 Molecular Evolution, FOR300H1 Forest Products in Sustainable Forestry/310H1 Bioenergy from Sustainable Forest Management/410H1 Bioenergy and Biorefinery Technology/423H1 Design and Manufacturing of Biomaterials, GGR305H1 Biogeography/310H1 Cultural Biogeography, IMM334Y1 Introductory Immunology, LMP301H1 Introduction to the Biochemistry of Human Disease/363H1 Principles of Pathobiology/404H1 Bone and Skeletal Disorders, MGY350H1 Model Org to Disease/377H1 Microbiology I: Bacteria/378H1 Microbiology II: Viruses/428H1Functional Genomics/451H1 Genetic Analysis of Development, NFS382H1 Vitamin and Mineral Metabolism Throughout the Life Cycle*/386H1 Food Chemistry/487H1 Functional Foods and Nutrigenomics*, PSL462H1 Molecular Aspects of Cardiovascular Function
6. 0.5 FCE from GGB depth course HMB421H1 Seminar in Genes, Genetics and Biotechnology/431H1 Biotechnology: Interface between Science and Industry/435H1 Selected Topics in Molecular Cell Biology/436H1 Human Fungal Interactions/441H1 Genetics of

Human Disease/HMB499Y1 Research Project in Human Biology

*additional prerequisites required

Academic Rationale:
The Genes, Genetics & Biotechnology (GGB) Major program aligns with our current GGB Specialist program. By offering priority enrolment into our GGB core and depth courses, it makes available more focused learning than is possible for students in our Human Biology Major program. As students improve their academic record, the availability of courses shared between the GGB Major and Specialist programs facilitates the GGB Major student's late-entrance into and completion of our aligned GGB Specialist Program.

Learning Outcomes:
In the fields of genes, genetics, and biotechnology, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
  - DNA to phenotype
  - Inheritance
  - Molecular & population genetics
  - Genetic variation
  - Goods & services production using living organisms
- Describe specific techniques, and their application
  - Gene isolation & manipulation
  - Molecular genetic diagnostics
  - Genetic engineering
  - Bioengineering & biotechnology
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives
a. Depth of Knowledge
Depth of knowledge is developed in this program by starting with broad areas of biology, chemistry and mathematics or physics or psychology in 1st-year, and more specialized areas of life sciences of general relevance to their program in 2nd and subsequent years (biochemistry, physiology).

Starting in 2nd-year, students are introduced to all three aspects of this major in 3 different required courses: genes from *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; genetics from *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis; and biotechnology from *HMB201H1 Introduction to Genes, Genetics, and Biotechnology,* introducing the basics, applications and social implications of biotechnology.

Students increase their depth of knowledge of gene structure and the regulation of gene expression by taking one of several 300-level courses: *BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow, CSB34H1 Eukaryotic Gene Expression*, or *PSL350H1 Mammalian Molecular Biology*. In addition, students can choose to study advanced subject material in specific areas of genes, genetics and biotechnology. They are required to demonstrate a command of increasingly advanced material in 300-level courses that probe more thoroughly into either genes and genetics (*HMB321H1 Topics in Genetics*) or biotechnology (*HMB301H1 Biotechnology)* or apply principles from both areas in the laboratory course *HMB311H1 Laboratory in Genes, Genetics, and Biotechnology*. They are also required to choose one course from a large variety of 300- or 400-level courses from Human Biology or other units in Arts & Science or Medicine (BCH, CSB, EEB, FOR, GGR, HPS, MGY, PCL, PSL) that probe increasingly advanced material in genes, genetics and biotechnology.

Students are also required to take a 4th-year course (0.5 FCE) that uses scholarly material and research tools relevant to either genes and genetics (*HMB441H1 Genetics of Human Disease*) or biotechnology (*HMB431H1 Biotechnology: Interface between Science & Industry*), or both (*HMB421H1 Seminars in Genes, Genetics & Biotechnology; HMB435H1 Selected Topics in Molecular Cell Biology, HMB436H1*

Human Fungal Interactions, HMB489H1 Advanced Laboratory in Human Biology, HMB499Y1 Research Project in Human Biology). Every 4th-year depth course includes a substantial research or inquiry-based component as part of the evaluation.

In the field of genes, genetics, and biotechnology, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. These critical and creative thinking competencies are further developed in an assignment in their other 2nd-year core course, HMB201H1. In all three core 3rd-year courses and all 4th-year depth courses, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (critical essays, grant proposals, and/or manuscript-style lab reports); and/or presenting well-informed and well-evaluated arguments (verbal and/or poster) assignments. Graduates of all our 4th-year courses would have successfully examined how the knowledge within specific areas of genes, genetics and biotechnology has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication:

All students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. Our 3rd-year courses bridge between these advanced 4th-year requirements and the relatively minor but for many students intimidating 2nd-year communication skills. In both 2nd-year required HMB courses, students write summaries. As well, in one they work in groups to make and present a poster. In the other, they work every week in groups to present problems and their solutions. Exams in both courses require writing.

Students have the option of taking courses that have a larger focus on communication:
HMB311H1 lab requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:

Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in both our 2nd-year core courses where students become familiar with using popular and scientific resources. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In 3rd-year courses, required information from scholarly sources and the length of each assignment are increased. By 4th-year, students are expected to effectively access and use scholarly sources in all courses, as well as critically use popular literature in some.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:

Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically

assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to both optional lab courses (300- and 400-level).

v. Social and Ethical Responsibility:
All our graduates are expected to have internalized good ethical and social responsibility standards. All GGB Major students are exposed to biotechnology ethics in *HMB201H1 Introduction to Genes, Genetics & Biotechnology*, and in *HMB431H1 Biotechnology: Interface Between Science & Industry* further develop the political, social and environmental consequences of industrialized biotechnology. Students can also choose the opportunity of developing medical ethics around genetic testing & counselling in *HMB321H1 Topics in Genetics*, and continue the development of these medical ethical dilemmas in *HMB441H1 Genetics of Human Disease.*

c. An Integrative, Inquiry-Based Activity
All our 4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. They all involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (e.g., critical literature review, grant proposal) or verbal (seminar, debate) component, or both.
In addition, students have other options for a second experience:
HMB311H1 laboratory course with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB489H1 advanced laboratory with independent study
HMB499Y1 independent research project

Estimated Enrolment: 100 students; based on number of students applying to specialist program, and previous enrolment in 2nd year core GGB course HMB201H1

Global Health Major (8.0 FCE)

Non-GPA Restricted

First Year (2.5 FCE): BIO150Y1 Organisms in Their Environment; CHM138H1 Introductory Organic Chemistry I, 139H1 Chemistry: Physical Principles; MAT135Y1 Calculus I/PHY131H1 Introduction to Physics I/PSY100H1Introductory Psychology

Higher Years:
1. 3.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism /CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Cell and Developmental Biology; HMB265H1 General and Human Genetics/BIO260H1 Concepts in Genetics; PSL302Y1 Human Physiology/BIO270H1 Animal Physiology I, 271H1 Animal Physiology II
2. 0.5 FCE: GH core course HMB203H1 Introduction to Global Health

300- & 400-level:
3. 0.5 FCE: GH core course HMB303H1/323H1
4. 1.0 FCE from GH relevant courses:
   HMB303H1 Global Health and Human Rights /304H1 Biomedical Visualization/305H1 Personalized Modern Science/312H1 Laboratory in Health and Disease/314H1 Laboratory in HumanBiology/323H1 Global Health Research/397H1 Scientific Communication/404H1 Biomedical Visualization II/433H1 Topics in Global Health/434H1 Complementary and Alternative Medicine/442H1 Epidemiology of Health & Disease/443H1 Global Hidden Hunger/444H1 Human Biology and Human Destiny: Science, Popular Science and Science Fiction/473H1 Exercise and Mental Health/498Y1 Research Project in Global Health/HAJ453H1AIDS: A Global Perspective, ANA300Y1Human Anatomy and Hisotlogy/301H1 Human Emryology; BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow /CSB349H1 Eukaryotic Gene Expression /PSL350H1 Mammalian Molecular Biology; BCH370H1 Laboratory Course in Biochemical Techniques, CSB325H1 Endocrine Physiology /327H1 Extracellular Matrix Biology and Pathology/328H1 Developmental

Biology/330H1 Techniques in Molecular, Cellular and Developmental Biology/331H1 Advanced Cell Biology I: Cell Adhesion and Migration/346H1 Neurobiology of Respiration/351Y1 Introductory Virology/431H1 Evolution of Development/483H1 Developmental Biology Seminar I, EEB318H1 Principles of Evolution/319H1 Population Ecology/321H1 Community Ecology*/328H1 Physiological Ecology/362H1 Introduction to Macroevolution/375H1 Environmental Factors/428H1 Global Change Ecology/460H1 Molecular Evolution, IMM334Y1 Introductory Immunology, LMP301H1 Introduction to the Biochemistry of Human Disease/363H1 Principles of Pathobiology/404H1 Bone and Skeletal Disorders/406H1 Pathobiology of the Cardiovascular System, MGY350H1 Model Org to Disease*/377H1 Microbiology I: Bacteria/378H1 Microbiology II: Viruses*, NFS382H1Vitamin and Mineral Metabolism Throughout the Life Cycle*/386H1 Food Chemistry/487H1 Functional Foods and Nutrigenomics*, PCL389H1 Pharmacology & Toxicology in Society*, PHC320H1Medicinal Chemistry*, PSL372H1 Mammalian Physiology Laboratory/420H1 Reproduction I: Development and Function/421H1 Reproduction II: Pregnancy and Birth, PSY321H1 Cross-Cultural Psychology*

5. 0.5 FCE from GH depth course HMB433H1 Topics in Global Health/434H1 Complementary and Alternative Medicine/443H1 Global Hidden Hunger/498Y1 Research Project in Global Health/HAJ453H1AIDS: A Global Perspective

*additional prerequisites required

Academic Rationale:

The Global Health (GH) Major program aligns with our current GH Specialist program. By offering priority enrolment into our GH core and depth courses, it makes available more focused learning than is possible for students in our Human Biology Major program. As students improve their academic record, the availability of courses shared between the GH Major and Specialist programs facilitates the GH Major student's late-entrance into and completion of our aligned GH Specialist Program.

Learning Outcomes:

In the fields of global health, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
  - The determinants of health and the major forces including natural, educational, cultural, economic, social and technological that influence health,
  - Health systems,
  - Unique features of woman and child health, infectious diseases and non communicable diseases,
  - Human rights and health.
- Demonstrate an in depth understanding of global health problems such as
  - HIV/AIDS,
  - Hunger,
  - Current global environmental issues.
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives:

a. Depth of Knowledge

Depth of knowledge is developed in this program by starting with broad areas of biology, chemistry and mathematics or physics or psychology in 1st-year, and more specialized areas of life sciences of general relevance to their program in 2nd and subsequent years.

In 2nd-year, students in this major gain comprehensive understanding of global health from their core course *HMB203H1 Introduction to Global Health.* In this course, students gain a global perspective on health and medicine, and begin to develop an understanding of the natural, political, economic, social and technological forces that influence health. To provide more depth in four broad areas of science, students also take 200-level courses in *BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism*, introducing proteins, enzymes, membranes and metabolism or *CHM247H1 Introductory Organic Chemistry II*,

studying reactions of organic compounds; *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; *BIO241H1 Cell and Developmental Biology,* focusing on the molecular aspects of cell and developmental biology; *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis; and human (*PSL302Y1*) or animal (*BIO270H1, 271H1*) physiology.

In 3rd-year, students study advanced subject material in specific areas of global health in one of two human biology courses in global health: *HMB303H1 Global Health & Human Rights* and *HMB323H1 Global Health Research.* They are required to demonstrate a command of increasingly advanced material in these 300-level courses that probe more thoroughly into either the theoretical framework on which the distinct elements of human rights, health and the right to health can be understood or current global health research advances and approaches. They are also required to choose two courses from a large variety of 300- or 400-level courses from Human Biology or other units in Arts & Science or Medicine (ANA, BCH, CSB, EEB, IMM, LMP, MGY, NFS, PCL, PHC, PSL, PSY) that probe increasingly advanced material in global- and health-related issues.

Students are also required to take a 4th-year course (0.5 FCE) that uses scholarly material and research tools relevant to global health. We provide a menu of such courses. Some are seminar based (*HMB433H1 Topics in Global Health; HAJ453H1 Aids: A Global Perspective*); some lecture based (*HMB434H1 Complementary & Alternative Medicine; HMB443H1 Global Hidden Hunger);* and one is based on a research project (*HMB498Y1 Research Project in Global Health).* Every course includes a substantial research or inquiry-based component as part of the evaluation.

In the field of global health, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. These critical and creative thinking competencies are further developed in assignments in their 2nd-year core course, HMB203H1. In both core 3rd-year courses and all 4th-year depth courses, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (critical essays, grant proposals, and/or manuscript-style lab reports); and/or presenting well-informed and well-evaluated arguments (verbal and/or poster) assignments. Graduates of all our 4th-year courses would have successfully examined how the knowledge within specific areas of global health has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication:

All students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. Our 3rd-year courses bridge between these advanced 4th-year requirements and the relatively minor but for many students intimidating 2nd-year communication skills. In both 2nd-year required HMB courses, students write summaries and work every week in groups to present problems and their solutions. Exams in both courses require writing.

Students have the option of taking courses that have a larger focus on communication:
HMB312H1 and HMB314H1 labs requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)

HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:
Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in both our 2nd-year required courses where students become familiar with using popular and scientific resources. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In 3rd-year courses, required information from scholarly sources and the length of each assignment are increased. By 4th-year, students are expected to effectively access and use scholarly sources in all courses, as well as critically use popular literature in some.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:
Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to both optional lab courses (300-level) and the research project (400-level).

v. Social and Ethical Responsibility:
All our graduates are expected to have internalized good academic ethical and social responsibility standards. In our core GH 2nd-year course, *HMB203H1 Introduction to Global Health*, all students gain social and ethical perspective on health and medicine from lectures and inquiry-based processes. In 3rd-year, majors take one of 2 core courses, both of which have significant levels of social and ethical responsibility embedded. *HMB303H1 Global Health & Human Rights* is a case-based course that integrates the social determinants of health and human rights. In *HMB323H1 Global Health Research*, students learn about social responsibility as they develop global health research skills and an appreciation for health as a responsibility shared worldwide. In all 4th-year GH depth courses, social responsibility is integral to content learning. In *HMB443H1 Global Hidden Hunger*, an internationalized course module with Dr. Richard Lee studying nutrition in Belize is available which embodies social responsibility.

c. An Integrative, Inquiry-Based Activity
All our 4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. They all involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (e.g., critical literature review, grant proposal) or verbal (seminar, debate) component, or both.
In addition, students have other options for a second experience:
HMB312H1/314H1 laboratory courses with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB489H1 advanced laboratory with independent study
HMB498Y1 global health independent research project

Estimated Enrolment: 100 students; based on number of students applying to specialist program, and previous enrolment in 3rd year core GH course HMB303H1

Health and Disease Major (8.0 FCE)

Non-GPA Restricted

First Year (2.5 FCE): BIO150Y1 Organisms in their Environment; CHM138H1 Introductory Organic Chemistry I, 139H1 Chemistry: Physical Principles; MAT135Y1 Calculus I /PHY131H1 Introduction to Physics I /PSY100H1 Introductory Psychology

Higher Years:

1. 3.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism /CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Cell and Developmental Biology; HMB265H1 General and Human Genetics /BIO260H1 Concepts in Genetics; PSL302Y1 Human Physiology /BIO270H1 Animal Physiology I, 271H1 Animal Physiology II
2. 0.5 FCE: H&D core course HMB202H1Introduction to Health and Disease

300- & 400-level:

3. 0.5 FCE: H&D core course HMB302H1 Vertebrate Histology and Histopathology/312H1 Laboratory in Health and Disease /314H1 Laboratory in Human Biology/322H1 Human Diseases in our Society
4. 1.0 FCE H&D-relevant courses:
   HMB302H1 Vertebrate Histology and Histopathy/304H1 Biomedical Visualization/305H1 Personalized Modern Science/306H1 Epistemological Ethics in Modern Science/312H1 Laboratory in Health and Disease/314H1 Laboratory in Human Biology/322H1 Human Diseases in our Society/397H1 Scientific Communication/402H1 Bench-to-bedside: Translating Lab Research into Clinical Practice/404H1 Biomedical Visualization 2/406H1 Health Care Ethics/422H1 Seminar in Health and Disease/432H1 Topics in Histology and Histopathology/434H1 Complementary and Alternative Medicine/435H1 Selected Topics in Molecular Cell Biology/436H1 Human Fungal Interactions/440H1 Dementia/441H1 Genetics of Human Disease/442H1 Epidemiology of Health & Disease/443H1 Global Hidden Hunger/470H1 Exercise and Sports Medicine/471H1 Performance Enhancement/472H1 Exercise Physiology/473H1 Exercise and Mental Health/489H1 Advanced Laboratory in Human Biology/499H1 Research Project in Human Biology/HAJ453H1 AIDS: A Global Perspective; ANA300Y1 Human Anatomy and Histology/301H1 Human Embryology; BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow/CSB349H1 Eukaryotic Gene Expression /PSL350H1 Mammalian Molecular Biology; BCH370H1 Laboratory Course in Biochemical Techniques/426H1 Regulation of Signalling Pathways*/441H1 Bioinformatics*/444H1 Protein Trafficking in the Secretory & Endocytic Pathways*/446H1 Cell Surface Dynamics*, CSB325H1 Endocrine Physiology/327H1 Extracellular Matrix Biology and Pathology/328H1 Developmental Biology/330H1 Techniques in Molecular, Cellular and Developmental Biology /331H1 Advanced Cell Biology I: Cell Adhesion and Migration/332H1 Neurobiology of the Synapse/346H1 Neurobiology of Respiration/347H1 Comparative Cellular Physiology/351Y1 Introductory Virology/352H1 Bioinformatic Methods/431H1 Evolution of Development/435H1 Regulatory Networks and Systems in Molecular Biology/472H1 Computational Genomics and Bioinformatics/473H1 Chemical Genomics/483H1 Developmental Biology Seminar I, EEB318H1 Principles of Evolution/323H1 Evolutionary Genetics/331H1 Introduction to the Fungi/375H1 Environmental Factors/460H1 Molecular Evolution/461H1 Advanced Evolutionary Genomics, IMM334Y1Introductory Immunology, LMP301H1 Introduction to the Biochemistry of Human Disease/363H1 Principles of Pathobiology/404H1 Bone and Skeletal Disorders/406H1 Pathobiology of the Cardiovascular System/412H1 Pathobiology of the Lymphatic System, MGY350H1 Model Org to Disease*/377H1 Microbiology I: Bacteria/378H1Microbiology II: Viruses*, NFS382H1 Vitamin and Mineral Metabolism Throughout the Life Cycle*/386H1 Food Chemistry/486H1 Nutrition and Human Disease*, PCL389H1 Pharmacology and Toxicology in Society*, PHC320H1 Medicinal Chemistry*, PSL372H1 Mammalian Physiology Laboratory/420H1 Reproduction I: Development and Function/421H1Reproduction II: Pregnancy and Birth/425H1 Integrative Metabolism and its Endocrine Regulation/470H1 Cardiovascular Physiology/472H1 Sleep Physiology and Chronobiology, PSY333H1 Health Psychology*/341H1 Psychopathologies of Childhood*
5. 0.5 FCE H&D depth course: HMB402H1 Bench-to-bedside: Translating Lab Research into Clinical Practice/422H1 Seminar in Health and Disease/432H1 topics in Histology and Histopathology/440H1 Dementia/442H1 Epidemiology of Health & Disease/470H1 Exercise

and Sports Medicine/471H1 Performance Enhancement/472H1 Exercise Physiology/473H1 Exercise and Mental Health/HMB499Y1 Research Project in Human Biology

*additional prerequisites required

Academic Rationale:
The Health & Disease (H&D) Major program aligns with our current H&D Specialist program. By offering priority enrolment into our H&D core and depth courses, it makes available more focused learning than is possible for students in our Human Biology Major program. As students improve their academic record, the availability of courses shared between the H&D Major and Specialist programs facilitates the H&D Major student's late-entrance into and completion of our aligned H&D Specialist Program.

Learning Outcomes:
In the fields of health and disease, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
    - Molecular, cellular, tissues, organs to whole organisms
    - General physiology and pathobiology
    - Inheritance
    - Basic Medical Science
    - Interdisciplinary healthcare practices
- Describe specific techniques and their application
    - Basic microbiology identification
    - Histology and histopathology: structure and functional identification
    - Immunohistochemistry for the identification of human disease
    - Microarray analysis for health and disease states
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives:
a. Depth of Knowledge
Depth of knowledge is developed in this program by starting with broad areas of biology, chemistry and mathematics or physics or psychology in 1st-year, and more specialized areas of life sciences more relevant to their program in 2nd and subsequent years.

In 2nd-year, students in this major gain comprehensive understanding of health and disease from their core course *HMB202H1 Introduction to Health & Disease.* In this course, students become familiar with central components of human health and disease from a bio-cultural and evolutionary perspective. Learning is enhanced with self-directed research projects and an introductory laboratory. To provide more depth in four broad areas of science, students also take 200-level courses in *BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism*, introducing proteins, enzymes, membranes and metabolism or *CHM247H1 Introductory Organic Chemistry II*, studying reactions of organic compounds; *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; *BIO241H1 Cell and Developmental Biology,* focusing on the molecular aspects of cell and developmental biology; *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis; and human (*PSL302Y1*) or animal (*BIO270H1, 271H1*) physiology.

In 3rd-year, students study advanced subject material in specific areas of health and disease in one of several human biology program-specific courses: *HMB302H1 Vertebrate Histology and Histopathology,* exploring the functional morphology and the adaptive response at the level of cells, tissues and organs; *HMB312H1 Laboratory in Health and Disease,* applying relevant, current research techniques in biomedical experiments*;* and *HMB322H1 Human Diseases in Our Society*, focusing on a multi-disciplinary approach to several diseases, and including a health care professional shadowing experience. They are required to demonstrate a command of increasingly advanced material in these 300-level courses. They are also required to choose two courses from a large variety of 300- or 400-level courses from Human Biology or from departments in Arts & Science or Medicine (ANA, BCH, CSB, EEB, IMM, LMP, MGY, NFS, PCL, PHC, PSL, PSY) that probe increasingly advanced material in other health- and disease-related topics.

Students are also required to take a 4th-year depth course (0.5 FCE) that uses scholarly material and research tools relevant to a specific topic in health and disease. We provide a menu of such courses. They focus on a specific aspect of disease (*HMB402H1 Bench-to-bedside: translating lab research into clinical practice; HMB440H1 Dementia; and HMB473H1 Exercise and Mental Health*); a specific health topic (*HMB471H1 Performance Enhancement; HMB472H1 Exercise Physiology*); or integrate both areas of this major (*HMB422H1 Seminar in Health and Disease; HMB432H1 Topics in Histology and Histopathology; HMB442H1 Epidemiology of Health & Disease; HMB470H1 Exercise and Sports Medicine*). Every course includes a substantial research or inquiry-based component as part of the evaluation.

In the field of health and disease, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. These critical and creative thinking competencies are further developed in lab assignments in their 2nd-year core course, HMB202H1. In all three core 3rd-year courses and all 4th-year depth courses, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (critical essays, grant proposals, and/or manuscript-style lab reports); and/or presenting well-informed and well-evaluated arguments (verbal and/or poster) assignments. Graduates of all our 4th-year courses would have successfully examined how the knowledge within specific areas of health and disease has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication:

All students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. Our 3rd-year courses bridge between these advanced 4th-year requirements and the relatively minor but for many students intimidating 2nd-year communication skills. In the 2nd-year required HMB course HMB265H1, students write summaries and work every week in groups to present problems and their solutions. Exams require writing. Written work is also part of the 2nd-year core course.

Students have the option of taking courses that have a larger focus on communication:
HMB312H1/314H1 lab requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:

Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in both our 2nd-year required courses where students become familiar with using popular and scientific resources. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In 3rd-year courses, required information from scholarly sources and the length of each assignment are increased. By 4th-year, students are expected to effectively access and use scholarly sources in all courses, as well as critically use popular literature in some.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:
Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to optional lab courses (300- and 400-level).

v. Social and Ethical Responsibility:
All our graduates are expected to have internalized good ethical and social responsibility standards. All H&D Major students are exposed to medical ethics in *HMB202H1 Introduction to Health & Disease.* Problems such as genetic screening, informed consent, withholding treatment and reproductive technology are integrated into assignments and lecture material. Specific social and ethical responsibilities are further explored in all three 300-level courses: stem cells in *HMB302H1 Vertebrate Histology and Histopathology*; representation of data and full disclosure in *HMB312H1 Laboratory in Health and Disease*; and interprofessional health care practice in *HMB322H1 Human Disease in Our Society.* In HMB322H1, students also develop social responsibility while shadowing health care professionals. In all seven 4th-year depth courses that study disease, the social and ethical responsibilities of clinical care are integrated. In two 4th-year depth courses, HMB440H1 and HMB473H1, service learning components that increase social responsibility are integral to the course goals.

c. An Integrative, Inquiry-Based Activity
All our 4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. They all involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (e.g., critical literature review, grant proposal) or verbal (seminar, debate) component, or both.
In addition, students have other options for a second experience:
HMB312H1/314H1 laboratory course with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB489H1 advanced laboratory with independent study
HMB499Y1 independent research project

Estimated Enrolment: 200 students; based on number of students applying to specialist program, and previous enrolment in 2nd year core H&D course HMB202H1

Health Care Ethics Major (8.0 FCE)

Non-GPA Restricted

First Year (2.5 FCE): BIO150Y1 Organisms in their Environment; CHM138H1 Introductory Organic Chemistry I, 139H1 Chemistry: Physical Principles; MAT135Y1 Calculus I /PHY131H1 Introduction to Physics I /PSY100H1 Introductory Psychology

Higher Years:
1. 3.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism /CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Cell and Developmental Biology; HMB265H1 General and Human Genetics /BIO260H1 Concepts in Genetics; PSL302Y1 Human Physiology /BIO270H1 Animal Physiology I, 271H1 Animal Physiology II
2. 0.5 FCE: HCE core course PHL281H1 Bioethics/275H1 Introduction to Ethics/HPS250H1 Introduction to Philosophy of Science
300- & 400-level:
3. 0.5 FCE: HCE core course HMB306H1 Epistemological Ethics in Medicine
4. 0.5 FCE: HCE relevant humanities course PHL380H1 Global Bioethics/381H1 Ethics and Medical Research/382H1 Ethics: Death and Dying/383H1 Ethics and Mental Health/384H1 Ethics, Genetics and Reproduction, HPS300H1 Topics in History and Philosophy of Science and

Technology/318H1 History of Medicine I/319H1 History of Medicine II

5. 0.5 FCE: HCE relevant science course
   HMB303H1 Global Health and Human Rights/305H1 Personalized Modern Science/314H1 Laboratory in Human Biology/322H1 Human Diseases in our Society/397H1 Scientific Communication/402H1 Bench-to-bedside: Translating Lab Research into Clinical Practice/422H1 Seminar in Health and Disease/432H1 Topics in Histology and Histopathology/434H1 Complementary and Alternative Medicine/440H1 Dementia/442H1 Epidemiology of Health and Disease/444H1 Human Biology and Human Destiny: Science, Popular Science and Science Fiction/
   JEH455H1 Current Issues in Environment and Health/470H1 Exercise and Sports Medicine /471H1 Performance Enhancement/472H1 Exercise Physiology/473H1 Exercise and Mental Health/499H1 Research Project in Human Biology*, ANA300Y1 Human Anatomy and Histology/301H1 Human Embryology, BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow/CSB349H1 Eukaryotic Gene Expression/PSL350H1 Mammalian Molecular Biology, BCH370H1 Laboratory Course in Biochemical Techniques, CSB325H1 Endocrine Physiology/327H1 Extracellular Matrix Biology and Pathology/328H1 Developmental Biology/331H1 Advanced Cell Biology I: Cell Adhesion and Migration/346H1 Neurobiology of Respiration/351Y1 Introductory Virology, EEB318H1 Principles of Evolution/319H1 Population Ecology/321H1 Community Ecology, IMM334Y1 Introductory Immunology, LMP301H1 Introduction to the Biochemistry of Human Disease, NFS382H1 Vitamin and Mineral Metabolism Throughout the Life Cycle*/386H1 Food Chemistry/490H1 International and Community Nutrition*, PSL372H1 Mammalian Physiology Laboratory/420H1 Reproduction I: Development and Function, PSY314H1 Moral Development/370H1 Thinking and Reasoning
6. 0.5 FCE: HCE depth course HMB406H1 Health Care Ethics

*additional prerequisites required

Academic Rationale:

The Health Care Ethics (HCE) Major program embodies the competency for Social and Ethical Responsibility recommended by the CRRC. It provides our science students the option of a Major program in the area of ethics applied to clinical care. It makes available more focused medical ethical learning than is possible for students in our Human Biology Major program who currently are restricted to few and overly subscribed courses offered primarily by the Department of Philosophy. The program will be instrumental in developing values of academic and personal integrity in many students whose priority is to enter a health care profession.

Learning Outcomes

In the fields of health care ethics, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
  - Moral and legal dilemmas in medical practice
  - Ethical issues in biomedical research
  - Knowledge acquisition, claims and implementation
  - Standards of proof and regulatory processes
  - Health policy development
  - Academic & personal integrity
- Describe and use specific techniques
  - Critical reflection
  - Judgment and value development
  - Discussion and argument
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives:

a. Depth of Knowledge

Depth of knowledge is developed in this program by starting with broad areas of biology, chemistry and mathematics or physics or psychology in 1st-year, and more specialized areas of life sciences more relevant to their program in 2nd and subsequent years.

In 2nd-year, students in this major gain comprehensive understanding of health care ethics from all core course options: *PHL281H1 Bioethics*, *PHL275H1 Introduction to Ethics*, and *HPS250H1 Introductory Philosophy of Science*. In PHL281H1, students study moral and legal issues associated with clinical practice (e.g., patient rights), biomedical research (e.g., human subjects) and health policy (e.g., euthanasia). In PHL275H1, students are introduced to major ethical issues, such as the nature of moral judgements. In HPS250H1, they explore central issues in the philosophy of science, including scientific inference, method, and explanation. To provide more depth in four broad areas of science, students also take 200-level courses in *BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism*, introducing proteins, enzymes, membranes and metabolism or *CHM247H1 Introductory Organic Chemistry II*, studying reactions of organic compounds; *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; *BIO241H1 Cell and Developmental Biology,* focusing on the molecular aspects of cell and developmental biology; *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis; and human (*PSL302Y1*) or animal (*BIO270H1, 271H1*) physiology.

In 3rd-year, students study advanced subject material in a specific area of health care ethics in their core course: *HMB306H1 Epistemological Ethics in Medicine*. This course focuses on non-bioethical problems in biomedical sciences (e.g., knowledge acquisition and claims, standards of proof, regulatory processes). These issues involving the practice of science affect decisions in medicine most often when the negative impact of a disease on health is high. Students also explore other ethical issues in medicine and science as they choose one such course offered by the Department of Philosophy or the Institute for the History and Philosophy of Science and Technology. They are required to demonstrate a command of increasingly advanced material in these 300-level courses. They are also required to choose a course from a large variety of 300- or 400-level science courses from Human Biology and departments in Arts & Science or Medicine (ANA, BCH, CSB, EEB, IMM, LMP, MGY, NFS, PSL, PSY) that probe increasingly advanced material in other health and health-care related topics.

Students are required to take a 4th-year depth course (0.5 FCE) that uses scholarly material and research tools relevant to a specific topic in health care ethics: *HMB406H1 Health Care Ethics*. Health care ethics, central to quality care, encompasses the ethical issues of every patient contact as well as rare ethical problems. Ethical principles are presented in the context of specific clinical cases. Ethical judgment develops as students engage in discussion using common frameworks and arguments to resolve specific cases.

In the field of health care ethics, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. These critical and creative thinking competencies are further developed in their other 2nd-year core courses. In the core 3rd-year and 4th-year depth courses, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (e.g., critical essays); and presenting well-informed and well-evaluated arguments. Graduates of our 4th-year HCE course would have successfully examined how the knowledge within specific areas of health care ethics has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication:

All students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively

using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. Our 3rd-year courses bridge between these advanced 4th-year requirements and the introductory 2nd-year communication skills in the required HMB265H1 course and the more developed skills in the core courses.

Students have the option of taking courses that have a larger focus on communication:
HMB312H1/314H1 lab requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:
Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in our 2nd-year required course where students become familiar with using popular and scientific resources. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In the 3rd-year core course, required information from scholarly sources and the length of each assignment are increased. By the 4th-year depth course, students are expected to effectively access and use scholarly sources, as well as critically use popular literature.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:
Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to the optional lab course.

v. Social and Ethical Responsibility:
All our graduates are expected to have internalized good ethical and social responsibility standards. Our HCE Major students will have studied these aspects in great depth in core courses devoted to these responsibilities in 2nd- (*PHL281H1 Bioethics*, *PHL275H1 Introduction to Ethics*, and *HPS250H1 Introductory Philosophy of Science)*, 3rd- (*HMB306H1 Epistemological Ethics in Medicine*) and 4th-year (HMB*406H1 Health Care Ethics*). Their expertise will encompass these responsibilities in clinical practice and medical research.

c. An Integrative, Inquiry-Based Activity
All our 4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. They all involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (e.g., critical literature review, grant proposal) or verbal (seminar, debate) component, or both.
In addition, students have other options for a second experience:
HMB312H1/314H1 laboratory course with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB499Y1 independent research project

Estimated Enrolment: 70, based on Human Biology Major students currently in PHL281H1, and expressed interest in this new program

Neuroscience Major (8.0 FCE)

Non-GPA Restricted

First Year (3.0 FCE): BIO150Y1 Organisms in their Environment; CHM138H1 Introductory Organic Chemistry I, 139H1 Chemistry: Physical Principles; MAT135Y1 Calculus I /PHY131H1 Introduction to Physics I; PSY100H1 Introductory Psychology

Higher Years:

1. 2.0 FCE: BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism /CHM247H1 Introductory Organic Chemistry II; BIO240H1 Molecular Biology, 241H1 Cell and Developmental Biology; HMB265H1 General and Human Genetics /BIO260H1 Concepts in Genetics
2. 0.5 FCE: NRS core course HMB200H1Introduction to Neuroscience/204H1 Introduction to Human Behavioural Biology
3. 0.5 FCE from 200-series PSY course

300- & 400-level:

4. 0.5 FCE: NRS core course HMB300H1 Human Behavioural Biology/310H1 Laboratory in Neuroscience/320H1 Neuroanatomy
5. 0.5 FCE: PSL300H1 Human Physiology
6. 0.5 FCE from NRS relevant course
   HMB300H1 Human Behavioural Biology /310H1 Laboratory in Neuroscience/320H1 Neuroanatomy/397H1 Scientific Communication/400Y1 Project in Neuroscience/420H1 Seminar in Human Behavioural Science/430H1 Trends in Neuroscience/440H1 Dementia/471H1 Performance Enhancement/473H1 Exercise and Mental Health/489H1 Advanced Laboratory in Human Biology; ANA300Y1 Human Anatomy and Histology/301H1 Human Embryology, BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow/CSB349H1 Eukaryotic Gene Expression/PSL350H1 Mammalian Molecular Biology, BCH446H1 Cell Surface Dynamics, CSB325H1 Endocrine Physiology/328H1 Developmental Biology/332H1 Neurobiology of the Synapse/346H1 Neurobiology of Respiration/347H1 Comparative Cellular Physiology/425H1 Endocrinology of Transformation/428H1 Advanced Cell Biology II: Cell Polarity and Cytoskeletal Dynamics/430H1 Developmental Neurobiolgy/445H1 Biology of Sleep, EEB322H1 Behaviour and Behavioural Ecology*; JLP315H1 Language Acquisition; LMP410H1 Pathobiology of Neurodegenerative Disease, NFS489H1 Nutritional Neurosciences*, PCL475Y1 Neuropsychopharmacology, PSL372H1 Mammalian Physiology Laboratory/432H1 Theoretical Physiology/440Y1 Neuroscience I: Systems and Behaviour/443H1 Motor Control Systems/444Y1 Neuroscience II: Cellular and Molecular/452H1 Membrane Physiology/472H1 Sleep Physiology and Chronobiology, PSY 300-series*/397H1 Biological Rhythms/460H1* Learning Seminar/470H Memory Seminar*
7. 0.5 FCE from NRS depth course HMB400Y1Project in Neuroscience/420H1 Seminar in Human Behavioural Biology/430H1 Trends in Neuroscience/440H1 Dementia/471H1 Performance Enhancement/473H1 Exercise and Mental Health, CSB425H1 Endocrinology of Transformation/428H1Advanced Cell Biology II: Cell Polarity and Cytoskeletal Dynamics/430H1 Developmental Neurobiology/445H1 Biology of Sleep, PSL432H1 Theoretical Physiology/452H1 Membrane Physiology/472H1 Sleep Physiology and Chronobiology, PSY460H1 Learning Seminar*/470H Memory Seminar*/497H1 Advanced Topics in Biological Rhythms*

*additional prerequisites required

Academic Rationale:

The Neuroscience (NRS) Major program aligns with our current NRS Specialist program. By offering priority enrolment into our NRS core and depth courses, it makes available more focused learning than is possible for students in our Human Biology Major program. This opportunity to belong to a Major in a specific area of interest in the broad area of Human Biology not only increases depth of learning, but is also likely to motivate students to learn. As students improve their academic record, the availability of courses shared between the NRS Major and Specialist programs facilitates the NRS Major student's late-entrance into and completion of our aligned NRS Specialist Program.

Learning Outcomes:

In the fields of neuroscience, graduates of this program will be able to

- Describe general concepts, illustrating with concrete examples
    - Anatomy, physiology, development & evolution of brain systems
    - Human & animal behaviour
    - Learning
    - Memory
    - Neurodegenerative disease
- Describe specific techniques, and their application
    - Brain imaging
    - Immunocytochemistry
    - Neuropharmacology
    - Gene manipulation, analysis & targeting
    - Animal behaviour (e.g., startle reflex)
- Apply these basic principles to solve specific problems/issues
- Analyze both current and historical original literature
- Evaluate on the basis of scientific, ethical, socioeconomic, and legal grounds
- Formulate new proposals to address significant outstanding questions

Degree Objectives

a. Depth of Knowledge

Depth of knowledge is developed in this program by starting with broad areas of biology, chemistry, psychology, and mathematics or physics in 1st-year, and more specialized areas of life sciences more relevant to their program in 2nd and subsequent years.

In 2nd-year, students in this major gain comprehensive understanding of neuroscience from both choices of core course: *HMB200H1 Introduction to Neuroscience* and *HMB204H1 Introduction to Human Behavioural Biology.* In HMB200H1, students become familiar with brain systems and techniques for their study. In HMB204H1, students explore the biology of selected types of human behaviour. The topics chosen represent areas where recent understanding has dramatically shifted or where controversies still exist. To provide more depth in four broad areas of science, students also take 200-level courses in *BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism*, introducing proteins, enzymes, membranes and metabolism or *CHM247H1 Introductory Organic Chemistry II*, studying reactions of organic compounds; *BIO240H1 Molecular Biology,* introducing the flow of information form DNA to cell function; *BIO241H1 Cell and Developmental Biology,* focusing on the molecular aspects of cell and developmental biology; and *HMB265H1 General and Human Genetics*, introducing classic and modern methods of genetic analysis.

In 3rd-year, students study advanced subject material in specific areas of neuroscience in one of several human biology program-specific courses: *HMB300H1 Human Behavioural Biology,* exploring in depth the higher brain functions and mechanisms underlying human and animal behaviours; HMB310H1 Laboratory in Neuroscience, applying relevant, current research techniques in neuroscience*;* and *HMB320H1 Neuroanatomy*, a rigorous, introductory course that presents the functional and comparative anatomy of the vertebrate brain. They are required to demonstrate a command of increasingly advanced material in these 300-level courses. They are also required to choose one course from a large variety of 300- or 400-level courses from Human Biology or from departments in Arts & Science or Medicine (ANA, BCH, CSB, EEB, LMP, NFS, PCL, PSL, PSY) that probe increasingly advanced material in other neuroscience-related topics.

Neuroscience Major students are required to take a 4th-year depth course (0.5 FCE) that uses scholarly material and research tools relevant to a specific topic in neuroscience. A large menu of such courses is available. These course offerings provide neuroscience perspectives from human biology, cell and systems biology, physiology and psychology. Courses include a substantial research or inquiry-based component as part of the evaluation.

In the field of neuroscience, graduates of this program will be able to

- understand historical and current advanced subject material
- access, evaluate and synthesize original literature
- write and present a substantial research or inquiry-based work including critical literature reviews/grant proposals/laboratory, case & research reports
- apply concepts to solve challenging issues

b. Competencies

i. Critical and Creative Thinking:

All students in this Major program are required to take a 2nd-year course, HMB265H1, that integrates problem-solving and application in weekly tutorials. Students in this course are also required to analytically read and synthesize information from their textbook and a small amount of original literature. These critical and creative thinking competencies are further developed in assignments in their 2nd-year core course, HMB202H1. In all three core 3rd-year courses and 4th-year depth courses, students extend these competencies following year-specific goals: reading analytically (more original literature); writing analytically, synthesizing new and published ideas (critical essays, grant proposals, and/or manuscript-style lab reports); and/or presenting well-informed and well-evaluated arguments (verbal and/or poster) assignments. Graduates of 4th-year courses would have successfully examined how the knowledge within specific areas of neuroscience has been generated, the questions posed, and the evidence for new ideas generated. In addition, all students would have had to extrapolate to and justify new ideas and theories.

ii. Communication:

Students participate in developing communication skills in every Human Biology course. We have structured our courses so that these science students develop this competency gradually throughout each program. By 4th-year, our students need to be able to express their scientific knowledge effectively using multiple venues. Student evaluation relies on written and verbal critical literature reviews, grant proposals, debates, case studies and lab reports. 3rd-year courses bridge between these advanced 4th-year requirements and the relatively minor but for many students intimidating 2nd-year communication skills. In the 2nd-year required HMB course HMB265H1, students write summaries and work every week in groups to present problems and their solutions. Exams require writing. In the 2nd-year NRS core course, HMB204H1, use their developing communication skills in multiple presentations and written assignments. Students have the option of taking courses that have a larger focus on communication:
HMB310H1 lab requiring multiple individual lab reports in manuscript format (focus on different parts of paper early in course)
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iii. Information Literacy:

Students are required to independently and in groups become familiar with and appropriately use multiple types of sources. Information literacy is first introduced in both our 2nd-year required courses where students become familiar with using popular and scientific resources. These students are required to find, evaluate, synthesize and present knowledge in short written and verbal assignments. In 3rd-year courses, required information from scholarly sources and the length of each assignment are increased. By 4th-year, students are expected to effectively access and use scholarly sources in all courses, as well as critically use popular literature in some.

Students have the option of taking a course that has a larger focus on information literacy:
HMB397H1 scientific communication course (develop reading, speaking, and writing skills using multiple sources/formats)

iv. Quantitative Reasoning:

Most of our students improve their quantitative reasoning during 1st-year by choosing introductory math or physics. Students are expected to have developed their quantitative reasoning so that they can critically assess original scientific literature minimally in 2nd-year, at an intermediate level in 3rd-year, and effectively enough that it is usually their exclusive source of written knowledge in 4th-year. In our required 2nd-year course HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. The evaluation in this required course relies heavily on solving quantitative problems. Quantitative reasoning is also integral to optional lab courses (300- and 400-level).

v. Social and Ethical Responsibility:

All our graduates are expected to have internalized good ethical and social responsibility standards. In one of the two core NRS 2nd-year courses, ethical issues are addressed in debates of current controversies in human behavioural biology. In two HMB depth 4th-year courses, HMB440H1 and HMB473H1, service learning components that increase social responsibility are integral to the course goals.

c. An Integrative, Inquiry-Based Activity

4th-year courses include a required integrative, inquiry-based learning component. These capstone assignments are integral to each course. They involve substantial searching and synthesis of the original literature, as well as dissemination that includes a written (e.g., critical literature review, grant proposal) or verbal (seminar, debate) component, or both. In addition, students have other options for a second experience:

HMB310H1 laboratory course with significant individual project work
HMB397H1 scientific communication course with individual mentored literature review or grant proposal
HMB400Y1 independent research project
HMB489H1 advanced laboratory with independent study

Estimated Enrolment: ~200 students (based on popularity of request for NRS specialist program; enrolment in HMB204H, A NRS course prioritized for HMB majors)

Department of Immunology

Immunology is an integrative branch of the medical sciences that draws upon the more traditional disciplines of Molecular Biology, Microbiology, Pathology, and Biochemistry. It is the study of the physiological responses that result when foreign (i.e. non-self) materials are introduced into a vertebrate organism such as humans. Traditionally, the discipline has focussed on the body's response to infectious micro-organisms, with the purpose of developing effective vaccines. However, the scope of modern Immunology now encompasses all aspects of self vs. non-self recognition phenomena including organ transplantation, tumour immunology and autoimmune diseases. Recent major advances in our understanding of the cellular and molecular basis of the immune response promise to provide us with a new generation of prophylactic, therapeutic and diagnostic reagents of relevance to human and animal health.

The Department of Immunology, in collaboration with Trinity College, co-ordinates a specialist program in Immunology. The emphasis of the specialist program is to provide students with a sound theoretical understanding of the cellular and molecular basis of non-self recognition, together with sufficient laboratory experience to enable the students to consider embarking on a career in the discipline. The major program will offer students fundamental training in immunology and give students the opportunity to combine immunology with another program in Life Sciences, Basic Sciences, or within the Arts.

Immunology Major Program

(8 full courses or their equivalents)

Only students with a GPA of 2.7 or higher will be considered for entrance into the major program. Enrolment is limited and selection is based on performance in the first-year courses.

First Year:
BIO150Y Organisms in Their Environment; CHM138H Introductory Organic Chemistry I; CHM139H Chemistry: Physical Principles
Second Year:
BCH210H Biochemistry I: Proteins, Lipids and Metabolism; BIO240H Molecular Biology; BIO241H Cell and Developmental Biology; IMM250H The Immunity System and Infectious Disease; HMB265H General and Human Genetics
Third Year:
IMM334Y Introductory Immunology; CSB349H Eukaryotic Gene Expression/ BCH311H[1] Biochemistry II: Nucleic Acids and Biologic Information Flow; One full-course equivalent from the following list: CSB357H Biology of Vector-Bourne Parasitic Diseases/ MGY377H Microbiology I: Bacteria/ BCH370H Laboratory Course in Biochemical Techniques/ MGY378H Microbiology II: Viruses/ BCH304H Cell Dynamics & Interactions/ PHL281H Bioethics
Fourth Year:
One full-course equivalent from the following list: IMM429H Developmental Immunology / JBI428H Molecular Immunology/ IMM430H The Immune Response/MIJ485H[2] Vaccines and Immunity/ IMM435H[3] Practical Immunology

[1]BCH311H requires CHM247 as pre-requisite
[2]MIJ485H requires MGY377H & MGY378H as pre-requisites.
[3]This course is capped at 40 students. Priority will be given to Immunology Specialist students, followed by Immunology Major students.

Academic Rationale:
The Department of Immunology currently hosts the immunology specialist program, which is a 14 FCE program that gives students an in depth and thorough theoretical and hands-on research-based undergraduate training in Immunology. With emerging and established infectious diseases such as SARS, bird flu, HIV, and drug resistant pathogenic bacteria that are currently dominating newspaper headlines and informal conversations, there is a strong interest amongst students to learn more about how our bodies fight these pathogens. Indeed, there has been tremendous interest in a new course that we are mounting (IMM250) for the 2009 winter term entitled "The Immune System and Infectious Disease", which currently has more than 200 students enrolled in this course. In this regard, our Department has been interested in providing a more accessible program in immunology that can be combined with other major programs, either within the sciences or from other faculties.

Learning Outcomes:
Because immunology spans many fields of study, students initially require basic training in each of these fields to be able to better comprehend the general concepts being taught about immunology. As a result, the curriculum early in the program is heavier in these other fields to be able to lay the groundwork for the later part of the program which has a heavier emphasis on immunology courses. The curriculum in the first 2 years of this program includes courses from biochemistry, biology, chemistry, and genetics. A course offering the basic concepts within immunology but with more emphasis on pathogens is offered in the 2nd year (i.e. IMM250H). In the 3rd year, students will undertake more training in genetics, biochemistry and microbiology, but will now be exposed to a full-year intensive introductory immunology course (IMM334Y). In the 4th year, students will be well positioned to benefit from advanced immunology courses and will be given the choice to take 2 of 5 400 level courses offered by our Department.

The multidisciplinary nature of immunology will allow students graduating with an immunology major to have a basic concept of immunology and each of the realms that immunology are a part of. Throughout the program, students will be encouraged to think independently, establishing problem-solving skills that will be useful throughout life.

a. Depth of Knowledge
The immunology major program is designed to give students a broad understanding about how vertebrates interact with and defend themselves from microscopic organisms. The program draws together various disciplines including microbiology, biochemistry, biology, and genetics. Thus, the curriculum in the first 2 years is skewed towards developing basic knowledge in these diverse fields with one course introducing the general concepts of immunology (IMM250). In third year, students learn more immunology in the full year IMM334 course which teaches all aspects of the immune system to some depth. Finally, in the 4th year, students pick 2 of 5 advanced levels courses that explore different aspects of the immune system. Overall, a combination of lecture-based courses that include literature research and written term papers, as well as hands-on laboratory research with written and oral reports will allow students to develop a strong insight of the concepts being taught and give students experience of what it is like being a researcher. Students that graduate from this program and that major in a related life-sciences program will be well positioned to further pursue a career in academic research in immunology.

b. Competencies
i. Critical and Creative Thinking
Although the main purpose of the immunology major program is to teach students general concepts within immunology, students will be given the opportunity to apply this knowledge by researching and presenting term papers and oral reports of topics of their choice within the immunology realm (see below). All students in the immunology major program are required to take HMB265 that integrates problem-solving and application in weekly tutorials. Students taking IMM250 will be required to analytically read and synthesize information from original literature to write a term paper (see below) of a topic of their choice. 4th year courses further develop critical and creative thinking competencies as a result of year-specific goals, such as reading analytically from original literature in IMM430, writing analytically in

IMM435 (manuscript-style lab reports); synthesizing new ideas in MIJ485 (grant proposals); and presenting well-informed and evaluated arguments as oral reports in IMM435 and IMM429. Some courses within this program (i.e. IMM250, IMM334, IMM430, and IMM435) are taught from the perspective of the scientist that is confronted with an unknown, and the methodology and findings that led to the discovery and present day knowhow. Questions that test critical and creative thinking are frequently directed towards the student audience in many of these courses.

ii. Communication

The immunology major program gives students the opportunity to develop written and oral skills as outlined below:

Written skills: The 1st year required course BIO150Y has a laboratory component with written laboratory reports. BIO240H/BIO241H requires two term papers from the students and will be lectured on how to write a scientific paper. Courses offered by the Dept of Immunology also allow for development of written skills: Students will be required to write a term paper in the required IMM250 course (see below), while students enrolled in the 4th year course IMM430H will be required to write a term paper relevant to the course outline. Students in MIJ485H will be required to write a CIHR-like grant (11-page) on a research project of their choice (see below). In addition, students taking the optional IMM435 laboratory course will be trained on how to write scientific reports by writing 8 laboratory reports detailing and critically evaluating their research findings. These reports are similar to scientific publications. Thus, all students graduating from the immunology major program will have written training in their 1st, 2nd and 4th years, while those students taking the optional IMM435 course will have specific training on scientific writing.

Oral skills: The optional 4th year courses IMM429 and IMM435 will require students to research and give a 10-minute oral presentation of a scientific publication or a novel scientific technique that can be used in immunology research. Students taking the MIJ485H course will be required to give a 30-minute presentation on the topic of their written CIHR-like grant (see below). In all three courses, the students will be required to critically assess the scientific work that they are presenting and present it in a manner that is clear and coherent to the class.

iii. Information Literacy

The required BIO150Y course has a library assignment that trains students on how to obtain information from library and online academic sources. The required IMM250 course and the optional IMM435 and MIJ485 courses will provide students with the knowledge on how to use online academic search engines such as PubMed or the Faculty of 1000 websites to retrieve relevant information on specific topics of their choice. Students will use this knowledge in these courses as well as in IMM429 and IMM430 to research and evaluate the retrieved information and then synthesize written and oral reports in these courses. Students are expected to effectively access and use scholarly sources, as well as critically use popular literature. Thus, all students that graduate from the immunology major program will have basic training on finding and assessing academic information from various sources.

iv. Quantitative Reasoning

The science courses in the program all have quantitative components because quantification is an important part of evaluation of scientific experiments. All students entering the immunology major program will require advanced high-school level mathematics for entrance into the 1st year required chemistry courses CHM138 and CHM139. This knowledge will be necessary to understand lecture material in the chemistry course. The required BIO150Y and BIO240H/241H have laboratory components in which students will further develop their mathematical skills by analyzing and interpreting data. BIO150Y has further training in basic statistical analysis. In HMB265H1, all our students improve their quantitative reasoning skills during weekly practice solving genetic problems. Immunology lecture-based courses in the 3rd (IMM334) and 4th year draw upon the knowledge gained in these earlier courses and further develop these skills in the 4th year. The optional JBI428 course teaches analytical skills because the exams are of a problem solving nature, including some quantitative analysis. This is also covered in lecture material. Students taking the optional IMM435H laboratory course will have further training in numerical data analysis. This training is particularly prevalent in specific lab modules in which numerical data obtained by the students is compared between different sets. These two courses also emphasize how this quantitative reasoning is necessary as part of the scientific process, such as the development and testing of hypotheses. Thus, all students graduating from this program will receive training in numerical data analysis and statistical analysis.

v. Social and Ethical Responsibility

Students within the immunology major program will receive extensive instruction on social and ethical issues and how it relates to immunology. The required BIO150Y covers ethical issues in biology through lectures, group discussion on ethical issues, and an ethics report and presentation that are worth ~4% of the final mark. The IMM250H course required by all students will have lectures discussing the ethical implications of clinical trials, HIV research in Africa, compulsory flu vaccines, and stem cell research with regards to growing and immune system *in vitro*. These themes are extended in the third year required IMM334Y course, where the increased depth of knowledge on the fundamental properties of the immune response includes discussion of the social and economic consequences of vaccination as well as the ethical issues surrounding transplantation, stem cells and gene therapy. Students within the immunology major program are also offered the opportunity to take the bioethics course PHL281H in their 3rd year. The optional course IMM435H has a lecture component on animals and their use in research, and a required 1-page written report on the ethics of use of animals in research. The 4th year optional course MIJ485 invites Dr. Alison McGeer from the Public Health Laboratories to give a 90-minute lecture on policy decision on implementing of vaccines in a population including social, economic and ethical issues. Thus, all students in the immunology major program will receive some education on social and ethical responsibility in BIO150, IMM250 and IMM334, while those students taking IMM435, MIJ485, and PHL281 will receive selective ethics education on animal welfare, government policy on vaccine implementation, and moral and legal problems in medicine and biomedical research, respectively.

c. An Integrative, Inquiry-Based Activity

The second year IMM250 course that is required for all immunology major students will have an essay component that requires the student to research and write a 15-page double-spaced term paper on a disease/infection of their choice. The term paper will include details on epidemiology, mode of transmission (for infectious disease), genetics (especially for autoimmune diseases), involvement of the immune system, evasion of the immune system (if applicable), and treatments (current and potential).

Four of the five 4th year level courses offered as options by the immunology major program have oral and/or written components to their program. Students in IMM430H are required to write a 10-page term paper relevant to the course outline on a topic to be chosen by the student and approved by the course coordinator. Students taking the optional MIJ485 course will find and research a topic within infection and immunity or how pathogens evade immunity. The students will be asked to give a 30-minute lecture on this topic and write a CIHR-like research proposal on that topic. Students taking the other two optional 4th year level courses IMM429 and IMM435 are required to research and give a 10-minute oral presentation on a research technique or publication of their choice within specific guidelines that are set by the course co-ordinator. Therefore, students will be required to take one 2nd year level course and at least one 4th-year level courses that have an inquiry-based research project that will be presented as either an oral report, written report, or both (depending on the combination of courses taken). These reports will draw upon the knowledge gained within the course and throughout the program and from their research of scientific literature.

Estimated Enrolment: 75 undergraduate students. (This number is based on resource limitations (e.g. TA) in 4th year courses. We want to CAP all 4th year courses at 40 students, and this number of major students would lead to an average of 30 students/class).

LATIN AMERICAN STUDIES

Latin American Studies at the University of Toronto (LAS@UofT) is a programme for students in the social sciences, humanities and sciences who seek a deeper understanding of the Latin American regions, their histories, cultures and societies. LAS@UofT seeks to inspire knowledge and experience across the University's three-campus community and beyond. The programme's courses encourage students to complement special interests in fields such as Anthropology, Political Science, Geography, History or Sociology with a broader interdisciplinary framework, while at the same time committing themselves to an emphasis upon the languages and the historical and cultural experiences of Spanish and Portuguese America.

LAS@UofT exists to bring together the energy and insights of a multi-disciplinary collection of individuals and units, to develop innovative courses and to stimulate exchange. The programme's research and

pedagogical mission encompasses everything from the ancient American civilizations and the ideas, peoples and commodities that came together and emerged within a wide Iberian world, through the archaeology, geography, history, languages, literatures, politics, societies and cultures of the Latin American regions and countries, to the natural sciences and transnational investigation of Latin Americans and their descendants in Canada and elsewhere.

Latin American Studies Minor programme:

4 full courses or their equivalent, must include LAS 200Y1 Latin American History, at least one full course at the 300+ level (0.5 FCE of which must be an LAS 300+-level seminar), and a minimum of one full course derived from the Humanities and one full course deriving from the Social Sciences. Language study is recommended, but not a requirement of the Minor programme)

Academic Rationale:
After three successful years building the Major programme, adding the option of a Minor will significantly increase the programme's reach, strength and student interest. The interdisciplinary core of this programme begins with its required "gateway" course, LAS200Y1, a wide-ranging lecture course with tutorial discussion sections that is open to students in at least their second year of undergraduate study. It provides both a broad interdisciplinary foundation, examining cultural, geographical, historical, literary, political and social topics from across Latin America. The introductory course is the point of departure for the Minor's other three FCE, an invitation to study Latin America more deeply, both in LAS-sponsored seminars and in different disciplinary concentrations.

While courses and programmes exist to address specific, disciplinary issues related to the Latin American region, there are no Minor programmes at the University where students can attain knowledge in a sustained multidisciplinary way that brings together the Social Sciences and the Humanities. We wish to create a fully interdisciplinary LAS Minor to meet this need, and in response to consistent inquiries and requests for it from students themselves, many of whom have come to develop an interest in Latin America and in the Spanish and/or Portuguese language later in their undergraduate careers. Language knowledge will always be a recommendation, but for the Minor it is not required.

Learning Outcomes:
The Programme's sponsored courses introduce students to the study of Latin America from a number of disciplinary perspectives, including Anthropology, Political Science, Spanish and Portuguese literatures, Geography, History and Sociology. Among the goals of the broad, interdisciplinary foundation built in LAS 200Y lecture course and in the LAS 300-level seminars is to expose students to different methodologies and ways of learning and knowing, helping them to identify special interests to pursue in greater depth. Offering an overarching set of perspectives on a diverse region in the world, LAS encourages its students to branch out into the complementary disciplines of their choice, while at the same time committing themselves to an emphasis upon the historical and cultural/ literary experiences of Spanish and Portuguese America.

Students will develop the ability to understand the Latin American region in a complex manner and to subject what they read, hear and see to careful, critical analysis. Chief learning outcomes include: a nuanced approach to Latin American historical and cultural experiences, to questions of national identity, literary and artistic creativity, race, religion, sexuality, cultural constructions, indigenous populations, economic inequality, political repression versus democracy, and the relationships between global and local phenomena. Perhaps most importantly of all, students living and studying Latin America in Toronto, Canada, will gain an international perspective: they will learn to understand themselves and their home society in relation to a broader hemispheric and global experience. An LAS Minor acquires methodological skills, learning tools and a sensitivity that facilitates further study and prepares the graduating student to prosper and engage fruitfully in a multi-cultural world.

Estimated Enrolment: 30-50

Department of Molecular Genetics and Microbiology

Molecular Genetics and Microbiology Major program

(8 full courses or their equivalent)

Enrolment is limited and selection is based on performance in First year required courses.

First Year:

BIO150Y1 Organisms in Their Environment; (CHM138H1Introductory Organic Chemistry I, CHM139H1 Chemistry: Physical Principles)/CHM151Y1 Chemistry: The Molecular Science; MAT135Y1 Calculus I/ MAT137Y1 Calculus!

Second Year:

BCH210H1 Biochemistry I: Proteins, Lipids and Metabolism; BIO240H1 Molecular Biology, BIO241H1 Cell and Developmental Biology, BIO260H1 Concepts in Genetics/HMB265H1 General and Human Genetics

Third Year:

BCH311H1 Biochemistry II: Nucleic Acids and Biologic Information Flow/CSB349H1 Eukaryotic Gene Expression; MGY312H1 Principles of Genetic Analysis/MGY376H1 Microbiology Laboratory
plus 1.0 full-course equivalent from MGY350H1 Model Org to Disease; MGY377H1 Microbiology I: Bacteria; MGY378H1 Microbiology II: Viruses

Fourth Year:

1.0 full-course equivalent from the following list: MGY428H1 Functional Genomics, MGY434H1 Bacterial Signalling and Physiological Regulation, MGY440H1 Molecular Virology, MGY445H1 Genetic Engineering for Prevention and Treatment of Disease, MGY451H1 Genetic Analysis of Development I, MGY452H1 Genetic Analysis of Development II, MGY470H1 Human and Molecular Genetics, MIJ485H1 Vaccines and Immunity

Academic Rationale:

The MGY Major will provide an integrated exposure to molecular genetics and microbiology to students who wish the breadth of a double Major path towards a BSc. The current MGY Specialist program provides students with extensive depth in these topics, but we would like to increase the exposure of Arts & Science undergraduates to these disciplines. The emphasis of both programs is the molecular aspects of genetics and microbiology, which reflects the research expertise of the Department of Molecular Genetics. Our rationale is to teach students aspects of advanced genetics and microbiology, with particular emphasis on how scientific thought and experimentation lead to our understanding of these processes.

Our Department, and our courses, study the basic mechanisms and principles of molecular genetics that apply to all organisms. Developments in genetics and microbiology have contributed greatly to our basic understanding of the fundamental processes of life as well as to the treatment of genetic and infectious diseases. Modern molecular genetics also incorporates genomic studies at the organismal level arising from complete genome sequences of model organisms, of pathogens, and of humans. The growing number of genetic diseases that are understood and examined at the molecular level, and the continual emergence of new infectious and multi-drug resistant bacterial and viral diseases emphasizes to us the interest and the need to teach these programs at the undergraduate level to Major students as well as to Specialist students.

Learning Outcomes:

Molecular genetics and molecular microbiology require an interdisciplinary base of courses in preparation for upper-level courses. The curriculum in the first two years incorporates biology, math, chemistry, biochemistry, and introductory molecular biology and genetics. These courses provide basic analytical, quantitative and descriptive tools to understand the molecular concepts in 3rd and 4th year courses.

In the 3rd and 4th years, the program allows students to focus on microbiology or genetics, but requires all of them to obtain exposure to both. In third year, students begin to learn some depth in microbiology and genetics by choosing two of three intermediate level courses offered by the Department. Two courses are microbiology courses; the learning outcome is that students are introduced to the biology, physiology,

molecular biology, and pathogenesis of bacteria and/or viruses. The third course is an intermediate genetics course that extends concepts from 2nd year genetics, with some emphasis on modern molecular and medical genetics. In addition, all students participate in experimental-based learning by taking a dedicated laboratory course, either genetics (MGY312H) or microbiology (MGY376H). The learning outcome here is to understand how science knowledge is determined by evaluation of experimental data, and to complement the lecture courses in genetics and microbiology. Finally all students must take intermediate-level molecular biology so that students can understand the molecular aspects of genetics and microbiology.

The 3rd year courses in turn provide the proper background for the depth of 4th year. In 4th year, students must choose two 400-level MGY courses, but they have flexibility in the topics on which they must focus: human genetics, developmental genetics, genomics, bacteriology, virology, for example. The learning outcomes here are to learn some advanced microbiology and genetics, including concepts and experimental approaches from the scientific literature, and how to apply this information to scientific thought.

Degree Objectives:

a. Depth of Knowledge

Specific depth of knowledge is provided by the requirement for two of our 4th year advanced genetics and/or microbiology courses. The MGY Major is designed to give the students an overall broad exposure to these disciplines, but requires them to focus on one or two areas in the advanced 4th year courses. The objective is that students will be able to bring together the information learned in earlier years in order to understand and interpret advanced subject material and to independently understand and evaluate scientific literature.

b. Competencies

i. Critical and Creative Thinking

Critical and creative thinking are incorporated into MGY courses within the MGY Major program. The advanced 4th year courses require essays, problem sets, and/or independent presentations from each student on current scientific topics related to the content of the course. All students must take 2 of these courses. Every student is required to take one of the 3rd year MGY lab courses. Exercises in these courses ask students to critically evaluate data that they generate and to develop their own hypotheses on the results. These courses require students to read analytically, solve problems, analyze and interpret data and scientific arguments, and develop their own ideas in response to information presented.

ii. Communication

In 3rd year the students develop written skills by lab reports for each of the required lab courses, generally written in the style of scientific publications (introduction, results and discussion of results). They must learn to write analytically and concisely. In 4th year, both written and oral skills are developed through the essays and oral presentations of the 4th year advanced MGY courses. The nature of the assignments vary from 4th year course to course, but students are all required to submit either a written assignment and/or an oral presentation. For example, students in MIJ485 submit a CIHR-like grant proposal and must defend it in a 30 minute presentation. Courses require student participation in class discussions. MGY428H hold small quizzes each lecture in which students must discuss literature reading assigned for each lecture. Students in MGY434H each present a talk on a scientific paper relevant to microbial physiology.

iii. Information Literacy

MGY students will learn how to use library and online resources to research a topic, coordinate information from various sources, identify and evaluate investigative methods, and use tools to analyze information to support hypotheses and to produce original arguments. The required BIO150Y course has a library assignment that trains students on how to obtain information from library and online academic sources. In third year, the genetics lab course MGY312H has an experiment that trains students to find and analyse genetic information using various web resources. The 4th year MGY courses all require extensive reading and analysis of current scientific literature. Students must be able to find, evaluate and use this information, and present interpretations in the form of essays and oral presentations. For example, MGY428H requires students to find and read scientific literature from the library or other web sources for each lecture and students are quizzed on their interpretations each lecture. MGY434H,

MGY440H and MIJ485H require students to research scientific literature and present their analyses to the class in individual oral presentations and/or written grant proposal exercises.

iv. Quantitative Reasoning

We require a 1st year math course (MAT135 or MAT137) to establish a quantitative basis for future courses. First year chemistry also requires quantitative analyses. The later year science courses in the program have quantitative components because quantification is an important part of evaluation of scientific experiments. Specifically, the 3rd year lab courses require students to develop hypotheses based on quantitative results. Evaluation of scientific literature in 4th year courses includes evaluation of the quantification of the results presented in these publications. Courses also emphasize how this quantitative reasoning is necessary as part of the scientific process; eg. development and testing of hypotheses.

v. Social and Ethical Responsibility

Students in the MGY program will receive instruction on social and ethical responsibility as it pertains to scientific thought, experimentation, and the use and dissemination of scientific information. For example, the required BIO150Y covers ethical issues in biology through lectures, group discussion on ethical issues, and an ethics report and presentation that are worth ~4% of the final mark. MGY courses (taught in the 3rd and 4th years) discuss social and ethical issues that pertain to the topics in the course. Third year MGY Major students must take two of three lecture courses we offer (MGY350H Model organism genetics and disease, MGY377H Bacteriology, MGY378H Virology), and all include these responsibilities. As examples, MGY377H includes discussion of the social use and misuse of antibiotics and spread of resistance, the lack of regulation on the access of antibiotics in many developing countries (no prescription required), excessive use of antibiotics in farms to raise animals in food industry, and the failure of patients to complete the antibiotic medication prescribed by physicians. MGY378H includes discussion of various routes of transmission of viruses and simple strategies to prevent them, as well as the impact of viruses on health on a global level. In the case of HIV, the current state of the HIV epidemic, the social cost of to those affected and how, even in developed countries, HIV continues to be an ignored epidemic, "safe sex" responsibilities, and information to encourage students to get involved with prevention at several levels (education, fund raising etc.). The new course MGY350H will include discussion of stem cells, including the social and ethical issues of stem cell research. Specific examples at the 4th year level include MGY470H (Human Genetics), in which the instructor discusses privacy concerns and the use of personal genetic information, such as acceptable or recommended practise in genetic diagnosis - particularly when aspects relate to differences in 'consumer genetics' versus 'health practise', or different laws/guidelines in different countries. The 4th year course MIJ485 (Vaccines & Immunity, given jointly with Immunology) invites Dr. Alison McGeer from the Public Health Laboratories to give a 90-minute lecture on policy decision on implementing of vaccines in a population including social, economic and ethical issues.

c. An Integrative, Inquiry-Based Activity

The primary integrative, inquiry based activity in the MGY Major is the requirement to take one of two third year laboratory courses (half-credit full year courses) offered by our department. Students may choose either the Principles of Genetics lab course, MGY312H, or Microbiology lab course, MGY376H. Both courses involve substantial experimentation by students, and data evaluation and hypothesis learning in the context of written lab reports and laboratory discussions. In addition, the written and oral assignments in 4th year MGY courses require inquiry-based analyses of scientific literature followed by integration into the presentation.

Estimated Enrolment: 40 (due to resources for the MGY lab courses)

DELETED PROGRAMS

Department of Economics

The **Quantitative Methods specialist program** (Science program), started in 1983, draws on four different departments. The Department feels that the program is out-dated and does not adequately serve a student's needs to focus on one or two areas adequately, and thus does not meet the depth of knowledge criteria in the curriculum renewal. Since it is a B.Sc., it is attractive to some but does not have adequate depth beyond core economics courses. The student choses from a wide range of courses and yet must still meet a 400 level requirement.

Department of Physics

Applied Physics Specialist – The Department of Physics has made minor revisions to its Physics specialist program to give it the flexibility to encompass Applied Physics students. The Applied Physics program has much smaller enrollment and many of those students take it because it has more flexibility, not necessarily because of the area of focus.

"General" Physics Major – Student programs currently span the range between the general and core programs. We propose to drop the "Core" Label and changed the Physics Major to give it the flexibility to encompass both "Core" and "General" Physics students.

Department of Geography

- **Historical and Cultural Geography**
- **Urban Economic and Social Geography**

Both Historical and Cultural and Urban Economic Geography have been combined to form the proposed new Human Geography program. Within this new program, students are able to concentrate a variety of themes.