Washtenaw Community College Comprehensive Report

BIO 162 General Biology II Cells and Molecules
Effective Term: Spring/Summer 2016

Course Cover

Division: Math, Science and Engineering Tech
Department: Life Sciences
Discipline: Biology
Course Number: 162
Org Number: 12100
Full Course Title: General Biology II Cells and Molecules
Transcript Title: Gen Bio II Cells and Molecules
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Course Change
Change Information:
Consultation with all departments affected by this course is required.
Pre-requisite, co-requisite, or enrollment restrictions
Rationale: update pre-requisites
Proposed Start Semester: Fall 2016
Course Description: In this course for biology majors, students are provided an introduction to the basic principles of biology and their practical applications. Topics include chemistry, cell biology and energetics, classical and molecular genetics and gene expression. Basic concepts of development, ecology, evolution and sustainability issues will be covered. Students will read and discuss scientific literature, write two formal lab reports and a short paper and complete relevant lab exercises, including an inquiry-based experiment. This course is part of a two course sequence that serves as a comprehensive, year-long sequence for biology majors and other interested students.

Course Credit Hours

Variable hours: No
Credits: 4
Lecture Hours: Instructor: 45 **Student:** 45
Lab: Instructor: 45 **Student:** 45
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

Prerequisite
High school biology or high school chemistry or high school environmental science

or
Prerequisite
BIO 101 minimum grade "C"
or
Prerequisite
CEM 101 minimum grade "C"
or
Prerequisite
ENV 101 minimum grade "C"

General Education

MACRAO
MACRAO Science & Math
MACRAO Lab Science Course
General Education Area 4 - Natural Science
Assoc in Applied Sci - Area 4
Assoc in Science - Area 4
Assoc in Arts - Area 4
Michigan Transfer Agreement - MTA
MTA Lab Science

Request Course Transfer

Proposed For:
Central Michigan University
College for Creative Studies
Eastern Michigan University
Ferris State University
Grand Valley State University
Jackson Community College
Kendall School of Design (Ferris)
Lawrence Tech
Michigan State University
Oakland University
University of Detroit - Mercy
University of Michigan
Wayne State University
Western Michigan University

Student Learning Outcomes

1. Describe and identify the macromolecules of life and the structure and function of cells; recognize how cells harvest and harness energy in cellular respiration and photosynthesis.
   Assessment 1
   Assessment Tool: Departmental Exams
   Assessment Date: Fall 2016
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students taking the course (up to 24)
   How the assessment will be scored: Item analysis of selected exam questions. Any essay and/or short answer questions will be scored using a departmentally-developed rubric.
   Standard of success to be used for this assessment: Seventy percent of students will score an overall average score of 70% or better on each assessment question.
   Who will score and analyze the data: Appropriate life science faculty will assess the data after student names have been removed or blacked out.

2. Describe and identify key components of mitosis, meiosis, genetics, gene expression, development, ecology, evolution and sustainability issues.
   Assessment 1
   Assessment Tool: Departmental Exams
   Assessment Date: Fall 2016
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students taking the course (up to 24)
   How the assessment will be scored: Item analysis of selected exam questions. Any essay and/or short answer questions will be scored using a departmentally-developed rubric.
   Standard of success to be used for this assessment: Seventy percent of students will score an overall average score of 70% or better on each assessment question.
   Who will score and analyze the data: Appropriate life science faculty will assess the data after student names have been removed or blacked out.

3. Perform lab work to elucidate biological concepts and to develop scientific skills including designing, completing and interpreting a scientific experiment.
   Assessment 1
   Assessment Tool: Departmental lab exams
   Assessment Date: Fall 2016
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students taking the course (up to 24)
   How the assessment will be scored: Item analysis of selected exam questions. Any essay and/or short answer questions will be scored using a departmentally-developed rubric.
   Standard of success to be used for this assessment: Seventy percent of students will score an overall average score of 70% or better on each assessment question.
   Who will score and analyze the data: Appropriate life science faculty will assess the data after student names have been removed or blacked out.

4. Demonstrate college-level scientific writing skills.
   Assessment 1
   Assessment Tool: The final draft of one of the two formal lab reports
   Assessment Date: Fall 2016
   Assessment Cycle: Every Three Years
   Course section(s)/other population: all sections
   Number students to be assessed: All students taking the course (up to 24)
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 70% of the students will score 70% or higher
   Who will score and analyze the data: Appropriate life science faculty will assess the data after student names have been removed or blacked out.

Course Objectives

1. Define or identify the parts of the experimental method; explain the purpose of a control in an experiment, interpret scientific literature.
2. Define, identify, or write short essays from among the following central themes in biology: cell theory, molecular basis of inheritance, descent with modification (evolution), cells are information-processing systems, living systems exist in non-equilibrium states, and/or function follows structure.
3. Identify or define element, atomic number, atomic mass, isotope, ion, octet rule; use the periodic table to describe the properties of atoms, including bonding patterns.
4. Identify or describe the nature of ionic bonds, covalent bonds, hydrogen bonds; describe when chemical reactions occur.
5. Describe the structure of water and how this leads to the properties of water.
6. Identify or define terms relating to acid-base chemistry; explain why small changes in pH

have large effects in biological systems.
7. Identify functional groups; describe how hydrolysis breaks and dehydration synthesis makes macromolecules. Define isomers and describe how shape determines function in macromolecules.
8. Identify the structure and function of carbohydrates, nucleic acids, proteins, and lipids. Describe the four levels of protein structure and distinguish between denaturation and degradation of proteins. Describe the structure and function of energy nucleotides such as ATP, NADH and FADH2.
9. Describe the common techniques of cell biology, including light and electron microscopy. Describe the advantages and disadvantages of the techniques.
10. Describe the structure and function of parts of a prokaryotic cell; compare and contrast eubacteria and archaea.
11. Describe the structure and function of parts of a eukaryotic cell; compare and contrast prokaryotic and eukaryotic cells; compare and contrast plant and animal cells. Identify structures and functions of the endomembrane system. Identify structure and function of elements of motility and cell-cell interactions.
12. Describe the fluid-mosaic model of membranes; describe how the structure affects the functions of membranes. Describe the structure and function of phospholipids.
13. Identify and distinguish from among passive transport (including osmosis), active transport, exocytosis and endocytosis. Compare and contrast osmosis and diffusion.
14. Give examples of and/or define energy terms, such as: the first and second law of thermodynamics, kinetic energy, potential energy, reduction reactions, oxidation reactions, activation energy, catalysts, and entropy.
15. Describe how enzymes function as biological catalysts; define terms such as enzyme specificity, active sites, catalytic cycle of an enzyme; describe environmental factors affecting enzyme function such as temperature, pH, inhibitors, activators, allosteric inhibition.
16. Describe structure and function of biochemical pathways; describe feedback inhibition and identify why this occurs with anabolic pathways.
17. Describe the structure and function of mitochondria. Identify the 4 steps in cellular respiration (glycolysis, oxidation of pyruvate, Krebs cycle, ETC), identifying: the number of ATP and NADH made or used up, and the carbon molecule at the beginning and end of each stage. Describe why the presence of glycolysis in all living cells indicates a common ancestor that could also perform glycolysis.
18. Describe that ATP can be made directly (substrate-level oxidation) or indirectly (oxidative phosphorylation); describe how metabolism harvests energy in stages, describe the role of NADH in cellular respiration; describe how the proton gradient connects the ETC with ATP synthesis.
19. Define chemiosmosis, describe the structure and function of ATP; describe why fermentation is a solution for producing energy when there is little oxygen present.
20. Identify the structure and function of a chloroplast. Describe the overview for photosynthesis including purpose, major steps, use of pigments in a photosystem, and use of NADPH to shuttle electrons in the cell.
21. Identify light-dependent and light independent reactions of photosynthesis; identify O2 comes from water, not CO2; identify that energy from ATP and NADPH made in the light reactions reduces CO2 to sugar.
22. Define photorespiration; describe the adaptations of C4 and CAM plants to minimize photorespiration.
23. Describe how cell-cell signal transduction pathways lead to cellular responses; identify key membrane receptors.
24. Identify that binary fission is a form of cell division in prokaryotes; identify the structure of a prokaryotic chromosome; identify the steps in binary fission.
25. Identify that mitosis is a form of cell division in somatic cells in eukaryotes; identify the structure of eukaryotic chromosomes; identify key steps in the cell cycle and mitosis; identify that cancer occurs when control over the cell cycle is lost.
26. Identify that meiosis is a form of cell division producing gametes in eukaryotes; identify the overview in meiosis; identify the steps in meiosis; identify that failure of chromosome

separation in meiosis leads to aneuploidy.

27. Distinguish between mitosis and meiosis; identify the processes unique to meiosis; identify that aneuploidy results when control over meiosis is lost.
28. Identify Mendel's laws of inheritance and the experiments upon which they are based; be able to work monohybrid, dihybrid and probability problems; be able to interpret and work problems involving alterations to Mendel's ratios such as complementation, epistasis, sex-linkage and linkage.
29. Explain the evidence for genes being on chromosomes. Explain how dosage compensation in mammals works; explain uni-parental inheritance, such as mitochondrial, paternal (Y-DNA). Draw and explain what the results are for nondisjunction in humans.
30. Explain how mutations can give phenotypes, including disease phenotypes.
31. Describe the phenomenon of transformation.
32. Describe the evidence for DNA as genetic material; describe the structure and function of DNA; relate the importance of complementarity for DNA structure and function.
33. Identify the basic mechanism, the enzymes and the location for DNA replication in prokaryotes and eukaryotes. Explain why replication is discontinuous on one strand; explain the function of telomeres; explain why DNA repair is critical for cells.
34. Identify the basic mechanism, the enzymes and the location for transcription and translation in prokaryotes and eukaryotes; distinguish between transcription and translation.
35. Summarize the experiments that revealed the genetic code; describe the characteristics of the genetic code; identify the relationship between codons and amino acids; define co-linearity; describe splicing; distinguish between point mutations and chromosomal mutations.
36. Identify the point at which control of gene expression usually occurs; list differences between control of gene expression in prokaryotes and eukaryotes; explain control of gene expression in operons such as the lac operon and the trp operon; describe ways in which gene expression is regulated.
37. Describe some of the techniques, applications and results of molecular biology, genomics and/or proteomics; describe applications such as personalized medicine, crop enhancement; describe the controversial issues that have arisen with these techniques.
38. Describe how development of animals and plants differ; describe the basic mechanisms of development.
39. Define evolution and natural selection; explain why evolution can't make perfect organisms; describe how protein and gene sequences can act as "tape measure of evolution," define microevolution and give 5 causes for microevolution; Define the terms in the two Hardy-Weinberg equations and work simple problems using the equations.
40. Define species and communities and identify the major interactions between species; identify the components of the major biogeochemical cycles and describe how they function; and describe how energy flows in ecosystems.
41. In a 3-5 page paper, relate one of the topics covered to sustainability issues facing the world today (e.g., synthesis of biofuels, production of GM crops, synthesis of edible vaccines, etc...).
42. Perform lab work and demonstrate skills in things such as: scientific method, graphing, use of the metric system, and light microscopy. Use the skills learned to identify the structure and functions of cells and subcellular components, to graph experimental results and to perform experiments.
43. Perform lab work and be able to do things such as: identify structure and function of macromolecules, define osmosis and diffusion and distinguish between them; examine enzyme reaction rates and factors that affect the rates; perform chromatography; determine the wavelength of maximum absorption of chlorophyll.
44. Observe and be able to identify the stages of mitosis and meiosis; perform a molecular biology experiment such as transformation; practice and be able to solve standard monohybrid and dihybrid genetic problems.
45. Pose hypotheses, design and set up appropriate experiments with controls, interpret the data, draw conclusions from data, accept or reject the hypothesis, present analysis of the experiments in written form and as an oral report. Perform one or more inquiry-based

experiments. Write two formal lab reports of two drafts each.

New Resources for Course

1) 12 Dell latitude laptop computers, $1,100 each for a total of $13,200 2) Beckworth mobile laptop cart with shipping $1887 2) supplies to start new labs, $2,500 total is $17587

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Reviewer	Action	Date
Faculty Preparer:		
Anne Heise	*Faculty Preparer*	*Oct 22, 2015*
Department Chair/Area Director:		
Anne Heise	*Recommend Approval*	*Oct 22, 2015*
Dean:		
Kristin Good	*Recommend Approval*	*Oct 22, 2015*
Curriculum Committee Chair:		
Kelley Gottschang	*Recommend Approval*	*Nov 11, 2015*
Assessment Committee Chair:		
Vice President for Instruction:		
Michael Nealon	*Approve*	*Nov 17, 2015*