



The University of Vermont
FACULTY SENATE

**Curricular Affairs Committee of the Faculty Senate
Minutes**

Thursday, October 7, 2021, 4:15 – 6:15 pm

Present: Professors Kervick, Everse, Almstead, Blom, Borchert, Colburn, Dale, Emery, Hazelrigg, Hibbeler, Hunt, Jones, Rosebush, Sargent, Seidl, Sisk, Swogger, Teneback, Tomas

Absent: Professors Barnaby, Berry, Poleman

Guests: Jennifer Dickinson, Cynthia Forehand, Alison Maynard

Chair Kervick called the meeting to order at 4:16 on MS Teams.

I. **Approval of the Minutes.** The September 2, 2021 minutes were approved as written.

II. **Chair's Remarks** – Colby Kervick made the following comments:

- A. **Unit Curriculum Committee Meeting.** Colby Kervick and Stephen Everse held a meeting with the chairs of the unit curriculum committees to discuss protocols, curricular initiatives in the pipeline, and any curricular issues/questions that are arising within the units. Laura Almstead provided recommendations and tips from her experience as CAC Chair. J. Dickinson and Pablo Bose also attended to provide an update on the Catamount Core Curriculum. Another meeting will be scheduled for the Spring semester. Thomas Borchert noted that J. Dickinson and Pablo Bose are scheduled to provide an update on the Catamount Core at the October Faculty Senate meeting.
- B. **Recordings folder** - recordings of the CAC meetings are available in the CAC-FacSen Team. The "Recordings" folder is located in the 2021-2022 CAC Meetings Channel, under the Files tab.
- C. **Changes to the agenda.** Colby Kervick proposed changing the order of items presented on this agenda to hear the APR reports first. There were no objections.

III. **Reports**

- A. **New Certificate, and Micro-Certificate of Graduate Study in Education for Sustainability (EFS), (GC/CESS)** – Amy Tomas and David Jones served as the review subcommittee for this proposal and their report is attached to these minutes. The proposal, from the Graduate College and the College of Education and Social Services (CESS), Department of Education, is for a new Certificate of Graduate Study (CGS), and new Micro-Certificate of Graduate Study (mCGS) in Education for Sustainability (EFS). Both proposals are designed and sponsored through a collaboration between Shelburne Farms and the CESS, and involve core faculty members from CESS, and the Rubenstein School of Environment and Natural Resources. The proposed CGS in

EFS and mCGS in EFS prepare practicing educators to empower learners to make positive changes in their communities. Each of these programs utilize place-based education, service-learning, and systems-thinking as students work to design, implement and lead learning and systems-change across a variety of scales. The subcommittee noted the following: A change in the role of Program Director from Penny Bishop to Simon Jorgenson, the proposed courses have completed the approval process, and the MOU between Shelburne Farms and UVM is in place. The subcommittee recommends approval of the CGS/mCGS in EFS.

Motion: Colby Kervick called a vote to approve the proposal for a new Certificate of Graduate Study and new micro Certificate of Graduate Study in Education for Sustainability in the College of Education and Social Services.

Vote: 17 approved, 0 opposed, 0 abstained. **The motion carried.**

IV. **APR Reports**

- A. **Materials Science Program (GC)** – Joan Rosebush and Stephen Everse served as the review subcommittee, and strongly recommend a positive assessment of the APR process for the Materials Science Program. They reported that the process was followed with integrity and that the program should be commended for a thorough, constructive, and inclusive self-study and APR. The subcommittee report is attached to these minutes.

Motion: Colby Kervick called a vote to accept the subcommittee's report on the APR of the Materials Science Program.

Vote: 16 approved, 0 opposed, 0 abstained. **The motion carried.**

- B. **Biochemistry and Chemistry Programs (CALs, CAS, LCOM)** – Meaghan Emery and Elizabeth Sargent served as the review subcommittee, and their report is attached to these minutes. The review subcommittee recommend that the CAC accept the report as documentation that the APR process was followed appropriately.

Motion: Colby Kervick called a vote to accept the subcommittee's report on the APR of Biochemistry and Chemistry Programs.

Vote: 17 approved, 0 opposed, 0 abstained. **The motion carried.**

- C. **Pathology Master's Degree Program (LCOM)**. Stephen Everse and Ann Hazelrigg served as the review subcommittee, and their report is attached to these minutes. Both the thesis and non-thesis tracks were evaluated. The Program had no corrections to the Reviewer's report and have read and approved the APR Subcommittee report. The APR subcommittee attests that, to date, the APR process has been followed.

Motion: Colby Kervick called a vote to accept the subcommittee's report on the APR of the Pathology Master's Degree Program.

Vote: 16 approved, 0 opposed, 0 abstained. **The motion carried.**

Thomas Borchert noted that the APR reports often highlight structural challenges at UVM, and that the CAC is in the position to observe trends. Discussion included pathways for communicating trends (both challenges and positives) to the Senate. It was also noted that the role of the external reviewer is valuable in their ability to not only reiterate what is included in the self-study report, but to offer ideas on how to overcome and move forward.

V. **Other Business:**

- A. **No-Contest Deactivation of the RN to BS Program (CNHS)** – Colby Kervick presented a proposal from the Department of Nursing in the College of Nursing and Health Sciences (CNHS) for a **No-Contest Deactivation of the RN-BS Program** in Nursing due to consistent low enrollment. It is extremely unlikely that there will be a need for this program in the future for the following two reasons: first, the competition for these students has increased significantly and will continue to increase as long as the market exists; and secondly, the market will not continue to exist, as increasingly nurses are prepared at the baccalaureate level per national nursing organization initiatives. The CNHS Curriculum Committee, faculty and Dean, have approved this proposal. **Motion:** Rosi Rosebush moved to approve the deactivation of the RN to BS Program in the College of Nursing and Health Sciences. The motion was seconded
Vote: 17 approved, 0 opposed, 0 abstained. The motion carried.
- B. **No-contest termination Speech and Debate Minor (CAS)** – Colby Kervick presented a proposal from the Department of Theatre and Dance in the College of Arts and Sciences (CAS) for a no-contest termination of the Speech and Debate minor due to low enrollment and little demand at the present time. The termination of this minor is a reflection not just of the small number of students who have chosen the minor, but of dissatisfaction within the Speech/Debate faculty about the structure and content of that minor. The College has supported and welcomes the development of a proposal for a new minor to come from Speech faculty and others in the near future. Termination of this minor has no implications for loss of faculty and/or staff. **Motion:** Selene Colburn moved to approve the request to terminate the Speech and Debate Minor in the College of Arts and Sciences. The motion was seconded. Discussion included a concern about the low number of votes cast by the CAS faculty, clarification that the low number of votes were at the CAS faculty meeting, not at the CAS Curricular Committee, and that although many CAS faculty opted not to vote, they also did not speak against the proposal. No comments were received during the 30-day public comment period.
Vote: 17 approved, 0 opposed, 0 abstained. The motion carried.
- C. **No contest termination Italian Studies Major (CAS)** – Colby Kervick presented a proposal from the Department of Romance Languages and Cultures in the College of Arts and Sciences (CAS) for a no-contest termination of the Italian Studies major due to low enrollment. Termination of this major has no implications for loss of faculty and/or staff. By terminating the Italian Studies major, faculty would be able to continue to teach in the existing Italian Studies minor and teach more courses in English that can serve wider curricular needs, supporting a variety of other CAS majors and minors. No comments were received during the 30-day public comment period. **Motion:** Rosi Rosebush moved to approve the request to terminate the Italian Studies Major in the College of Arts and Sciences. The motion was seconded. Discussion included statements of support for the Italian program and its faculty.
Vote: 17 approved, 0 opposed, 0 abstained. The motion carried.
- D. **No contest termination Italian Minor (CAS)** – Colby Kervick presented a proposal from the Department of Romance Languages and Cultures in the College of Arts and Sciences (CAS)

for a no-contest termination of the Italian minor due to low enrollment. Termination of this minor has no implications for loss of faculty and/or staff. By terminating the Italian minor, it is anticipated that the enrollment in the Italian Studies minor (which will remain in effect) will increase, thereby helping to ensure the success of that program. The Italian faculty will pivot from classes taught in Italian, which few students have the necessary language skills to enroll in, and start teaching more courses in English, which are more accessible to a wider range of students. No comments were received during the 30-day public comment period.

Motion: Rosi Rosebush moved to approve the request to terminate the Italian Minor in the College of Arts and Sciences. The motion was seconded. Discussion included clarification that terminating the Italian minor would mean the number of Italian Language courses offered would decrease, and enable faculty to teach in other areas, such as Global Regional Studies, World Literature, or the Honors College.

Vote: 17 approved, 0 opposed, 0 abstained. The motion carried.

- E. **No contest termination of the Vermont Studies Minor (CAS)** – Colby Kervick presented a proposal from the College of Arts and Sciences (CAS) for a no-contest termination of the Vermont Studies minor due to low enrollment and little demand for the minor at the present time. While students are very interested in courses on Vermont, they are not interested in combining separate courses into a distinct minor in the area. Terminating the minor does not affect interest in or enrollments in core courses when they are offered. Termination of this minor has no implications for loss of faculty and/or staff.

Motion: Rosi Rosebush moved to approve the request to terminate the Vermont Studies Minor in the College of Arts and Sciences. The motion was seconded. Discussion included one explanation of intent to abstain from Selene Colburn due to the lack of clarity on the institutional commitment to the discipline and courses in Vermont Studies.

Vote: 16 approved, 0 opposed, 1 abstained. The motion carried.

- F. **Change to New Proposal Template to require a check box indicating that the unit has communicated with UVM Libraries to discuss resources needed** – Colby Kervick presented the proposed revision to the text and the addition of a check box to the new proposal submission guidelines to encourage increased communication between units proposing new programs and UVM Libraries. The committee believes adding this minor revision to the form will encourage increased collaboration and coordination between program proposers, Deans and UVM Libraries around current resources available to support new programs as well as more clearly identifying resource needs.

Motion: Rosi Rosebush moved to accept the proposed revision to the New Proposal Template to add a check box to indicate that the unit has communicated with UVM Libraries to discuss resources needed. The motion was seconded. There was no discussion.

Vote: 17 approved, 0 opposed, 0 abstained. The motion carried.

VI. **New Business:**

A. New subcommittee needed to review proposal for a new B.A. in Neuroscience (CAS).

B. New subcommittee needed to review proposal for substantial revision/changes to major and minor in Classical Civilizations (CAS).

C. Cynthia Forehand, Dean of the Graduate College, reported that clarifying language has been added to the Standards for micro-Certificates (mCGS) and Certificates of Graduate Studies (CGS) to address the process for aligning an existing mCGS with a new CGS. The updated Standards are available on the Curricular Resources page of the Faculty Senate website.

D. Thomas Borchert, Faculty Senate President, announced that there will be a call for a volunteer from among the members of the CAC to serve on an ad hoc committee as part of a governance process to review proposals related to the establishment, reorganization, or elimination of colleges, schools, schools within a college, or departments. The Faculty Senate has been working with the administration to develop a process for reviewing proposals that are not strictly curricular. An example is an anticipated proposal to create a School of the Arts, which would bring the Departments of Music, Art and Art History, Theater and Dance into a single administrative unit without changing their curriculum. The new processes being developed call for an ad hoc committee to be comprised of 3 faculty senators elected from the Faculty Senate, and one member each from the Faculty Senate Standing Committees, and one member of the Faculty Senate Executive Council. The ad hoc committee will gather faculty commentary, review the proposal, and make a recommendation regarding the proposal to the Faculty Senate.

Thomas Borchert moved to adjourn 6:06 PM

Curricular Affairs Committee of the Faculty Senate

MEMO

To: Curricular Affairs Committee of the Faculty Senate
From: Amy Tomas and David A. Jones
Date: October 7, 2021
Re: Approval of proposals for a new Certificate, and a new Micro-Certificate, of Graduate Study in Education for Sustainability submitted by the College of Education and Social Services

We have reviewed proposals for a new Certificate of Graduate Study (CGS) and new Micro-Certificate of Graduate Study (mCGS) in Education for Sustainability (EFS) submitted by Dr. Penny Bishop of the Department of Education, College of Education and Social Services. We recommend approval of both proposed programs.

Both proposals are designed and sponsored by a collaboration between Shelburne Farms and the College of Education and Social Services (CESS), and involve core faculty members from the latter unit (Penny Bishop *, Simon Jorgenson and Regina Toolin), and the Rubenstein School of Environment and Natural Resources (Walter Poleman). The CGS in EFS comprises 18 credits of coursework, including 12 required credits via 4x courses that also compose the entirety of the mCGS in EFS, all of which have been approved for inclusion in the 2021-2022 Graduate Catalogue. The original proposed starting date listed on the CGS proposal was summer 2021. This has been revised to a proposed start in summer 2022.

Hereafter, descriptions of program rationale, assessment plans, etc. apply to both the CGS and mCGS in EFS, unless otherwise indicated, such as descriptions in specific reference to the mCGS.

** Penny Bishop, sponsor of the proposals, has since accepted a Dean position at the University of Maine. Professor Simon Jorgenson has assumed the role of Program Director.*

Program Description and Rationale

The CGS in EFS prepares practicing educators to empower learners to make positive changes in their communities and shift societies to improve the quality of life for current and future generations. The planet is undergoing rapid and dramatic changes that threaten not only economies and coastlines but the ability of the planet to support life as we know it. Meanwhile, racism and systemic inequity continue to seep through all aspects of our society, leading to unjust and dangerous experiences for many. Educators seeking to prepare their students for these realities need a new kind of professional learning. The CGS in EFS seeks to prepare learners to engage and thrive in a democratic and sustainable society through nurturing a sense of place, building an understanding of interdependence through systems thinking and systems sensing, and positioning students to discover their own agency through service-learning to lead learning and systems change across a variety of scales from classroom to community.

The proposed CGS in EFS is a collaborative effort with Shelburne Farms—an experienced partner who has engaged 5,000 educators over the past five years through their own EFS-focused professional learning

programs. The proposed CGS and mCGS represent an outgrowth of place-based education initiatives developed by CESS faculty to pursue certificate opportunities identified in the *2018 CESS Strategic Plan*. The proposed CGS also honors UVM's commitment to the Greater Burlington Regional Center of Expertise (RCE), a local network co-founded by UVM and Shelburne Farms that is among 155 RCEs that comprise the Global RCE Network, an initiative of the UN's Education for Sustainable Development Project. The proposed CGS in EFS exemplifies the university's land grant mission to prepare students to improve the well-being of people and planet, and will help fulfill the mission to "prepare students to be accountable leaders who will bring to their work dedication to the global community, a grasp of complexity, [and] effective problem-solving."

To earn the proposed CGS in EFS, students must complete 18 credits via 12 required credits (4x three-credit courses) and 6 credits of electives (detailed below). The goal is to provide high-quality professional learning in Education for Sustainability to practicing educators, including k-12, post-secondary, and informal educators, so that they can successfully design, implement, and lead EFS with their own learners. Educators who complete the CGS in EFS are expected to be able to do the following:

- Demonstrate understanding of the concepts of socio-ecological systems nested within a local-to-global vision of sustainability in order to address social, environmental and economic issues with students;
- Design and implement EFS curricula that incorporates elements of transdisciplinary or concept-based design, and project- or inquiry-based learning;
- Co-create authentic and contextualized learning experiences that center student voice and agency, community impact and honor identity and positionality;
- Establish and nurture reciprocal relationships with community partners and other local resources in pursuit of the co-creation of engaging and authentic learning opportunities for students and significant contribution to the quality of life;
- Grow their capacity to participate in and lead a professional learning community through engaging in reflection and collaborative practices;
- Critically explore their own identity, positionality and personal journey as the starting point for transforming educational practices and systems; and
- Reflect upon and further develop their own personal and professional values and ethics in light of multiple perspectives on sustainability and social justice.

The mCGS in EFS is designed to meet the needs of students interested in EFS but facing logistical or economic constraints. The 4 required courses that compose all 12 credits of the proposed mCGS are the same core courses for the CGS described in the proposal as "the essential curricula necessary for preparing students to educate for sustainability, without the transdisciplinary focus of the full CGS-EFS."

Justification and Evidence for Demand

Educators report wanting to teach about complex issues such as food systems, climate change and racial injustice, which is important for society because education has the power to affect change in our local and global communities. As described in the CGS proposal, educators need content, resources, time, and opportunities to design units of study and engage in critical reflection. In order to change their practice, teachers require programming that models collaborative relationships, long-term duration, and contextualization of place, all of which have been incorporated into the four core courses of the proposed CGS in EFS.

The CGS proposal mentions four comparable graduate-level certificate programs currently offered in the United States: Manhattanville College in New York, West Chester University in Pennsylvania, and Antioch

University New England offer Advanced or Graduate Certificates in EFS, and Webster University in Missouri offers a Graduate Certificate in Sustainability and Social Equity Studies. While these programs could be seen as comparable in terms of course content, there are several attributes that make this proposed CGS in EFS unique. Foremost, it requires more coursework and is more integrated in field-based learning than the others. The UVM CGS in EFS will be situated within a comprehensive Land-Grant University, and offered in partnership with Shelburne Farms. Situated on two exemplary campuses, the CGS in EFS will have robust physical and environmental resources through which students will explore sustainability concepts. UVM is well-positioned to advance this CGS in EFS, as there are no examples of comprehensive, research-based universities engaged in EFS professional development for educators, and certainly none capable of drawing nationally for this audience. Locally, both Champlain College and Middlebury College offer education courses as well as sustainability related courses, but neither offer graduate-level coursework in Education for Sustainability.

Through the proposed CGS (and mCGS) in EFS, UVM's and Shelburne Farms' collaboration would provide the foundational course work to support educators, and thereby their students, to transform their schools and communities. Shelburne Farms continues to experience an increased demand for EFS programming as evidenced by enrollment in their programs. Over the past 5 years, 5,000 educators have engaged in Shelburne Farms' EFS-focused professional learning programs. In that same period, an earlier version of the four core courses proposed here in partnership with Shelburne Farms have had over 500 participants, with 51 of these enrolling in courses for graduate credit. During the summer of 2020, CESS and Shelburne Farms offered these courses collaboratively for the first time, resulting in 33 participants, with 13 graduate course registrations.

Based on the summer 2020 enrollment, as well as on the enrollment of EFS graduate certificates at other institutions, an average of 12-15 participants are anticipated to enroll in the CGS in EFS each year.

Relationship to Existing Programs

The proposed CGS in EFS would be the only sustainability-focused CGS in education at UVM. The proposed CGS in EFS is a natural counterpart to CESS's new undergraduate certificate in Place-Based Education (PBE). As CESS does not currently offer any sustainability-focused programming at the graduate level, the proposed CGS would provide graduates of the PBE undergraduate certificate an opportunity for continued professional learning at UVM after graduation. The proposed CGS (and mCGS) in EFS shares a titular focus on "sustainability" with other graduate certificate and degree programs at UVM, such as the CGS in Sustainable Enterprise and The Sustainable Innovation MBA (Grossman School of Business), and the new PhD program in Sustainable Development, Economics and Governance (CALs). The proposed CGS in EFS is distinctive in its focus on training practicing educators (e.g., k-12, post-secondary, and informal educators) to apply course content to the design, implementation and leadership of EFS initiatives, which require a specific set of curricular and pedagogical skills. The proposal also notes that required courses for the CGS in EFS will complement those offered in the Rubenstein School for the Master's in Leadership for Sustainability (MLS) Program, and that Program Director Matt Kolan believes some MLS students would likely take electives offered for the CGS in EFS. Likewise, the CGS in EFS students would be able to take elective courses offered by the MLS program as electives.

Accompanying the CGS proposal were letters of support from administrative leaders of potentially affected units, including Dean Nancy E. Mathews (Rubenstein School of Environment and Natural Resources), Dean Leslie Parise (College of Agriculture and Life Sciences), Jane Kolodinsky (Chair, Community Development and

Applied Economics) and Christopher J. Koliba (Faculty Director, Office of Engagement), among others (see the penultimate section below for a full list).

Accompanying the mCGS proposal was a letter of support from Brenda Solomon (CESS Curricular Affairs Committee Chair) to CESS Dean Scott Thomas, which noted that “If, in addition to the four core courses of the MICRO-CGS, students wish to expand knowledge outside of education by taking at least an additional three credit-hours from a related “breadth course,” then they would still be welcomed to take the original, full CGS.”

Curriculum

To earn the CGS in EFS, students must complete 18 credits: 12 credits from four core courses, plus 6 credits of electives. The four core courses take place in the summer at Shelburne Farms’ campus or online, and elective courses are offered on the UVM campus during the academic year or summer sessions. The four required courses are newly developed in partnership with instructional faculty from Shelburne Farms, all of which have been approved for inclusion in the 2021-2022 Graduate Catalogue under the course prefixes, numbers, and titles listed below:

Number	Name	Credits
EDCI 343	Foundations of Education for Sustainability	3
EDCI 344	Methods in Education for Sustainability	3
EDCI 345	Transformative Leadership in Education for Sustainability	3
EDCI 346	Education for Sustainability Inquiry and Action	3
	Breadth Course: Elective 1	3
	Breadth Course: Elective 2	3

CGS in EFS students will also select 6 credits of elective courses from an array of options, such as 300 level courses with prefixes that include BSAD (5x), CDAE (3x, plus 3x 200 level course), PSS (4x), FS (2x) and PA (1x).

The proposed CGS is expected to increase enrollment in existing courses that are willing to increase enrollment. There are no required changes to existing courses to meet the needs of the CGS. The included courses were selected in consultation with UVM colleges, schools, and departments to distribute students across the sponsoring and supporting academic units.

The proposed mCGS in EFS comprises the core 12-credit curriculum of the proposed CGS in EFS shown above, whereas the CGS in EFS includes more depth with 6 required elective credits. The parallel proposal for the CGS in EFS contains all elements in support of both the CGS and mCGS in EFS.

Admission Requirements and Process

Prospective students will be required to complete an application for admission to the CGS in EFS. Application requirements include a short statement of purpose, academic transcripts, and three letters of recommendation, preferably one from a prior academic supervisor. Preferred candidates will have prior experience in education, will have completed undergraduate teacher preparation programs, or will have experience in related fields. Students must have successfully completed a bachelors degree, having earned at least a 2.5 GPA.

Anticipated Enrollment and Impact on Current Programs

The CGS proposal lists an anticipated enrollment of 12-15 participants each year.

Advising

The Program Coordinator of the M.Ed. in Curriculum and Instruction in CESS will advise students in the certificate programs.

Assessment Plan

The CGS and mCGS in EFS will undergo Academic Program Review (APR) within the College of Education and Social Services, as all four required courses are delivered by the Department of Education (CESS) and listed with an EDCI prefix.

The CGS in EFS proposal outlines a six page assessment plan (see Appendix A) in a three-year cycle that includes direct and indirect assessment components focusing on student experiences, outcomes and program design, as well as engaging students in formative assessment of course learning objectives. Direct assessments of the CGS in EFS comprise: (1) Each year, UVM faculty, Shelburne Farms faculty, and students will co-create rubrics to be used in evaluating projects and presentations. (2) Also on an annual basis, the CESS Assessment Coordinator and Shelburne Farms staff will prepare a summary report of CGS in EFS statistics, feedback from students, and other relevant data related to learning outcomes to be presented at a CESS departmental meeting. (3) Every other year beginning in year 2, UVM faculty and Shelburne Farms staff teaching the EFS Inquiry and Research course will model the action research process and products (report and proposal) alongside students. (4) Every three years, the CESS Assessment Coordinator, participating UVM faculty, Shelburne Farms faculty, faculty of comparable CGSs within the University, and student representatives will hold a curricular retreat to review student feedback, completion rates, and formative assessments.

Indirect assessments include yearly student surveys, a virtual newsletter of programmatic impacts and highlights shared with stakeholders every two years, and alumni surveys every three years. Assessment activities will be designed to ensure alignment with the CESS Diversity, Equity, and Inclusion Plan that includes six principles and implementation activities across the broad categories of People, Programs and Place.

Staffing Plan, Resource Requirements, and Budget

The proposers net revenue projection showed projections of positive net revenues. The CGS in EFS proposal states that no adjustments in present staff assignments will be necessary. The CGS will be offered through partnership with and material support from Shelburne Farms (Shelburne, VT). Instructional faculty for the program will be drawn from UVM. In addition, and on a co-teaching basis, faculty will be drawn from among the instructional faculty in Shelburne Farms education division. A new Director position will be added, and CGS will be coordinated by the Program Coordinator of the M.Ed. in Curriculum and Instruction.

During a first round review of the EFS CGS by the UVM Graduate College, questions were raised about the use of Shelburne Farms instructional partners as teaching faculty. At issue is how UVM may appoint part-time faculty through inter-organizational partnership and on an unpaid basis. With support of the UVM Provost's Office and the UVM General Counsel, Mary Brodsky (UVM Labor Relations) has developed an acceptable process by which such faculty appointments may be sought and achieved, which is detailed in a letter from Mary Brodsky included in the proposal.

The UVM library system currently has ample resources to support the CGS in EFS. The CGS in EFS does not have any UVM physical space needs, as courses will be either held in-person on the Shelburne Farms campus or offered on-line. No additional demands or equipment are anticipated.

Evidence of Support

Accompanying the CGS in EFS proposal were letters of support from: Dean William A. Falls (College of Arts and Sciences); Pat Fitzsimmons (Proficiency-Based Learning Team Leader, Vermont Agency of Education); Christopher J. Koliba (Faculty Director, Office of Engagement); Jane Kolodinsky (Chair, Community Development and Applied Economics); Dean Nancy E. Mathews (Rubenstein School of Environment and Natural Resources); Mike McRaith (Assistant Executive Director, Vermont Principals Association); V. Ernesto Méndez (Interim Chair, Department of Plant and Soil Science); Dean Leslie Parise (College of Agriculture and Life Sciences); Dean Sanjay Sharma (Grossman School of Business); Amy B. Trubek (Chair, Nutrition and Food Sciences); and Mary Brodsky (UVM Labor Relations).

Accompanying the mCGS in EFS proposal were letters of support from CESS Dean Scott L. Thomas, Brenda Solomon (CESS Curricular Affairs Committee Chair), and Graduate College Dean Cynthia Forehand who stated, "The Graduate College Executive Committee unanimously approved this proposal to establish the mCGS EFS in parallel with the larger 18 credit CGS EFS."

Summary

The proposed CGS in EFS and mCGS in EFS prepare practicing educators to empower learners to make positive changes in their communities. Each of these programs utilize place-based education, service-learning, and systems-thinking as students work to design, implement and lead learning and systems-change across a variety of scales. Offered through partnership with Shelburne Farms and representing the first and only sustainability-focused CGS/mCGS in education at the university, the proposed programs offer unique and important professional learning opportunities for practicing educators. The proposals are well developed and well supported both at UVM and through the collaboration with Shelburne Farms. Thus, we recommend approval of the CGS/mCGS in EFS.

**Faculty Senate Curricular Affairs Committee
Academic Program Review Subcommittee Report
University of Vermont's Materials Science Program (MATS)
August 4, 2021**

Academic Program Review Subcommittee:

Chair: Senior Lecturer Joan Marie Rosebush

Member: Dr. Stephen Everse

External Reviewer: Eric Hellstrom, Ph.D., Florida State University

The external reviewer, Eric Hellstrom, from Florida State University, did his remote site visit of the University of Vermont's Materials Science Program from Monday, April 26, 2021 through Wednesday, April 28, 2021 as part of the Materials Science Program's Academic Program Review (APR). This report provides an overview of the program, summarizes the strengths and the areas in need of improvement of the program identified through the review process, provides a synopsis of the external reviewer's recommendations, references the unit's self-study report completed in March 2021, and offers the APR internal review subcommittee's conclusions.

Dr. Schneebelli provided this subcommittee with some comments about the external reviewer's report. These comments are in purple.

Overview of Materials Science Program

This program was proposed in January 1981 and approved by the Board of Trustees in June 1981. This field of inquiry is the chemical, electrical, mechanical, metallurgical, and optical properties of materials, especially solids, and the applications of these materials. The broad objective of this program is "to educate students in the theoretical and experimental techniques that are required for the solution of ...materials-based problems," such as "corrosion, analysis and synthesis of electronic materials, development of bulk and thin film electronic devices and integrated circuits, optimization and mechanical properties of structural materials, and failure analysis."

No courses are owned by this program. It is interdisciplinary, drawing faculty from many departments: Chemistry, Electrical Engineering, Mathematics and Statistics, and Mechanical Engineering.

The Materials Science Program is now administered by the Graduate College; the Program Director reports to the Dean of the Graduate College. There are three areas of concentration in the program: Electronic Materials, Bio- and Polymeric Materials, and Mechanics of Materials.

The program is interested in adding two national research themes in the next five to ten years: Computational Materials Science and Soft Quantum Matter. Expansion into these areas will require buy-in from multiple departments, in order to hire new faculty members. A clear strategic program plan would help in this planning and eventual inclusion.

Strengths (S) and Areas Needing Improvement Weaknesses (W)

Strengths (S)

S1: The Materials Science Program is an important asset for UVM and is critical to UVM's goal to become an R-1 university. Advances in the field of materials science are critical to improving the nation's and world's technologies. Burlington experiences this first-hand through the Global Foundry facility where applied materials science converts silicon wafers into advanced integrated circuits.

S2. Dr. Furis did an outstanding job leading MATS. (Dr. Schneebeil is the new director, since summer 2021.)

S3. MATS has a clear mission, which is to train the next generation of engineer-scientists in the field of materials science.

S4. MATS graduates are in demand now and in the foreseeable future because materials science is central to many of society's needs. As a result, graduate MATS programs, whether they be full-fledged departments or interdisciplinary programs, like UVM's, admit students with a wide range of BS degrees and then train them as materials scientists through formal course work and most importantly through their research.

S5. The MS program is flexible as it offers thesis and non-Thesis options.

S6. Local students working for industry can earn their MS on a part-time basis.

S7. MATS also has the AMP option but no students have done AMP in the past 10 years.

S8. All recent graduates of the program got jobs, including at Intel, Global Foundries, and Pratt and Whitney.

S9. Diversity! Like many US materials science programs, half or more of the UVM PhD graduate students are **international** students. This provides diversity as MATS students interact with fellow students from many different countries who have a wide range of experiences and backgrounds. Diversity among students affiliated with MATS is high, with two Black, one Hispanic, and five female students among the current 19 PhD students. Twenty faculty members were listed as affiliated with MATS, five (25 %) of whom are **female**.

Faculty

S10: The MATS faculty are outstanding: they bring in significant external funding, they produce PhD graduates who are hired into significant positions after graduating, and they write significant journal articles about their research. Twelve of UVM's NSF CAREER award winners are, or have been, faculty members in MATS. The faculty members associated with MATS are research-active, having brought in roughly \$34 M in the past 10 years. In the past 10 years, they have produced 16 PhDs and have written 412 journal articles.

S11. Faculty from Chemistry, Mechanical Engineering, and Physics credit part of their success getting external funding with their being part of MATS and having access to MATS students. In particular, they mentioned the advantage of advising MATS students who typically have undergraduate different than the faculty member's tenure department. They emphasized the MATS students have the research skills they need for their research programs.

S12. MATS faculty members earned their PhDs at top universities. Three faculty members have formal training in materials science and engineering, and the others have degrees in allied fields such as chemistry, physics, and mechanical engineering where materials science research is done.

S13. Since 2009, eight MATS faculty members received NSF CAREER awards. Since 2009, only seven other faculty members across campus received NSF CAREER awards. These numbers reflect the outstanding quality of faculty members who are participating in MATS.

S14. The faculty members are active researchers in terms of external grants awarded and research papers written. In the area of grants, MATS faculty members are equal to the national average for all categories, but it is significantly above average when compared only to R-2 universities. These data show MATS faculty have significant success writing proposals that are funded by external agencies. Since the 2010 MATS review, MATS faculty members have published 412 papers in 107 different peer-reviewed journals. Many of these are in top journals.

Students

S15. In general, students in the program are pleased with it.

S15A. Specifically, they spoke highly of Dr. Furis's leadership of MATS, including her academic advising, her encouragement of them, and her assistance with their problems.

S15B. Dr. Furis helped former students create the UVM student chapter of the Material Research Society and was its faculty advisor. This student group actively brought MATS students together before the pandemic.

S15C. Students liked that MATS invited materials science faculty and scientists from national labs and industry to visit UVM to give talks after the annual Materials Research Society conference, which is held in Boston the week after Thanksgiving.

S15D. Several students mentioned that they liked that MATS provided the opportunity for them to choose from a variety of research projects in different departments.

S15E. Students mentioned that they are satisfied with the research they are doing in MATS.

Quoting Prof. Hellstrom: "Several of the students who started during the pandemic were "meeting" one another for the first time in they virtual meeting with me. They were looking forward to meeting one another in person in 2021-2022.++"

We already have a Welcome Back" luncheon event scheduled for the beginning of the Fall semester. We will also start a biweekly seminar series for Materials Science students and faculty in the Fall. These meetings will be in-person, and are designed to bring back a community feeling to the Materials Science program. We will also work on implementing a program-wide half-day retreat (similar to what the UVM CMB and Neuroscience programs offer every year) to students and faculty.

We have started to update the Materials Science website. We anticipate the website overhaul to be complete during the next couple of months

Curriculum

S16. MATS provides a flexible curriculum that satisfies the student's classroom education.

S17. UVM's MATS does not have its own courses. Hence, courses from multiple departments make up the curriculum. This is an advantage for elective courses because students can choose from many elective courses across many departments.

Advising

S18. Do the three departments, (Chemistry, Mechanical Engineering, and Physics), count advising a MATS PhD student the same as advising a PhD student in their home department? Yes! This is a significant advantage for UVM's MATS program.

We thank Prof. Hellstrom for pointing out this key challenge. This is a fluctuating number. Now, with a Chemist — Prof. Schneebeli — as the new director of the Program, and several new faculty from Engineering (Linda Schadler, Amber Doiron, Wei Li, Raju Badireddy, and Jihong Ma) and Chemistry (Mike Ruggiero, Yangguang O.U., and David Punihaole) added as members of the Materials Science program, it is our mission to further diversify the student body in Materials Science in terms of faculty advisor disciplines. Recently, the proportion of new Materials Science students with research advisors in other disciplines has been increasing, and we anticipate that the Materials Science Program will be able to further grow its student enrollment by highlighting its unique interdisciplinary nature, and also by starting to offer a small number of Materials Science specific courses, controlled by the Materials Science Program itself (vide infra). To enable more students in Chemistry and Engineering to fit into the Materials Science program, we have also started to revise the Materials Science curriculum.

Resources

S19. MATS programs are equipment-intensive. MATS faculty members have been successful in acquiring major equipment through external grants. These faculty members use many facilities around the UVM campus.

Areas for Improvement (W)

W1. Despite the impressive work done by this program, UVM seems to be overlooking MATS's contributions to UVM's current successes and future plans because MATS is almost invisible. It is nearly invisible because it is a small, inexpensive, interdisciplinary graduate program. Twenty

faculty members are associated with MATS, but the administration does not recognize them as MATS faculty members because their salaries are paid by their tenure homes of Chemistry, Mechanical Engineering, or Physics.

Faculty

W2. The AcademicAnalytics data show that **comparing** UVM MATS to all materials science programs, a large fraction of MATS faculty members has published articles. However, individually, they have a relatively small number of publications. The AcademicAnalytics citation data show that a relatively large fraction of the faculty members' articles is cited and the number of citations per article is greater than average. When compared to only R-2 universities, the UVM MATS faculty members have greater than average numbers of publications and citations. These data show that compared to all materials science and engineering programs, UVM MATS faculty members write fewer papers than at other universities, but that these papers are well-cited.

W3. The Self Study said that UVM did not have a mechanism for recognizing any of the grants that MATS faculty helped secure. Consequently, MATS did not receive any overhead return.

Students

W4. The faculty in MATS stressed that it would be difficult for a MATS student with a BS degree outside the faculty member's home department to be admitted to the faculty member's home department. If such a student were admitted to the faculty member's home department, that student would struggle with classes and the PhD qualifying exam.

W5. Students had some concerns and suggestions for improvement.

W5A. Students said the diversity of available courses is good, but they indicated they would like to have more courses that are MATS specific, in particular core MATS courses.

W5B. Several of the students who started during the pandemic had never met each other.

W5C. Students mentioned that the website was not too useful because it was out of date.

We have started to update the Materials Science website. We anticipate the website overhaul to be complete during the next couple of months.

W5D. Several students mentioned that some of the MS and PhD qualifying exam questions appeared to be exact, or near-exact, questions from courses. They said they would have liked to have a broader spectrum of questions on the exam.

Prof. Schneebeli — who administers the qualifying exam — will work with participating faculty to provide a broader spectrum of questions, if the need arises.

W5E. Students mentioned that Furis answered questions about MATS for them, but MATS did not have an administrator, so they had to get administrative support through their advisor's home

department. The students thought this led to different treatment of MATS students depending on their advisor's department.

Beth Stinebring now provides administrative support for the Materials Science program.

W5F. Students mentioned concerns with the amount they were paid as GTA's or GRA's and whether they were paid for an academic or calendar year. They said this was a problem because Burlington has very high living costs. They also said the stipend problem was campus-wide and not specific to MATS and recognized that campus-wide problems need to be addressed at the campus level. Students wondered whether MATS has a safety net to support them if there were problems with their GTA or GRA funding.

We thank Prof. Hellstrom for bringing this well-known issue to our attention. However, we agree that this is a campus-wide issue, and needs to be addressed campus-wide.

W5G. The MATS students expressed concern with the current small number of tenured/tenure track faculty members in physics saying that they saw this as contributing to making it difficult for physics to teach all the required and elective courses in a timely manner.

We thank the evaluator for pointing out this challenge. This is under the control of the CAS Dean's office. However, we would also like to point out that there are alternative core courses offered in other departments (e.g. Chemistry). For instance, "Advanced Physical Chemistry" can serve as a substitute for "Quantum Mechanics" in Physics, if needed. Thus, although not ideal, there is some flexibility in the system to make up for the potentially less-frequent course offerings in Physics.

W6. MATS's two dedicated GTA's make it easier for MATS to provide support for incoming MATS students and place these students. The MATS GTA's cannot (or should not) be used for year two and beyond. This means that a MATS student with a MATS GTA in year one needs to be supported on external funding or a departmental GTA beginning in year two. Typically, between 33 and 44 % of the MATS PhD students are externally funded and the rest are supported as GTA's. This fraction of GTA funding seems high for a university that wants to increase its research footprint as it strives to become an R-1 university.

It is assumed that as student enrollment in the Materials Science program increases, faculty will start to write more collaborative grant proposals, which will fund additional GRAs.

Curriculum

W7. MATS does not control the courses that make up its curriculum. Courses have homes in UVM departments; so, it is very difficult for a MATS faculty member to create a new course that is primarily targeted for MATS students and only cursorily addresses the needs of students in the faculty member's department.

This is again an excellent point, and we thank Prof. Hellstrom for bringing it to the table. To address it, Prof. Schneebeli (as the new Materials Science Program director) has made it a priority to work closely with Deans Forehand, Schadler, and Falls to establish at least two core Materials Science courses.

W8. MATS has little or no control of course scheduling in the departments that offer the core courses. Many of the core courses are taught every other year, which can cause problems because the content of core courses varying each year.

We thank the evaluator for pointing out these issues. We have already started to work on revising and clarifying the core curriculum. However, we would also like to point out that to avoid a bias in the qualifier exam, we offer a selection of potential questions to solve for all the students each time the exam is offered. Students can choose which questions they want to answer and have graded. We do our best to include a question from all core curriculum Materials Science courses, which the students have taken. While this increases the work for the Program Director and the faculty who prepare the exam questions, we feel that this solution presents a fair way to administer the qualifier exam, even with shifting core courses.

W9. MATS requires that MS and PhD students take five core courses, one in each of five specific topic areas (Applied Mathematics, Materials Properties of Solids, Quantum Mechanics, Solid State Theory, and Thermodynamics and Kinetics). The topics covered in these five core areas are reasonable for the MATS curriculum. A list of courses satisfying each of these five areas is not readily available to students or faculty.

W10. Although the curriculum states that five core courses need to be taken, a sixth core area is mentioned in some curriculum lists. That is Biophysics and Chemistry. What are the actual requirements?

W11. No core nor elective courses in MATS have ever been created specifically for MATS in any department.

W12. Some only offer core courses every other year. MATS solves this core course timing problem by allowing students to take different courses to fulfill **some** requirements, depending upon the year they enter the program. Students entering in odd years take one group of courses; students entering in even years take another group. The issue is that the focus can be very different in different courses: Chemical Thermodynamics versus Thermal Physics, for example. This variation can cause problems for students when they take the MATS PhD qualifier exam, which is designed to test learning and understanding based on the core courses the students have taken.

Advising

W13. Physics got its own PhD program two years ago. Before this, MATS PhD students were a source of students for physics faculty members. The Self Study reports that from 2010 through 2020 physics faculty members advised 14 of the 16 students who earned PhDs in MATS. When

UVM administration created the physics PhD program it established metrics that physics has to meet about the minimum number of physics PhD students it will produce after some period of time. This may create pressure going forward from the physics and the A&S administrations for physics faculty members to prioritize physics students over MATS students.

W14. Chemistry faculty members are now advising three MATS students. These are the first MATS students advised by chemistry faculty members in almost fifteen years. These data show that the active MATS faculty, defined by me as advising a MATS PhD student, is only probably less than 50 % of the total faculty members listed for MATS.

Resources

W15. The maintenance of the scanning electron microscope is expensive, (\$35-50 k per year).

W16. Library resources are barely adequate. It is often very expensive for a library to subscribe to online access to handbooks that move to digital formats.

External Reviewer's Recommendations (R)

Faculty

R1. Director of MATS has advisory input when hiring new faculty members for MATS.

We thank Prof. Hellstrom for this suggestion. We will reach out to the Deans of the participating units to discuss this recommendation.

R2. The director of MATS writes a yearly letter to the department chair of each active MATS faculty member that details their contributions to MATS. This is for input to the faculty member's annual evaluation.

We thank Prof. Hellstrom for this suggestion. We will follow the processes established in the CBA, which currently specifies that the program directors provides an assessment for faculty with Materials Science secondary appointments for any RPT actions.

R3. The MATS faculty members meet at least once per semester; the Executive Committee meet at least once per month.

This suggestion has already been implemented, partially, over the summer. We already have monthly executive committee meetings scheduled for the semester.

Students

R4. MATS Executive Committee members review all applicants who meet the requirements for admission.

This suggestion has already been implemented over the summer, and the executive committee reviewed its first application for Spring 2022 on Aug. 26, 2021.

R5. Increase the number of dedicated GTA's for MATS.

We thank Prof. Hellstrom for this suggestion. We will reach out to the Graduate College and Deans of the participating units to discuss this recommendation.

R6. Create a dedicated 0-credit MATS seminar series that all MATS students must take every semester through graduation. Have students present their work and do critiques of oral presentations and posters. Have lab tours. Review research papers of interest to all MATS students. Attend and present research seminars given over zoom. Why 0 credits? This way, the seminar will not interfere with students taking three 3-credit courses per semester.

We will try to implement this suggestion. A possible solution could also be a one-credit course. Students can take up to 10 credits in their first semester.

R7. Have a MOU between MATS and the department where a MATS GTA is placed that lays out how the student will be supported in years two through graduation.

This is a great suggestion. The only issue is that financial planning for multiple years out can be difficult and highly inaccurate. Often, the Dean's office does not know the exact need for GTAs until near the start of the semester. Also, faculty often don't know whether they are going to receive the grants they applied for in advance. However, we will definitely work with the Dean's and Chairs of the participating units, to establish better guidelines on the minimum number of GTA positions available (as a backup, for when faculty grants don't get funded).

Curriculum

R8. Publish a list of courses on the web that satisfy the five core course areas listed in the MS and PhD curriculum.

A great suggestion. We will implement it as soon possible.

R9. Emphasize the MATS AMP MS degree to undergraduate students and publish a road map showing how an undergraduate in chemistry, mechanical engineering, or physics could do the AMP program earning a BS in their current department and an MS in MATS.

Again, a great suggestion. We will work on popularizing the AMP Materials Science degree, both on the website, and with on-campus events.

We will work on popularizing the AMP Materials Science degree, both on the website, and with on-campus events and also clarify the possible AMP paths to degree completion.

R10. Coordinate with the various departments that offer core courses to set when these courses will be taught in upcoming years.

This is a great suggestion. The executive committee will communicate with the Dean's and Chairs of the participating to implement this suggestion.

R11. Make available to MATS students all core courses recorded during the pandemic so they can study the information presented in equivalent core courses to broaden their understanding of the core topics and to better prepare for the PhD qualifier exam.

We thank Prof. Hellstrom for this suggestion. We will explore this option as well as other multimedia-based teaching options to further increase student preparation for the qualifier exam.

Advising

R12. Have one person in MATS who knows the curriculum be the first-year advisor for incoming students. This same person should coordinate creation of the qualifying exam.

We completely agree with this suggestion. This role is now being fulfilled by Prof. Schneebeli as the new program director. It has been fulfilled in the past by Prof. Furis.

R13. The MATS director assigns a MATS faculty member to be the faculty advisor for the student chapter of the Materials Research Society.

This is a great suggestion. The director itself has, up to now, fulfilled this role.

Resources

R14. Office of the Vice President of Research uses a fraction of the overhead return to create a fund to repair equipment that a faculty member allows to be shared by other research groups across campus.

We thank Prof. Hellstrom for this suggestion. We will reach out to the VP for Research to try to build in such an overhead return system into future budgets.

R15. Hire a part-time administrator for MATS.

R16. Keep hard copies of reference materials, even though they may not be completely up-to-date. Online materials are often very expensive.

IMPORTANT CONCERNS (C)

C1. MATS needs to develop a strategic plan that can articulate how MATS can impact materials research at UVM and can be used at the department, college, and upper administrative levels. This plan could help guide hiring in multiple departments.

We thank the evaluator for this suggestion. We will work with Deans Schadler and Falls in trying to establish such a strategic plan.

C2. Should MATS even have a comprehensive exam for an MS degree in MATS, particularly if a student does a MATS AMP MS?

We thank the evaluator for this suggestion. However, based on information we received from the Graduate College, having a comprehensive exam for MS degrees is a University-wide requirement. Therefore, we will not be able to eliminate this requirement.

C3. The Self Study listed all the awards for the past 10 years that had a MATS faculty member as PI, which totaled \$34 M. This amount is too high, because some of the MATS faculty members have never advised a MATS student. How can UVM deal with apportioning some of the credit for the awards to MATS? One way is to count all awards for the past 10 years only for physics faculty members, because they took MATS PhD students to do the research. This gave \$5.8 M. The second way is to multiply \$34 M by the ratio of papers published that have a MATS student coauthor (41) to the total number of papers published by MATS faculty members (412) for the past 10 years. This gives \$3.4 M. Both amounts show that MATS faculty bring in significant funds to UVM and generate significant overhead. From the information in the Self Study, I question whether the amount of overhead MATS generates is commensurate with UVM's investment in MATS.

Summary and Conclusion

The Materials Science Program is an asset for UVM and is critical to UVM's goal to become an R-1 university. The faculty in this program are outstanding: they bring in external funding, produce quality PhD graduates, and write significant articles about their research.

In spite of the phenomenal work done in this program, it is nearly invisible because it is small, inexpensive, and interdisciplinary.

Dr. Schneebeli convened the Materials Science Executive Committee on Thursday, August 26th. They addressed the concerns of Dr. Hellstrom and are already addressing many of the areas in need of improvement.

This subcommittee strongly recommends a positive assessment of the APR process for the Materials Science Program. We believe the process was followed with integrity and that the program should be commended for a thorough, constructive, and inclusive self-study and APR.

Faculty Senate Curricular Affairs Committee
Academic Program Review Subcommittee Report
Chemistry Department and Biochemistry Program
October 7, 2021

Academic Program Review Subcommittee: Meaghan Emery and Elizabeth Sargent

External Reviewers: Professors Karen N. Allen, Boston University and Steven L. Suib, University of Connecticut

The external review team visited the University of Vermont's Chemistry and Biochemistry Programs for a 2-day review on April 21-22, 2021 as part of the Chemistry and Biochemistry Programs' Academic Program Review (APR). This report summarizes the strengths and weakness of the program identified through the review process, provides a synopsis of the external reviewers' recommendations, and offers the APR internal review subcommittee's conclusions.

Overview of Chemistry and Biochemistry

The UVM Chemistry program has a long history beginning with the founding of the University in 1791. The program offers four degrees (B.A., B.S., M.S. and Ph.D.) and is comprised of eleven tenure-track faculty, five emeritus tenured faculty, and four non-tenure-track faculty. The learning outcomes of the respective degree programs align well with the University mission with respect to preparing students to be analytical thinkers and apply knowledge to solving important societal and natural world problems. The Chemistry programs reflect UVM's core foundation in the natural sciences and attracts high caliber students with respect to academic ability.

The Biochemistry undergraduate program is a collaboration between the College of Agriculture and Life Sciences (CALs), the College of Arts & Sciences (CAS), and the Larner College of Medicine (LCOM) which launched in 2003. Students can earn a B.S. or minor through either CALs or CAS with the only difference being College specific requirements. Enrollment is typically 135-150 students. Faculty heavily participating in the program reside in the Biochemistry Department, Chemistry Department and Microbiology and Molecular Genetics Department.

With respect to UVM's reorganization, the Department of Chemistry, including the Biochemistry undergraduate program, is strongly advocating for a structure that will facilitate TT hiring, support graduate support structures and programming, and accelerate the development of new research programs in the fundamental sciences. Given the shared content, core values, and teaching philosophies with other disciplines, such as materials science, biology and neuroscience, faculty and students often participate in courses and research programs across programs. Consequently, faculty and students value having the natural sciences grouped together in one unit.

Strengths and Weaknesses

Based on two days of discussion including interviews with the administration, faculty members, staff members, and current and former undergraduates and graduate students, the external reviewers' final report was very positive regarding the quality of the two programs and the learning outcomes. They wrote of the high quality of research and teaching provided by the Chemistry program and the overall strength of the graduate program, which currently has 42 students (a typical number, according to the current chair). According to the reviewers, the curriculum is comprehensive and up-to-date, the facility is quite good and the instrumentation excellent, the faculty are successful in obtaining grants and contracts in order to address contemporary problems, and the

overall stature and productivity is higher than many state schools in New England. Much of their report explains how the Chemistry Department serves the state, and it cites the example of the certificate program, which trains industrial researchers in Vermont. Faculty leaders are well-regarded and supported by the department faculty, staff, and students.

The level of collegiality and collaboration in both programs create a positive working and learning environment. A unique aspect of the Chemistry and Biochemistry programs is the shared campus with the medical school, which provides students with the opportunity to engage in faculty research. Student interviews in both Chemistry and Biochemistry spoke highly of the quality mentorship provided by both programs. Advising is reported to be excellent, and job placement is monitored by the Department. Graduates find positions in industry, academia, and government labs and are the recipients of numerous awards. Assistant Professors reported the same level of quality for peer mentoring.

Regarding curriculum and advising experiences, students responded positively overall and both remarked favorably on the “Organic first” course sequence, the new statistics course, and Biochemistry Club and noted the need for more programming that addresses diversity. Over the two-day discussion with the external reviewers, it was suggested that diversity, both within the faculty and the curricular content/advising experiences, is relatively lacking in the two programs and could have an effect on recruitment and retention, particularly for the graduate programs. Another note with regard to the recruitment of graduate students concerned the Cellular, Molecular, and Biomedical Sciences (CMB) Program. While the teaching assistantship program provides strong undergraduate instruction, this program does not translate into the same number of graduate research assistants joining biochemistry laboratories.

The external reviewers wrote that more faculty members in the Department of Chemistry need to be hired in order to offer more special topics courses and maintain the level of excellence of the current programs. One faculty member is leaving due to retirement and a second was recently denied tenure, exacerbating the need for teaching faculty. Another concern is funding, particularly within the context of university restructuring. Reviewers noted that Chemistry and Biochemistry programs at other institutions are often funded through a direct line to the Provost’s Office. Their report cites the incentive-based budget model as a concern, particularly with regard to the teaching structure of the Biochemistry program -- “The Biochemistry program is . . . of concern due to the interdisciplinary nature of the program” -- and to the lost possibility of long-term planning. Overall, the reviewers stressed the need for more commitment and support from the University administration.

External Reviewers’ Recommendations

Due to one retirement and unsuccessful hire, the external reviewers recommend two new hires with a long-term goal of 15 tenure-track faculty members in the Chemistry Department. Without additional faculty, and importantly diversity hires, graduate advising will suffer as will faculty research programs. The reviewers also recommend the hiring of a new staff member, i.e., a Proposal Development Administrator, in order to handle the pre-award grant support. Currently, there is an inadequate level of administrative support for the preparation and submission of grants, which places a heavy demand on faculty members’ time. Retention should be a priority for the University administration, and the external reviewers suggest the return of some F&A funds as a gesture and more certainty regarding their place within the College of Arts and Sciences. Restructuring discussions have been a source of stress and the external reviewers encourage the University administration to give due consideration to faculty concerns.

For Biochemistry, the reviewers wrote that there is no funding for new equipment or repairs, and they recommend a small budget for that expense, which could be covered by new student lab fees. There is also no funding for an upper-level laboratory, further hampered by faculty and space availability. They also recommend

administrative support for summer stipends for all students given the disparity between what CAS and CALS are able to offer. The teaching and advising structure of Biochemistry, straddling LCOM, CALS, and CAS, is handicapped by the differential levels of support provided by each corresponding unit, which additionally creates inconsistency in the nature of the requirements and in the merit systems for faculty members and program directors. As a result, the level of innovation within existing courses and ability to develop new courses may be hampered. The external reviewers, therefore, recommend that Biochemistry directly report to the Provost or that an MOU be drafted by the Deans so that the programs' needs are not subject to territorial interests due to differences in culture, pay, goals, union/non-unionization. Without a change in the reporting structure and/or installation of a long-term plan that provides for a commonly agreed upon funding mechanism (including startup in order to grow the faculty) and functioning of the program, they fear that these fissures will weaken the program.

Regarding stockroom staffing, the external reviewers recommend the hiring of a staff person in the place of undergraduate students. Staff time and the level of equipment use, particularly with the new Certificate program, should also be measured; and finally, the reordering of equipment should be centralized and streamlined so as not to overtax the PIs' time.

Discussions with students led to a number of recommendations, including enabling more exposure to industrial researchers by empowering graduate students to invite a speaker to campus each year; integrating diversity and inclusion more effectively into courses and assessing effectiveness; and increasing exposure to computational methods, which could be done through a new hire. Regarding retention specifically, the external reviewers recommend expanding the Chemistry Scholars Program. They also noted that student teaching assistants indicated the need to feel as valued as the professional teaching assistants.

Finally, regarding diversity, the external reviewers recommend a more concerted effort at the level of the University administration rather than in the individual units to provide training in diversity, ethics, and social responsibility to students, faculty members, and staff members. In order to serve traditionally underrepresented and under-resourced populations, they recommend dropping the requirement for GRE scores collegewide and waiving application fees as well as providing funding outside of the graduate teaching assistantship by supporting the last year of a graduate student's academic career.

Summary and Conclusions

The Chemistry and Biochemistry programs have provided evidence of high-quality research and teaching, while preparing students to critically think and to solve societal and natural world problems. The Chemistry program includes a robust cohort of graduate students lending to the high productivity of the research laboratories. The Biochemistry program straddles multiple colleges and the interdisciplinary nature of the program was a concern for the external reviewers. Consequently, the two programs have advocated for the reorganization of both programs in one college. Support for reorganization was noted by the external reviewers who documented a collaborative working relationship between the two programs.

The external reviewers noted a lack of administrative support and funding for necessary lab equipment and repairs, as well as a need to hire additional faculty. In addition, diversity was lacking among the faculty in both programs, which may have an impact on recruitment and retention of both faculty and graduate students.

We recommend that the CAC accept this report as documentation that the APR was followed appropriately.



**Faculty Senate Curricular Affairs Committee
Academic Program Review Subcommittee Report
Master's Degree in Pathology
September 10, 2021**

Academic Program Review Subcommittee: Stephen Everse, Ph.D. (Chair) & Ann Hazelrigg, Ph.D.

External Reviewer: John Kolega, Ph.D., University at Buffalo, SUNY

The external review team visited the University of Vermont's Master's Degree in Pathology for a 2-day review via Zoom on April 28 – 29, 2021 as part of the Department of Pathology & Laboratory Medicine Academic Program Review (APR). This report summarizes the strengths and weakness of the program identified through the review process, provides a synopsis of the external reviewers' recommendations, and offers the APR internal review subcommittee's conclusions.

Overview of Master's Degree in Pathology

Master's Degree in Pathology has two tracks:

- A thesis track that was on hiatus for a number of years due to shifts in Departmental goals. In 2019 it underwent a curriculum revision and Graduate Executive Committee approval in February 2020 so they could accept their first student in Fall 2020.
- A non-thesis track (historically referred to as the Student Fellowship which was established in 1956) was revised in 2015 for medical students between their 3rd and 4th years of their degree program to earn an MS in Pathology. Two funded fellowships are available each year for students in the program.

Regardless of the track taken, both require:

- Equivalent preparatory coursework (BIOC 201, CLBI 301, PATH 300). Typically, students in the non-thesis track select more clinically-oriented electives (PATH 310) while students in the thesis track participate in more research-oriented electives (CLBI 394, NSCI 327, NSCI 328);
- Participation in Departmental journal clubs and a formal presentation at Pathology Grand Rounds (PATH 308/309);
- 7 credits of Pathology Rotations (PATH 330);

The tracks differ with the thesis track requiring 15 credits of PATH 391 (Masters Research) and a written thesis whereas the non-thesis track requires an additional 15 credits of Pathology Rotations (PATH 330) and a oral presentation.

Strengths and Weaknesses

There is a well-established performance record for the non-thesis track, whereas the thesis-track Master's has not yet graduated its first student since resuming operation in Fall 2020. Therefore, the evaluation of the thesis track is a review of the proposed revitalized program.

Strengths – Non-thesis Track

- Over 30 physician faculty contribute to the clinical training in the non-thesis students. The Department has 16 residents and 4 fellows (in Cytopathology, Dermatopathology, Surgical Pathology, and Hematopathology) that support the education of these students.
- There is a need for Pathologists, but too few are selecting residencies in Pathology. Exposing medical students to residency-level training in Pathology is a powerful recruiting tool. This recruiting pipeline not only produces potential candidates for its own residency program, but it serves the discipline as a whole by populating other pathology departments and practices with its graduates. This also substantially raises LCOMs profile in this field.
- Students receive an inside look and direct experience at pathology and how medical research works which is a benefit for residency applications.
- Students return to the MD program for their 4th year of training after completing the Master's bringing their clinical experience, understanding of research, and new perspectives back to their classmates. Given the intimate exchange of information among medical students, this inevitably elevates the education of the medical student population at LCOM in general.
- The addition of new coursework that is taken with the thesis-track students such as PATH300 (Biomedical Research Design) adds rigor to the research training of the clinically oriented students in the non-thesis track. The non-thesis trainees will also receive more exposure to basic science and other Pathology research projects through the required PATH308 and PATH309 classes (Grand Rounds and Journal Club). This will augment their research and basic science experience, thereby increasing the extent to which the program is cultivating physician-scientists, a persistent theme in contemporary medical education.
- The program has strong mechanisms for ensuring students move efficiently through the year – students are assigned a mentor and there are clear and frequent benchmarks during the year.

Weaknesses – Non-thesis Track

- The limited size of the program (≤ 2 students/year).
- One-year is a very short window for completing a research project.

Strengths – Thesis Track

- The biggest strength of the program may be the growing importance of Pathology & Laboratory Medicine in both medical practice and biomedical research.
- The research faculty (N=18) in the Department of Pathology & Laboratory Medicine are productive in publishing and obtaining external funding with approximately \$10 million in extramural funding and 100 publications annually. The group has explicitly indicated their commitment to supervising Master's projects.
- The Department has significant core services in support of research (in Histology, Clinical Biochemistry, Microscopy Imaging, Population Health, Genomics and Biobank).
- A competitive intra-departmental research funding program provided by the Chair for research and clinical faculty who collaborate in research projects have been an effective mechanism for engaging clinicians. This not only expands project options for Master's students, but can also enhance clinical relevancy of basic science projects and promulgates a culture of communication between clinicians and basic scientists that elevates both.
- There is enthusiastic leadership for the re-vitalized Master's program. The depth of thought and amount of effort invested in re-starting the thesis-track Masters by Drs. Fung, Wilcox and Zhang

is evident in their report and their responses to inquiries in the site visit, as is their enthusiasm for the endeavor. The fact that the program is the product of a strong collective effort, as opposed to a single excited visionary, is a good indication that progress can be sustained.

- The involvement of an education specialist (Dr. Zhang) in the curriculum design and as director of a major core course will go a long way toward ensuring a high quality of instruction.

Weaknesses – Thesis Track

- Poorly defined mission. It is not very clear exactly where program graduates are expected to go with their degrees.
- The faculty's commitment to Master's training is yet to be tested. Master's students are often something of a second tier in terms of quality compared to a PhD candidate. Until the program has seen a reasonable number of trainees, the long-term enthusiasm and capacity for Master's students by faculty is unknown.
- The specific target market for this particular program has not been clearly identified. Therefore, the demand for its graduates is uncertain, and it is more difficult to sell the program to desirable students.

External Reviewers' Recommendations

1. Maintain the non-thesis track Master's. Two students a year is probably the maximum size that can be managed while maintaining the program's high quality. The size of the faculty, clinical space, and relationship to the residency program are the primary limitations, although a secondary obstacle is funding for the fellowships that make participation in the program feasible for a medical student. It is **NOT** recommended that the program be expanded, unless there is major change in the clinical infrastructure and residency program.
2. Allow the thesis-track Master's to run for 5 years before making a decision on its long-term fate. It will take a year or two for the program to become recognized and grow its applicant pool, and then two more years for a full complement of incoming students to graduate. At that point it will be fair to assess the effectiveness of the program and the market for it.
3. Clarify the objectives of the thesis-track Master's. The current objectives are relatively generic biomedical Master's objectives. There are several issues to consider:
 - What will the Pathology Master's degree provide for the students that makes it worth two years of their lives and a substantial financial investment? What makes a Pathology Master's degree special?
 - If the program wants to be more than just a bridge to PhD or MD programs, it should identify employment opportunities for graduates with a terminal Master's degree in Pathology.
 - Decide which markets the program can and should attempt to serve. This will direct recruiting efforts, help convince students to matriculate, and inform the curriculum that the program should deliver.
4. Increase the Research Faculty ownership of the Master's program, most notably in Program Leadership, Course Development, and Scholarly Activity of Master's Program.
 - Active PIs should be represented on all bodies making decisions about the Master's program.
 - Faculty should be clear about what a Master's program provides to the Department, and must buy into at least some of those advantages.

5. After the target market and overall program objectives are honed, the curriculum and assessment plan should be re-examined and revised as necessary to align with desired post-graduate endpoints.
6. Determine program capacity and desired operational size. This will determine how much effort and resources need to go towards promotion of the program and recruitment and evaluation of applicants.
 - The limiting factor for a thesis-track program is most commonly the availability of spaces in labs for research projects. A shared project list can stimulate new ideas and collaborations among program faculty or even be used to attract participation from faculty in other departments.
 - Survey faculty before each admissions cycle to determine who is willing and able to take new students, and what areas those students could work on. This will dictate how many and what type of students to admit.
 - To maximize program capacity, cultivate faculty interest in Master's training. Workshops with faculty who have had productive Master's or undergrad experiences is a good way to promulgate strategies for maximizing success, and to encourage participation of hesitant PIs. Input of successful Master's mentors can be especially valuable during the admissions process. They can identify the intrinsic qualities that were most important in making their students successful.
7. Promote the program to appropriate audiences!
 - Because Master's students usually must pay their own way in graduate school, they tend to stay close to home. Thus, the biggest applicant market is usually regional undergraduate programs.
 - Another potential applicant pool is people in the existing workforce who are seeking a professional upgrade; e.g., entry-level hospital or research-lab technicians. Don't overlook promoting through local job boards, unions, trade societies, etc.
 - MAINTAIN A STRONG PROGRAM WEBSITE.
 - Build on-line visibility through other social media.
 - Faculty should mention the program's opportunities during presentations both locally and at other institutions and scientific meetings.
8. Identify and/or develop sources of financial support for Master's students. Scholarship and aid programs abound for undergraduates and doctoral students, but there is little available to most Master's students outside of educational loans. Being able to offer even small amounts of support, such as a part-time job, teaching assistantship, summer research stipend, is hugely beneficial in recruiting.

Summary and Conclusions

Overall Dr. Kolega believes the thesis and non-thesis track Master's programs are meritorious enterprises with rational plans for continuing the programs in an effective manner, with the appropriate resources and faculty to support their success. He strongly encourages the program to evaluate the thesis track in 5 years before making a decision on its fate.

The Program had no corrections to the Reviewer's report and have read and approved this APR Subcommittee report. The APR Subcommittee attests that, to date, the APR process has been followed.