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| **Assurance of Student Learning Report****2021-2022** |
| Ogden College of Science and Engineering | Department of Chemistry and Department of Biology |
| Biochemistry, Ref. 519 |
| Kevin M. Williams, Chair, Department of Chemistry |

***Is this an online program***? [ ]  Yes [x]  No

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages.*** |
| **Student Learning Outcome 1:** Students will be able to communicate effectively in written form |
| **Instrument 1** | **Assessment of protein paper in CHEM 447 (Biochemistry laboratory)** |
| **Instrument 2** |  |
| **Instrument 3** |  |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 2:** Students will have the ability to read and interpret data about chemical systems. |
| **Instrument 1** | **American Chemical Society Exam in Analytical Chemistry** |
| **Instrument 2** |  |
| **Instrument 3** |  |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 3:** Students will have an understanding of structure-property-function relationships for a variety of molecules |
| **Instrument 1** | **American Chemical Society Exam in Organic Chemistry** |
| **Instrument 2** |  |
| **Instrument 3** |  |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[ ]  Met** | **[x]  Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| 1. A question analysis was performed on the national ACS exams for Quantitative Analysis and the Organic Chemistry sequence. Based on the content analysis, individual questions were developed by faculty and used to assess student understanding over the duration of the semester. This is opposed to the end-of-the-semester national exam assessment. An increase in student performance was observed for both courses.
2. The faculty explored the use of a combination of in-term and end-of-term assessments to gauge student short term vs long term understanding and performance during the Fall 2021 semester. Results from the Fall semester in-term and end-of-term assessments showed that student performance was better on in-term assessments than on end-of-term assessments. This is probably due to the fact that the in-term assessments focus on a smaller amount of material and the material was recently covered in class. The end-of-term assessments require students to recall and apply significantly larger amounts of material.
3. We will reassess these three SLOs in the upcoming year and will consider assessing different outcomes in the year after.
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| **Student Learning Outcome 1** |
| **Student Learning Outcome**  | Students will be able to communicate effectively findings in written form |
| **Measurement Instrument 1**  | **Assessment of protein paper**In biochemistry laboratory, students chose a protein and investigated the structural details and the function of the protein in the scientific literature. Each student then wrote a paper explaining how the structure of the protein contributes directly to its function. The papers were scored on a scale of 1 to 4 using the AACU Written Communication rubric using the 5 categories of the rubric. In the fall, seven biochemistry majors submitted papers and all 7 were assessed by the rubric. |
| **Criteria for Student Success** | The papers should score an average of 2.6 on the 4-point scale of the Written Communication Rubric |
| **Program Success Target for this Measurement** | At least 75% of the papers will score at least an average of 2.6.  | **Percent of Program Achieving Target** | 100% (7 out of 7) |
| **Methods**  | The papers were evaluated using the Written Communication VALUE rubric by Dr. Kevin Williams. A score of 1 (benchmark) to 4 (capstone) was assigned for each category and the values were averaged. The papers had averages that ranged from 2.8 to 3.4. |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| The written assignment is described in the syllabus and discussed at the beginning of the semester. Students are required to get approval of their protein choice and are expected to submit a draft of their paper (or at least an outline) a few weeks before the end of the semester in order to get feedback about the quality of their work. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The rubric has been working well but it will continue to be evaluated for appropriateness. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to assess this outcome in the upcoming year. |

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| **Student Learning Outcome 2** |
| **Student Learning Outcome**  | Students will have the ability to read and interpret data about chemical systems. |
| **Measurement Instrument 1** | **American Chemical Society Exam in Analytical Chemistry**This is a nationally-normed 50-question multiple choice exam given at the conclusion of the CHEM 330 (Quantitative Analysis) course (required of all majors and minors).  |
| **Criteria for Student Success** | 50%-tile ranking or higher |
| **Program Success Target for this Measurement** | 50% of students taking the exam | **Percent of Program Achieving Target** | 53% |
| **Methods**  | Assessments were given to all students in the course. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) |
| Course content is being evaluated in the context of exam topics. This exam is made available in an updated version approximately every two years. This update cycle allows the exam to reflect the current topical content recommended by the exam committee.A question level analysis was completed for the Fall 2021 semester. Specific content areas identified and assessed were acid/base chemistry, statistics, electrochemistry, chromatography and spectrophotometry. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| t is proposed that the decrease in the percentage of students achieving the target percentile of content mastery (73% AY 20/21 to 53% AY 21/22) is a function of the student’s lack of mastery of content material from previous coursework. Faculty observed that students for AY 21/22 were not as well grounded in the fundamental content material. The lack of mastery of previous contant material is most likely an after effect of switching course modalities from face-to-face to primarily online. Faculty have decided to include more review type exercises at the beginning of the course so that students can identify their content weaknesses and review those areas early in the ocurse. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to assess this outcome again next year. We will consider alternative means of assessing this outcome. |

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| **Student Learning Outcome 3** |
| **Student Learning Outcome**  | Students will have an understanding of structure-property-function relationships for a variety of molecules. |
| **Measurement Instrument 1** | **American Chemical Society Exam in Organic Chemistry**This is a nationally-normed 50-question multiple choice exam given at the conclusion of the CHEM 342 (Organic Chemistry 2) course. |
| **Criteria for Student Success** | 50%-tile ranking or higher |
| **Program Success Target for this Measurement** | 50% of students taking the exam | **Percent of Program Achieving Target** | 39% |
| **Methods**  | Assessments were taken by all students in the course. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[ ]  Met** | **[x]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| Course content is being evaluated in the context of exam topics. This exam is made available in an updated version approximately every two years. This update cycle allows the exam to reflect the current topical content recommended by the exam committee.A question level analysis was completed for the Fall 2021 semester. Specific content areas identified and assessed were acid/base chemistry of organic molecules, sterochemistry, electrophilic substitution reactions, reactions of alcohols, ethers and carboxylic acids. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| It is proposed that the decrease in the percentage of students achieving the target percentile of content mastery (69% AY 20/21 to 39% AY 21/22) is a function of the student’s lack of mastery of content material from previous coursework. Faculty observed that students for AY 21/22 were not as well grounded in the fundamental content material. The lack of mastery of previous contant material is most likely an after effect of switching course modalities from face-to-face to primarily online. Faculty have decided to include more review type exercises at the beginning of the course so that students can identify their content weaknesses and review those areas early in the ocurse. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to reassess this outcome next year. |

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| **CURRICULUM MAP TEMPLATE** |  |  |  |  |  |
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| **Program name:** | B.S. in Biochemistry (Ref. 519) |   |  |  |  |  |
| **Department:** | Chemistry and Biology |   |  |  |  |  |
| **College:** | Ogden College of Science and Engineering |   |  |  |  |  |
| **Contact person:** | Kevin Williams |   |  |  |  |  |
| **Email:** | kevin.williams@wku.edu |   |  |  |  |  |
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| **KEY:** |  |  |  |  |  |  |  |
| **I = Introduced** |  |  |  |  |  |  |  |
| **R = Reinforced/Developed** |  |  |  |  |  |  |
| **M = Mastered** |  |  |  |  |  |  |  |
| **A = Assessed** |  |  |  |  |  |  |  |
|  |  |  | **Learning Outcomes** |  |  |  |  |
|  |  |  | **LO1:** | **LO2:** | **LO3:** | **LO4:** | **LO5** |
|   |  |  | Effectively communicate findings through written reports | Read and interpret scientific data | Describe the relationships between structure and biological or chemical property | Apply fundamental principles to predict rate and spontaneity of key biochemical reactions | Apply basic biological and chemical principles to key metabolic pathways |
| **Course Subject** | **Number** | **Course Title** |  |   |   |   |  |
| BIOL | 120 | Biol Conc Cell Metab Genetics |  |   | I |   | I |
| BIOL | 121 | Biol Conc Cell Metab Genetics Lab | I | I |   |   | I |
| BIOL | 122 | Biol Conc Evol Div Ecol |  |   |   |   |  |
| BIOL | 123 | Biol Conc Evol Div Ecol Lab | I | I |   |   |  |
| CHEM | 120 | College Chemistry I |  |   | I | I | I |
| CHEM | 121 | College Chemistry Laboratory I | I | I | I |   |  |
| CHEM | 222 | College Chemistry II |  |   | R | R,A | I |
| CHEM | 223 | College Chemistry Laboratory II | I | I |   |   |  |
| BIOL | 319 | Intro to Molecular and Cell Biology |  |   | R |   | R |
| BIOL  | 322 | Intro to Molecular and Cell Biology Lab |  | R | R |   | R |
| CHEM  | 330 | Quantitative Analysis | R | R,A |   | R,A |  |
| CHEM | 340 | Organic Chemistry I |  |   | R | R | R |
| CHEM | 341 | Organic Chemistry Laboratory I | R | R | R |   |  |
| CHEM  | 342 | Organic Chemistry II |  |   | R,A | R | R |
| CHEM | 343 | Organic Chemistry Laboratory II | R | R | R |   |  |
| BIOL | 411 | Cell Biology |  |   | R |   |  |
| BIOL/CHEM | 446 | Biochemistry I |  | R | M | R | R |
| BIOL/CHEM | 447 | Biochemistry Laboratory | M,A | R, A |   |   | R |
| BIOL/CHEM | 467 | Biochemistry II |  |   | M | R | M,A |

AACU VALUE Rubric for Written Communication

