Department: Chemistry

Assessment Committee: Emily Borda, Elizabeth Raymond, George Kriz

Departmental Mission: To provide exceptional opportunities for students to learn chemistry and biochemistry through classroom, laboratory, and research experiences. Students participating in our program will master content, develop critical thinking and communication skills that will prepare them for professional careers as scientists, educators, health professionals, and scientifically literate citizens.

Departmental Student Learning Outcomes: Upon graduation, majors will be able to:

1. Understand and integrate fundamental chemical principles that unify all traditional and emerging areas of chemistry and biochemistry including:
   a. atomic theory,
   b. molecular structure and bonding,
   c. physical properties of molecules,
   d. kinetics, thermodynamics and equilibrium,
   e. reaction mechanisms, and
   f. chemical synthesis.
2. Acquire detailed, in-depth knowledge from the traditional and emerging areas of chemistry and biochemistry and be able to integrate and apply these principles to solve complex scientific problems.
3. Acquire laboratory skills necessary to answer questions of chemical relevance, including:
   a. understanding and demonstrating safe and effective laboratory practices,
   b. understanding the theory behind and being able to interpret data generated by a variety of chemical instruments,
   c. interpreting experimentally-generated data to reach a sound conclusion, and
   d. designing an experiment to answer a scientific question.
4. Connect the theory they learn in class with the experiments and procedures they perform in the lab.
5. Be able to critically analyze chemistry-related claims and connect chemistry-related ideas to everyday and societal contexts.
6. Develop effective quantitative reasoning skills.
7. Effectively communicate scientific information in written and oral forms.
8. Use primary literature to further their knowledge of advances in the fields of chemistry and biochemistry.
9. Work both individually and collaboratively with peers to advance the skills outlined above.
### Student Learning Outcomes Assessed This Year:

<table>
<thead>
<tr>
<th>Assessment Measures</th>
<th>SLO's Assessed</th>
<th>Use of the Information</th>
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<tbody>
<tr>
<td>1) Homework questions administered via Sapling Online Learning pre- and post-instruction and 2) itemized exam scores during fall quarter for two sections of CHEM 121. The two sections were set up as a treatment and control, to test a new virtual lab curriculum. Both were taught by the same instructor.</td>
<td>1,4,6</td>
<td>Students in the “treatment” class (the one with the new virtual lab curriculum) showed greater pre-post gain scores on all but one of the Sapling questions and slightly higher scores most of the exam items related to the content in the new labs, compared to the “control” (all wet lab) group, although none of these differences were statistically significant.</td>
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<td>Itemized final exam data from most chemistry courses during winter quarter 2011 and fall quarter 2012</td>
<td>1,2,4,6</td>
<td>Items assessing students' knowledge of thermodynamics concepts consistently result in lower scores than items assessing most other chemistry content. This is true across classes, from general to organic to physical chemistry, as well as across instructors.</td>
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<td>Course offering statistics from FactBook and ClassFinder</td>
<td>2, 5</td>
<td>Uneven distribution of electives across sub-disciplines (e.g. organic chemistry vs. analytical chemistry vs. physical chemistry vs. biochemistry.)</td>
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### Program Changes Based on Assessment

The pilot version of the virtual lab curriculum for chem 121 seems to have been met with some initial success. Although we can’t definitively say the new curriculum is better than the all wet-lab version with our data, we can at least postulate it was at least as effective. Therefore, we will continue to implement and revise this curriculum for all chem 121 sections.
Several members of the chemistry department were involved in writing an NSF-TUES grant to implement a system of assessment and revision of our general chemistry series. Central to that proposal is a plan to start restructuring the thermodynamics unit in chem 122. If the grant is funded, planning will begin during summer 2013.

We have created more electives in different areas and have planned to teach electives that have not been taught recently – e.g. medicinal chemistry, biofuels, nanotechnology, surface science and virology.