UNIVERSITY OF TORONTO

University of Toronto Quality Assurance Process (UTQAP)
Cyclical Review: Final Assessment Report and Implementation Plan

Programs Reviewed:	Astronomical Sciences, B.A. (Hons): Specialist Astronomy, B.A. (Hons): Major Biological Chemistry, B.A. (Hons): Specialist Biomedical Physics, B.A. (Hons): Specialist Chemistry, B.A. (Hons): Specialist, Major, Minor Earth Science, B.A. (Hons): Specialist, Major, Minor Environmental Geosciences, B.A. (Hons): Specialist [offered with UTM Department of Geography] Geology, B.A. (Hons): Specialist Physics, B.A. (Hons): Major, Minor
Unit Reviewed:	Department of Chemical and Physical Sciences, University of Toronto Mississauga (UTM)
Commissioning Officer:	Vice-Principal Academic and Dean, UTM
Reviewers (Name, Affiliation):	1. Professor Emeritus Nils Petersen, Department of Chemistry and Centre for Molecular Structure and Dynamics, University of Alberta 2. Professor Harm Rotermund, George Munro Professor of Physics & Department Chair, Department of Physics and Atmospheric Science, Dalhousie University
Date of review visit:	February 27 – 28, 2017
Date reported to AP&P:	November 2, 2017

Unless otherwise noted, all bulleted comments apply to all programs reviewed.

1 Outcome

- The Committee on Academic Policy and Programs (AP&P) concluded that there were no issues to be drawn to the attention of the Agenda Committee but requested a follow up report in one year on the progress made in considering the sustainability of Astronomy within the Department. The follow-up report will be considered by AP&P at the Cycle 2 meeting in 2018-19.

2 Significant Program Strengths

- Impressive delivery of quality programs across disciplines
- Innovative Research Opportunity Program (ROP) and advanced interdisciplinary research laboratory (AirLAB), which enhance student experience
- Successful recruitment of faculty, staff and graduate students to support increased enrolments
- Impressive quality and quantity of faculty research, and strong leadership within the department
- State of the art renovations to the Chemistry and Physics teaching laboratories

3 Opportunities for Program Enhancement

The reviewers recommended that the following be considered:

- Increasing focus on designing learning outcomes and course objectives to ensure that students can better appreciate program expectations, can understand which programs are associated with specific pathways, and receive sufficient preparation to succeed in their chosen pathway
- Designing programs to allow students to take all their courses at UTM
- Having the Curriculum Committee review admissions criteria to ensure similar standards for entry into equivalent programs
- Ensuring that TAs have sufficient educational background, training, and feedback to ensure an optimal learning environment and experience for undergraduate students
- Developing a long term hiring plan to support the programs with the appropriate mix of tenure- and teaching-stream faculty and disciplinary expertise
- Continuing to prioritize the planned renovations to the Earth Science teaching laboratories, to address a range of space concerns

4 Administrative Response & Implementation Plan

UNIVERSITY OF
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MISSISSAUGA

OFFICE OF THE DEAN

October 2, 2017

Professor Sioban Nelson
Vice-Provost, Academic Programs
Simcoe Hall
University of Toronto

Dear Sioban,

I am writing to provide an administrative response to the External Review of UTM's Department of Chemical and Physical Sciences, which was held in February of 2017. This Department includes programs in Astronomy, Chemistry, Earth Science, and Physics. I am pleased with the largely favourable review, which highlights the delivery of quality programs across multiple disciplines, providing strong undergraduate and graduate education and faculty research activity. Reviewers commended the innovative research opportunities available to students, including both a range of Research Opportunity Programs (ROPs) and interdisciplinary AirLAB offerings. The state of the art teaching laboratory facilities for chemistry and physics were also acknowledged as positive developments in the Department. I expect that, with continued support, the Department will continue to provide outstanding programs across a range of fields. An implementation plan with timelines can be found at the end of this letter.

Curriculum and Program Delivery

The reviewers commended the department's strategies to meet the challenges of delivering educational and research programs in four disciplines. They encouraged more focus on designing learning outcomes (e.g., Physics) and course objectives (e.g., Earth Sciences) to ensure that students can (1) better appreciate program expectations; (2) understand which programs are associated with specific pathways (e.g., graduate school, professional certification, etc.); and (3) receive sufficient preparation (e.g., in joint courses) to succeed in their chosen pathway.

The Department has already begun the process of creating Curriculum Maps of its programs, which directly addresses the more explicit creation of learning outcomes and course objectives, as well as providing the Department with targeted knowledge of the preparation students are receiving in their courses, and where any gaps may exist. For example, computational skills are a concern for many of the degree programs in this Department, and the Curriculum Maps will help to highlight gaps in existing requirements and courses, as well as places where solutions will best fit; more details are provided in the Implementation Plan, including proposed joint courses.

Points (1) and (2) are also addressed by the newly unveiled Program Plans for degree programs in this Department (and others) created by the UTM Career Office with support from the Dean's Office and the departments, which provides accurate and parallel advice on academic, co-curricular, work experience and skills training for each stage of undergraduate study, including

links to UTM campus-based support for each of these (see http://www.utm.utoronto.ca/program-plans/ for examples). These will be expanded to cover all the major degree streams in the Department. Both the Curriculum Maps and the Program Plans will require regular updates and revisions as the Department continues to improve its degree offerings.

Earth Science, in particular, will be making major changes to their degree programs as they re-orient their existing degree programs with new faculty hires (see below) and to achieve APGO (Association of Professional Geologists of Ontario) compliance; their Curriculum Maps and Program Plans will be essential tools in this process.

Reviewers suggested that the department design programs to allow students to take all their courses at UTM.

Students in Chemistry, Physics, and Earth Science degree programs all generally complete their degrees with courses offered at UTM. Geology and Astronomy are the only programs with insufficient course offerings at UTM to allow completion without including courses offered on the St. George campus. Earth Science will be undertaking major curriculum revisions in conjunction with two new hires, whose searches are currently underway (anticipated start date July 1, 2018), including reassessment of the Geology program. Astronomy is addressed below.

The reviewers recommended that the Curriculum Committee review admissions criteria to ensure similar standards for entry into equivalent programs.

The Department reviewed admission criteria across all their programs at a recent departmental retreat (May 11, 2017). The discussion made it clear that it would not be appropriate to make all programs equivalent, given the diversity of disciplines within the Department. For programs where equivalency would be appropriate, admission requirements are in the process of being streamlined and made equivalent. For other programs, especially programs expected to undergo major changes in curriculum or enrolment (e.g., Earth Science, Astronomy), admissions criteria will be reviewed regularly and changes made as appropriate, on a longer time scale. The ongoing development of Curriculum Maps and Program Plans will help the Department to monitor and assess these issues.

Reviewers were concerned around the sustainability of Astronomy as currently structured and recommended that the department pursue one of several options to merge this division into the other divisions of the department to ensure critical mass, availability of courses on the UTM campus, and competitiveness.

The Department agrees that this is a major concern and this was a major discussion topic at the recent retreat. The Department is currently reviewing options, and is considering two main options proposed by reviewers as well as other potential alternatives that may be beneficial for students and faculty, such as linking to an Astrophysics program and/or a Planetary Science program. Because of the impact these changes could have on multiple aspects of the Department, we do not want to rush this decision.

The department uses both undergraduate and graduate students as teaching assistants. The reviewers strongly recommend that TAs have sufficient educational background, training, and feedback to ensure an optimal learning environment and experience for undergraduate students.

To deal with the variety of training provided across the various disciplines and graduate programs from which Chemical and Physical Sciences draws its TAs, and to provide more uniform instruction specifically tailored to CPS needs, an in-house TA training program is currently being developed, to begin in 2018-19. CPS will draw on TATP and other expertise to develop the training program.

Faculty

The reviewers recommended the development of a long term hiring plan to support the programs with the appropriate mix of tenure- and teaching-stream faculty and disciplinary expertise.

The Department values the reviewers' suggestion and has already begun to reflect on the appropriate mixture of responsibilities and appointment categories to support their programs, courses, and research. As noted, Earth Science is already in the process of hiring two new positions, one teaching-stream and one tenure-stream, to address the significant needs of this program. The Department will continue to discuss the complementary needs of each program.

Organizational and Financial Structure

The reviewers recommended continued prioritization of the planned renovations to the Earth Science teaching laboratories to address a range of space concerns.

The Earth Science teaching labs continue to be a priority for the Department and the division (UTM). Plans are well underway for the space; most unfortunately, there has been a delay due to delays in other building projects at UTM, and while there are shared teaching labs where Earth Science is considered to be the primary user, the new labs dedicated to Earth Science will allow much improved teaching and more lab sessions as the program grows. The labs should be operational no later than 18 months after the original completion date of Fall 2018, in Jan 2020, with hopes for an earlier completion in Fall 2019. A new Earth Science lab coordinator was hired in August 2017 and will be instrumental in the lab design process.

Implementation Plan - Department of Chemical and Physical Sciences, UTM

The Department and the Office of the Dean, in consultation, will undertake the following approaches to enact positive changes:

<u>Immediate Term (6 months)</u>

Curriculum and Program Delivery

- Curriculum mapping of all programs, including attention to learning outcomes and course objectives, and student preparation at each stage for degree requirements; project underway, will take 1-2 years to complete, then requires continual review and updating; *Department with assistance from UTM Dean's Office (Associate Dean Undergraduate)*
- Program plans for degree programs; first phase completed, annual updates of existing plans and new developments for new degrees; *Department working with UTM Career Centre*

- Computational skills/training to be addressed by initiatives in the current curriculum cycle, with medium/long term implementation; *Department*; examples include:
    - Computational training components to be introduced in existing 1st and 2nd year Physics courses
    - Introduction of an additional joint Chemistry and Physics (JCP) course at the 200-level to introduce scientific computing, specifically to train students on numerical software tools to solve practical Chemistry and Physics problems relevant in both academic and industrial settings
    - Computational modelling course currently being proposed at the 300-level for Physics students
- For programs where equivalent admissions criteria are appropriate, admission requirement changes are being proposed in this year's curriculum cycle; *Department*

Faculty
- Hiring of two new faculty in Earth Science (one teaching-stream and one tenure-stream); *Department with funding from the Dean's Office*

Medium Term (1-2 years)

Curriculum and Program Delivery
- Continue new work on and revisions to Program Plans
- Continue new work on and revisions to Curriculum Maps
- Physics to pursue a new specialist stream in Physics or Computational Physics (medium to long term); *Department with assistance of Dean's Office (Program and Curriculum Officer)*
- Earth Science continues major curriculum review and overhaul, with new faculty hires beginning in July 2018, including consolidating the Earth Science programs with the existing Geology programs (medium to long term); *Department with assistance of Dean's Office (Program and Curriculum Officer);* Goals include:
    - Addressing the enrolment issue with existing Geology specialist program
    - Streamlining existing program requirements to clarify program and course objectives and expectations, align with student interest and career goals
- Astronomy will assess effects of program changes put in place shortly before the review; continued discussion of future options for Astronomy degree stream; *Department with assistance of Dean's Office (Vice-Dean Teaching and Learning, as needed)*
- Certification/Accreditation
    - Earth Sciences curriculum changes planned to allow their degree programs to become APGO (Association of Professional Geologists of Ontario) compliant, including Professional Geoscientist (P.Geo) designation (medium to long term); *Department with assistance of Dean's Office (Program and Curriculum Officer)*
    - The Chemistry Specialist and Biological Chemistry Specialist programs have been accredited with the Canadian Society for Chemistry (CSC) for the past 10 years; accreditation is up for renewal in 2018 and CPS plans on seeking a 5-year renewal; *Department with assistance of Dean's Office (Program and Curriculum Officer)*
- Computational skills/training to be addressed by initiatives in the next curriculum cycles, with medium/long term implementation; in addition Chemistry to review new Physics

programs at all levels (see Immediate) to determine if this is an appropriate fit for their programs and students; if yes, they will bring this into their programs; *Department*
- In-house TA training program currently being developed, to begin in 2018-19; *Department, with assistance of TATP and other groups*

Faculty
- Annual assessment of faculty complement needs, including future directions of Astronomy program; *Department with funding from the Dean's Office*

Organizational and Financial Structure
- Earth Science teaching labs should be operational within 18 months of the original completion date of Fall 2018 (ideally by Fall 2019, at the latest by January 2020); *UTM Facilities and Dean's Office*

Long Term (3-5 years)

Curriculum and Program Delivery
- See medium term goals above
- For programs where equivalent admissions criteria were not deemed to be appropriate in earlier stages, monitoring and regular review will occur (especially with program and enrolment level changes), with admission changes made as appropriate (medium-long term); *Department*
- Monitor, review and discuss options for Astronomy degree stream for final decision about direction to be taken; *Department with assistance of Dean's Office (Vice-Dean Teaching and Learning)*

Faculty
- Annual assessment of faculty complement needs, including future directions of Astronomy program; *Department with funding from the Dean's Office*

Please let me know if you have any questions about this response.

Sincerely,

Amrita Daniere
Vice-Principal, Academic & Dean

Heather M.-L. Miller
Vice-Dean, Teaching & Learning

5 Executive Summary

The reviewers identified the programs' strengths as the impressive delivery of quality programs across disciplines; innovative Research Opportunity Program (ROP) and advanced interdisciplinary research laboratory (AirLAB), which enhance student experience; successful recruitment of faculty, staff and graduate students to support increased enrolments; impressive quality and quantity of faculty research, and strong leadership within the department; and state of the art renovations to the Chemistry and Physics teaching laboratories. The reviewers recommended that the following issues be addressed: increasing focus on designing learning outcomes and course objectives; designing programs to allow students to take all their courses at UTM; having the Curriculum Committee review admissions criteria; ensuring that TAs have sufficient educational background, training, and feedback; developing a long term hiring plan to support the programs; and continuing to prioritize the planned renovations to the Earth Science teaching laboratories. The Dean's Administrative Response describes the Campus, unit and programs' responses to the reviewers' recommendations, including an implementation plan for any changes necessary as a result. The Committee on Academic Policy and Programs (AP&P) concluded that there were no issues to be drawn to the attention of the Agenda Committee but requested a follow up report in one year on the progress made in considering the sustainability of Astronomy within the Department. The follow-up report will be considered by AP&P at the Cycle 2 meeting in 2018-19.