**BIO-1500: PRINCIPLES OF BIOLOGY I**

Cuyahoga Community College

**Viewing:** BIO-1500 : Principles of Biology I

**Board of Trustees:**
2018-05-24

**Academic Term:**
Spring 2019

**Subject Code**
BIO - Biology

**Course Number:**
1500

**Title:**
Principles of Biology I

**Catalog Description:**
Designed for science majors. The molecular and cellular basis of life is explored through an introduction to cell biology, molecular biology, genetics, and evolution in both lecture and laboratory settings. Topics include scientific inquiry; chemical aspects of life; cell structure and function; energy and metabolism; cell division; molecular genetics; inheritance; population genetics; mechanisms of evolution; and evidence for evolution.

**Credit Hour(s):**
4

**Lecture Hour(s):**
3

**Lab Hour(s):**
3

**Other Hour(s):**
0

**Requisites**

**Prerequisite and Corequisite**
ENG-0990 Language Fundamentals II or appropriate score on English Placement Test; and MATH-0955 Beginning Algebra or appropriate score on Math Placement Test.

**I. ACADEMIC CREDIT**

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

**II. ACCESSIBILITY STATEMENT**

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.
For specific information pertaining to ADA accommodation, please contact your campus SAS office or visit online at http://www.tri-c.edu/accessprograms/. Blackboard accessibility information is available at http://access.blackboard.com.

III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:

- For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.
- For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have “Never Attended” a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available at http://www.tri-c.edu/student-resources/documents/studenthandbook.pdf. You must also comply with the College’s Zero Tolerance for Violence on College Property available at http://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf
Outcomes

Course Outcome(s):
Process of Science: Apply the process of scientific inquiry to develop and explore questions about the natural world, and effectively communicate the findings.

Objective(s):
1. Distinguish among an observation, hypothesis, experiment, conclusion, and theory.
2. Document experimental results in a written format.
3. Distinguish between observations and inferences.
4. Apply proper lab skills and techniques in observation and experimentation.
5. Use scientific inquiry to write a hypothesis, design an experiment, analyze data and draw a conclusion.

Course Outcome(s):
Chemical Aspects of Life: Relate the chemical properties of atoms, molecules, and bonds to biological processes.

Objective(s):
1. Distinguish among elements, atoms, and molecules.
2. Compare and contrast ionic, covalent, and hydrogen bonds.
3. Relate the properties of water to hydrogen bonding and how they are significant to life.
4. Describe the biological macromolecules important to life and their role in living organisms.
5. Explain the reactions involved in the synthesis and degradation of macromolecules.
6. Explain how the structure of a molecule determines its function.

Course Outcome(s):
Cell: Illustrate how the components of cells contribute to cell signaling, transport, and metabolism.

Objective(s):
1. Compare and contrast prokaryotic and eukaryotic cells.
2. Describe the structures and functions of cellular organelles and other cellular structures.
3. Describe the parts of the endomembrane system and explain how they work together in the synthesis and distribution of macromolecules.
4. Explain the structure of the cell membrane and how it functions in cell transport, identity, and signaling.
5. Compare and contrast various types of passive, active, and bulk transport.
6. Explain the pathway from an extracellular chemical signal to an intracellular response.
7. Differentiate among the types of cell junctions and their roles in tissue formation and cell communication.

Course Outcome(s):
Energy: Analyze the acquisition, transformation, utilization, and storage of energy in living things.

Objective(s):
1. Explain the laws of thermodynamics and how they relate to living systems.
2. Describe potential and kinetic energy, and recognize how one form of energy is converted to another.
3. Compare and contrast exergonic and endergonic reactions and describe how they relate to metabolism.
4. Explain the properties of enzymes and how the structure of an enzyme determines its function.
5. Describe how the structure of adenosine Triphosphate (ATP) is linked to its role in energy storage and transfer.
6. Describe how a cell extracts energy from macromolecules in the presence or absence of oxygen.
7. Explain how photoautotrophs convert light energy into chemical energy through the process of photosynthesis.
8. Compare and contrast cellular respiration and photosynthesis.

Course Outcome(s):
Continuity of Life: Illustrate how cell-cycle regulation controls cell division and development.

Objective(s):
1. Identify the stages in the sexual life cycle and explain the roles of mitosis and meiosis.
2. Describe the phases of the eukaryotic cell cycle and explain how it is regulated.
3. Compare and contrast mitosis and meiosis.
4. Explain how meiosis contributes to genetic diversity.
5. Describe the stages of early embryological development.
Course Outcome(s):
Genetics: Relate the principles of molecular genetics and patterns of inheritance to genotype and phenotype.

Objective(s):
1. Describe the structure of DNA and the process of semiconservative replication.
2. Describe how genes are expressed through the transcription of DNA and translation of RNA into an amino acid sequence.
3. Explain how mutations affect genotype and phenotype.
4. Identify patterns of inheritance determined by Mendelian and non-Mendelian genetics.
5. Explain the effect of abnormal chromosome number on development and phenotype.

Course Outcome(s):
Evolution: Utilize evidence to support how populations change genetically over time through the process of evolution resulting in the unity and diversity of life.

Objective(s):
1. Explain the effect of a changing environment on the gene pool of a population.
2. Differentiate among the mechanisms by which populations change genetically over time.
3. Use evidence to support the scientific theory of evolution.
4. Explain how new species form.
5. Describe the natural mechanisms that keep species reproductively isolated.
6. Explain the theories of gradualism and punctuated equilibrium as they relate to the rate of evolution.

Methods of Evaluation:
1. Quizzes
2. Exams
3. Laboratory practicals
4. Written reports
5. Research papers
6. Projects (individual or group)
7. Presentations (individual or group)
8. Article discussions/review/summaries
9. Discussion boards
10. Homework assignments
11. Case studies

Course Content Outline:
1. Concepts:
   a. Characteristics of life
   b. Cell theory
   c. Biological hierarchy
   d. Process of science, including observations and hypothesis testing
   e. Experimental design, including data, variables, and controls
   f. Scientific theory
   g. Inductive and deductive reasoning
   h. Primary and secondary sources
   i. Matter and elements
   j. Atomic structure
   k. Bonds, including covalent, ionic, and hydrogen
   l. Chemistry and properties of water
   m. pH, acids, bases, and buffers
   n. Dehydration synthesis and hydrolysis
   o. Biological macromolecules, including carbohydrates, lipids, proteins, and nucleic acids
   p. Levels of protein structure
   q. Prokaryotic and eukaryotic cell structure
   r. Cell membranes and cell walls
   s. Surface area to volume ratio
   t. Evolution of endomembrane system and nucleus
   u. Endosymbiotic theory of mitochondrion and chloroplast evolution
   v. Cell transport, including active, passive, and bulk
w. Cell-cell interactions
x. Potential and kinetic energy
y. Laws of thermodynamics
z. Enzyme structure and function
aa. Oxidation-reduction reactions
bb. ATP as an energy carrier
cc. Metabolic pathways
dd. Feedback inhibition and activation
ee. Catabolism of carbohydrates, proteins, and fats
ff. Aerobic cellular respiration (glycolysis, pyruvate oxidation, Krebs cycle, electron transport, and chemiosmosis)
gg. Anaerobic cellular respiration
hh. Fermentation
   ii. Photosynthesis, including C_3(light dependent and independent reactions), C_4, and CAM pathways
jj. Cyclic and non-cyclic phosphorylation
kk. Photospiration
ll. Types of cellular receptors
mm. Signal transduction pathway, including ligands, receptors, signal amplification, and response
nn. Prokaryotic cell division
oo. Eukaryotic cell cycle and mechanisms of control
pp. Mitosis
qq. Loss of cell cycle control and cancer
rr. Eukaryotic chromosomes, including chromatids and homologues
ss. Meiosis and crossing-over
tt. Gametogenesis in animals
uu. Embryological development in animals
vv. Independent assortment and segregation of chromosomes
ww. Nondisjunction of chromosomes
xx. Alleles
yy. Patterns of inheritance
zz. Phenotype versus genotype
aaa. Monohybrid and dihybrid crosses
bbb. Mutation
ccc. Double helix structure of DNA and complementary base pairing
ddd. Semiconservative replication of DNA
eee. Biotechnology
   fff. Gene expression, including transcription and translation
ggg. Control of gene expression in prokaryotes and eukaryotes
hhh. The genetic code
   iii. Theory of evolution
      jii. Agents of evolution, including natural selection, mutation, genetic drift, gene flow, and nonrandom mating
kkk. Population genetics
lll. Adaptations
mmm. Evidence for evolution
nnn. Speciation
ooo. Punctuated equilibrium and gradualism
2. Skills
   a. Demonstrate proper lab safety procedures.
   b. Write a hypothesis.
   c. Design and perform an experiment to analyze questions about the natural world.
   d. Document experimental results in a written format.
   e. Critically evaluate the source of information.
   f. Distinguish between primary and secondary resources.
   g. Gather, organize, and analyze data using computer graphing programs.
   h. Measure mass, volume, and length using the metric system.
   i. Measure liquids utilizing standard pipettes and micropipettes.
   j. Calculate simple statistics, including mean, standard deviation, and percent error.
   k. Utilize the compound microscope and dissecting microscope.
l. Prepare wet mount slides, utilizing stains when appropriate.
m. Differentiate between types of prokaryotic and eukaryotic cells using a microscope.

n. Measure absorbance and percent transmittance using a spectrophotometer.
o. Create a standard curve to determine the concentration of an unknown.
p. Identify stages of mitosis in animal and plant cells under the microscope.
q. Differentiate between sister chromatids and homologous chromosomes.
r. Identify early stages of development in animal embryos.
s. Construct a Punnett square to predict genotypic and phenotypic probabilities of offspring.
t. Identify patterns of inheritance using a pedigree.
u. Solve Mendelian genetics problems.
v. Interpret a karyotype to determine gender and chromosomal abnormalities.
w. Transcribe a DNA sequence and translate an RNA sequence.
x. Perform gel electrophoresis and interpret the results.
y. Interpret a DNA fingerprint.

z. Calculate frequencies of alleles and genotypes using the Hardy-Weinberg equation.

3. Issues
   a. Relationship between structure and function
   b. The nature of science
   c. Biodiversity
   d. Evolution as a scientific theory
   e. Continuity of life
   f. Cells as the basic unit of life
   g. Homeostasis
   h. Populations change over time
      i. The species concept
   j. Flow of energy through living systems
   k. The unity and diversity of life due to evolution
   l. Universal nature of the genetic code

Resources


Resources Other
1. The Biology Project -http://www.biology.arizona.edu/
2. Virtual Cell Animation Collection -http://vcell.ndsu.edu/animations/
3. Learn Genetics -http://learn.genetics.utah.edu/
5. PBS Evolution -http://www.pbs.org/wgbh/evolution/
10. NSF National Center for Case Study Teaching in Science -http://sciencecases.lib.buffalo.edu/cs/
12. NOVA -http://www.pbs.org/wgbh/nova/

Instructional Services

OAN Number:
TMNS, OSC003, and OSC024 (1 of 2 courses, both must be taken)

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