

FINAL ASSESSMENT REPORT
Institutional Quality Assurance Program (IQAP) Review
Health and Radiation Physics and Radiation Sciences Graduate Programs

Date of Review: March 3rd and 4th, 2020

In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the graduate programs delivered by Radiation Sciences. This report identifies the significant strengths of the program, together with opportunities for program improvement and enhancement, and it sets out and prioritizes the recommendations that have been selected for implementation.

The report includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the Final Assessment Report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy or governance that will be necessary to meet the recommendations and who will be responsible for acting on those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

Executive Summary of the Review

In accordance with the Institutional Quality Assurance Process (IQAP), the Radiation Sciences program submitted a self-study in January 2020 to the Vice-Provost and Dean of Graduate Studies to initiate the cyclical program review of its graduate programs. The approved self-study presented program descriptions, learning outcomes, and analyses of data provided by the Office of Institutional Research and Analysis. Appendices to the self-study contained all course outlines associated with the program and the CVs for each full-time member in the department.

Two arm's length external reviewers and one internal reviewer were endorsed by the Dean, Faculty of Science, and selected by the Vice-Provost and Dean of Graduate Studies. The review team reviewed the self-study documentation and then conducted a site visit to McMaster University on March 3rd and 4th, 2020. The visit included interviews with the Provost and Vice-President (Academic); Vice-Provost and Dean of Graduate Studies, Associate Dean, Grad Studies and Research, Director of the program and meetings with groups of current students, full-time faculty and support staff.

The Director of the Program and the Dean of the Faculty of Science submitted responses to the Reviewers' Report (May 2020 and January 2021). Specific recommendations were discussed and clarifications and corrections were presented. Follow-up actions and timelines were included.

Strengths

- As it is currently constructed and operating, the Radiation Sciences Graduate Program provides a strong foundational training and education for its students. Interactions with faculty appear to be extremely productive and collegial. Faculty are accomplished and, in multiple instances, are

considered to be internationally recognized leaders in their respective fields. The program has an excellent history in producing HQP and it is the opinion of the reviewers that it can continue in this capacity moving forward. Invested resources at this time are appropriate for the size and scope of the program. There has been renovation of existing space in order to provide for excellent housing of the current trainees and administrative staff.

Areas for Enhancement/Improvement

- (from section 8) The placement of Radiation Sciences underneath the “umbrella” of the Department of Physics appears to have been done for administrative or budgetary simplicity rather than for a reason related to the academic mission. Given the potential growth opportunities for the Department moving forward and an expansion of its current mission and profile, removing the Department from Physics and allowing it to grow with a dedicated leadership and vision (perhaps re-branded as “Radiation Medicine” or something similar) is considered by the reviewers to be an appropriate step at this time.
- (from section 7) There may be an opportunity to re-structure the program as an independent Department (with a modified title: “Radiation Medicine”?), with its own Chair, that specializes in four distinct efforts:
 - Radiation Biology: this would require some investment for succession planning, although there are also outstanding mid-career investigators in place that can lead more innovative approaches into human- and animal-health as well as environmental impacts of radiation exposure. This would be an academic stream leading to traditional graduate outcomes.
 - Health Physics: this might be the most promising effort for Radiation Sciences, as it will culminate in the desired professional Masters program. As this would be an on-line delivery, it would require support for its development and launch, but would be internationally appealing (based on the program history and current international need) and should be revenue generating as it would represent a significant option for continuing development for professionals seeking the opportunity.
 - Clinical Medical Physics (CAMPEP): this also has potential for significant returns on investment, although somewhat more difficult to envision than the Health Physics program discussed above. The Canadian marketplace for CAMPEP is already very crowded, with ~13 graduate programs already accredited, and there is some concern that this number may already be oversaturating the demand in radiation physics. What would make McMaster unique as compared to its competitors? It would also require a significant increase in the research funding of the involved faculty to support the trainees. This could perhaps be buffered if the Health Physics program is revenue generating, but this considered to be of secondary importance to the Health Physics Program.
 - Radiation Physics: this would be the default program within the Department that trains students on the fundamental aspects of the discipline leading to traditional outcomes. This would share some crossover with Radiation Biology, but with obvious differences in the final product.
- (from section 1) The geographic distribution appears to be a concern that will only grow in time. A significant number of students are currently in a position where significant amounts of their time is spent traveling back and forth between main campus and the Cancer Center. This travel

is associated with not only their coursework requirements, but also for their TA duties. The amount of time that is essentially lost and utterly unproductive on a weekly basis is considerable and can easily reach 10 hours/week/student based on a rough estimate. This concern is also present for the faculty members in the Department that must move between campuses regularly for curricular delivery, etc.

McMaster University and the program in Radiation Sciences is at a crossroads with multiple potential pathways. Left alone, with minimal investment and housed underneath the Department of Physics, the program in Radiation Sciences will likely continue to move forward with low student numbers, a reputation that will become increasingly difficult to maintain, and a faculty that will struggle to maintain sufficient funding to attract and retain more PhD students.

It is recommended that McMaster University engage in a process by which the historic strengths of the program, in combination with the Juravinski Cancer Center and the existing infrastructure in the region are re-evaluated in the context of a broader interdisciplinary academic and continuing professional development mission.

Can McMaster build on the existing and historic strengths of the program in order to fully integrate the basic sciences established within Radiation Sciences with Oncology, health outcomes, epidemiology, etc.? As noted by one of the reviewers “this is medical physics, where is the integration with the medical programs?” A similar approach can be taken with the program expertise in Radiation Biology, where the impact of radiation on human, animal and environmental health outcomes is a critical area for investigation and McMaster appears to be almost uniquely situated to capitalize on this opportunity.

The faculty in Radiation Biology have world-class reputations in an area which can be broadly described as Low Dose Radiation Biology. This is a rapidly developing and very important field which, in fact these investigators had a large part in creating with implications in many areas including environmental, ecological, human health and long-term effects of therapy. Research in other areas of Radiation Biology is however still of more than historical importance and it may be that collaborations with Molecular Biologists and research-oriented Radiation Oncologists would be worth exploring.

From the Continuing Professional Development perspective, it is recommended that the investment into the Masters in Health Physics be continued and, potentially, expanded. This is considered to be an additional area in which McMaster and the region have a competitive advantage over the vast majority of other institutions and that their strong reputation for producing HQP from the program can lead to significant professional and economic benefits. While there is a strong desire on the part of the faculty and students in the program to earn CAMPEP accreditation, and the history of the program and the infrastructure surrounding it certainly makes this appealing, it is unclear that the current funding profile of the faculty will be sufficient to make this investment of time and resources beneficial. It is suggested that this be developed in the aftermath of the Health Physics program, with potential revenue generation buffering the costs associated with additional trainee investment into CAMPEP.

- (from section 3) There was some concern expressed by faculty and students that the first year was very heavy with courses, and that some flexibility would be appreciated so that courses could be selected that are aimed at specific student research areas, and to allow time for research in the lab during the first critical year. The role of and support for the faculty at the Cancer Center in the evolution of the program needs to be seriously considered. Their involvement will be vital for the program moving forward on multiple fronts, but there appears to be no attention paid to succession planning or support for these members of faculty.
- (from section 4) It is strongly encouraged that more formalized approaches be developed for graduate student presentations of research to broader groups (with the opportunity to receive

feedback). Attendance at appropriate clinical Grand Rounds should be strongly encouraged/mandatory.

- (from section 7) More novel areas of investigation such as radiomics, advanced data analytics, AI/machine learning, and direct engagement with the clinical operations were not discussed to a meaningful extent. This is an area for concern as it suggests that there are opportunities on which McMaster may not be capitalizing.

Summary of the Reviewers' Recommendations with the Department's and Dean's Responses

Recommendation	Proposed Follow-Up	Responsibility for Leading Follow-Up	Timeline for Addressing Recommendation
Geographic isolation	a) Shuttle b) Enhanced IT c) Event scheduling	Hunter & JCC faculty Chettle/Rheinstadter	Initial evaluation by Dec 2020
(JCC) faculty research funding	Provide low cost access to research students	Hunter Chettle/Rheinstadter	Initial evaluation by Dec 2020
Deeper links with JCC	CAMPEP may lead to greater engagement	Hunter Rheinstadter/Luke	Present recommendation to Dean of Science by May 2021
Succession planning	New appointment in Medical & Biological Physics New faculty appointments	Luke with P&A in consultation with JCC & other key stakeholders	Initial evaluation by May 2021 Full proposals emerging over 2021-24
Community Engagement	Closer links with current graduate student activities in P&A	Rheinstadter	Emerging discussion & integration during 2020/21 academic year
Radiation Biology succession planning	Discussions between P&A and Biology and between Physics and Radiation Oncology at the JCC	Rheinstadter/Chettle with Dept Biology Hunter with Radiation Oncology	
Professional MSc in Occupational Health Physics	Working group engaged in development	Byun with working group	Submit proposal to Faculty of Science for September 2020, follow established time line
	Consult MacPherson re on-line resources		

CAMPEP costs/benefits	Continued evaluation by working group	Wierzbicki & Hayward with Chettle & Rheinstadter	Seek financial advice from within Faculty of Science by end of June 2020, submit proposal to Faculty of Science by September 2020
1 st year course heavy	Move Med Phys 775 from Fall to Winter	Byun	Implement for Winter 2021, evaluate at end 2020-21 academic year
Grad student seminars	Participation in P&A Symposium Day Establish journal clubs	Rheinstadter, JCC faculty, Mothersill/Seymour, Byun	Continue existing participation in P&A Symposium Day Establish or reemphasise journal clubs by December 2020.
Attendance at Grand Rounds	Encourage attendance at P&A colloquia	Rheinstadter and Radiation Sciences faculty supervisors in Med Phys and Health Phys	Renewed emphasis for start of 2020-21 academic year
Radiomics etc.	Include in criteria for succession planning & search criteria	Luke and P&A search committee	Include in discussions beginning September 2020, hopefully resulting a successful search by July 2021.

Faculty Response

The Dean thanked the review team for their constructive report on the Radiation Sciences Graduate Program and was pleased to see recognition of both the strong international reputation of the faculty in the program and the quality of the training being provided to the students. This program was rehomed within the Department of Physics and Astronomy after the dismantling of the former Department of Medical Radiation Sciences in 2015. While the reviewers offered the suggestion of developing an entirely new Department to house the program as a means to address its perceived isolation, we agree with the program leadership that keeping it placed within the Faculty of Science makes the most sense at the present time. We will support the program in further developing interdisciplinary partnerships within the Faculty of Science and in strengthening their existing linkages with other Faculties. To address one of the concerns about succession planning, we are currently in the process of searching for a new tenure stream faculty appointment in the area of Medical and Biological Physics for a proposed July 1, 2021 start date.

The recommendations made by the review team for enhancement have been carefully considered by the program leadership, and some of these (related to the course balance of the curriculum and increased engagement of graduate students in seminars/colloquia/grand rounds) have been addressed

already. The geographic isolation is an ongoing challenge, but the program is exploring various ways to deal with this issue. We agree with the reviewers that a major first initiative should be the development of the professional Masters in Occupational Health Physics, and the department is in the final stages of completing their proposal for this program. We also agree that it would be wise to delay the process for gaining CAMPEP accreditation until the new professional Master's program is underway, as revenue from the Health Physics Masters could help buffer the costs associated with the CAMPEP accreditation.

One of the new developments at McMaster which will help guide us in the implementation of initiatives with the Radiation Sciences program is the pending arrival of a new Assistant Vice President (Nuclear) in April, 2021. This is a new position designed to advance McMaster's role as a global leader in nuclear research and we expect that the new VP will work closely with the Radiation Sciences graduate program to both enhance the existing research enterprise and develop/lead new initiatives related to research-driven economic development and commercialization.

The Faculty of Science is committed to supporting the Department of Physics and Astronomy as it moves forward with the action plan associated with this review. Together with the program leadership will work to enhance the many strengths while continuing to reflect on our processes to engage in continued program enhancement.

Quality Assurance Committee Recommendations

That the Quality Assurance Committee recommend that the Radiation Sciences Program should follow the regular course of action with an 18-month progress report and a subsequent full external cyclical review to be conducted no later than 8 years after the start of the last review.