**Annual Departmental Assessment Report December 2018**

**Department or Program:** Chemistry & Biochemistry

**Academic Year of Report:** AY 2017-2018

**Department Contact Person for Assessment:** Julie A. Haack

**Section 1: Learning Objectives Assessed for this Report**

The learning objective assessed during this period are described below as learning goals 1 and 2 and are the same for both our Chemistry and Biochemistry majors. Figure 1 documents how the number of students we serve has increased over the past 20 years peaking from 2013 to 2016.

**Learning Goal 1:** Master a broad set of chemical concepts concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical and biochemistry). Students will demonstrate an understanding of structure, chemical properties, and reactions of chemicals and biomolecules.

**Learning Goal 2:** Demonstrate a firm foundation in the conceptual, quantitative, and computational thinking that underlies the theories and models that form the basis for reasoning about molecular systems. Students should be able to connect this theoretical understanding to the experimental methods used to test those theories and models.

**Figure 1. Number of Chemistry and Biochemistry Majors over Time.** Shows the number of chemistry majors (blue) and biochemistry majors (orange) per year from fall 1998 to fall 2018 (20 years). The total number of majors is shown in gray.

**Section 2: Assessment Activities**

**Learning Goal 1:** Master a broad set of chemical concepts concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical and biochemistry). Students will demonstrate an understanding of structure, chemical properties, and reactions of chemicals and biomolecules.

This year our faculty began a process of identifying and evaluating reliable tool(s) to assess the mastery of a broad set of chemical concepts for our majors. The American Chemical Society – Division of Chemical Education Examinations Institute provides national exams that can be used to assess student performance at different stages of the chemistry curriculum. Our faculty reviewed three exams covering the first, second and final years of the chemistry and biochemistry curriculum and selected the DUCK18 – 2018 Diagnostic of Undergraduate Chemical Knowledge, as a senior level exam. We will begin using this exam to evaluate all graduating students in chemistry and biochemistry starting Winter 2019.

One advantage of this approach is that the exams institute provides a tool that compares the performance of our students with student performances from other US schools. This will enable us to track internal and external performance from year to year and potentially identify gaps in our curriculum.

**Learning Goal #2:** Demonstrate a firm foundation in the conceptual, quantitative, and computational thinking that underlies the theories and models that form the basis for reasoning about molecular systems. Students should be able to connect this theoretical understanding to the experimental methods used to test those theories and models.

Because chemistry and biochemistry are experimental sciences, one of the most accepted ways to demonstrate the core components of learning goal #2 is to publish work in a peer reviewed journal. In February 2018, we began documenting the number of peer reviewed research publications that include undergraduate authors. Figure 2 shows the data collected from faculty via email in February 2018 and November 2018.

**2018**

**Figure 2. Publications with Undergraduate Authors.** The number of peer reviewed papers published by faculty in the Department of Chemistry & Biochemistry with undergraduate author since 2016. Note that data were collected in November for 2018 and thus does not accurately reflect publications in this year.

**Conclusions**

For the 2017-2018 academic year, the Department of Chemistry & Biochemistry selected external, direct measures of performance that include a national exam for documenting core knowledge and peer reviewed publication documenting a firm foundation in the conceptual, quantitative, and computational thinking that underlies the theories and models that form the basis for reasoning about molecular systems. Both measures are considered best practice in our discipline.

**Section 3: Actions Taken Based on Assessment Analysis**

We were surprised by the number of undergraduate authors on peer reviewed publications. This has led us to invest more resources into supporting and growing our undergraduate research community. This fall we hosted our first ever meet-and-greet and we are hosting a Faculty Research Showcase event in January 2019. Our goal is to host community building events each quarter. In the future, we will use these events to collect more qualitative data regarding the health and accomplishments of our students.

As described above we will begin implementing the DUCK18 – 2018 Diagnostic of Undergraduate Chemical Knowledge, as a senior level exam. We will begin using this exam to evaluate all graduating students in chemistry and biochemistry starting Winter 2019.

**Section 4: Other Efforts to Improve the Student Educational Experience**

We are increasing the number and diversity of upper division advanced electives for our majors and modifying how we advertise these opportunities using social media. The lack of advanced electives, especially for our biochemistry majors has been a significant challenge. We used to encourage our biochemistry majors to enroll in appropriate advanced electives offered in the Biology department but due to capacity issues, Biology only reserve two spots per class for our majors. This drives our majors to change their majors to Biology in order to get priority registration access or change to majors like human physiology that have fewer logistical challenges.

We are seeing fewer students expressing frustration because they are unable to graduate on time due to the lack of advanced course offerings.

**Section 5: Plans for Next Year**

As discussed above, we will begin assessing learning outcome #1 using a comprehensive chemistry exam provided by the American Chemical Society (ACS). The exam will be given to all graduating seniors and scores will be reported to the ACS so that we can compare our performance to national norms.

In addition, we will begin documenting and comparing a variety of demographic data for all of our graduates including information about their age, gender, “at risk” status, pre-college preparation and compare that with performance in our program. We will include tracking the following metrics – time to degree, GPA, participation in the Honors College, recipients of scholarships and departmental honors, numbers of students participating in undergraduate research and post-graduation plans. However, without national norms for comparison, this information has limited value.

We will also continue to grow our professional development curriculum to include more opportunities for students to participate in Individual Development Planning workshops.

Budgetary implications include the costs for collecting and analyzing data, hosting quarterly events and purchasing ACS exams.