3-Year Academic Assessment Plan Cover Sheet

Assessment plans are due February 16, 2015
Email to: assessment@unlv.edu

Program Information:

<table>
<thead>
<tr>
<th>Program Assessed</th>
<th>Bachelor of Science (B.S.) in Biological Sciences</th>
</tr>
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<tbody>
<tr>
<td>Department</td>
<td>School of Life Sciences</td>
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<tr>
<td>College</td>
<td>College of Sciences</td>
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<tr>
<td>Department Chair</td>
<td>Dennis Bazylinski</td>
</tr>
<tr>
<td>Assessment Coordinator</td>
<td>Lawrence Walker</td>
</tr>
<tr>
<td>Date Submitted</td>
<td>February 10, 2015</td>
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</tbody>
</table>

Contact Person for This Plan

<table>
<thead>
<tr>
<th>Name</th>
<th>Lawrence Walker</th>
</tr>
</thead>
<tbody>
<tr>
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<td>702 895 3196</td>
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<tr>
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<td><a href="mailto:walker@unlv.nevada.edu">walker@unlv.nevada.edu</a></td>
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</tbody>
</table>

Please address the following items:

- What are the student learning outcomes? Please provide a numbered list.
- **Plans must include a curriculum map showing which courses will address which learning outcomes.** Examples can be found here: http://provost.unlv.edu/Assessment/map.html
- Which learning outcomes will be assessed in each cycle year (i.e., assessment timeline)?
- How will the learning outcomes be assessed? (Programs must use at least one direct assessment of student learning.)
- Undergraduate programs should assess at least one University Undergraduate Learning Outcome (UULO) each year, which may or may not overlap with a program learning outcome.
- Graduate programs should assess at least one outcome related to one of the following graduate level requirements each year:
  - student engagement in research, scholarship, creative expression and/or appropriate high-level professional practice.
  - activities requiring originality, critical analysis and expertise.
  - the development of extensive knowledge in the field under study.
- What is your plan for sharing the assessment results and acting on them (i.e., closing the loop)?

Please limit the narrative portion of your report to no more than four pages. You may attach appendices with data, tables, charts, or other materials as needed. Please explain the relevant conclusions from any appendices in your narrative. Please contact the Office of Academic Assessment if you have questions or need assistance.
A. Student Learning Outcomes

Table 1 shows our student learning outcomes. These were developed for our first 5-year plan (2010-2015) and remain unchanged. They still seem to fundamentally represent what we, as an integrated biology department, want our students to learn.

B. Assessment Methods and Analyses

Table 2 shows our assessment methods, instruments, and analysis. These reflect our initial 5-year plan as slightly modified in our most recent annual report (2013 data reported in March 2014 by Lloyd Stark). These have been slightly modified as indicated in the next section, in response to results from 2012 and 2013.

C. Results and past responses

Table 3 shows results from 2013 reported by Lloyd Stark. These results have led to few specific course changes, because students largely met our expectations. One of these was an effort to improve instructor coverage of Concept Essay 1 for Biology 196 (on cell structure and function) because student scores were lower than desired for that question. For the content test for Biology 196, student responses also fell slightly below our expectations. Again, instructors have been advised to adequately cover the content in these test questions (addressing outcomes 1, 2, 3, 4, and 5). In Biology 197 and 251, students exceeded our expectations in content essays and identification of unknowns, respectively. Rates of acceptance of pre-professional students into medical school and dental school were far above national averages. As reported in 2014, additional, programmatic changes in these biology core courses included:

a) study guide implementation in 196 and 197
b) instructional outlines created for teaching assistants in 196 and 197
c) coordinating lab quiz questions and grading guides for the many sections of 196 and 197
d) editing of lab manuals for 196 and 197 to include more inquiry-based lab exercises
D. Future directions

Our specific goals for 2015 will focus on learning outcome 7 (effective communication of biological concepts, both oral and written) in 3 classes: 196, 197, and 351. We will collect more data (a), evaluate that data (b), and act on those evaluations (c-e).

a) We will evaluate the 2014 data from the concept essays and the 351 (Microbiology unknown report). We will also collate the 2015 data.

b) We will meet with the professors teaching these courses (and lab instructors, where appropriate) to explore ways to further improve evaluation of student communication skills.

c) We will explore ways for 196 lab instructors to ensure coverage of the topics of Question 1 (cell structure and function), a deficiency noted in Table 3.

d) We will ask professors and lab instructors to consider ways to evaluate oral skills of students, perhaps in 5 minute topic presentations in labs? If such a practice is feasible with so many large classes, we can consider using metrics such as found in the M.S. and Ph.D. assessment plans.

e) Within 2 years we will revisit Learning Outcome 7 to see if it can be made more specific. Currently, several forms of oral presentations are suggested, but it is unclear to us if there is any regularity in the implementation of these across sections.

Actions for years 2 and 3 will depend on results from 2015. Possibilities include evaluation of what further parameters need to be modified for the 100 and 200 level courses and continued development of assessment tools for the 300 and 400 level courses (e.g., determining the educational influence of such classroom tools as break-out sessions, clickers, and other tools used to elicit student engagement.
Table 1.
All students graduating with a Bachelor of Science in Biological Sciences should be able to:

1. Understand the nature of scientific knowledge.
   - Describe the differences between opinions, facts, and scientific theories
   - Appropriately utilize the scientific method within the laboratory environment
   - Apply their understanding of the scientific method to successfully design an experiment
   - Critically analyze scientific content presented both orally and in writing

2. Understand cell structures and functions.
   - Explain the similarities and differences between prokaryotic and eukaryotic cells
   - Explain the similarities and differences between plant and animal cells
   - Describe the structure and function(s) of common eukaryotic organelles (nucleus, ribosomes, rough and smooth endoplasmic reticulum, Golgi apparatus, vesicles, lysosomes, mitochondria, chloroplasts, peroxisomes, vacuoles, and cytoskeleton)
   - Diagram the structure of an animal cell membrane, including the phospholipid bilayer, cholesterol, proteins, and carbohydrates
   - Explain the functions of the cell membrane, including passive and active transport and communication/information processing

3. Understand the physical nature of genetic information.
   - Describe the structure of DNA
   - Diagram the basic structure of a gene, including regulatory and coding sequences
   - Explain how genetic information is used in reproduction, including the processes of mitosis and meiosis
   - Explain how genetic information is utilized during transcription, translation, DNA replication, and cell division
   - Explain how genetic information can be changed through processes of mutation
   - Explain how epigenetic regulation of gene expression can occur

4. Understand that all organisms are genetically related, have evolved, and are evolving.
   - Explain the relationship between genetic information, physical characteristics, and the environment
   - Provide a timeline of major evolutionary events describing the emergence of the main forms of life (prokaryotes, eukaryotes, multicellular life, fungi, plants, insects, fish, amphibians, reptiles, birds, mammals)
   - Articulate the mechanisms of evolution including mutation, selection, and speciation
   - Apply their understanding of evolutionary relationships to accurately interpret phylogenetic trees
   - Explain experimental techniques used to investigate evolution

5. Understand the metabolic complexity of cells and organisms.
   - Provide examples of diverse mechanisms used by cells/organisms to extract energy from the environment
   - Explain the reactions of energy transformation that occur in mitochondria,
chloroplasts, microbes, and multicellular organisms

- Provide examples of diverse mechanisms used by cells/organisms to synthesize biological molecules
- Explain how cells/organisms regulate the internal environment

6. Understand the complex interplay of how organisms respond to and interact with each other and their environment.
   - Describe how interactions change as the scale of life transitions from cells to ecosystems
   - Articulate the different patterns of population growth and explain the environmental factors that underlie each pattern
   - Explain community structure and the various forms of biodiversity
   - Provide examples of the types of interactions that can occur between community members, including competition, predation, parasitism, coexistence, mutualism, and commensalism
   - Explain how communities can respond to disturbances
   - Discuss the interactions that occur between organisms and the nonliving components of their environment, including the role of biogeochemical cycling

7. Effectively communicate complex biological concepts, orally and in writing.
   - Effectively discuss individual biological concepts in short written format such as a two to four paragraph response
   - Effectively articulate the relationships between many biological concepts in an extended written format such as an eight to ten page paper
   - Effectively explain individual biological concepts in a ten to fifteen minute oral presentation
   - Effectively answer questions from the audience following an oral presentation
   - Summarize key points from a peer-reviewed journal article in a written report or during a group discussion

8. Fulfill their professional goals.
Table 2.

<table>
<thead>
<tr>
<th>Assessment Instrument (e.g., survey, exit exam)</th>
<th>Briefly describe the instrument, sampling strategy, and how the results are collected</th>
<th>Learning outcome(s) assessed (list by #)</th>
<th>Expected Measures (results that would indicate success)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept essays for BIOL 196</td>
<td>3 writing assignments are administered during the laboratory throughout the semester; scientific content and writing are assessed for all students. Results from the fall semester are obtained from the laboratory coordinator.</td>
<td>2, 3, 4, 5, 6, 7</td>
<td>70% of students will meet or exceed the expectations that are explained in the grading rubrics</td>
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<tr>
<td>Concept essays for BIOL 197</td>
<td>3 writing assignments are administered during the laboratory throughout the semester; scientific content and writing are assessed for all students. Results from the fall semester are obtained from the laboratory coordinator.</td>
<td>2, 3, 4, 5, 6, 7</td>
<td>70% of students will meet or exceed the expectations that are explained in the grading rubrics</td>
</tr>
<tr>
<td>Content test for BIOL 196</td>
<td>20 common questions collaboratively developed by all instructors, are included in the final exam. Results from the fall semester are obtained from the course instructors.</td>
<td>1, 2, 3, 4, 5</td>
<td>At least 70% of students will answer each content question correctly</td>
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<tr>
<td>Microbiology unknown identification report rubric</td>
<td>Student reports are assessed for scientific content, process, and writing. Results from the fall semester are obtained from the laboratory coordinator.</td>
<td>1, 2, 5, 6, 7</td>
<td>75% of students will meet or exceed the expectations that are explained in the grading rubrics</td>
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<tr>
<td>Student enrollment data</td>
<td>Student enrollment data for the entire year for all core biology courses is obtained from the registrar.</td>
<td>8</td>
<td>For BIOL 196 &amp; 197, at least 85% of initially enrolled students will complete the course with a grade (less than 15% will receive W, I, or AUD)</td>
</tr>
<tr>
<td>Pre-Professional data collection</td>
<td>Information about student applications and rates of acceptance into professional schools for the entire year is obtained from the Pre-Professional Academic Advisor.</td>
<td>8</td>
<td>The acceptance rate into professional schools will match or exceed the national average</td>
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<tr>
<td>Grade distribution data</td>
<td>Grade reports for the entire year for all core biology courses are obtained from the registrar.</td>
<td>196: 1, 2, 3, 5 197: 1, 4, 5, 6 300/304: 1, 2, 3, 4 351: 1, 2, 4, 5, 6 415: 1, 3, 4, 6</td>
<td>For BIOL 196 &amp; 197, at least 70% of students will earn a C or better For BIOL 300, 304, 351, ad 415, at least 75% of students will earn a C or better</td>
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</table>
Concept essays for BIOL 196

Concept Essay questions assessing program outcomes 2, 3, 4, 5, 6, and 7 were administered as part of the laboratory exercises in Biology 196 in the Fall semester of 2013. Three essay questions were assigned. Essays were graded as “Excellent”, “Good”, “Pass”, or “Fail”. Specifically, Question 1 included the subjects of the cell nucleus (structure and function), ribosomes (structure and function), endoplasmic reticulum (structure and function), golgi body (structure and function), mitochondria (structure and function), chloroplast (structure and function), and cytoskeleton (structure and function). Question 2 included the subjects of the light reactions of photosynthesis, carbon fixation, glycolysis, pyruvate oxidation, citric acid cycle, electron transport chain, and ATP. Question 3 included elements of transcription (initiation, elongation, and termination) and translation (initiation, elongation, and termination). Elements of writing quality included organization, voice, sentence fluency, and grammar. The total number of possible points was 10, and the goal that at least 70% of the students earn a “Pass”. For Question 1, 290 students responded, with 126 receiving an average of “Pass” or higher, or 43%. For Question 2, 215 students responded, with 156 receiving an average of “Pass” or higher, or 73%. For Question 3, 169 students responded, with 117 receiving an average of “Pass” or higher, or 69%.

These outcomes are below our expectations for Question 1, at the level of our expectations with Question 3, and above our expectations with Question 2. We have no comparable data from 2012. We conclude that we need to take greater care to standardize the grading procedure, and ensure that the materials covered for Question 1 (where students scored only 43%) are adequately covered in the course.

Concept essays for BIOL 197

Concept Essay questions assessing program outcomes 2, 3, 4, 5, 6, and 7 were administered as part of the laboratory exercises in Biology 197 in the Fall semester of 2013. Three essay questions were assigned. Essays were graded as “Excellent”, “Good”, “Pass”, or “Fail”. Specifically, Question 1 included the subjects of endosymbiosis, evidence for evolution, biology of the Archaea and the Bacteria. Question 2 included aspects of evolutionary adaptation. Question 3 included elements homeostasis, metabolism, circulation, and behavior. Elements of writing quality included organization, voice, sentence fluency, and grammar. The total number of possible points was 10, and the goal that at least 70% of the students earn a “Pass”. For Question 1, 428 students responded, with 310 receiving an average of “Pass” or higher, or 72%. For Question 2, 299 students responded, with 250 receiving an average of “Pass” or higher, or 84%. For Question 3, 338 students responded, with 321 receiving an average of “Pass” or higher, or 95%.

These outcomes exceeded our expectations for all three Questions. We have no comparable data from 2012. We conclude that we need to take greater care to standardize the grading procedure.

Content test for BIOL 196
Content test questions assessing outcomes 1, 2, 3, 4, and 5 were administered in the Fall 2013 semester for Biology 196 (enrollment = 198), and consisted of 20 multiple choice questions as a component of the final exam. The average score for these questions was 62%, with the mean for 8 of the questions falling above 70%, and for 12 of the questions falling below 70%.

These outcomes are somewhat below our expectation of 70% for all 20 questions. We have no strictly comparable data from 2012. We conclude that the instructors need to ensure that the material on which the questions are based are adequately covered in lectures.

Microbiology unknown identification report
Rubric scores were evaluated for 166 students enrolled in 6 different lab sections during the Fall semester of 2013. The mean score was 124.9 out of 150, corresponding to 83.3%. The goal is that 75% of the students will meet or exceed the expectations stated in the rubric. This goal was exceeded as 89% of the students earned a score of 70% or above.

Student enrollment and grade distribution data

<table>
<thead>
<tr>
<th>Course</th>
<th>Percentage of initially enrolled students that completed the course with a grade</th>
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<tbody>
<tr>
<td>BIOL 196</td>
<td>89% (compared to 84% in 2012). Percentage of students earning a C or better was 59% (compared to 70% in 2012).</td>
</tr>
<tr>
<td>BIOL 197</td>
<td>95% (compared to 90% in 2012). Percentage of students earning a C or better was 69% (compared to 75% in 2012).</td>
</tr>
<tr>
<td>BIOL 300</td>
<td>93% (compared to 96% in 2012). Percentage of students earning a C or better was 92% (compared to 90% in 2012).</td>
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<tr>
<td>BIOL 304</td>
<td>91% (compared to 94% in 2012). Percentage of students earning a C or better was 81% (compared to 82% in 2012).</td>
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<tr>
<td>BIOL 351</td>
<td>90% (compared to 92% in 2012). Percentage of students earning a C or better was 84% (compared to 77% in 2012).</td>
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<tr>
<td>BIOL 415</td>
<td>97% (compared to 97% in 2012). Percentage of students earning a C or better was 80% (compared to 85% in 2012).</td>
</tr>
</tbody>
</table>
Our goals of 85% student retention in the two introductory courses and 90% student retention in the upper division core courses were exceeded in one of the core courses monitored, and not achieved in the other 3 core courses. Our goals for student achievement (at least 70% of students earning a grade of C or better in the introductory courses and at least 75% earning a C or better in the upper division courses were generally met. In the introductory courses, student achievement fell short of 70%; however, in all upper division courses student achievement exceeded 75%. We shall inform the faculty who teach BIOL 196 of the numbers (59%); clearly, longer term data are needed to determine if the 2013 data indicate a need to reassess our instruction in this course.

**Pre-Professional data collection**

The goal is that the acceptance rate into professional schools will match or exceed the national average. UNLV students were accepted into professional schools at rates that substantially exceed the national average. The national average for acceptance into medical school is ~45%. The rate of acceptance into medical school for students involved in the UNLV Pre-Professional Program was ~85%. The national average for acceptance into dental school is ~40%. The rate of acceptance into dental school for students involved in the UNLV Pre-Professional Program was 100%. As of this writing (May 2014), the statistics for 2013 medical and dental school acceptance were unavailable, so the latest data are for the calendar year 2012, which were essentially unchanged from 2011.