BIO-150H: HONORS PRINCIPLES OF BIOLOGY I

Cuyahoga Community College

Viewing:BIO-150H : Honors Principles of Biology I

Board of Trustees:
2016-05-26

Academic Term:
Spring 2019

Subject Code
BIO - Biology

Course Number:
150H

Title:
Honors Principles of Biology I

Catalog Description:
Honors course designed for science majors with exploration of the molecular and cellular basis of life through an introduction to cell biology, molecular biology, genetics and evolution with a strong focus on inquiry-based learning as the basis of scholarly research. Emphasis on evolution as the unifying theory in biology.

Credit Hour(s):
4

Lecture Hour(s):
3

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
ENG-1010 College Composition I with grade of "B" or higher; or ENG-101H Honors College Composition I; and MATH-0955 Beginning Algebra or appropriate Math Placement score.

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 athttp://www.tri-c.edu/accessprograms (http://www.tri-c.edu/accessprograms/). Blackboard accessibility information is available athttp://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 log in 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 athttp://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 athttp://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, critically evaluate information and data, and effectively communicate the findings.

Objective(s):
1. Distinguish among an observation, hypothesis, experiment, conclusion, and theory.
2. Explain why the theory of evolution is a unifying theme in biology.
3. Critically evaluate sources of information, and distinguish between primary and secondary resources.
4. Distinguish between observations and inferences.
5. Use scientific inquiry to write a hypothesis, design an experiment, analyze data and draw a conclusion.
6. Evaluate scientific data using statistical analysis.
8. Apply proper lab skills and techniques in observation and experimentation

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Course Outcome(s):

Chemical Aspects of Life: Explain chemical properties of atoms, molecules, and bonds as they relate to biological processes.

Objective(s):
1. Compare and contrast ionic, covalent, and hydrogen bonds.
2. Illustrate how the structure of a water molecule results in hydrogen bonding, and how that bonding results in the unique properties of water in living systems.
3. Describe the biological macromolecules important to life and their role in living organisms.
4. Describe the current hypotheses regarding the evolution of precellular biological macromolecules.
5. Explain the reactions involved in the synthesis and degradation of macromolecules.
6. Predict how the structure of a molecule will determine its function
7. Distinguish among elements, atoms, and molecules.

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Course Outcome(s):

Cell: Explain how the components of cells contribute to cell signaling, transport, and metabolism.

Objective(s):
1. Explain how evolutionary processes have resulted in the similarities and differences between prokaryotic and eukaryotic cells.
2. Describe the structure and function of cellular organelles and other cellular structures.
3. Illustrate the role of the endomembrane system by explaining how macromolecules are synthesized and distributed.
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, and recognize when each type would occur.
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

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Course Outcome(s):

Energy: Explain 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 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. Compare the catabolic pathways of carbohydrates, proteins, and fats.
8. Explain how phototrophs convert light energy into chemical energy through the process of photosynthesis.
10. Compare and contrast cellular respiration and photosynthesis.
11. Explain the major events in the evolution of metabolism

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Course Outcome(s):

Continuity of Life: Describe 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. Explain how cancer is caused by a failure of cell cycle control.
4. Describe the roles of proto-oncogenes and tumor suppressor genes.
5. Compare and contrast mitosis and meiosis.
6. Explain the evolution of sexual reproduction and meiosis, and describe how they contribute to genetic diversity.
7. Explain how nondisjunction in meiosis can lead to aneuploid gametes.
8. Describe the stages of early embryological development
Course Outcome(s):
Genetics: Relate molecular genetics and patterns of inheritance to genotype and phenotype.

Objective(s):
1. Describe historical experiments that have lead to our current understanding of genetics.
2. Describe the structure of DNA and the enzymes involved in the process of semiconservative replication.
3. Describe how genes are expressed through the transcription of DNA and translation of RNA into an amino acid sequence.
4. Explain transcriptional and post-transcriptional control of gene expression in prokaryotic and eukaryotic cells.
5. Illustrate how mutations affect genotype and phenotype, and explain the evolutionary significance of these changes.
6. Identify patterns of inheritance determined by Mendelian and non-Mendelian genetics.
7. Explain the effect of abnormal chromosome number on development and phenotype.
8. Explain how biotechnology is being used to advance our understanding of genetics, and how it is applied in medicine, agriculture, and everyday life

Course Outcome(s):
Evolution: Explain and use 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. Predict the impact on a population's gene pool when multiple evolutionary forces interact simultaneously.
4. Compare how different types of selection impact phenotype distribution.
5. Use evidence to support the scientific theory of evolution.
6. Using scientific evidence and theory, address the common misconceptions and criticisms of evolution.
7. Explain how experiments can be used to test evolutionary hypotheses.
8. Explain how new species form through sympatric and allopatric mechanisms.
9. Describe the natural mechanisms that keep species reproductively isolated.
10. Explain the concepts of gradualism and punctuated equilibrium as they relate to the rate of evolution.

Methods of Evaluation:
1. Required research paper and/or project
2. Quizzes
3. Exams
4. Laboratory practicals
5. Written reports
6. Presentations (individual or group)
7. Poster Presentations
8. Article discussions/reviews/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. Evolution of structures for cell motility
w. Cell transport, including active, passive, and bulk
x. Cell-cell interactions
y. Potential and kinetic energy
z. Laws of thermodynamics
aa. Enzyme structure and function
bb. Oxidation-reduction reactions
cc. ATP as an energy carrier
dd. Metabolic pathways
ee. Feedback inhibition and activation
ff. Catabolism of carbohydrates, proteins, and fats
gg. Aerobic cellular respiration (glycolysis, pyruvate oxidation, Krebs cycle, electron transport, and chemiosmosis)
hh. Anaerobic cellular respiration by methanogens and sulfur bacteria
ii. fermentation
jj. Electromagnetic spectrum
kk. Photosynthesis, including C$_3$(light dependent and independent reactions), C$_4$, and CAM pathways
ll. Cyclic and non-cyclic phosphorylation
mm. Photosynthesis
nn. Types of cellular receptors
oo. Signal transduction pathway, including ligands, receptors, signal amplification, and response
pp. Prokaryotic cell division
qq. Eukaryotic cell cycle and mechanisms of control
rr. Mitosis
ss. Loss of cell cycle control and cancer
tt. Proto-oncogenes and tumor suppressor genes
uu. Eukaryotic chromosomes, including chromatids and homologues
vv. Meiosis and crossing-over
ww. Gametogenesis in animals
xx. Embryological development in animals
yy. Independent assortment and segregation of chromosomes
zz. Nondisjunction of chromosomes
aaa. Aneuploid gametes
bbb. Alleles
ccc. Patterns of inheritance
ddd. Phenotype versus genotype
eee. Monohybrid and dihybrid crosses
fff. Mutation
ggg. Double helix structure of DNA and complementary base pairing
hhh. Semiconservative replication of DNA
iii. Applications of biotechnology
jjj. Gene expression, including transcription and translation
kkk. Transcriptional and post-transcriptional control of gene expression in prokaryotes and eukaryotes
lll. The genetic code
mmm. Theory of evolution
nnn. Agents of evolution, including natural selection, mutation, genetic drift, gene flow, and nonrandom mating
ooo. Types of selection, including frequency-dependent, stabilizing, disruptive, directional, sexual, and artificial
ppp. Population genetics
qqq. Adaptations
rrr. Evidence for evolution
Common misconceptions of evolution

Speciation

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. Critically evaluate the source of information.
   e. Distinguish between primary and secondary resources.
   f. Document experimental results in a written format.
   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, percent error, r-squared values, t-test, and chi-squared test.
   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 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. Determine the sequence of a gene based on the amino acid sequence of a protein.
   y. Predict the results of a mutation in a gene.
   z. Perform gel electrophoresis and interpret the results.
   aa. Interpret a DNA fingerprint.
   bb. 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


BIO-150H: Honors Principles of Biology I


**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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