

Course Student Learning Outcomes Assessment

BIOL 211 Cellular and Molecular Biology

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General Information (Course Student Learning Outcomes Assessment)

Standing Requirements

📖 Course Description

An investigation into the molecular and cellular basis of life including the evolution of cells cell structure and function energy and information flow cellular reproduction genetics and the molecular basis of inheritance. Required of majors in Biology Medicine Forestry and Agriculture. This course is a prerequisite for Biology 212 and Biology 214. Prior completion of Chemistry 119 or 209 or equivalent recommended.

📖 Course Student Learning Outcomes

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome	
Outcome	Mapping
Outcome 1 Express a coherent understanding of fundamental biological concepts that include cell structure, energy, cell reproduction, and genetics.	Institutional Student Learning Outcomes: Act 1, Act 3, Communicate 3, Learn 1, Learn 2, Learn 3
Outcome 2 Employ the principles of the scientific method to investigate both laboratory and ordinary situations.	Institutional Student Learning Outcomes: Think 2
Outcome 3 Conduct laboratory investigations according to given experimental procedure, collect and analyze resulting experimental data, and formulate valid conclusions based on the results.	Institutional Student Learning Outcomes: Communicate 1, Learn 1, Learn 3, Think 1, Think 3

2014-2015 Assessment Cycle

Measurements

Outcomes and Measures

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome

Outcome 1

Express a coherent understanding of fundamental biological concepts that include cell structure, energy, cell reproduction, and genetics.

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

Description of Measurement Tool: A set of 8 multiple choice questions embedded in the lecture final exam given during the 16th week.

Criteria for Success: Individual & Collective Student Criterion: The success of understanding the fundamental biological concepts in each topic area will be assessed by comparison of the actual percentage of correct student responses to the expected percentage. "Success" will be defined here as the ability of the class to provide the following expected percentages of correct responses. For each question, 75% (or more) is expected.

Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Outcome 2

Employ the principles of the scientific method to investigate both laboratory and ordinary situations.

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2015

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Outcome 3

Conduct laboratory investigations according to given experimental procedure, collect and analyze resulting experimental data, and formulate valid conclusions based on the results.

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

Description of Measurement Tool: A laboratory exercise will be conducted exploring how the pH of a buffer is affected by varying the ratio of 0.2 M acetic acid and 0.2 M sodium acetate in the buffer and comparing the ability of the buffer to resist pH changes, as compared to water, when acid (HCl) or base (NaOH) is added to each.

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Cycle of Assessment: Fall 2016

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings

Finding per Measure

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome

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Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

Summary of Findings: 1. The metabolic reaction pathway known as the Electron Transport Chain occurs specifically:

- On the inner membrane of the mitochondria
- In the Cytosol
- In the matrix of the mitochondria
- Within the Golgi apparatus of the cell
- None of the above

Total # responses: 65, # correct responses: 45, % correct responses: 69.2%

2. The production of lipids and hormones, and the detoxification of poisons are the primary functions of which organelle?

- Golgi apparatus
- Rough endoplasmic reticulum
- Lysosome
- Smooth endoplasmic reticulum
- Ribosome

Total # responses: 65, # correct responses: 37, % correct responses: 56.9%

3. For every 1 molecule of Glucose that enters the Glycolysis pathway, 2 molecules of _____ come out at the end of Glycolysis.

- Pyruvate
- Acetyl Co A
- FADH₂
- Carbon Dioxide
- None of the above

Total # responses: 65, # correct responses: 51, % correct responses: 78.5%

4. The Glycolysis pathway occurs specifically in the:

- Intermembrane space of the mitochondria
- Matrix of the mitochondria
- Inner membrane of the mitochondria
- Outer membrane of the mitochondria

e. Cytosol

Total # responses: 65, # correct responses: 50, % correct responses: 76.9%

5. Starting with a 2n cell, division by Meiosis results in _____ while Mitosis results in _____.

- a. 4 genetically unique 1n cells, 2 genetically identical 2n cells
- b. 2 genetically identical 2n cells, 4 genetically unique 1n cells
- c. 4 genetically identical 2n cells, 2 genetically unique 1n cells
- d. 2 genetically unique 2n cells, 4 genetically unique 1n cells
- e. None of these

Total # responses: 65, # correct responses: 53, % correct responses: 81.5%

6. During Anaphase of Mitosis

- a. Chromosomes line up at the center of the cell
- b. Homologous duplicated chromosomes connect at chiasmata
- c. The nuclear membrane begins to break down
- d. Duplicated chromosomes separate at their centromeres
- e. Chromatin begins to condense into chromosomes

Total # responses: 65, # correct responses: 63, % correct responses: 96.9%

7. A copy of the DNA code is sent out of the nucleus to the ribosomes in the form of

- a. Messenger RNA
- b. Complementary DNA
- c. Ribosomal RNA
- d. Genomic DNA
- e. Transfer RNA

Total # responses: 65, # correct responses: 53, % correct responses: 81.5%

8. When complementary base pairing occurs between the nucleotides of the two strands of DNA, Cytosine will form _____ with its complement, while Thymine will form _____ with its complement.

- a. 2 hydrogen bonds, 3 hydrogen bonds
- b. 2 covalent bonds, 3 covalent bonds
- c. 3 hydrogen bonds, 2 hydrogen bonds
- d. 3 covalent bonds, 2 covalent bonds
- e. 2 ionic bonds, 3 ionic bonds

Total # responses: 65, # correct responses: 53, % correct responses: 81.5%

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: Overall, the class demonstrated success of understanding the fundamental biological concepts in 3 of the 4 areas assessed. Easy questions based on cell structure were answered correctly by less than 75% of the class. It is interesting to note that the order of these categories (Cell Structure, Energy, Cell Reproduction, and Genetics) is chronological with the semester and that the latter topics had higher class scores and the earlier topics had lower scores. It appears that the class performance here may be related to the recentness of the material presented.

The ability to perform well on this assessment would rely on associative connections formed between the vocabulary terms and the concepts they represent. The lower performance on easy level material from the start of the course may be an indication of students relying more on memorization than on an effort to compare and contrast concepts and build connections.

Recommendations: I plan to continue using this new assessment tool in the Fall of 2017 to continue gathering data and evaluate changes I plan to implement to switch the students efforts away from simply memorization and towards the increased use of higher level cognitive skills for learning.

Outcome 2

Employ the principles of the scientific method to

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

investigate both laboratory and ordinary situations.

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2015

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

Outcome 3

Conduct laboratory investigations according to given experimental procedure, collect and analyze resulting experimental data, and formulate valid conclusions based on the results.

▼ **Measure:** Means of assessment 211

Course level; Direct - Exam

Description of Measurement Tool: A laboratory exercise will be conducted exploring how the pH of a buffer is affected by varying the ratio of 0.2 M acetic acid and 0.2 M sodium acetate in the buffer and comparing the ability of the buffer to resist pH changes, as compared to water, when acid (HCl) or base (NaOH) is added to each.

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Cycle of Assessment: Fall 2016

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

Overall Recommendations

No text specified

 **Plans of Action**

 **Status Reports**

2013-2014 Assessment Cycle

Measurements

Outcomes and Measures

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome

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Cycle of Assessment: Fall 2016

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Finding per Measure

BIOL 211 Cellular and Molecular Biology Outcome Set

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Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

Outcome 2

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Course level; Direct - Exam

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Criteria for Success: Individual & Collective Student Criterion:

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Findings for Means of assessment 211

No Findings Added

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Cycle of Assessment: Fall 2016

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

Summary of Findings: Student identifies and states the hypothesis tested in the research article.

2 points – Hypothesis of research article is clearly stated by student.

1 point – Hypothesis is not clearly stated, but student generally mentions the goal or purpose of the research.

0 points – Student does not state hypothesis or mention in general the goal of the research.

Total # Students 68

scoring 1 or higher 67

Average % score for this section 87.5%

Student identifies and describes how the researchers limited the factors in their experimental design.

2 points – Student describes in detail an adequate number of methods used by the researchers to limit the factors in their research (or details the lack of).

1 point – Student describes a few methods used by the researchers to limit the factors in their research, but not much detail is provided.

0 points – Student does not mention any examples of how the researchers limited the factors in their research.

Total # Students 68

scoring 1 or higher 64

Average % score for this section 83.1%

Student identified and described the experimental controls of the research study.

2 points – Student clearly describes the experimental control(s) used in the research (or points out accurately that none was used).

1 point – Student mentions what the researchers used as their experimental control(s), but does not identify it as such.

0 points – Student does not mention the experimental control(s) and is unaware of it altogether.

Total # Students 68

scoring 1 or higher 63

Average % score for this section 83.8%

Student explained why this study is (or is not) repeatable based on the article.

2 points – Student describes in detail how the details provided in the research article relates to its repeatability.

1 point – Student describes in general that this research is or is not repeatable, but does not provide much support as to why.

0 points – Student does not comment on whether or not this research is repeatable.

Total # Students 68

scoring 1 or higher 57

Average % score for this section 73.5%

Student explains if the data gathered in the study is measurable in nature.

2 points – Student adequately comments on whether or not the data gathered in the research is accurately measurable in nature.

1 point – Student makes some attempt at judging the quality of the data gathered, but does not support their position well.

0 points – Student does not comment on the quality of the data gathered in the research.

Total # Students 68

scoring 1 or higher 57

Average % score for this section 70.6%

Results: Criteria for Success Achievement Status: Met

Analysis of Findings: The observed total average score for all three lab groups combined is 79.8% compared to the benchmark value of 70%. Individually, the M/W lab section's total average score is 91.0%, the T/Th lab section's total average score is 76.4 %, and the T/Th (PM) lab section's total average score is 71.0 %. Thus, each lab section independently scored above the benchmark value. From this summary of data, I conclude that the class as a whole has successfully achieved this student learning outcome.

This was the second semester utilizing a rubric to score the journal article research study report as the assessment tool. I will continue to assess this SLO using the same rubric on future class reports.

Overall, all three lab groups were satisfactory in their performance, however from a further breakdown of the data, both the T/TH and T/TH (PM) lab groups performed less than satisfactory in 2 of the 6 areas of their evaluations. Specifically, they were less than satisfactory in being able to identify and/or comment on the repeatability of an experimental design or on whether or not the experiment was designed well enough to produce measurable results. Very similar results were obtained from the assessment performed last semester.

Recommendations: Data collection will continue in Fall of 2016 during the next 3-year cycle of assessing this specific SLO.

Last semester, I increased the emphasis of the importance of experimental repeatability and measurable results during lecture and lab in an attempt to improve student performance in these areas. Judging from these results, there was little to no improvement observed in this semester's data by providing more activities, discussions, and/or exam questions based on these topics. It is clear that I will have to employ a different, more creative approach next semester to improve student awareness and understanding of the importance of repeatability and the quality of measurable results in good experimental design. I will attempt to increase awareness by integrating student critiques of each lab exercise throughout the semester with respect to identifying and summarizing the characteristics of good experimental design. I will provide subtle, but extra emphasis on repeatability and measurable results.

Overall Recommendations

No text specified

Plans of Action

Status Reports

2012-2013 Assessment Cycle

Measurements

Outcomes and Measures

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome

Outcome 1

Express a coherent understanding of fundamental biological concepts that include cell structure, energy, cell reproduction, and genetics.

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Outcome 2

Employ the principles of the scientific method to investigate both laboratory and ordinary situations.

▼ **Measure:** Means of assessment 211
Course level; Direct - Exam

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Outcome 3

Conduct laboratory investigations according to given experimental procedure, collect and analyze resulting experimental data, and formulate valid conclusions based on the results.

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Cycle of Assessment: Spring 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Finding per Measure

BIOL 211 Cellular and Molecular Biology Outcome Set

Outcome

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Course level; Direct - Exam

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

Outcome 2

Employ the principles of the scientific method to investigate both laboratory and ordinary situations.

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Course level; Direct - Exam

Description of Measurement Tool:

Criteria for Success: Individual & Collective Student Criterion:

Cycle of Assessment: Fall 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

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Cycle of Assessment: Spring 2014

Who is Responsible for Assessment Activity?: Biology faculty currently teaching the course.

Findings for Means of assessment 211

No Findings Added

Overall Recommendations

No text specified

 **Plans of Action**

 **Status Reports**