

UNIVERSITY OF CALGARY | FACULTY OF SCIENCE

BSc BIOCHEMISTRY PROGRAM
DEPARTMENT OF BIOLOGICAL SCIENCES

EXECUTIVE SUMMARY
DECEMBER 2016

Overview and Context of the Program

Biochemistry explores the chemistry of living organisms and the molecular basis for the changes occurring in living cells. In the Biochemistry Program, students obtain the education necessary to unravel the complex chemical reactions that occur in various life forms. The BCEM program is very well structured and recognizes the importance of building a strong foundation in mathematics, chemistry, and physics.

In recent years, molecular and quantitative approaches to biology or “quantitative biology” have become critical components of rapidly emerging fields in clinical and health sciences with the “omics” revolution in diagnostics and interventions and modern bio-technology solutions ranging from metabolic engineering in model organisms to targeted plant biochemistry. In-depth understanding of life’s molecular foundations and progress in chemical instrumentation enabled this progress. The newly emerging disciplines re-shaped markets and imposed substantial requirements for a highly-skilled labor force, trained at the interface of traditional biology, chemistry, quantitative analysis of large data-sets and applications to challenging problems in biomedical sciences and biotechnology.

The Biochemistry program within the Faculty of Science has historically recognized transformative processes in the Biological Sciences. There currently is a major shift to quantitative approaches and the requirement for better analytical skills and experience with data analysis and instrumentation. The research activities of the BCEM faculty are tightly integrated with our approach to teaching and our course offering to BCEM majors. There has been a notable shift from more traditional “cellular biochemistry” to course offering and training focused on providing our students with a rigorous fundamental training in molecular theories in biochemistry, applications of modern biochemical techniques to problems in human health and biotechnology and critical analysis of large biological datasets. Our teaching strategy builds on the strengths and expertise of the faculty teaching in this program. The focus on the domain of quantitative biology domain is naturally coupled with a potential for cross-departmental and cross-faculty teaching, with BCEM academic staff playing active roles in nanoscience, biomedical engineering and health science teaching.

A key goal of the BCEM program’s strategy for the next years is to capitalize on the creativity, knowledge and skills of its members to continue on a transformative path to quantitative biology teaching. Our ultimate goals are to train the next generation of highly skilled workers with strong foundations in analytical thinking, math skills and broad knowledge about the molecular basis of chemical processes occurring in living matter.

What makes our BCEM program unique is its position in the biological sciences and focus on the across-scale integration with emphasis on analytical skills. We offer a professional designation and our Honours Biochemistry program is accredited by the Canadian Society for Chemistry and hence require our students to take training in analytical and organic chemistry in addition to core biochemistry techniques. We teach biological sciences and biochemistry students in all years and can integrate biochemistry with the other biological sciences. We see our students getting a strong foundation in biochemistry, proteomics, structural and membrane biology and relevant skills in molecular biology to take forward in their careers, not limited to the biomedical field alone.

Guiding Questions

The following critical questions and concerns were used to guide the curriculum review process: Questions 1 and 2 were formulated by the Undergraduate Programs Curriculum Committee of the Biological Sciences Department, and approved by Department Council. Questions 3 and 4 are questions asked by all programs in the Faculty of Science.

1. How well do the BioCore courses prepare students for senior courses in each program?

(The BioCore courses refer to a common set of first- and second-year core courses completed by students in all programs).

2. In considering courses in each program outside of the BioCore courses: Is course material properly scaffolded throughout the program to best prepare students to meet requirements? (i.e., to what extent do the content and expectations of later courses build upon the content and expectations of earlier courses?) Are there gaps in the curriculum, in the order in which material is delivered or in the level of expectations as student progress from one course to another?

3. Are High Impact Practices being used regularly in each program?

High-Impact Practices (HIPs) share several traits: They generally demand considerable time and effort, facilitate learning outside of the classroom, require meaningful interactions between faculty and students, encourage collaboration with diverse others, and provide frequent and substantive feedback. Examples of HIPs include, but are not limited to:

- Learning community or some other formal program where groups of students take two or more classes together
- Courses that included a community-based project (service-learning)
- Work with a faculty member on a research project
- Internship, co-op, field experience, student teaching, or clinical placement
- Study abroad
- Culminating senior experience (capstone course, senior project or thesis, comprehensive exam, portfolio, etc.)

4. If HIPs are not being used regularly in each program, what is preventing these practices from being used?

Action Plan

To address the guiding questions, data were collected from academic staff teaching in the Biochemistry program as well as from both current students and alumni. We also used data from the 2014 National Survey of Student Engagement, as well as data provided by the Office of Institutional Analysis, University of Calgary. The action plan below was developed based on information from those sources, and outlines how the Biochemistry program will address the findings of this review, to enhance student learning and strengthen the program in the interval between curriculum reviews.

The following chart outlines the recommendations, specific action items, the individual/team responsible, and the timeline for implementation (Short-term: One year or less; Medium-term: Two to three years; Long-term: Four to five years)

Recommendation	Action Item	Who is Responsible?	Due Date
Stimulate development of independent learners in Bio-core courses	<ul style="list-style-type: none"> • Assist students in the identification of reliable versus non-reliable on line resources • Incorporate more data analysis from diverse sources • Offer opportunities for students to practice and develop oral and written communication skills 	Course Instructors, Associate Head (Undergraduate)	Short term
Promote a more interdisciplinary approach in Bio-core courses.	<ul style="list-style-type: none"> • Support interdisciplinary and inter-departmental teaching • Integrate and use calculus and other non-trivial math throughout the Bio-core courses • Introduce students to bioinformatics searches in the first-year courses and progress into a more frequent use of these tools in subsequent years • Train students in biostatistics and analysis of large datasets • Foster collaboration among instructors in the Bio-core courses 	Course Instructors, Associate Head (Undergraduate), Dept. Head	Medium-long term
Expand experiential learning opportunities within the BCEM program (i.e. Honours and independent research projects)	<ul style="list-style-type: none"> • Recognize the investment of time and resources by Faculty engaged in undergraduate research projects as part of their teaching assignments • Support faculty members in building/maintaining research programs, to help them maintain leadership in their fields and attract high caliber graduate students and post-doctoral fellows who contribute to the quality of the program. Decrease administrative burdens. • Support Research facilities, maintenance of equipment and support staff, to offer students training in state of the art analytical techniques 	BCEM faculty, Associate Head (Undergraduate), Dept. Head	

