

## Final Assessment Report Academic Review

# Biotechnology

### A. Summary

1. The Centre's Self Study was considered and approved by the Academic Review Committee of Senate on Feb 9, 2012.
2. The Review Committee consisted of two external reviewers: William Hintz (University of Victoria) and John Honek (University of Waterloo), and an internal reviewer, Brian Ross (Computer Science).
3. The site visit occurred on February 27-29, 2012.
4. The Reviewers' Report was received on March 28, 2012.
5. The Centre's response was provided on April 17, 2012.
6. The Faculty Dean's response from Ejaz Ahmed was received on April 30, 2012.
7. The Dean of Graduate Studies' response from Mike Pyley was received on May 10, 2012.

The academic programs offered by the Centre which were examined as part of the review included:

- BSc (Honours) in Biotechnology
- BSc (Honours) in Biotechnology with Co-op option
- BSc (Pass) in Biotechnology
- BSc with Major, Biotechnology with Introduction to Business
- MSc in Biotechnology
- PhD in Biotechnology

This review was conducted under the terms and conditions of the IQAP approved by Senate on June 6, 2011.

The reviewers assigned the program an outcome Category 3 ("Good Quality With Concerns").

The reviewers made no recommendations regarding the graduate program.

## B. Strengths of the Program

In their report, the Reviewers complemented the departments of Biology and Chemistry for their highly effective level of collaboration. This collaboration was notable in both teaching and research. Furthermore, they stated, "the recognition for the Biotechnology Center was instrumental to making a compelling argument for the visioning and construction of the Cairns Family Health and Bioscience Complex building."

With respect to teaching, the Reviewers examined "the student course responses and the tables of Degree Level Expectations combined with student interviews and a reading of course descriptions." They observed that both "the undergraduate and graduate Biotechnology programs are strong, with excellent courses in Chemistry and Biology being provided." Of the undergraduate program, they noted that it is "very solid in academic rigor," while the graduate program is a very strong program that addresses the desired goals. The quality of training is very high."

The Reviewers also took note of teaching spaces and equipment, stating that the program possesses "very good laboratories to provide experimental skills. The instrumentation is acceptable to deliver the programs, especially the graduate level program since graduate students are provided with excellent research instrumentation and facilities in their faculty advisor's laboratory." They concluded by noting that the Brock library system provides all students with ready access to the required literature through its vast e-journal subscription list.

## C. Opportunities for Improvement and Enhancement

The Reviewers provided nine recommendations grouped under three headings.

1. Leadership: An outside Director for the program is required that does not immediately have a vested interest with either of the founding departments, and who could act as a champion for it...In order to add to the research excellence of the University, it is recommended that the administration attempt to fill this position with an Industrial Research Chair in Biotechnology position.

In its response, the Centre stated that:

The appointment of an NSERC Industrial Chair in Biotechnology would be an immediate solution to this leadership consistency problem. That these five-year positions are potentially renewable is an additional attraction to this recommendation. This additional faculty member would bring core scientific strength and profile to the program. We recognize, however, that the administrative demands of the Directorship may not align entirely with the mandate of the NSERC Industrial Chair program, which states that "Chairholders are expected to focus their activities on conducting research and training highly qualified personnel, while carrying a reduced administrative and teaching load." We would therefore need to define the Chairholder's responsibilities to attend to program policy development and to be the program's liaison with industry. The Biotechnology Program Committee would then be responsible solely for the day-to-day management of the program.

In his response, Dean Ahmed stated that

[E]fforts to obtain an externally funded position should be pursued. The terms for such industrial chairs, however, invariably mitigate against a substantive administrative load, so such a chair is unlikely to serve as Director of the Centre for Biotechnology. Thus, another strategy must be used to address the issue of leadership. As the reviewers point out, however, the program requires structural and content overhaul, a new vision needs to be articulated and a strategic plan should be put in place. After completing this first, crucial step, a case could be made for changing the length of the director's term.

In ARC's view, the issue of appropriate governance structures for the Centre is recognized and will be addressed by the Dean and the Centre in concert. While it would appear that the "Industrial Chair" option may not be feasible, other options do exist. Thus, ARC considers that the recommendation has been accepted and is in the process of being implemented.

### Implementation Plan (First Priority)

Responsible for facilitating:	Dean of Mathematics and Science
Responsible for approving:	Centre and Dean of Mathematics and Science
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre and Dean of Mathematics and Science
Timeline:	Dean to report by end of 2012-13 academic year

2. Undergraduate Curriculum: Convert BTEC 2P09 into a 1st year “Introduction to Biotechnology” course.

The Centre responded that:

The movement of BTEC 2P09 (*Introduction to Biotechnology*) to the first year of the program would necessitate the removal of another 0.5-credit course which, since first year Chemistry and Biology courses are full credit courses (CHEM 1F92 and BIOL 1F90) would mean moving one half context credit to upper years. The only other options are moving first year mathematics and physics requirements that would have serious repercussions on progression through the program.

Dean Ahmed comments that:

A Year 1 course would have the advantage of providing focus to BTEC students early in their studies and would open the possibility of increasing enrollment if this course is open to non-BTEC students in the Faculty of Mathematics & Science. The other courses would provide more opportunities to network with industries and would greatly enhance the knowledge and skills required for success in industry.

He goes on:

Thus, these appear to be worthwhile recommendations and should be considered seriously by the BTEC Program Committee. **The Program Committee will have to judge, however, whether it is possible incorporate any or all of these changes into the curriculum without compromising the required scientific content in a program that is already tightly organized.** The program committee also needs to determine whether an additional microbiology course is required, and whether it is feasible to develop a four-year Major Program in Biotechnology. A review of the undergraduate curriculum is needed to consider all these possibilities. The new vision should include the role and place of the program with respect to the Cairns Complex.

In ARC’s view, the six recommendations included under the heading of “Undergraduate Curriculum” are a package that should be addressed together through the mechanism of a curriculum review conducted by the Centre, which should include consultation with other units including Chemistry, Biology and Physics.

#### Implementation Plan (First Priority)

Responsible for facilitating:	Director of the Centre
Responsible for approving:	Centre
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2012-13 academic year

3. Undergraduate Curriculum: Addition of a 2nd year “gateway” course for undergraduate students to help them define the area of biotechnology and introduce them to both the scientific and business aspects of this field.

The Centre’s response was as follows:

The unique relationship between Biotechnology and business, given the practical and entrepreneurial nature of the industry, as well as the importance of technology transfer and patent issues, support the inclusion of such a course. Brock has attempted encourage this sort of student experience by its introduction of the Biotechnology with Introduction to Business program in the 2007-08 academic year. Unfortunately, this program attracted only two students, both of whom have switched from the program to General Science, and Biological Sciences; neither has yet graduated. As the reviewers note, students perceived this program to be a pastiche of business courses chosen to supplement core courses in the sciences, and that the business courses did not specifically address issues pertinent to, or exemplified by, the biotechnology industry.

Providing students with a course that combined science and business would be a distinct advantage as the nature of the specific issues in this industry could be raised along with the unique products and service that biotechnology provides. It is not immediately clear if this could be accomplished solely by faculty in the departments of Chemistry or Biological Sciences, or whether this would require partial teaching responsibilities from the Faculty of Business. This could certainly be explored. This course could also be presented by the holder of the Industrial Chair, should it fall in their area of expertise.

In ARC’s view, the six recommendations included under the heading of “Undergraduate Curriculum” are a package that should be addressed together through the mechanism of a curriculum review conducted by the Centre, which should include consultation with other units including Chemistry, Biology and Physics.

#### **Implementation Plan (First Priority)**

Responsible for facilitating:	Director of the Centre
Responsible for approving:	Centre
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2012-13 academic year

4. Undergraduate Curriculum: Addition of a 2nd year BTEC-specific microbiology course with a focus on the use of microbes (bacteria, fungi, and algae to produce recombinant and other bio-products).

In its response, the Centre noted that:

The undergraduate BTEC program currently includes BIOL 2P98 (*Principles of Microbiology*) amongst course choice in the second year. The addition of a more specific course tailored to the needs and practices of the biotechnology industry is an excellent idea. It is difficult at the moment to solve program content issues by the invention of new courses when current faculty are already pushed to their limits in meeting the current course loads.

One of the ways that the spirit of this recommendation might be met would be if BIOL 2P98 were made mandatory. We want our students to have basic, general knowledge along with applied knowledge. Introductory courses such as BIOL 2P98 are valuable as is. The applied content is included in courses such as BTEC 3P43 and BTEC 3P50.

In ARC's view, the six recommendations included under the heading of "Undergraduate Curriculum" are a package that should be addressed together through the mechanism of a curriculum review conducted by the Centre, which should include consultation with other units including Chemistry, Biology and Physics.

#### Implementation Plan (First Priority)

Responsible for facilitating:	Director of the Centre
Responsible for approving:	Centre
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2012-13 academic year

5. Undergraduate Curriculum: Addition of a 4th year “capstone” course relating to the technology development, business development and legal aspects of biotechnology, with seminars by industrial companies, workshop associated seminars and student projects.

The Centre responded as follows:

Again, the reviewers have made a very creative suggestion that would transform the BTEC program into a program that better incorporates aspects of business and legal issues that guide and control the industry. However, finding appropriate instructors for this course would put an added load onto faculty members who are already looking to streamline course offerings in related programs such as Chemistry, Biochemistry, and Biology. The addition of new courses would not be possible without new faculty appointments.

We see the tremendous value to such a plan, if the Industrial Chair takes on this responsibility. If this course were listed in the calendar as strictly BTEC, it might also lend itself to greater student identification with the program.

Dean Ahmed notes that:

The “capstone” course in Year 4, as envisaged, would fit extremely well with the University’s Strategic Plan by involving regional companies and integrating with research and industrial development associated with the Cairns Family Bioscience Research Complex. This has good potential to help enhance industrial development within the Niagara Region.

In ARC’s view, the six recommendations included under the heading of “Undergraduate Curriculum” are a package that should be addressed together through the mechanism of a curriculum review conducted by the Centre, which should include consultation with other units including Chemistry, Biology and Physics.

#### Implementation Plan (First Priority)

Responsible for facilitating:	Director of the Centre
Responsible for approving:	Centre
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2012-13 academic year

6. Undergraduate Curriculum: Addition of a B.Sc. with Major degree, to be an option for students who wish to receive a more competitive 4-year degree in biotechnology, but who may not satisfy the grade requirements of the Honours or Co-op Honours degrees.

The Centre responded:

This is a fine idea, with few requirements for extra infrastructure or faculty. It would potentially increase fourth year enrollments should a jump in recruiting occur, but without the inclusion of the two-credit Honours thesis this would be easier to accommodate and might attract students whose plans do not necessarily include graduate school but who could, in a four year non-thesis degree, still accrue significant scientific training along with the business, economic, and legal aspects that the suggested new courses would provide. Much of this structure could be provided by the Industrial Chair / Director and their ability to attract guest instructors/speakers for the biotechnology industry, both local and beyond.

In ARC's view, the six recommendations included under the heading of "Undergraduate Curriculum" are a package that should be addressed together through the mechanism of a curriculum review conducted by the Centre, which should include consultation with other units including Chemistry, Biology and Physics.

#### Implementation Plan (First Priority)

Responsible for facilitating:	Director of the Centre
Responsible for approving:	Centre
Responsible for resources:	Dean of Mathematics and Science
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2012-13 academic year

7. Recruitment and Retention: The program director, Dean of Science, and university communications office should promote the Biotechnology programs during news conferences and other communications regarding the Cairns complex.

The Centre's response noted:

Of course, we agree with this recommendation. The program should be promoted appropriately and there is unlikely to be as good an opportunity as the opening of the Cairn's Complex with its modern research space largely devoted to life science research. Notably, there is also a fermentation laboratory in the building that could be used as a specific selling point to link biotechnology with industrial applications rather than just bench research.

Although Dean Ahmed did not address this recommendation directly, ARC assumes that decanal support exists. Further, it seems that a formal communication strategy is both desirable and feasible. Thus, ARC considers this recommendation to have been accepted and in the process of being implemented.

#### **Implementation Plan (Second Priority)**

Responsible for approving:	Centre and Dean of Mathematics and Science
Responsible for resources:	Centre, Dean of Mathematics and Science, Office of University Communications
Responsible for implementation:	Centre, Dean of Mathematics and Science, Office of University Communications
Timeline:	Dean to report by end of 2013-14 academic year

8. Recruitment and Retention: The web site for the Centre of Biotechnology needs to be improved and expanded.

The Centre responded:

This should be a fairly straightforward thing to do. There could certainly be a more interesting introductory page with rich, attractive images and a brief background on what the discipline is, plus examples in the marketplace, and stories of our own research success.

In his response, Dean Ahmed states:

The Dean's Office agrees with the recommendations to promote the Centre for Biotechnology and links with the Cairns Complex through news releases, up-dating the website and any other means possible. The recommendation for a "career-planning" document is also appropriate. The Dean's Office is looking forward to working with the Center and is willing to assist the Center.

Thus, ARC considers this recommendation to have been accepted and in the process of being implemented.

#### Implementation Plan (Second Priority)

Responsible for approving:	Centre
Responsible for resources:	Centre, Dean of Mathematics and Science, Office of University Communications
Responsible for implementation:	Centre, Dean of Mathematics and Science, Office of University Communications
Timeline:	Dean to report by end of 2013-14 academic year

9. Recruitment and Retention: Creation of a “career planning” document to be prominently placed on the website.

The Centre noted:

A flow-chart such as the reviewers [suggested] would be an excellent guide to students searching our pages and deciding on entry into one of our programs... In our opinion, such a flowchart would work best if conceived to include all of the programs in the Faculty of Mathematics and Sciences. In this way students would have a better idea of program and course progression, and would be better equipped to plan their careers.

As noted above, Dean Ahmed has indicated that “The recommendation for a “career-planning” document is also appropriate.”

Thus, ARC considers this recommendation to have been accepted and in the process of being implemented.

**Implementation Plan (Second Priority)**

Responsible for approving:	Centre
Responsible for resources:	Centre
Responsible for implementation:	Centre
Timeline:	Dean to report by end of 2013-14 academic year

## **D. Recommendations to be Implemented**

The IQAP requires that ARC “set out and prioritize the recommendations that are selected for implementation.” Using the specific ARC proposals enunciated above, the following priorities are proposed:

First Priority:

Recommendations 1, 2 - 6.

Second Priority

Recommendations 7, 8 and 9.

Implemented Recommendations

None.

## **E. Recommendations that Will Not be Implemented**

None.