SCIE1101 Biology
Jeffrey R. Christianson, Ph.D.
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I. CBU PROFESSOR BIO

Jeffrey R. Christianson, Ph.D., is Professor of Science and Worldview at Vyrsity and Colorado Biblical University. He is also a Data Scientist, has previously held a Postdoctoral Researcher appointment (computational chemistry) in the Chemical Engineering department at the University of Delaware, and has served as a Graduate Researcher (theoretical physical chemistry) and Teaching Assistant (general chemistry) in the Chemistry department at the University of Wisconsin – Madison, where he received his Ph.D. in Physical Chemistry. He received B.S. degrees in Chemistry and Mathematics from Truman State University.

II. COURSE DESCRIPTION

This course provides a broad survey of the field of Biology for non-science majors. Learners will be introduced to the structure and function of the cell, the fundamental concepts of genetics and inheritance, evolutionary processes, biological diversity and classification, and ecology. The course is designed to equip the Learner with an understanding and appreciation for the field of Biology, the distinction between operational and historical science, and the interplay between inductive and deductive thought that is common among all natural sciences, thereby providing information, experience, and tools necessary for a worldview-informed treatment of science in transformative learning and leadership.

Module 1: Foundations of Biology
Clark, et al. (1.1 – 1.2, 2.1 – 2.3, 3.1 – 3.5, 6.2 – 6.3)
Stadler (p. 1-32)
Tomkins (p. 9-21)
Reading Assessment #1
Module Assessment #1

What is biology? How is it related to other sciences? How is the study of biology informed by the biologist's worldview? Upon successful completion of this module, the Learner will be able to define biology, distinguish between observational and historical biology, and demonstrate the ability to apply key concepts from chemistry to describe basic building blocks of biology such as carbohydrates, lipids, proteins, nucleic acids, and energy.

Module 2: Cell Structure
Clark, et al. (4.1 – 4.6)
Tomkins (p. 23-47)
Reading Assessment #2
Module Assessment #2

What is a cell? What are its primary components and how are they related to their function? Upon successful completion of this module, the Learner will be able to describe the role of cells in organisms, summarize cell theory, describe the structure of prokaryotic and eukaryotic cells, recognize the relationship between the components of the endomembrane system and cytoskeleton and their functions, and describe the connections between cells and cellular activity.

Module 3: Cell Transport
Clark et al. (Chapter 5.1 – 5.4)
Tomkins (p. 67-81)
Reading Assessment #3
Module Assessment #3

How does a cell interact with its environment? How are materials passed to and from the cell and regulated? Upon successful completion of this module, the Learner will be able to understand the structure of the cell membrane and how it correlates with its function, explain how passive and active transport occur, and describe key processes of bulk transport (endocytosis and exocytosis).

Module 4: Metabolism, Cellular Respiration, and Photosynthesis
Clark, et al. (6.1 – 6.2, 6.4 – 6.5a, 7.1 – 7.4, 8.1 – 8.3)
Tomkins (p. 83-89)
Reading Assessment #4
Module Assessment #4

How do cells generate and transfer energy? Upon successful completion of this module, the Learner will be able to explain the two major types of metabolic pathways, explain how enzymes function as molecular catalysts, describe the role of ATP in cellular energy, and summarize the processes that comprise aerobic cellular respiration and photosynthesis.

Module 5: Cell Reproduction
Clark, et al. (10.1 – 10.2, 11.1 – 11.2)
Tomkins (p. 57-65)
Reading Assessment #5
Module Assessment #5

How do cells reproduce? What kinds of processes are involved in cell replication and division? Upon successful completion of this module, the Learner will be able to distinguish between chromosomes, genes, and traits, describe the cellular events that take place in and the behavior of chromosomes during mitosis and meiosis, explain the differences in the processes of mitosis and meiosis, and summarize the three different life-cycle types among sexually reproducing multicellular organisms.

Module 6: Genetic Heredity and Inheritance
Clark, et al. (12.1 – 12.3, 13.1)
Stadler (p. 33-80)
Reading Assessment #6
Module Assessment #6

How are individual traits inherited from parents? Why do populations exhibit genetic variation? Upon successful completion of this module, the Learner will be able to describe the reasons for the success of Mendel's experiments on genetics, apply basic rules of probabilities to calculate expected population inheritance patterns, summarize and apply the rules of Mendelian inheritance patterns, identify non-Mendelian inheritance patterns, and describe the key components of the Chromosomal Theory of Inheritance and its relationship to Mendelian genetics.

Module 7: DNA Structure and Function
Clark, et al. (14.1 – 14.6)
Tomkins (p. 49-55, 91-111)
Reading Assessment #7
Module Assessment #7

What is DNA? What is its structure and how is it determined? How is DNA replicated during cellular reproduction? Upon successful completion of this module, the Learner will be able to describe the historical basis of the modern understanding of DNA, describe the structure of DNA and how it is

sequenced, explain the key components to the DNA replication process in both prokaryotes and eukaryotes, discuss different types of DNA mutations, and explain DNA repair mechanisms.

Module 8: Evolution and Adaptation
Clark, et al. (18.1 – 18.3, 19.1 – 19.3)
Stadler (p. 81-157)
Reading Assessment #8
Module Assessment #8

What are evolutionary processes? How are they studied? Upon successful completion of this module, the Learner will be able to identify the biological processes that are described by the term evolution, distinguish between those processes on the basis of observability, describe how population genetics are used to study population evolution, explain the importance of adaptability, and identify its source.

Module 9: Biological Diversity and Classification
Clark et al. (20.1, 22.1, 23.2, 24.1, 25.4, 26.2 – 26.3, 27.1 – 27.2)
Lightner
Wood
Reading Assessment #9
Module Assessment #9

What are the major forms of life? How can they be classified? Upon successful completion of this module, the Learner will be able to identify the major classifications of living organisms, list some of their key characteristics, explain key features that are used to classify them, and describe similarities and differences between them.

Module 10: Introduction to Ecology
Clark, et al. (44.1 – 44.4, 45.1, 46.1)
Jones (p. 21-60, 75-84)
Reading Assessment #10
Module Assessment #10
Course Assessment
Competency Assessment

How do living organisms interact with one another? Upon successful completion of this module, the Learner will be able to define ecology, distinguish between abiotic and biotic components of the environment, describe the effects of abiotic factors on aquatic and terrestrial environments, recognize distinguishing characteristics of terrestrial and aquatic biomes, explain the primary features of population ecology, and describe the basic ecosystem types and how they are studied.

III. COURSE READING

Clark, Mary Ann; Douglas, Matthew; Choi, Jung. *Biology 2e* (Houston, TX: OpenStax, Mar 28, 2018), ISBN: 978-1-947172-52-4, https://openstax.org/details/books/biology-2e, Free Online (open source, hard copy retail: $52), sections as specified for each module.

Jones, J. Y. *Worship Not the Creature* (Ventura, CA: Nordskog Publishing, 2009), ISBN: 978-0-9824929-1-8, $15.

Lightner, Jean; Hennigan, Tom; Purdom, Georgia; Hodge, Bode. "Determining the Ark Kinds", *Answers Research Journal*, 4 (2011): 195-201, free online: https://answersresearchjournal.org/determining-the-ark-kinds/

Stadler, Rob. *The Scientific Approach to Evolution* (North Charleston, SC: CreateSpace Independent Publishing Platform, 2016), ISBN: 978-1-532988-09-7, $10.

Tomkins, Jeffrey P. *The Design and Complexity of the Cell* (Dallas, TX: ICR, 2012), ISBN: 978-1-935587-08-8, $12.

Wood, Todd Charles. "A Baraminology Tutorial with Examples from the Grasses", *Journal of Creation*, 16 (2002): 15-25, free online: https://creation.com/a-baraminology-tutorial-with-examples-from-the-grasses-poaceae

IV. LEARNING OUTCOMES

Course Learning Outcomes (CLOs)

1. Understand the major concepts within the field of Biology and how they are studied (CBULO 1, 2, BPCO 1, APCO 1).
2. Apply knowledge of these major concepts to solve problems that are regularly addressed by biologists (CBULO 3, BPCO 2, APCO 1).
3. Analyze common life-science ideas and examine their major epistemological presuppositions and socio-political implications (CBULO 4, 5, BPCO 3, 4, APCO 2, 3).

Bachelor's Program Competency Outcomes (BPCOs)

1. To prepare Learners for roles in transformative education teaching and service.
2. To provide Learners a foundation for effective individual and organizational leadership in diverse environments.
3. To ensure Learners demonstrate worldview foundation for empowering people and building communities.
4. To help Learners formulate a Biblical approach to transformative learning and leadership.

Associate's Program Competency Outcomes (APCOs)

1. To prepare Learners for specialized undergrad study in transformative education theory and in leadership strategies.
2. To provide Learners key worldview foundations for critical thinking and study.
3. To provide Learners with practical experience germane to their transformative learning and leadership.

CBU Learning Outcomes (CBULOs)

1. Critical Thinking, Problem Solving, and Research – Learners will demonstrate ability to think critically, solve problems, and conduct interdisciplinary research at a level appropriate to their program.

2. Personal Growth – Learners will understand how learning is related to personal growth, and will be challenged to grow in their thinking, communication, conduct, and engagement with others.

3. Skills Development – Learners will advance in skills related to their program, demonstrating a level of competency appropriate to their program.

4. Social Responsibility – Learners will appreciate the diversity in and value of others as designed by our Creator, and will grow in willingness and capability to serve others.

5. *Worldview Applications* – Learners will become capable at thinking from a worldview perspective understanding the relationship of description and prescription, so that they can ground their actions in sound principles.

V. GRADING RUBRIC (1000 POINTS)

Module Assessments (25 points each x 10)	250 Points (Multiple Choice)
Reading Assessments (25 points each x 10)	250 Points (Multiple Choice)
Course Assessment	250 Points (Multiple Choice)
Competency Assessment	250 Points (3000-word research paper)

Module Assessments will primarily evaluate the Learner's understanding of the lecture content, which will for the most part follow the Clark et al. assigned reading for each module. Reading Assessments will evaluate understanding of the other assigned reading for each module, which has been selected to encourage critical thinking about the course material at the worldview level. The final Course Assessment will evaluate a comprehensive understanding of all lecture and reading content.

The Competency Assessment will primarily evaluate the Learner's progress in achieving CLO 3. The Learner will work with the course mentoring faculty member to select a socio-political issue that is significantly related to the field of biology. The Learner will then research the topic to search for perspectives from science and from multiple worldviews and write a 3000-word paper that both summarizes the research findings and critically analyzes the issue from the perspective of the Learner's worldview. The Learner should keep the mentoring faculty member updated with the progress and direction of the research throughout the process of completing the assessment.

VI. GRADING SCALE

91-100%	A
81-90%	B
71-80%	C
61-70%	D
0-60%	F

VII. CARNEGIE UNIT CREDIT HOUR EQUIVALENT

Total Hours of Module Content:	30 hours
Total Hours of Reading Content:	50 hours
Total Hours of Assessment Preparation:	20 hours
Total Hours of Minor Assessments:	12 hours
Total Hours of Major Assessment:	3 hours
Total Hours of Competency Assessment:	20 hours

Equivalent of 3 Credit Hours (135 hours of total course time)