Office of the Provost and Vice President for Academic Affairs

Biochemistry Program

Academic Year 2014-15 Assessment Report

MISSION STATEMENT

The mission of the Biochemistry Program is to promote top quality pedagogy and research in the discipline of biochemistry at the University of Montana.

DEPARTMENT OBJECTIVES and ALIGNMENT WITH STRATEGIC ISSUES

1. Facilitate and solidify cross-departmental collaboration between departments with faculty involved in research and pedagogy in the discipline of biochemistry, in particular, but not limited to, the Department of Chemistry & Biochemistry and the Division of Biological Sciences. (Education for the Global Century)

2. Foster an environment where faculty and students can pursue cutting edge biochemical research and create the interdisciplinary collaborative environment that is necessary to achieve this goal. (Discovery and Creativity to Serve Montana and the World)

3. Produce and maintain the high quality biochemistry curriculum necessary to educate students at the BS, MS and PhD levels so that they can make significant contributions as biochemists in academic, commercial or governmental environments. (Partnering for Student Success and Education for the Global Century)

4. Provide curricula appropriate to students in allied disciplines that will allow them to succeed in their chosen career paths. (Education for the Global Century)

5. Create conditions that lead to optimal faculty development for biochemistry faculty at the University of Montana, particularly for junior faculty, such that they are effective classroom teachers, are good research mentors, are successful at procuring research funding and are able to develop national and international reputations for their research. (Dynamic Learning Environment)

6. Provide the skilled biochemical work force that will help to catalyze economic development in biochemical and biotechnology industries in Montana. (Discovery and Creativity to Serve Montana and the World)
## STUDENT LEARNING GOALS AND MEASUREMENT TOOLS

<table>
<thead>
<tr>
<th>1. Provide students with a solid working knowledge of the chemical concepts and descriptive chemistry that underlie biochemistry.</th>
<th>Successful completion of courses</th>
<th>American Chemical Society Standardized Exams</th>
<th>University-wide Program-level Writing Assessment</th>
<th>Presentations and Publications</th>
<th>Exit Interview/Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Provide students with a breadth of knowledge in biological sciences necessary to provide context for their understanding of biochemistry.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3. Provide students with the laboratory skills required to be successful biochemists.</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Produce graduates who are able to synthesize biological and chemical concepts and apply them to the study of biochemistry.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Produce graduates who are effective at communicating biochemical concepts and ideas both orally and in writing.</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6. Produce graduates who will be sought after by both graduate schools and employers.</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
## RESULTS AND MODIFICATIONS

We have grown the number of undergraduate biochemistry majors from 7 in spring 2010 to 60 in Autumn 2014. We began graduating students with a BS in Biochemistry in May 2012 (4 graduates) and graduated 10 majors in May 2014. A graph of growth in majors is provided as an attachment.

The BS in Biochemistry replaced the BS in Chemistry, Biological Chemistry option. Since Autumn 2012, the number of chemistry majors has remained essentially constant, while the numbers of biochemistry majors have continued to grow. Thus, the combined total has grown since Autumn 2012. There is an apparent steep loss in chemistry majors from Autumn 2011 to Autumn 2012. This drop may be exaggerated because lists of majors prior to Autumn 2012 did not provide data on whether a student was currently enrolled. In our major totals, starting in Autumn, 2012, we only count a student as a major if they are currently enrolled.

Of 21 BS in Biochemistry graduates in the last three years, we have been able to track 9 students:
- 4 are in graduate or professional programs
- 2 are in Medical School.
- 2 are working while applying to medical school (both have interviews!)
- 1 is working as a research technician

We know the plans of several other recent graduates included graduate school at the time of graduation, but we do not know the outcome in these cases. We will work on better ways to track our graduates.

| During the 2013-2014 academic year, our majors outperformed students nationally in first year chemistry. | Autumn 2013: Biochemistry majors average 13 percentile points above the national average in first year chemistry based on the American Chemical Society (ACS) standardized exam.  
Spring 2014: Biochemistry majors average 24 percentile points above the national average on the ACS exam.  
The increase autumn to spring is due in part to an approximately 15% attrition of biochemistry majors from the autumn to spring semesters, all students who were performing poorly in the class. |
|---|---|
| During the 2013-2014 academic year, our majors performed at or slightly above the national average in second year organic chemistry. | In CHMY 221, Organic Chemistry I, our students performed on average at the 49.6th percentile on the ACS Organic chemistry exam. Unfortunately while at the national average, their performance was below the class average of the 65th percentile.  
In CHMY 223, Organic Chemistry II, our students performed on average at the 56.4th percentile on the ACS Organic chemistry exam. Their performance was close to the class average of the 57th percentile.  
We need to collect data across more years to see, if the 2013-2014 data are typical, or an anomaly. |
<table>
<thead>
<tr>
<th>Biochemistry Program faculty continue to garner extramural grants to support research despite an increasingly difficult granting environment with funding rates near 10%.</th>
<th>Hot Water pre-grant reviews sponsored by the Center for Biomolecular Structure and Dynamics (CBSD) two to three times per year bring UM, MSU and McLaughlin Research Institute Faculty together to review grants and provide feedback in advance of submission to Federal Granting Agencies. The success rate of grants that go through this pre-review is 2 to 3 times the success rates at the granting agencies. Biochemistry Program faculty have current grants that have brought in over $7.5 million to the University of Montana. One of our faculty members is the PI on an NIH CoBRE grant for the Center for Biomolecular Structure and Dynamics (CBSD) which has brought an additional $9.8 million in research funding to the University of Montana. This grant funds the research of several of our younger faculty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry Program faculty are productive scholars.</td>
<td>Since the inception of the Biochemistry Program in 2009, our faculty has published ~125 articles (11 faculty reporting publications) in scholarly journals. An average of ~25 scholarly articles per year (more than 2 articles per faculty member annually). This level of scholarship is a strong benefit to our students at both the graduate and the undergraduate stages of education.</td>
</tr>
<tr>
<td>We have grown our graduate program from 3 students in 2009 to 10 students in autumn 2014.</td>
<td>In the first few years of the program, we struggled to fill TA positions and had a significant attrition rate. In spring 2013, we began a joint recruiting weekend with 6 other graduate programs in the Biomedical, Cellular, Biochemical, and Chemical Sciences (<a href="http://cas.umt.edu/draft/bcbc2013/default.php">http://cas.umt.edu/draft/bcbc2013/default.php</a> ) with assistance from the CBSD. This recruiting weekend has enhanced our ability to convert on offers to quality graduate students. In each of the last two years, we have successfully recruited the maximum number of new students with the three TA positions allocated to the program. Our graduate program now has 10 students actively engaged in graduate level coursework and independent research.</td>
</tr>
<tr>
<td>Many of our undergraduate majors participate in independent research in faculty labs</td>
<td>Of our 21 recent BS in Biochemistry graduates, 11 participated in independent research in a faculty lab. Of these, two are co-authors on scholarly articles. Our recent BS in Biochemistry graduates undergraduates made 10 presentations at research conferences. We need to do a better job of tracking independent research among our undergraduates. Many do research with faculty outside the Biochemistry Program. Incorporating a question about independent research, presentations and publication into our exit survey would be one step. But we also need a better way to track their independent research efforts while they are still students at UM.</td>
</tr>
</tbody>
</table>
The enrollment in most BCH courses has been steady, except for BCH 110/111 (see attached graph).

We have seen the enrollment in BCH 110/11 drop from 34 down to about 15 in the last five years. The initial high enrollment was buoyed up by Biology majors who chose BCH 110/111 in lieu of BIOB 160. When DBS moved BIOB 160 from the spring semester to the autumn semester, these students no longer enrolled in BCH 110/111. Starting with the 2015-2016 academic year, options within the Chemistry major that require BIOB 160, will require BCH 110/111 instead. This should correct this enrollment problem.

APPENDICES

1. Compendium of faculty publications and grant support, research with undergraduates and tracking of majors post-graduation
2. Curriculum map
3. Growth of majors graph (Biochemistry majors, Chemistry majors and sum of the two versus time)
4. BCH course enrollments since spring 2010

FUTURE PLANS FOR CONTINUED ASSESSMENT

Improve exit interview/survey to improve tracking of graduates and their participation in independent research.

We hope to develop a new biochemistry laboratory course to meet demand from non-majors: BCH 481, Biochemistry Laboratory. We are also considering developing an undergraduate physical biochemistry class that could replace BCH 360 in the major. Our efforts to accomplish these goals will depend on available resources.

Internships and Study Abroad – currently we are providing information on our website to alert students of these opportunities. We need to vet programs at int’l universities so that it is easier for our majors to do study abroad and still graduate in a timely manner.