

FACULTY OF SCIENCE UNIT REVIEW

Summary Report

The Site Visit of the Review Team for the University of Calgary's Faculty of Science took place from February 22-23, 2021. Due to COVID-19, the site visit took place virtually. The Review Team consisted of:

Matt Davison, Dean of Science, Western University

Jocelyn Hayley, Professor and Head, Civil Engineering, University of Calgary

Bruce Lennox, Dean of Science, McGill University

Janice Nerger, Dean of Science, Colorado State University

Following the Site Visit, the Unit Review Team prepared a written report containing comments and recommendations. The Faculty of Science subsequently provided responses to the recommendations. General comments and the recommendations and responses follow.

General Comments of the Unit Review Team

This report of the University of Calgary's Faculty of Science Review Team summarizes the conclusions derived from an assessment of the Faculty's submitted Report, 14 meetings involving representatives of many of the constituencies pertinent to the Faculty (University leadership, Faculty leadership, faculty, staff, students, and alumni), and written submissions from individuals. The Review Team's assimilation of this information is oriented around a set of 9 questions associated with the fundamental themes (teaching, research, and operations) that relate to a Faculty of Science in a student-oriented, research intensive university such as the University of Calgary. The result is a series of assessments concluding in a set of 26 recommendations. In addition, the Review Team undertook a 'Blue Sky' exercise, resulting in an additional 4 recommendations.

Faculty Response:

Under the leadership of the previous Dean, Dr. Lesley Rigg, the Faculty of Science has made tremendous progress in addressing the recommendations of the previous unit review and made numerous additional positive and forward-looking changes throughout the last five years. This includes the development and implementation of a strategic plan for the Faculty, the advancement of several EDI initiatives, the establishment of professional graduate programs for re-skilling and up-skilling, numerous leading edge research initiatives and associated infrastructure improvements, and a major expansion of our innovation activities, amongst many others.

This document responds to the report from the Faculty of Science Unit Review that was conducted on February 22-23, 2021. The Unit Review Report was circulated for comments and discussion to Associate Deans and Department Heads at the May 11, 2021 Dean's Advisory Committee meeting. Feedback was also solicited from Associate Heads in each of the six departments and undergraduate interdisciplinary program directors. The Leadership Team is highly appreciative of the Review Team's thoughtful and constructive feedback based on meetings with stakeholder groups during the site visit and the self-study document. The majority of the recommendations by the review team are in our view excellent and implementation of the recommendations will result in a stronger Faculty of Science. As highlighted by the reviewers, the virtual nature of the unit review may have left some gaps in their understanding of the Faculty and in a few cases we have endeavored to address these issues in our response. We would also like to highlight that we are in a period of decanal leadership transition. Therefore, some of the responses and proposed initiatives reported here will likely be further refined once a new Dean is in place.

The Faculty response is inserted below the nine questions and subsequent recommendations provided by the Unit Review Team.

Reviewer Recommendations and Unit Response Follow-up

UNDERGRADUATE

Recommendation 1: *Conduct a review of undergraduate programs, including multi-disciplinary and trans-disciplinary programs and concentrations. The review should highlight resource requirements, future directions, student demand, balance of general vs. specialized programs. This may result in a reduction of the number of programs or a re-definition of them as sub-structures to principal disciplinary programs.*

Faculty Response:

This is an excellent recommendation by the review team. Review of undergraduate programs is continuously occurring and all programs in Science are evaluated annually based on student numbers through the formal quality assurance process initiated by the Provost's office. In the future, we will ensure that these reviews address the issues of resource requirements, future directions and student demand. The Faculty will evaluate the right mix of programs and the balance between general versus more specialized programs, with the focus on avoiding over-specialization too early in the program. Some programs, e.g. Neuroscience, are low enrolment programs by design as they are programs with extremely high admission averages, while other programs are currently being evaluated within departments to ensure that they are meeting student needs. All undergraduate programs in the Faculty have completed curriculum reviews in the last five years and are scheduled for their next review in the coming 2-3 years. Specifically, the following programs will complete their next curriculum review within the next two years: Actuarial Science, Biological

Sciences, Computer Science, Environmental Science, General Mathematics, Mathematics, Geology, Geophysics, Natural Sciences, Nanoscience, Neuroscience and Physics and Astronomy.

Since the last curriculum review cycle, there has been significant discussion in the Departments of Biological Sciences and Geoscience around modifying offerings to meet student and industry needs (Geoscience, in particular, has seen a considerable reduction in the number of students seeking undergraduate degrees due to the economic downturn in the oil and gas sector). Both departments have discussed the option of modifying degree paths to include “areas of concentration” rather than multiple specialized BSc degrees. This would result in a reduction of the number of programs offered by the Faculty and impact associated teaching resource requirements. We encourage and fully support the curriculum review and modification process in all of our departments with the goal of modernization of programs and considering new paths for undergraduate students based on student and industry needs.

Recommendation 2: *Explore new structures to better align authority and accountability for leadership of multidisciplinary and transdisciplinary programs.*

Faculty Response:

The review team outlined four major concerns within this recommendation:

- niche programs that specialize undergraduate students too early and thus remove potential maneuverability in their careers;
- the ability of the University to pivot quickly enough to end low demand programs in favour of meeting current and future trends;
- the ability of departments to meet teaching resource requirements in resource intensive programs;
- the lack of formal procedures and policies needed by Program Directors to adequately resource programs in a multi-year cycle.

We agree with the reviewers that transdisciplinary programming is challenging and the Faculty will conduct a careful review evaluating how our interdisciplinary programs fit within our department and Faculty framework and refine their mandate in the context of the Growth through Focus vision. This may result in modifications to degree structures and requirements. We will also streamline procedures designed to improve teaching assignments to ensure that all programs are resourced appropriately. Interfaculty programs (including NEUR and ENSC) are particularly challenging since teaching is normally assigned in departments. In the last few years, a program director representative has been added to the standing membership of the Dean’s Advisory Committee to ensure improved consideration of programs in all stages of planning. We agree that a thorough review of interdisciplinary programs, structure, and governance is necessary and commit to conduct

this assessment in 2021-2022 to determine how to best serve all of our students and ensure broad consultation with directors prior to implementing potential programmatic changes.

EQUITY, DIVERSITY AND INCLUSION (EDI)

Recommendation 3: *Develop Faculty (or University) level best practices for EDI in academic hiring. Consider creating initiatives for targeted EDI academic hires.*

Faculty Response:

We fully agree with the review team that there is much more that needs to be done in creating a diverse and inclusive environment for all faculty, students and staff. The Faculty leadership is fully committed to further enhance and implement EDI initiatives in consultation with the Office of the Vice-Provost EDI and the Office of the Vice-Provost Indigenous Engagement, among numerous other stakeholders.

With respect to academic hiring, we have worked with our HR team to develop rigorous processes for recruitment and are dedicated to work with the University to further develop better resources around unconscious bias training for selection committees, as well as specific resources for chairs of hiring committees. We applaud and fully support the current initiatives by the Deputy Provost to clarify EDI-related regulations in the GFC Academic Staff Criteria & Processes Handbook, as well as, the efforts of the Vice-Provost EDI and her team to improve training materials for committees involved in hiring and other career processes. We have initiated a hire specifically for Indigenous Science and have repeatedly applied for approval for a Tier II CRC position in Indigenous Science as one step to increase diversity and appoint new faculty members from currently underrepresented groups. We will be working actively with the Faculty of Arts and the Schulich School of Engineering to connect our new Indigenous scholars across the academy. We are highly committed to pursue further options and initiatives for academic hires that increase the diversity in faculty ranks.

Recommendation 4: *Develop mechanisms and associated programs for faculty support and mentoring throughout all career stages.*

Faculty Response:

This is an excellent recommendation by the review team and the Faculty commits to increasing its efforts in building out an effective and impactful mentorship program. In 2018, we initiated an early career mentorship program in the Faculty of Science. This program is in part developed and supported by faculty members who have completed the [ELATES program](#). Two faculty (Lisa Gieg and Kristine Bauer) have participated in this program and these ELATES Fellows are instrumental in developing our internal Faculty mentorship program. Although this faculty mentorship program has grown over the last few years, we recognize the need for additional support from the Faculty office for this initiative to achieve its full potential. Throughout the next two academic years (2021-2023) we will expand our initial initiatives into a robust, leading-edge mentorship program for new faculty

members, CRC chairs and faculty at all career stages. The further development of our faculty mentorship program is particularly important as we are expecting to hire over 13 new faculty members in 2021/2022 and are poised to engage in future cluster-hire initiatives as such opportunities arise at the University.

Recommendation 5: *Develop low resource-intensive EDI programs that could have a large and broad impact on faculty, staff, and students.*

Faculty Response:

The Faculty of Science is dedicated to equity, diversity, and inclusion initiatives and was the second Faculty at the University to appoint an Associate Dean to this portfolio. Dr. Steven Vamosi is now completing the fifth year of this appointment and so it is an excellent time for us to consider next steps. We have had significant growth in this area including markedly improved diversity within CRC chair recruitments, the development of an allyship circle, creation of a wellness committee, and a Faculty-level implementation plan for the Campus Mental Health Strategy. In addition, a series of grassroots initiatives have started to enact significant change within departments. While we have had considerable successes, we agree with the review committee that further strengthening and expansion of EDI initiatives is of paramount importance. Together with the incoming Dean, we will determine the most impactful path forward with future EDI initiatives. This may include the appointment of a new person to an AD-EDI role or perhaps the appointment of a series of champions and advisors to lead specific initiatives. The main focus needs to be around enabling and empowering others to engage and develop EDI initiatives in all areas of the Faculty of Science. With regard to low resource-intensive programs, initiatives will include, but will not be limited to, an increase in the number of Diversity Dialogues and other workshops that focus on bystander intervention, culture change, and anti-bullying.

CENTRALIZED SUPPORT STAFF MODEL

Recommendation 6: *Clarify and communicate job portfolios, expectations (performance and workload), and how interactions happen within the new centralized model.*

Recommendation 7: *Related to (1), develop a multi-faceted, multi-month approach to reporting and managing the nature of the changes undertaken. In doing so, use well established Change Management techniques to create a network of local champions throughout the Faculty to steward the change.*

Faculty Response:

The following text addresses both recommendations #6 and #7. We fully agree with the reviewers that there is more work to do in maximizing the success of the major reorganization of administrative and technical services in the Faculty of Science, and we are fully committed to addressing current deficiencies in the near future.

In May 2020, the Faculty conducted a complete reorganization of administrative and technical support in the Faculty prompted by a \$1.8M budget shortfall and the expectation of ongoing reductions to the university's Campus Alberta Grant. This reorganization yielded some significant benefits, particularly in scientific technical support services (workshops, stores, electronics, glassblowing) and other areas (e.g., undergraduate science center (USC), and more recently, the graduate science center (GSC)) where amalgamation of resources and alignment of tasks has helped to bring groups together towards common goals and procedures. In our reorganization, there were also areas where cuts were too deep causing issues with staff workload and service efficiency. We have been working over the last few months to reinvest in key areas like the GSC. We continue to work with staff to ensure that they understand their job profiles, that job profiles are updated where needed, that we communicate better how work processes have changed, and that issues with respect to workload are addressed. We have also consulted with HR, and will continue to do so, to ensure that best practices for managing change are pursued and implemented, and will develop an improved reporting strategy that better communicates the changes made. Since the initiation of the current structure, we have invested in an additional seven support staff positions to deal with gaps in service and or issues with workload. This has been particularly important in the realm of graduate student support where an additional four positions have been added to the complement in recent months. It will be essential that we continue to effectively communicate with our staff and work to ensure that workloads are appropriate over the coming months and years. We also will work to empower staff to make decisions within their units. A key to our future success with the reorganized structure is the hiring of a director of operations in the next few months to help to coordinate activities between the units and build stronger relationships with departments and programs.

As the reviewers mention, issues of a shift from a predominantly department-focused to a Faculty team culture is accompanied by a need to change how work is completed, using unit emails and service monitoring tools and we commit to implementing these changes. We are also committed to aligning processes that were previously done in disparate ways in departments, which requires a deep understanding of the different approaches and adopting best practices. We are still exploring the most effective communication approaches, while using multiple platforms (some of them new) since remote operations began (e.g., SharePoint, Teams, Zoom, the use of a centralized email addresses for requests e.g., sci.research@ucalgary.ca). Although the implementation of the centralized support staff model has been challenging, we increasingly believe that it will be to the benefit of students and staff in the Faculty, with clear roles and consistent processes amongst all programs and to support staff productivity and wellbeing. To support the institutional goal of becoming a top 5 research university in Canada, we are committed to increasing the support staff complement, and the staff to faculty ratio, and will continue to do so within the realities of budgetary constraints.

We also would like to respond to some of the comments in the review around statements regarding "COVID Lessons". While there are circumstances where remote work has led to high productivity for staff, faculty, and some units (e.g., USC's student advising), we need to carefully evaluate this as we return to working together on campus. In many cases, high productivity for some staff has resulted from a place of significant privilege; in other cases, the working from home situation resulted in significant hardships. We feel it is important to recognize here that many of our staff have worked

tirelessly, not because it was easier, but because they were concerned about our students, their colleagues, and in some cases, maintaining their jobs. Overall, it is clear that the pandemic working conditions have been to the detriment of the Faculty and Institution. We have recently started the return to campus planning process for the restructured administrative and technical service units. It is certainly possible that some staff and faculty will request to work from home going forward. Our decisions will be made based on operational needs while ensuring we are supporting all of our staff, including those with unique situations based on accommodated grounds. We will also continue to recognize their efforts and accomplishments over the past year.

Recommendation 8: *Assure adequate student advising and support at the undergraduate and graduate levels. This will likely require a better understanding of the ‘unofficial’ (as in not being explicit in job descriptions) roles that advisors often play in student’s lives; this information may result in a need for additional staffing.*

Faculty Response:

The reviewers highlight support for undergraduate students as an area where there is some concern. While we agree that increased support would be helpful, it is important to note that not only has the USC been instrumental in bringing innovations to other Faculties on campus (e.g., use of QLESS to manage student appointments, use of time-management tools for staff), they have also been able to advise at least 50% more students on an ongoing basis using remote tools than in any other time. While there may be an overall lack of support for undergraduate student advising on campus, we feel that our team has done incredibly well to increase student access to supports during the pandemic. The USC is currently evaluating their service model to try and capitalize on the “lessons learned” during the pandemic and integrate them into ongoing services as students, staff and faculty return to campus. In the centralized graduate student center (GSC) we have realized that the initial cuts have been too deep. We have already commenced with allocating additional administrative positions to the GSC within our budgetary realities and will carefully monitor whether additional resource allocation will be needed to achieve highly satisfactory service levels for graduate students and their supervisors.

PROGRAM DEVELOPMENT

Recommendation 9: *Engage the current, or an expanded, Industry Advisory Council to help plan additional stackable certificates and graduate diploma programs.*

Faculty Response:

The Faculty of Science has had significant success in developing new stackable certificates and professional course-based Master programs over the last few years. We are fully committed to expanding existing and creating new stackable certificates and professional graduate programs, in close consultation with the current or expanded Dean’s Circle group, to ensure that we are meeting industry and student needs. Part of the development of new programs is conducting a market

analysis. Our [“Dean’s Circle”](#) includes industry leaders who are committed to helping us to build programs of interest to the community and for the economic recovery in the Province. In addition, some departments such as Computer Science have their own industry advisory groups. As budgets for post-secondary institutions continue to be reduced by the provincial government, the development of these revenue-generating programs will become increasingly important. Current expansion plans of our professional graduate programs are focused on adding new specializations to the highly successful data science program, as well as developing new programming in games and immersive technologies, applied computer science, and potentially environmental consultancy. We firmly believe that the Faculty of Science has a key role to play in enhancing and diversification of the Alberta economy through re-skilling and up-skilling of parts of the provincial workforce and the development and support of start-up companies in diverse industry areas.

Recommendation 10: *Create a realistic budgeting/business plan to ensure a sustainable delivery of stackable certificate programs, with all direct and indirect costs being identified.*

Faculty Response:

We agree with the reviewers and we are fully committed to continue to developing transparent budgeting for all programs and departments. To achieve this, the University needs to provide a more detailed breakdown on the sources of tuition dollars both within the Faculty of Science and our partner Faculties. Currently, all tuition dollars are reported to the Faculty in a single budget line item, and it has been difficult to get more granular data from the Provost’s office. The ability to differentiate tuition revenue from professional programs and other departmental programs is a key requirement for improved budgeting and realistic business planning, including understanding financial inputs and outputs with other Faculty partners. Program specific tuition revenue data will also allow us to manage expenses appropriately for these programs.

Recommendation 11: *Build programs so that they can be phased out when demand ebbs; for instance, set budgets for 3 to 5 years, with academic and financial reviews near the end of the stated time period.*

Faculty Response:

We have been considering this point carefully as we develop our professional graduate programs. Each program will need to undergo review within five years to ensure that it is still financially viable and to enact any changes needed to meet industry demands in a time of rapid technological and economic changes. Tenure-track faculty positions allocated to support these programs are established in a fashion so that new faculty members could also be deployed in support of other high-demand undergraduate programs in the Faculty of Science should other programs be phased out. As we develop further programming, it would be helpful for the University to advocate for some minor changes to the processes of the Campus Alberta Quality Council to allow degree programs to be developed in a more time- effective manner with increased onus on the University to ensure the quality of the degree. This could be particularly transformative for our professional

graduate programs where an overall degree structure has been approved by the Ministry. If changes were put in place to allow the University to approve new areas of specialization (and suspension of older specializations) within existing provincial government approved professional degree structures, this would reduce the time for approvals by many months and increase our flexibility and ability to be agile in a rapidly changing professional degree landscape.

Recommendation 12: *Create structures to ensure that students in the stackable certificate programs obtain mentoring and a sense of community.*

Faculty Response:

We agree that building community within our professional programs is of key importance. This includes both community within the participants of the degree program as well as industry leaders. We will work over the next years to build an industry/student collaborative board to strengthen connections between our professional graduate programs and the industry community in the City of Calgary and the Province of Alberta to foster deeper partnerships, collaborations, work-integrated learning opportunities and ultimately job placements.

Recommendation 13: *Explore alternative delivery methods and location for these professional certificates and graduate diplomas, including downtown and remote delivery options.*

Faculty Response:

We partially agree with this recommendation. Throughout the pandemic, we have already been considering different offerings of our professional graduate programs and will continue to develop such options for both undergraduate and graduate students. We are not currently considering site options related to our downtown campus, as remote and alternative face-to-face learning opportunities have been most widely requested by our students; we will continue to monitor market conditions and demand for downtown offerings, particularly as the city begins to transition towards economic recovery from the pandemic and the downturn in the oil and gas sector. If adequate faculty support can be secured, we are also planning to explore fully online versions of some programs.

RESEARCH STRENGTHS

Faculty General Comments:

We fully agree with the review team that an institution with the aspiration to become a top-5 research university also needs its Faculty of Science to move towards top 5 in the country. Based on NSERC discovery grant funding levels, the Faculty of Science currently ranks nationally towards the lower end of the top 10. The reviewers correctly point out that the Faculty of Science has a fantastic track-record in leveraging partnership funding from industry and the private sector with NSERC dollars, ranking 2nd nationally. This suggests that the Faculty of Science is extremely well positioned to further grow such partnerships in a variety of different applied research and innovation areas that have local, provincial and national benefits. Also, Faculty researchers obtain major grants from non-

NSERC sources such as CSA, NASA, MIF, Alberta Innovates etc. Capitalizing on emerging partnership opportunities should enable the Faculty of Science to grow its competitive annual research funding significantly. In turn, this will support an expansion of the number, and an increase of the quality, of our HQP; these changes will subsequently increase the success and impact of the research conducted in the Faculty, resulting in improved national and international rankings.

In terms of research focus areas, we point out that three of the Faculty's four grand challenges selected through a Faculty-wide grassroots approach in 2017, are now perfectly aligned with the focus areas in the Growth through Focus vision: energy transitions, digital innovations, and health and life sciences. A refinement of the Faculty of Science strategic plan and its alignment with the Growth through Focus vision will occur in 2022. With the excellent track record on delivering on major leading-edge research partnerships, we believe that the Faculty of Science is exceptionally well positioned to be a lynchpin and catalyst in achieving the lofty goals of the institutional Growth through Focus plan, while playing a leadership role in helping Alberta's economy recover and diversify using innovation-based science. It is somewhat disappointing that this viewpoint was either not shared or did not resonate sufficiently with the team of reviewers. Nevertheless, we hope that our response to the three recommendations maps out a clear and promising plan for lifting research activities in the Faculty of Science to national prominence and beyond in the coming years.

Recommendation 14: *Continue to seek and secure partnership funding and ensure that this funding covers all graduate student costs.*

Faculty Response:

We agree with the reviewers that securing more partnership funding in a wide range of areas is essential for our research enterprise in the Faculty of Science. We are fully committed to enhancing success with expanded research partnerships while being a catalyst in making the Growth through Focus vision a reality. Our Faculty is actively supporting our researchers in networking with potential partner organizations by running innovation workshops, developing larger collaborations with our Innovation Cluster initiative and by recognizing our researcher's effort by nominating them for research and innovation awards. Collaborative research projects are fully costed and include appropriate graduate student stipends. We are also working towards providing faculty members with non-financial support to enable them to take on additional graduate students. This includes investments in research project administration, proposal-writing support, and safety support.

Recommendation 15: *The Core Facility model should be extended to the operations of other research infrastructure in the Faculty.*

Faculty Response:

We agree with the reviewers and will continue to grow our core facilities where appropriate. We have started discussions with the Department of Biological Sciences to create a core facility similar to what has historically been supported for the Department of Chemistry. We have already observed that the centralization of our support staff will facilitate such an expansion of core facilities. We are also pursuing the concept of providing augmented researcher-supported administration and

management support centrally, with the vision that a centrally recruited and managed team will be available to faculty on a modest user-fee model.

Recommendation 16: *Alignment of the Faculty's strategic research plan with the University's aspiration to be a Top 5 University in Canada will require strategic decision-making regarding faculty hiring (particularly cluster hiring) and strategic infrastructure builds. How this will be achieved needs to be discussed widely in the Faculty and the means to do so decided upon.*

Faculty Response:

We agree with the reviewers on this point. To achieve this, a proposed approach would be to work with the department heads to identify a limited number of research focused areas in each department, where critical mass already exists or can be easily achieved, and where targeted investment of positions and infrastructure has the potential to lift the research area to national and international prominence. If agreement for such a plan can be secured amongst the leadership team, this process could be rolled out in a Faculty-wide, data-informed initiative. This process would collect highly valuable information and feedback for the renewal of the Faculty's strategic plan that expires in 2022, and inform the further development of hiring plans.

The Faculty of Science is extremely well positioned to grow major partnerships and take advantage of cluster-hire opportunities in a variety of different research and innovation areas such as energy transitions, computer science-based solutions for the tech sector (including artificial intelligence, machine learning and quantum computing), expansion in the agricultural sector with a holistic approach from crop science to impacts on receiving waterways and human and animal health, and finally health-related life sciences including synthesis of drugs, diagnostics, antibiotic resistance, amongst many others. These research and innovation areas are not only deeply embedded in the Growth through Focus vision, but are also of key importance for the economic recovery of the City of Calgary and the Province of Alberta. To provide further supports required for this growth, we will complete a space master plan to help to resolve infrastructure issues and will also work closely with campus planning on new building design and development over the next two years.

GRADUATE STUDENTS

Recommendation 17: *Create incentives for faculty to support more than current 2-3 students, either through workload management or through other recognitions. Support is needed for those with truly large groups and attention needed to make sure that the quality of supervision in large groups is adequate.*

Faculty Response:

The Faculty of Science is highly committed to play a leading role in increasing the number of high-quality graduate students at the University of Calgary as outlined in the Growth through Focus vision, and we are committed to exploring various incentive options in the future. We point out that the average number of graduate students (n = 762) per research-stream faculty member (n = 185) in the

Faculty of Science is 4. We also note that graduate student supervision is incorporated in the workload assessment in the Faculty of Science, but we commit to ensuring that this process is enhanced in a more transparent and consistent way across all departments in the future.

The Faculty of Science houses a number of highly successful research groups capable of generating sufficient funding to fully support an above-average number of highly-qualified personnel from research grants. Other researchers with limited research grant income do rely on partial support through graduate assistantship funding (GAT) to maximize the number of graduate students they can supervise. In these cases, the graduate student stipend support from GAT and research funds support is roughly equal, with most students employed between 6 and 12 hours per week. We consider this an extremely valuable part of professional development for our graduate students, and for undergraduate learning. While it is not possible to disconnect TA allocations from research funding for most departments, we have recently instituted a cross-program GAT recruitment process to facilitate interdisciplinary options which, combined with the centralization of the Graduate Science Centre, makes it easier to maximize the benefit of GATs to support an increased graduate student cohort.

We are currently developing initiatives that will allow researchers of mid-sized groups to access research support centrally in the Faculty. For many researchers currently supporting 2 or 3 graduate students, this additional support could be key in enabling them to apply for additional research grants and to grow and manage their research groups, thereby taking on additional graduate students.

In the Faculty, some researchers feel that a small research group size allows them to more effectively mentor and direct students. In other cases, the nature of the research makes it difficult to attract large research grants that can support large numbers of students (this is true of mathematics programs in North America, for instance). Nonetheless, it is our intention to work to increase the graduate student to faculty member ratio. A number of large new partnerships developed within the Growth through Focus framework will be an efficient approach to raise more research funds and fully or partially support an increased number of graduate student positions. In addition, we envision a mid-career mentorship program focused on strategies to incorporate larger numbers of graduate students into grant applications and subsequently into research groups.

We will also be increasing graduate student numbers through the rapid expansion of current and newly developed professional graduate programs that ladder certificates and diplomas to an MSc designation. This will require significant discussion and collaboration with industry, students and faculty to ensure that the offerings available are in alignment with the economic needs in the Province of Alberta. Also, expansion of graduate student numbers requires additional high-quality space and laboratories as further discussed under question 8. As our professional graduate programs are fully costed based on tuition revenue, we can scale them up when new faculty positions are provided through seed-funding initiatives (e.g. accelerated hires) and student interest is strong. As an example, this year we will be rejecting 80+% of the applicants for our data science program. This provides an excellent opportunity to add 1-2 additional cohorts to the program in the future, in the case that 4 to 8 accelerated academic hires could be secured. This alone would result in an increase of our graduate enrolment by 40-100 students and would be revenue generating in less than 2 years.

Recommendation 18: *Create initiatives to secure philanthropic support of graduate fellowships, both from alumni sources and from longstanding corporate partners. (see section 5)*

Faculty Response:

This is an excellent recommendation by the review team that we will enthusiastically pursue in the future. One of the key performance metrics for our new Dean will be around fundraising. We have spent a great deal of time and effort over the last 5 years cultivating strong relationships with our community and we feel we are in a good position for these kinds of initiatives to garner significant interest from the external community. In the past year, the interim Dean has provided start-up funding for two BIPOC scholarships in the Faculty (undergraduate and graduate). Our goal is to fully endow these scholarships through philanthropic contributions. Over the last number of years, donations to the Faculty have more than doubled because of very significant increases in our relationship-building activities. We are sure that our new Dean will be similarly engaged and will capitalize on these efforts, and increase philanthropic support for graduate students from industrial, alumni and various other sources.

Recommendation 19: *Create a gathering space or spaces for graduate students that promotes informal, social interactions and is inter-departmental in nature.*

Faculty Response:

While we entirely agree with the unit reviewers that additional graduate student spaces for interdisciplinary interactions (both informal and social interactions) would be highly desirable, the Faculty has limited spaces to accommodate this kind of activity. We will work through our space master planning exercise to try to identify new graduate student interaction spaces, as we evaluate how to use existing spaces in more productive ways. There are several graduate student spaces that are used for informal activities – particularly in Biological Sciences and Mathematics and Statistics – that could be used for collaborative activities. It is possible that the post-centralization re-entry of the university (i.e., when we are permitted) will free up some space (perhaps in association with our new Graduate Science Centre) that will permit better, and more, shared space for graduate student interactions. Currently, we are not in a position to earmark additional space, but we will work to consolidate spaces with this end goal in mind. Also, renovation costs are often a limiting factor.

Recommendation 20: *Develop new course-based MSc programs as potential revenue streams as well as incentivize the transition to PhD programs by offering a 5-year BSc/MSc degree.*

Faculty Response:

We are actively working on additional course-based programs that will ladder to MSc degrees, especially in professional graduate programs designed for re-skilling and up-skilling that can be delivered in a revenue-generating fashion. We will consider 5-year BSc/MSc programs as a potential future option since they provide opportunities to ladder students, in particular international

students, into 5-year BSc/MSc programs. Transitions between course-based MSc programs to PhD programs will need to be discussed by area and with consideration of appropriate funding models. Developing new course-based MSc programs outside of professional programs is viewed as not financially sustainable, unless such expansions are supported by investments in new academic and support staff positions.

GRADUATE STUDENT COMPLETION RATES

Recommendation 21: *Establish accurate tracking methods for graduate student completion rates in order to bring situations of low rates to the attention of faculty.*

Recommendation 22: *A thorough analysis of the low completion rates in coursework MSc programs should be undertaken and the relationship of the completion data to implicit or explicit admissions to research MSc and PhD programs determined.*

Faculty Response:

The following text addresses both recommendations #21 and #22. We fully agree with the review team recommendation that accurate tracking of graduate student completion rates and time to program completion is needed. We are committed to evaluate data related to graduate student completion rates and time to program completion in the 12 months following this unit review (e.g. academic year 2021/2022). The results provided by the Office of Institutional Analysis have identified a problem within either our data analysis, supervisory success or lack thereof, or other underlying factors such as recruitment of graduate students into industry jobs prior to thesis completion, amongst others. Our goal will be to provide a thorough analysis of graduate student progression and to identify areas where increased support (e.g. mentorship, funding etc.) will increase student completion rates in a timely fashion.

SPACE

Recommendation 23: *Planning and development of a new Transdisciplinary Sciences Building should be undertaken.*

Faculty Response:

We fully support this recommendation of the review team and will enthusiastically participate in the planning process, realizing that decisions about new buildings require full buy-in from the institutional executive leadership team, the provincial government, and others. The plan to significantly increase the number of graduate students is partially dependent and can only be fully realized if additional high-quality spaces and laboratories are available for experiential learning and training activities.

Recommendation 24: *Planning and development of a solution to the Dept. of Chemistry's physical infrastructure should be undertaken.*

Faculty Response:

We fully agree with the recommendation by the review team. One piece of our current planning that speaks to the reviewer points around infrastructure, is that the Faculty of Science will be completing a space master planning exercise in 2022. We are currently working closely with campus planning on the Interdisciplinary Science and Innovation Centre (ISIC), which will house vivarium-related activities, as well as a new Science building to address issues around the Biological Sciences, EEEL, and units housed in Science B and Science A. If the provincial government helps to fund these new buildings, it will reduce stress on existing buildings and will help us to build hubs around research and teaching themes (e.g. energy, digital innovations etc.), which are in alignment with the Growth through Focus vision. Through our space master planning exercise, we will also work to bring researchers together, renovate existing spaces and build a growth plan for the future. This plan will outline potential solutions for addressing issues limiting the Department of Chemistry as much as possible without the creation of a new science building.

Recommendation 25: *Informal student gathering spaces for undergraduates and graduate students should be created throughout the campus.*

Faculty Response:

In 2019, the Faculty of Science and the Student' Union invested \$570,000 in the creation of an interdisciplinary collaborative space for undergraduate students. The Science Collaborative Space houses dedicated study rooms, open study spaces, as well as a stage that can be used for student events. Because the review team was not able to visit campus, it is likely that they were unaware of this space. While we would love to build out additional spaces for undergraduate students, the Science Collaborative Space is their home. We commit to enhance our communication strategy for ensuring maximum use of this facility by undergraduate students.

We agree that collaborative graduate student spaces are not as well organized. There are several spaces in Biological Sciences, Mathematics, and smaller spaces in Chemistry and Physics, but there needs to be a concerted effort to create interdisciplinary spaces for graduate students in the Faculty of Science. We will try to identify spaces for this purpose through our space master planning.

Recommendation 26: *Critically examine lessons from COVID and in particular, investigate the possibility of releasing campus space currently occupied by select service units and relocating to leased vacant office space in downtown office buildings.*

Faculty Response:

Although the Faculty appreciates this recommendation, we are cautious about releasing existing space and considering new space, either in our downtown campus or in other office buildings. The effects of COVID on our workforce, how we work together, and how the community wants to interact with us will take some time to determine. The university has a downtown campus as well as a dedicated downtown space for the School of Architecture, Landscape and Planning. We are willing to explore opportunities to leverage the space we have in the downtown core for delivering select parts of our programs and/or better advertising our offerings. Further consideration will require significant conversations and will be informed by the return to campus transition throughout the next few months.

Recommendation 27: *The reorganization of staff that occurred in 2020 may become very apparent once faculty, staff, and students return to campus. A communications plan that identifies the advantages of the new structure should be developed.*

Faculty Response:

We entirely agree with this observation and recommendation. We are committed to working closely with all managers, HR and communications experts on a 'back to campus' plan.

BLUE SKY THINKING – MOVING THE FACULTY FORWARD

Recommendation 28: *Within the Growth through Focus plan there are opportunities for the faculty to grow individually as well as through interdisciplinary approaches to solving large problems. The Faculty of Science needs to “lean in” to the Growth through Focus plan and embrace transdisciplinary research collaborations. Furthermore, it was striking to the Review Team how little mention was made in the Report or in meetings as to how the Faculty was going to a key player in the University’s goal to be “The Entrepreneurial University”. Without question the University needs the Faculty of Science to be a leader in this initiative if it is to be realized.*

Faculty Response:

We agree with the reviewers that the Growth through Focus plan provides a unique opportunity for the Faculty of Science. We will ensure that the Faculty of Science will be a lynchpin and catalyst in achieving the lofty goals of the institutional Growth through Focus plan while it also assumes a leadership role in helping Alberta’s economy recover and diversify using innovation-based science. We will further foster the Faculty’s role as a leader in the drive towards an entrepreneurial university. We were the first Faculty to appoint an Associate Dean, Innovation and Strategic Partnerships and were able to attract the former Associate Vice-President Research and Special Advisor on Entrepreneurship and Innovation to this new role. The Faculty acquired a \$3M endowment in support of Innovation Fellowships that support faculty across campus in their innovation and startup activities. This donation was the largest in the history of the Faculty of

Science. Many faculty members are involved in a number of startups and have participated in Creative Destruction Lab (CDL) activities. When the review team was completing meetings with faculty, staff, and students, the Growth Through Focus vision was still in development stage and we suspect that this may be one reason why our past achievements and future potential in innovation and entrepreneurial activities may have not resonated sufficiently with the review team.

Recommendation 29: *Digital innovation is going to be key to growth and success throughout the academy. The Computer Science department will have a critical role in moving the University forward in this respect. Investment in Computer Science will be necessary but not necessarily by only adding traditional faculty lines. Novel approaches to program delivery, teaching, and research should be explored. Joint positions with industry, an “Industry Professor in Residence” program, postdoctoral programs, etc. should be explored.*

Faculty Response:

We agree with the review team that investments into the expansion of our Computer Science program is essential to fulfill industry demands, and to support digital initiatives across campus. We anticipate that major new partnerships developed through the Growth through Focus framework and through philanthropic efforts will create new opportunities in the next couple of years. Of key importance will be stable and dedicated technical support in the digital innovation space to explore novel approaches in program delivery, research and innovation. Creating strategic partnerships with outside organizations to appoint industry professors in residence is an interesting idea that is already in discussion within the Department of Computer Science industry advisory group, and requires commitments from partners, as we would envision to have a 50:50 split of work between industry and academia. As it is already difficult to attract qualified candidates for tenure track positions in Computer Science, we are concerned about the quality of applicants available for postdoctoral positions in that field. Changes to our collective agreement and an increase to the assistant professor salary scales would help in attracting top candidates to these roles.

Recommendation 30: *An Internship Office/Career Centre to provide internship programs for undergrads, job matching, and networking opportunities for graduates should be developed. This Centre could hold industry networking events, job fairs, and provide job counseling more specific to the sciences. Outcomes would be job placement after graduation, which is one of the areas of focus of the provincial government.*

Faculty Response:

The Faculty has invested substantially into our internship/career team and will be adding an additional position in support of graduate student internships in the near future. We see this as a first step towards expanded support of this area, provided that sufficient resources can be secured.

Over the past year, we have renovated a space for an internship office that will serve both undergraduate students and graduate students in our professional programs. We feel that this

office will help to serve our students in the way outlined by the review team. We also note that improved collaboration between Faculty Internship/Co-operative Education offices is needed, as is a stronger connection to central career services, to ensure that the University speaks with a singular voice when connecting with industry partners. The role of career services also needs to be reviewed and better integrated with the Faculty to ensure we are meeting the needs of all Science students. We hope to move forward to continue to build a strong career office in the Faculty of Science in the coming years.

Recommendation 31: *Explore the potential for philanthropy, particularly alumni-derived philanthropy, to fill the funding gaps that inevitably arise as government support decreases. The need for graduate research fellowships, undergraduate student experiences (internships, summer research experiences) and wellness resources are examples of needs that resonate with alumni yet are vulnerable in times of base funding cuts.*

Faculty Response:

The Faculty of Science is planning to expand our advancement initiatives once our director of advancement position is refilled. While we are already pursuing fund development opportunities for undergraduate and graduate student scholarships, we agree that there is considerable room for expansion in this area especially via alumni-derived philanthropy. We commit to a major expansion of our activities in this area over the next couple of years. As mentioned previously, we have invested several years in cultivating relationships with our community and these efforts are beginning to be realized. The next major step for the Faculty of Science may be the realization of a donation to the scale of those for the Schulich School of Engineering or the Haskayne School of Business as we are in an excellent position to be considered for a “named school”. We commit to continue working with the Dean’s Circle, Alumni and Development to target fundraising initiatives that help to engage donors with the vast range of opportunities available in the Faculty of Science.

Follow-up

The Review Team recommendations will be revisited mid-way through the cycle. At that point, the Faculty of Science will be required to report on its status in acting on the recommendations, providing explanations and timelines for those which have not been met. This interim report should be submitted to the Provost in August 2023, with the next full review scheduled in 2025-26.