

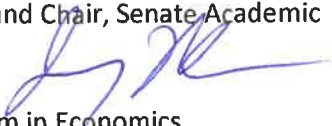


DATE: April 26, 2019

TO: Senate

FROM: Dr. Jerry Tomberlin, Provost and Vice-President (Academic), and Chair, Senate Academic Program Committee

RE: Final Assessment Report and Executive Summary: MA Program in Economics



The purpose of this memorandum is to request that Senate approve the Final Assessment Report and Executive Summary arising from the cyclical review of the MA program in Economics.

The request to Senate is based on a recommendation from the Senate Academic Program Committee (SAPC), which passed the following motion at its meeting of April 18, 2019:

THAT SAPC recommends to SENATE the approval of the Final Assessment Report and Executive Summary arising from the cyclical program review of the MA program in Economics.

The Final Assessment Report and Executive Summary is provided pursuant to articles 4.2.5-4.2.6 of the provincial Quality Assurance Framework and article 7.2.23 of Carleton's Institutional Quality Assurance Process (IQAP). Article 7.2.23.3 of Carleton's IQAP (passed by Senate on June 26th, 2015 and ratified by the Ontario Universities Council on Quality Assurance on September 25th, 2015) stipulates that, in approving Final Assessment Reports and Executive Summaries 'the role of SAPC and Senate is to ensure that due process has been followed and that the conclusions and recommendations contained in the Final Assessment Report and Executive Summary are reasonable in terms of the documentation on which they are based.'

In making their recommendation to Senate and fulfilling their responsibilities under the IQAP, members of SAPC were provided with all the appendices listed on page 2 of the Final Assessment Report and Executive Summary. These appendices constitute the basis for reviewing the process that was followed and assessing the appropriateness of the outcomes.

These appendices are not therefore included with the documentation for Senate. They can, however, be made available to Senators should they so wish.

Major modifications described in the Action Plan, contained within the Final Assessment Report, are subject to approval by the Carleton University Committee on Quality Assurance, the Senate Committee on Curriculum, Admission, and Studies Policy, the Senate Academic Program Committee (SAPC) and Senate as outlined in articles 7.5.1 and 5.1 of Carleton's IQAP.

Once approved by Senate, the Final Assessment Report, Executive Summary and Action Plan will be forwarded to the Ontario Universities' Council on Quality Assurance and to Carleton's Board of Governors for information. The Executive Summary and Action Plan will be posted on the website of Carleton University's Office of the Vice-Provost and Associate Vice-President (Academic), as required by the provincial Quality Assurance Framework and Carleton's IQAP.

Senate Motion April 26, 2019

THAT Senate approve the Final Assessment Report and Executive Summary arising from the Cyclical Review of the MA program in Economics.

**CARLETON UNIVERSITY COMMITTEE ON
QUALITY ASSURANCE
Cyclical Review of the Master of Arts in Economics
Executive Summary and Final Assessment Report**

This Executive Summary and Final Assessment Report of the cyclical review of Carleton's Master of Arts in Economics are provided pursuant to the provincial Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP).

EXECUTIVE SUMMARY

The Master of Arts in Economics is offered by the Department of Economics, a unit administered by the Faculty of Public Affairs.

As a consequence of the review, the program was categorised by the Carleton University Committee on Quality Assurance (CUCQA) as being of good quality. (Carleton's IQAP 7.2.12).

The External Reviewers' report offered a very positive assessment of the program. Within the context of this positive assessment, the report nonetheless made a number of recommendations for the continuing enhancement of the program. These recommendations were productively addressed by the Chair of the Department of Economics, the Dean of the Faculty of Public Affairs and the Dean of the Faculty of Graduate and Postdoctoral Affairs in a response to the External Reviewers' report and Action Plan that was submitted to CUCQA on April 10, 2019.

FINAL ASSESSMENT REPORT

Introduction

The Master of Arts in Economics is offered by the Department of Economics, a unit administered by the Faculty of Public Affairs. This review was conducted pursuant to the Quality Assurance Framework and Carleton's Institutional Quality Assurance Process (IQAP). As a consequence of the review, the programs were categorised by the Carleton University Committee on Quality Assurance (CUCQA) as being of good quality. (Carleton's IQAP 7.2.12).

The site visit, which took place on October 1, 2, and 3, 2018, was conducted by Dr. Francisco Alvarez-Cuadrado from McGill University and Dr. Philip DeCicca from McMaster University. The site visit involved formal meetings with the Provost, Vice-Provost and Associate Vice-President (Academic), Assistant Vice-President (Academic), the Dean of the Faculty of Public Affairs, the Dean of the Faculty of Graduate and Postdoctoral Affairs, and the Chair of the Department of Economics. The review committee also met with faculty members, staff, and undergraduate and graduate students.

The External Reviewers' report, submitted on November 1, 2018 offered a very positive assessment of the program.

This Final Assessment Report provides a summary of:

- Strengths of the programs
- Challenges faced by the programs
- Opportunities for program improvement and enhancement
- The Outcome of the Review
- The Action Plan
-

This report draws on five documents:

- The Self-study developed by members of the Department of Economics (Appendix A)
- The Report of the External Review Committee (Appendix B).
- Communication from CUCQA regarding the outcome of the external review (Appendix C).
- The response and action plan from the Chair of the Department of Economics, the Dean of the Faculty of Public Affairs and the Dean of the Faculty of Graduate and Postdoctoral Affairs (Appendix D).
- The internal discussant's recommendation report (Appendix E).

Appendix F contains brief biographies of the members of the External Review Committee.

This Final Assessment Report contains the Action Plan (Appendix D) agreed to by the Chair of the Department of Economics, the Dean of the Faculty of Public Affairs, and the Dean of the Faculty of Graduate and Postdoctoral Affairs, for the implementation of recommendations for program enhancement to have been advanced as a consequence of the cyclical program review process.

The Action Plan provides an account of who is responsible for implementing the agreed upon recommendations, as well as of the timelines for implementation and reporting.

Strengths of the programs

General

The External Reviewers' Report states that "the Carleton MA in Economics program is structured well to deliver a high-quality educational experience to its students."

Faculty

The external reviewers observed that the "program appears to have appropriate governance structures that are consistent with other economics MA programs in North America," and the program is "adequately resourced," with a faculty complement that is "sufficient, both in size and quality, to support high quality training of MA students in Economics."

Students

The external reviewers commented that the size of the Department makes for one of the "larger, if not largest producer of graduate degrees in Economics in Canada," and provides "excellent opportunities for graduate training." In meetings with students, the external reviewers found a "high degree of contentment with faculty/student relations", and felt students are "being prepared well and that this preparation is resulting in students being successful in the labour market after graduation."

Curriculum

The external reviewers noted that the "program's intellectual profile, objectives and learning outcomes serve the mission of Carleton University." They felt the program "provides academic training which is consistent with current standards in economics and its objectives match teaching and research strengths of the department."

Opportunities for program improvement and enhancement

The External Reviewers' Report did not identify any deficiencies in the program and made 2 recommendations- one was categorized as a concern and the other as an opportunity as follows:

1. Concern: Flexibility in the term of admission. Carleton is beginning to experiment with the possibility of winter admission into the MA program. In order to keep times to completion within reasonable bounds it may be necessary to duplicate the offering of certain compulsory courses in order to allow students to take them in the required sequence.
2. Opportunity: Research Methods course. This course provides some of the elements of experiential learning that in the University of Ottawa are provided through a formal final research paper. Not surprisingly the students interviewed at Carleton were very enthusiastic about this course. Being a research-oriented course, it requires a somewhat deep understanding of statistics and econometrics. Apparently, the current version of the course is devoting roughly half of its time to present and review this required knowledge at the expense of the more experiential, research-oriented, elements of the course. The department may want to think about potential solutions for this problem, including a second econometrics course that runs concurrently with the Research Methods course; such a course would free up time in the Research Methods course to focus on more core material.

The Outcome of the Review

As a consequence of the review, the Master of Economics was categorized by the Carleton University Committee on Quality Assurance (CUCQA) as being of good quality. (Carleton's IQAP 7.2.12).

The Action Plan

The recommendations that were put forward as a result of the review process were productively addressed by the Chair of the Department of Economics, the Dean of the Faculty of Public Affairs, and the Dean of the Faculty of Graduate and Postdoctoral Studies in a response to the External Reviewers' report and Action Plan that was considered by CUCQA on April 10, 2019. The Department of Economics agreed unconditionally to the recommendations that were proposed by the external reviewers.

It is to be noted that Carleton's IQAP provides for the monitoring of action plans. A midway report will be submitted by the academic unit and Faculty Dean and forwarded to CUCQA for its review. In the case of the programs in Economics the majority of monitoring will be achieved by means of a Midway Report, which is expected by June 30th, 2021.

The Next Cyclical Review

The next cyclical review of the Master of Arts in Economics will be conducted during the 2023-24 academic year.

ACTION PLAN

Programs Being Reviewed: MA in Economics

External Reviewer Recommendation & Categorization	Action Item	Owner	Timeline	Will the action described require calendar changes? (Y or N)
<p>Flexibility in the term of admission. (Concern) Carleton is beginning to experiment with the possibility of winter admission into the MA program. In order to keep times to completion within reasonable bounds it may be necessary to duplicate the offering of certain compulsory courses in order to allow students to take them in the required sequence.</p>	<p>Students in our MA (coursework) program must take four core courses: ECON 5029 – Research Methods, ECON 5020 – Microeconomics, ECON 5021 – Macroeconomics, and ECON 5027 – Econometrics. We currently offer ECON 5029 once per year, and the other courses twice per year.</p> <p>Starting in Fall 2019, we will also offer ECON 5029 in each term in order to allow students admitted in winter to take core courses in the required sequence and to keep the times to completion within reasonable bounds. No new teaching resources will be required, nor will additional resources be forthcoming from ODFPA, in order to offer this additional section.</p>	Department of Economics	Fall 2019 – Winter 2020	N
<p>Research Methods course (Opportunities). This course provides some of the elements of experiential learning that in the University of Ottawa are provided through a formal final research paper. Not surprisingly the students interviewed at Carleton were very enthusiastic about this course. Being a research-oriented course, it requires a somewhat deep understanding of statistics and econometrics. Apparently, the current version of the course is devoting roughly half of its time to present and</p>	<p>The Department of Economics is proposing a new plan of study that will require a second quantitative course.</p> <p>The new plan will not add an extra credit requirement; instead, it will require students to select at least one quantitative course as part of their electives. For coursework students this can be taken concurrently with ECON 5029, allowing it to focus on experiential and research-oriented elements.</p> <p>The new M.A structure (coursework) would be as follows:</p> <ol style="list-style-type: none"> 1) ECON 5020 (Micro) 2) ECON 5021 (Macro) 3) ECON 5027 (Econometrics) 	Department of Economics	Calendar changes in time for Fall 2020 intake. (August 2019)	Y

<p><i>review this required knowledge at the expense of the more experiential, research-oriented, elements of the course. The department may want to think about potential solutions for this problem, including a second econometrics course that runs concurrently with the Research Methods course; such a course would free up time in the Research Methods course to focus on more core material.</i></p>	<p>4) ECON 5029 (Research Methods) 5) One of the following quantitative courses: - ECON 5713 (Time-Series Econometrics) - ECON 5712 (Micro-Econometrics) - ECON 5055 (Financial Econometrics) - ECON 6714 (Advanced Topics in Econometrics) 6) Three electives</p> <p>The new M.A structure (Thesis) would be as follows:</p> <p>1) ECON 5020 (Micro) 2) ECON 5021 (Macro) 3) ECON 5027 (Econometrics) 4) 1.5 Credits in MA Thesis 5) One of four quantitative courses 6) One elective</p> <p>We are also considering requiring MA students to successfully pass ECON 4995 - Review of Math & Stat Methods.</p>			
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DATE: April 26, 2019

TO: Senate

FROM: Dr. Jerry Tomberlin, Provost and Vice-President (Academic), Chair, Senate Academic Program Committee

RE: 2020-21 Calendar Curriculum Proposals
Undergraduate Major Modifications



Background

Following Faculty Board approval and, as part of academic quality assurance, major curriculum modifications are considered by the Carleton University Committee on Quality Assurance (CUCQA), the Senate Committee on Curriculum, Admissions and Studies Policy (SCCASP) and the Senate Academic Program Committee (SAPC) before being recommended to Senate.

Library Reports (as required)

In electronic communication dated April 8, 2019 the Science Librarian, upon review of the proposal, confirmed no additional resources were required for the 2020-21 major modification included below.

Documentation

Recommended calendar language, along with supplemental documentation as appropriate, are provided for consideration and approval.

Major Modifications

1. B.Sc. in Chemistry, Concentration in Chemical Toxicology

CUCQA approval: April 10, 2019

SCCASP approval: April 16, 2019

SAPC Motion April 18, 2019

THAT SAPC recommends to Senate the approval of the introduction of the Concentration in Chemical Toxicology to the B.Sc. in Chemistry program as presented with effect from Fall 2020.

Senate Motion April 26, 2019

THAT Senate approve the introduction of the Concentration in Chemical Toxicology to the B.Sc. in Chemistry program as presented with effect from Fall 2020.

MEMORANDUM

To: Carleton University Committee on Quality Assurance (CUCQA)

From: Robert Crutchley, Chemistry Chair
David McMullin, Chemistry

CC: Chuck MacDonald, Dean of Science
Patrice Smith, Associate Dean (Academic Affairs)

Date: February 22, 2019

Subject: Major Modification to BSc Honours Chemistry- addition of concentration in Chemical Toxicology. Track A2

The Department of Chemistry is proposing the introduction of a new concentration- Honours Bachelor of Science Chemistry with a Concentration in Chemical Toxicology. The proposed new concentration to be introduced Fall 2020 is a **20.0** credit Honours degree program that will target students interested in understanding the adverse human, animal and environmental health effects caused by both natural and manufactured chemicals. The concentration will include **6** specialized courses (3.5 credits) outside core chemistry and biochemistry degree programs (highlighted in Appendix I). Toxicology plays an important role in the natural sciences and health professions meaning toxicologists have leading roles as custodians of both human and environmental health. Leveraging risk assessment expertise, graduates of the program will have the opportunity to contribute to disease prevention and health policy development by providing insights on the identification and management of real health risks. Toxicology should be seen as an essential source for informing policy and regulatory decisions that advance commercial enterprise while creating a safer and healthier world.

Historically, toxicology has been anchored in chemistry. Today, toxicology encompasses interdisciplinary fields including traditional toxicology, applied chemistry and more diverse fields of study including sustainable agriculture, ecosystem (abiotic and biotic) resiliency, plant and animal productivity, epidemiology, risk management, medicine and engineering. The American Chemical Society (ACS) has advanced the significance of toxicology and are generating educational programs to incorporate toxicological principles into the training of chemists. A strategic starting point for the implementation and improvement of educational (undergraduate, graduate, post doctorate) toxicology programs is identifying training requirements. Clearly defining the ideally trained individual who can meet the requirements of the interdisciplinary toxicological field is a primary consideration in identifying educational and training outcomes. The Society of Toxicologists (SOT) Professional Needs Assessment Task Force conducted a professional needs assessment to define the skills and credentials for the “Total Toxicologist” for successful careers without the need for extensive on-the-job training. The core competencies for the “Total Toxicologist” are listed below:

1. Fundamentals of toxicology
2. Advanced principles of toxicology
3. Pathophysiology
4. Anatomy and physiology
5. Applied systems biology
6. Biochemistry
7. Molecular genetics
8. Regulatory frameworks
9. Experimental design
10. Communication skills
11. Critical thinking skills
12. Data and statistical analysis

The proposed Honours Bachelors of Science Chemistry with Concentration in Chemical Toxicology degree program will provide graduates with 5 of these core competencies through mandatory courses (please see Table 1, Appendix I and II). Training is primarily focused in scientific disciplines such as chemistry and biochemistry (a core competency itself); however, a strength of this program is it addresses communication and critical thinking skills. The SOT Education Summit identified these two criteria as being deficient in new graduates. This has also been the opinion of potential employers within Government of Canada departments indicating the written and oral communication skills of new graduates being poor.

Table 1. Mandatory courses that fulfill “Total Toxicologist” core competencies

Core Competencies	Mandatory Courses
Fundamentals of toxicology	BIOC 4708, CHEM 4305, and CHEM 3800
Biochemistry	BIOC 2200 and BIOC 3101
Regulatory frameworks	FOOD 4103
Communication skills	FOOD 2004 and FOOD 4103
Critical thinking skills	FOOD 2004, FOOD 4103, and CHEM 4908/4907

All of the required courses and electives included in the Chemical Toxicology concentration are currently offered at Carleton University requiring minimal resource expenditure. This proposed new concentration in BSc Chemistry with concentration in Chemical Toxicology meets the Breadth Requirements for a BSc program and Experimental Science requirement mandated by Carleton University. Appendix I lists the courses and Major and Minor CGPA degree requirements. Appendix II is a degree progression chart that illustrates what courses should be taken during each academic year and semester with prerequisites visualized with arrows. This will act as a valuable tool for undergraduates when planning their degree programs and for faculty when advising students how to tailor their education to their interests or needs. The admission requirements for the Chemical Toxicology concentration would be the same as other Bachelor of Science Programs including Honours Chemistry.

The BSc Chemistry with Concentration in Chemical Toxicology is quite structured for the first 2.5 years. This is necessary to provide graduates with solid foundations in bio-, organic, analytical, physical, inorganic and environmental chemistry. These skills are required to understand the fate, distribution and metabolism of chemicals and other hazards in humans, animals and environment.

The final 1.5 years of the degree program consists of specialized courses in toxicology and provides flexibility through science continuation courses and electives for students to tailor the program to their interests. Students enrolled in the Chemical Toxicology concentration will possess necessary prerequisites to pursue other toxicological disciplines. This could include any number of Chemistry, Biology and Biochemistry, or potentially Health Science courses currently offered at Carleton University that fulfill additional core competencies or contribute to mandatory competencies listed in Table 1. Potential additional toxicological disciplines can be found in table 2, where most represent core competencies for the “Total Toxicologist”.

The BSc Chemistry with concentration in Chemical Toxicology differentiates itself from other academic institutions toxicology programs by providing training in biomedical toxicology (BIOC 4708), regulatory science (FOOD 4103) and communication skills (FOOD 2004). Courses from the Regulatory Governance Initiative have created a visibility for Carleton University through the graduates at the senior and intermediate level providing another link to employers in the public and private sector. The concentration would be amenable to cooperative education to exploit opportunities to place students in several Government of Canada departments conducting toxicological, policy, risk assessment and food safety work. This is expanded up on below; however, represents a source of additional mentors and potential employers. Graduates of the concentration would also be excellent candidates for the established Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology offered at the MSc and PhD level in the Department of Chemistry.

Table 2. Optional “Total Toxicologist” core competencies that may be pursued within the Chemistry with concentration in Chemical Toxicology degree program

Core Competencies	Elective Courses	Additional Prerequisites
Molecular genetics*	BIOL 3104- Molecular Genetics BIOC 4202- Mutagenesis and DNA Repair	BIOL 2104
Data and statistical analysis*	BIOC 3008- Bioinformatics	none
Data and statistical analysis*	HLTH 3201- Epidemiology	STAT 2507, HLTH 2001, HLTH 1000
Anatomy and physiology*	BIOL 3306- Human Anatomy and Physiology BIOL 3307- Advanced Human Anatomy and Physiology BIOC 3XXX- Biochemical pharmacology- new course	none
Regulatory frameworks**	HLTH 3104- Regulatory Issues and Human Health	HLTH 1000
Biochemistry**	3000 or 4000 BIOC courses	none
Nanotechnology (nanotoxicology)	CHEM 3600- Nanotechnology CHEM 3107- Experimental Methods in Nanoscience	none

*SOT “Total Toxicologist” core competencies

** Additional course for mandatory “Total Toxicologist” core competencies

Impact on Other Programs

Students enrolled in this structured degree program are required to take first year science courses (i.e. CHEM 1001/1002, BIOL 1103/1104, PHYS 1007/1008, MATH 1107) common to other popular Bachelors of Science Honours degree programs including Biology, Biochemistry and Biotechnology. Students with appropriate GPAs would be able to transfer to or from the Chemistry with Concentration in Chemical Toxicology program after first year without delaying their degree program. Many of the mandatory courses are also core to the Honours Biochemistry programs in second year enabling students to transfer between these degree programs with minimal difficulty. Bill Willmore (Director of the Institute of Biochemistry) was supportive of the Chemical Toxicology concentration in Chemistry and the introduction of Biochemistry courses (BIOC 2200, 3101 and other 3000/4000 level courses) into the proposed degree program. Students transferring to Honours Chemistry during second or third year would be required to complete CHEM 3101 (Quantum Chemistry) and an additional prerequisite (MATH 2008) which would not delay the completion of degree programs. With the exception of FOOD 2004 (Scientific Communication) taken in second year, the Chemical Toxicology concentration differentiates itself from other Carleton University degree programs including Chemistry and Biochemistry by requiring biomedical toxicology (BIOC 4708), environmental toxicology (CHEM 4305) and risk assessment (FOOD 4103) courses to be completed during the fourth year of study.

It is expected that the BSc Chemistry with concentration in Chemical Toxicology will attract additional high quality students to Carleton University without drawing them from other distinct programs. The Department of Chemistry has had success with developing new concentrations and programs. The now established Chemistry with Concentration in Nanotechnology B.Sc. Honours enrolls 23 additional students (2018/2019 data) compared to Honours (n=71) and General (n=41) Chemistry. The Food Science program within the Department of Chemistry enrolls an additional 75 students. With the proposed Toxicology concentration commencing in the Fall 2020 semester providing ample time to advertise the concentration, it is anticipated that at least 10 students would be recruited to the inaugural class.

Societal Need

Toxicology is an interdisciplinary field of science that encompasses disciplines including the natural, environmental and regulatory sciences, medicine, agriculture, engineering, and policy. As such, toxicologists have important roles in identifying, characterizing and communicating risks to the general public. With the toxicological discipline being essential to public and environmental health, and the economy, graduates of the Chemical Toxicology concentration will have diverse employment opportunities in industry, government, and academia. Graduates with chemistry and toxicology training will continue to be highly sought after as national and international policies are developed for chemical hazards, new threats to global health are identified and as technology rapidly develops. Carleton University is well situated in the Nation’s Capital to place graduates of the Chemistry with Concentration in Chemical Toxicology in various Government of Canada departments or agencies conducting toxicological studies, risk assessments, policy development, agricultural science and food safety research. These departments/agencies include but are not

limited to Health Canada, Canadian Food Inspection Agency, Public Health Agency of Canada, National Research Council, and Agriculture and Agri-Food Canada. In addition to the expertise at Carleton University, toxicologists with these potential employers are a source of mentors (adjunct professors, research scientists, etc.) to direct graduates toward viable careers and advanced educational options. High quality graduates of the concentration would make excellent candidates for the established Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology. This graduate program is currently offered through the Departments of Chemistry and Biology at Carleton University and the University of Ottawa at the MSc and PhD level.

Student Demand

Demand for toxicology has been consistently identified from consultations (individual meetings) with undergraduates in Chemistry, including Food Science, and Biochemistry, as well as graduate students enrolled in the Ottawa-Carleton Collaborative Program in Chemical and Environmental Toxicology.

Resources

To initiate the proposed BSc Chemistry with concentration in Chemical Toxicology requires no new resource expenditure. All of the mandatory and elective courses (see Appendix I and II) are currently offered regularly at Carleton University. No additional faculty or contract instructors are required. The concentration will be administered through the department of chemistry meaning no additional administrative support is necessary. It is anticipated that at least 10 undergraduates will enroll in the inaugural degree program (Fall 2020) meaning these additional students will have to be absorbed into core undergraduate and laboratory courses (i.e. CHEM 1001, BIOL 1103). No graduate student funding is requested as this is a BSc Honours concentration proposal. We do not anticipate changes to resource demands in administrative support, library resources, space, or equipment, mainly because the proposed new concentration is constructed of courses currently offered at Carleton University.

Appendix I- Honours BSc Chemistry with Concentration in Chemical Toxicology*

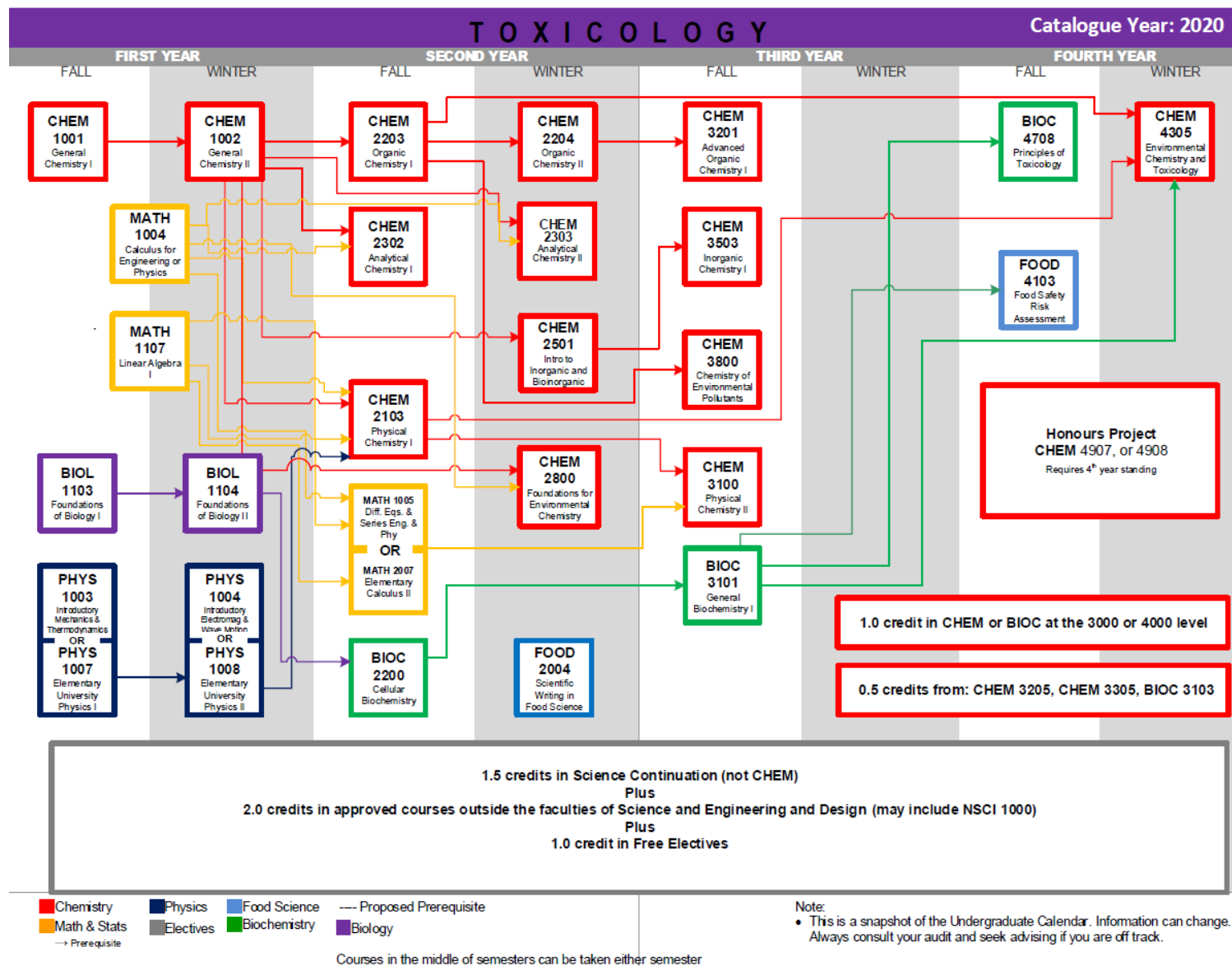
A. Credits Included in the Major CGPA (11.5 credits)	
1. 10.0 credits from:	
CHEM 1001 [0.5]	General Chemistry I
CHEM 1002 [0.5]	General Chemistry II
CHEM 2103 [0.5]	Physical Chemistry I
CHEM 2203 [0.5]	Organic Chemistry I
CHEM 2204 [0.5]	Organic Chemistry II
CHEM 2302 [0.5]	Analytical Chemistry I
CHEM 2303 [0.5]	Analytical Chemistry II
CHEM 2501 [0.5]	Introduction to Inorganic and Bioinorganic Chemistry
CHEM 2800 [0.5]	Foundations for Environmental Chemistry
BIOC 2200 [0.5]	Cellular Biochemistry
CHEM 3100 [0.5]	Physical Chemistry II
CHEM 3201 [0.5]	Advanced Organic Chemistry I
CHEM 3503 [0.5]	Inorganic Chemistry I
BIOC 3101 [0.5]	General Biochemistry I
CHEM 3800 [0.5]	Chemistry of Environmental Pollutants
FOOD 4103 [0.5]	Food Safety and Risk Assessment
CHEM 4305 [0.5]	Environmental Chemistry and Toxicology
BIOC 4708 [0.5]	Principles of Toxicology
CHEM 4907 [1.0] or	Honours Essay and Research Proposal
CHEM 4908 [1.0]	Research Project and Seminar
2. 0.5 credits from:	
CHEM 3205 [0.5]	Experimental Organic Chemistry
CHEM 3305 [0.5]	Advanced Analytical Chemistry Laboratory
BIOC 3103 [0.5]	Practical Biochemistry I
3. 1.0 credit from:	
CHEM or BIOC at 3000 or 4000 level	

B. Credits Not Included in the Major CGPA (8.5 credits)	
4. 1.5 credits from:	
MATH 1004 [0.5]	Calculus for Engineering or Physics
MATH 1107 [0.5]	Linear Algebra I
MATH 1005 [0.5] OR MATH 2007 [0.5]	Differential Equations and Infinite Series for Engineering or Physics

	Elementary Calculus II
5. 1.0 credit from:	
PHYS 1003 [0.5] & PHYS 1004 [0.5]	Introductory Mechanics and Thermodynamics Introductory Electromagnetism and Wave Motion
OR PHYS 1007 [0.5] & PHYS 1008 [0.5]	Elementary University Physics I Elementary University Physics I
6. 1.0 credit from:	
BIOL 1103 [0.5]	Foundations of Biology I
BIOL 1104 [0.5]	Foundations of Biology II
7. 0.5 credits from:	
FOOD 2004 [0.5]	Scientific Writing in the Food Sciences
8. 1.5 credits from:	
Science Continuation courses	
9. 2.0 credits from:	
Approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)	
10. 1.0 credit from:	
Free electives	

* Specialized concentration courses are highlighted

Appendix II- Chemistry with Concentration in Chemical Toxicology flow chart





Carleton
UNIVERSITY

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Professor and Director
Institute of Biochemistry
Departments of Biology and Chemistry
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Twitter: [Bill Willmore@billwillmore](https://twitter.com/billwillmore)

February 28, 2019

Dr. David McMullin
Department of Chemistry
Carleton University
1125 Colonel By Drive
Ottawa, Ontario, Canada K1S 5B6

Re: Concentration in Chemical Toxicology

Dear David,

This is a letter of support, from the Institute of Biochemistry, for the newly developed Concentration in Chemical Toxicology within the Department of Chemistry. Biochemistry is an integral part of Toxicology and it is important for students in a Toxicology program to have background knowledge in Biochemistry. The biological targets of toxins, the effects on biochemical pathways, as well as the whole organism, is important in terms of forming policy and regulations on toxins within the environment. Biochemistry is integral to this program and important for its success.

The Institute of Biochemistry has been consulted with during the conception of the Concentration in Chemical Toxicology with the Department of Chemistry and that students enrolled within the Concentration have permissions to register in Biochemistry courses, as they are essential to the curriculum.

This is wishing for the success of the Concentration in Chemical Toxicology. This is a very exciting initiative and the Institute of Biochemistry is very proud to be a part of it.

Sincerely,

William Willmore, Ph.D.
Professor and Director
Institute of Biochemistry
Departments of Biology and Chemistry
Carleton University

New Program Proposal

Date Submitted: 03/01/19 8:05 am

Viewing: **TBD-1931 : Bachelor of Science Honours in Chemistry with a Concentration in Chemical Toxicology**

Last edit: 03/01/19 8:05 am

Last modified by: rimasanaallah

Changes proposed by: rimasanaallah

In Workflow

1. CHEM ChairDir UG
2. SCI Dean
3. SCI FCC
4. SCI FBoard
5. CUCQA
6. PRE SCCASP
7. SCCASP
8. SAPC
9. Senate
10. PRE CalEditor
11. CalEditor

Approval Path

1. 11/13/18 10:11 am
Robert Crutchley
(robertcrutchley):
Approved for CHEM
ChairDir UG
2. 01/28/19 2:34 pm
Chuck MacDonald
(chuckmacdonald):
Approved for SCI Dean
3. 02/12/19 9:55 am
Patrice Smith
(patricesmith): Rollback
to Initiator
4. 02/12/19 12:43 pm
Robert Crutchley
(robertcrutchley):
Rollback to Initiator
5. 02/12/19 1:29 pm
Robert Crutchley
(robertcrutchley):
Approved for CHEM
ChairDir UG
6. 02/14/19 12:52 pm
Patrice Smith
(patricesmith): Approved
for SCI Dean
7. 02/20/19 5:36 pm
Patrice Smith
(patricesmith): Approved
for SCI FCC
8. 02/28/19 5:25 pm
Patrice Smith
(patricesmith): Rollback
to Initiator

9. 03/01/19 12:56 pm
Robert Crutchley
(robertcrutchley): Approved for CHEM ChairDir UG
10. 03/01/19 2:17 pm
Patrice Smith
(patricesmith): Approved for SCI Dean
11. 03/14/19 2:33 pm
Patrice Smith
(patricesmith): Approved for SCI FCC
12. 03/18/19 5:32 pm
Patrice Smith
(patricesmith): Approved for SCI FBoard

Effective Date	2020-21
Workflow	majormod
Program Code	TBD-1931
Level	Undergraduate
Faculty	Faculty of Science
Academic Unit	Department of Chemistry
Degree	Bachelor of Science Honours
Title	Bachelor of Science Honours in Chemistry with a Concentration in Chemical Toxicology

Program Requirements

Bachelor of Science Honours in Chemistry with a Concentration in Chemical Toxicology (20.0 credits)

A. Credits Included in the Major CGPA (11.5 credits)

A. 10.0 credits in:

10.0

<u>CHEM 1001</u> [0.5]	General Chemistry I
<u>CHEM 1002</u> [0.5]	General Chemistry II
<u>CHEM 2103</u> [0.5]	Physical Chemistry I
<u>CHEM 2203</u> [0.5]	Organic Chemistry I
<u>CHEM 2204</u> [0.5]	Organic Chemistry II
<u>CHEM 2302</u> [0.5]	Analytical Chemistry I
<u>CHEM 2303</u> [0.5]	Analytical Chemistry II
<u>CHEM 2501</u> [0.5]	Introduction to Inorganic and Bioinorganic Chemistry
<u>CHEM 2800</u> [0.5]	Foundations for Environmental Chemistry

<u>BIOL 2200</u> [0.5]	Cellular Biochemistry	
<u>CHEM 3100</u> [0.5]	Physical Chemistry II	
<u>CHEM 3201</u> [0.5]	Advanced Organic Chemistry I	
<u>CHEM 3503</u> [0.5]	Inorganic Chemistry I	
<u>BIOC 3101</u> [0.5]	General Biochemistry I	
<u>CHEM 3800</u> [0.5]	The Chemistry of Environmental Pollutants	
<u>FOOD 4103</u> [0.5]	Food Safety Risk Assessment, Communication and Management	
<u>CHEM 4305</u> [0.5]	Environmental Chemistry and Toxicology	
<u>BIOC 4708</u> [0.5]	Principles of Toxicology	
<u>CHEM 4908</u> [1.0]	Research Project and Seminar	
or <u>CHEM 4907</u> [1.0]	Honours Essay and Research Proposal	
2. 0.5 credits from:		0.5
<u>CHEM 3205</u> [0.5]	Experimental Organic Chemistry	
<u>CHEM 3305</u> [0.5]	Advanced Analytical Chemistry Laboratory	
<u>BIOC 3103</u> [0.5]	Practical Biochemistry I	
3. 1.0 credit in CHEM or BIOC at the 3000 or 4000 level		1.0
B. Credits Not Included in the Major CGPA (8.5 credits)		
4. 1.5 credits in:		1.5
<u>MATH 1004</u> [0.5]	Calculus for Engineering or Physics	
<u>MATH 1107</u> [0.5]	Linear Algebra I	
<u>MATH 1005</u> [0.5]	Differential Equations and Infinite Series for Engineering or Physics	
or <u>MATH 2007</u> [0.5]	Elementary Calculus II	
5. 1.0 credit from:		1.0
<u>PHYS 1003</u> [0.5]	Introductory Mechanics and Thermodynamics	
& <u>PHYS 1004</u> [0.5]	Introductory Electromagnetism and Wave Motion	
<u>PHYS 1007</u> [0.5]	Elementary University Physics I	
& <u>PHYS 1008</u> [0.5]	Elementary University Physics II	
6. 1.0 credit in:		1.0
<u>BIOL 1103</u> [0.5]	Foundations of Biology I	
<u>BIOL 1104</u> [0.5]	Foundations of Biology II	
7. 0.5 credits in:		0.5
<u>FOOD 2004</u> [0.5]	Scientific Writing in Food Science	
8. 1.5 credits in Science Continuation Courses (not CHEM)		1.5
9. 2.0 credits in approved courses outside the faculties of Science and Engineering and Design (may include <u>NSCI 1000</u>, if not used above)		2.0
10. 1.0 credit in free electives		1.0
Total Credits		20.0

New Resources

No New Resources

Summary

Implementation of new concentration in chemical toxicology (Honours Bachelor of Science in Chemistry)

Rationale

The most effective way to achieve Carleton University's vision statement, "to be an intellectual hub for technological, social, and cultural innovation within the National Capital Region and Eastern Ontario", is to collaborate with government, industrial partners and other academic institutions. There are many possible fields of collaboration, but perhaps the most important to public safety is the field of toxicology. Toxicology is the study of the effects of toxic substances on living systems. These toxic substances can either be organic or inorganic, synthetic or natural materials. Thus industries that use and/or produce toxic

substances must do so in a way that does no harm to people and the environment. Food producers must be keenly aware of toxic compounds that may contaminate food, such as those originating from biological organisms, industrial wastes or natural sources. The government's responsibility is to formulate policy, regulation and testing so that public safety is assured. To achieve these measures, it is clear that the training of highly qualified personnel in the field of toxicology is essential. Carleton University and the University of Ottawa have recognized this need and offer a collaborative program leading to an MSc or PhD with specialization in Chemical and Environmental Toxicology. The students who enter this program come from the fields of Biology, Chemistry and Earth Sciences but do so without a focus of undergraduate education that prepare them for a career in toxicology. The recent appointment of toxicology researchers in the Chemistry Department has provided a means by which undergraduate chemistry students can be given an enhanced toxicology education, thus leading us to the proposed undergraduate program: An Honours B.Sc chemistry degree with a concentration in chemical toxicology. This program has a threefold purpose: to increase recruitment, increase employment rates of our students, and increase collaboration between the university and other industry/government partners. The program will increase undergraduate recruitment as high school students will be able to see a clear path to employment in industry or government. It will also increase graduate recruitment as the program will provide a stream of trained personnel into our toxicology graduate program, thereby increasing the research impact of the Chemistry Department and the excellence of our highly qualified personnel. Furthermore, students will be encouraged to take a co-operative educational experience, which will not only aid students in finding employment as a result of their work experiences, but also improve collaboration between this university and its co-op partners. All of these factors together will enhance the national and international reputation of Carleton University.

Transition/Implementation No impact.

Program reviewer
comments

patricsmith (02/12/19 9:55 am): Rollback: As requested by Chemistry Administrator
robertcrutchley (02/12/19 12:43 pm): Rollback: In the rationale: fourth sentence. Period between toxicology. Toxicology and line 10 from bottom add chemical. An Honours B.Sc chemistry degree with a concentration in chemical toxicology.
patricsmith (02/28/19 5:25 pm): Rollback: Please add 4907 as discussed

Key: 1931