GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: BIO 1 DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Fall 2019 CURRICULUM APPROVAL DATE: 1/8/2019

SHORT TITLE: CELL AND MOLECULAR BIOLOGY

LONG TITLE: Cell and Molecular Biology

Units	Number of Weeks		Contact Hours/Week		Total Contact Hours
5	18	Lecture:	3	Lecture:	54
		Lab:	6	Lab:	108
		Other:	0	Other:	0
		Total:	9	Total:	162

COURSE DESCRIPTION:

A general biology course with an emphasis on the structure and function of cells, biological molecules, homeostasis, cell respiration, photosynthesis, cell life cycle and its controls, cellular communication, Mendelian and non- classical genetics, evolution and diversity of life. The philosophy of science, methods of scientific inquiry and experimental design are foundational to the course. The course is required for students majoring in biology and/or its subcategories (e.g., plant or animal sciences). (C-ID: BIO 190) PREREQUISITE: Biology 10 or Biology 12 or Environmental Science 1 with a grade of 'C' or better, or one year of high school AP or Honors Biology with a grade of 'B' or better completed within the last five years, and Chemistry 1A and Mathematics 240 with a grade of 'C' or better. ADVISORY: Eligible for English 250 and English 260.

PREREQUISITES:

(Completion of BIO 10, as UG, with a grade of C or better.
OR
Completion of BIO 12, as UG, with a grade of C or better.
OR
Completion of ES 1, as UG, with a grade of C or better.)
AND Completion of CHEM 1A, as UG, with a grade of C or better.
AND (Completion of MATH 233, as UG, with a grade of C or better.
OR
Completion of MATH 233B, as UG, with a grade of C or better.
OR
Completion of MATH 235, as UG, with a grade of C or better.
OR
Completion of MATH 240, as UG, with a grade of C or better.
OR
Completion of MATH 242, as UG, with a grade of C or better.

OR
Completion of MATH 3, as UG, with a grade of C or better.
OR
Completion of MATH 5, as UG, with a grade of C or better.
OR
Completion of MATH 6, as UG, with a grade of C or better.
OR
Completion of MATH 7, as UG, with a grade of C or better.
OR
Completion of MATH 12, as UG, with a grade of C or better.
OR
Completion of MATH 14, as UG, with a grade of C or better.
OR
Completion of MATH 8A, as UG, with a grade of C or better.
OR
Completion of MATH 8B, as UG, with a grade of C or better.
OR
Completion of MATH 1A, as UG, with a grade of C or better.
OR
Completion of MATH 1B, as UG, with a grade of C or better.
OR
Completion of MATH 1C, as UG, with a grade of C or better.
OR
Score of 33 on Intermediate Algebra
OR
Score of 13 on Pre-Calculus
OR
Score of 2600 on MM CCCApply Math
OR
Score of 2600 on MM Placement Tool Math
OR
Score of 2600 on Accuplacer Math)

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES
L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:
02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
04B - Laboratory - LEH 0.75

STUDENT LEARNING OUTCOMES:

1. Identify and describe biological molecules and explain their cellular function.

Measure of assessment: assignments, written exam, lab report

2. Compare and contrast cellular structures, interactions between prokaryotic and eukaryotic cells, and cellular processes including metabolism, photosynthesis, reproduction, and communication.

Measure of assessment: lecture quizzes, discussion written exam, lab report

Year assessed, or planned year of assessment: 2017

Semester: Spring

3. Apply the principles of classical and molecular genetics to solve genetic problems and relate the use of biotechnology to techniques used in the modern laboratory.

Measure of assessment: Assignments, Demonstration, Lab report, written exam

4. Describe how the structures of organisms are related to their function, and how those features develop through the process of evolution.

Measure of assessment: lecture quizzes, discussion, written exam, lab report

5. Explain how DNA replicates and how genes are expressed within organisms.

Measure of assessment: assignments, written exam, quizzes, lab practicum

6. Apply the process of scientific inquiry and experimental design to the study of biological concepts. Present biological data in written form and appropriate scientific style.

Measure of assessment: demonstration, discussions, lab write up, research paper(s)

7. Acquire, read, evaluate, and cite scientific literature.

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 1/8/2019

LECTURE 54 Hours, LAB 108 Hours

WEEK 1: 3 lec

CONTENT: Life's levels of organization, the process of science, evolution, unity and diversity, biology in everyday life

STUDENT PERFORMANCE- the student will be able to:

- Define a hypothesis and compare inductive and deductive reasoning.
- List the levels of organization from atom to ecosystem and note how the levels relate to each other.
- Describe and distinguish between the three domains of life. List examples of each domain.
- Describe seven properties that are common to all life.
- Describe the process of natural selection.

HOMEWORK:

- read Ch. 1 and study lecture notes

WEEK 2: 3 lec

CONTENT: The chemical basis of life: atoms, molecules, properties of water, rearrangements of atoms, organic compounds and their polymers

STUDENT PERFORMANCE- the student will be able to:

- Define the atomic number and mass number of an atom.
- Distinguish among nonpolar covalent, polar covalent, and ionic bonds, noting their relative strengths and functions.
- Describe the structure of the atom.

- Identify which elements are most common in living matter.
- Define a compound.
- Describe the relationship between acids, bases, and buffers.
- Define solute, solvent, and solution.

HOMEWORK

- Read Ch 2, study lecture notes

WEEK 3: 3 lec

CONTENT: Molecules of cells - organic compounds and their polymers

STUDENT PERFORMANCE - the student will be able to:

- Describe the ways that carbon skeletons can vary.
- Describe the structure and function of the different functional groups.
- Describe the difference between saturated and unsaturated fatty acids.
- Describe the similarities and differences among the common amino acids.
- Describe some of the functions of proteins.
- Describe the difference between primary, secondary, and tertiary structure of a protein.
- Define organic compounds, hydrocarbons, a carbon skeleton, and an isomer.
- List the four classes of macromolecules, explain the relationship between monomers and polymers.
- Explain why there are upper limits to cell size.
- Distinguish between prokaryotic and eukaryotic cells.

HOMEWORK:

- read Ch 3 and study lecture notes

WEEK 4: 3 lec

CONTENT: Reasons for cell size, organelles of the cell

STUDENT PERFORMANCE - the student will be able to:

- Explain why compartmentalization is important in eukaryotic cells.
- Compare the structures of plant and animal cells. Note the function of each cell part.
- Describe the structures and functions of the nucleus, endomembrane system, rough and smooth endoplasmic reticulum, Golgi apparatus, and lysosomes.
- Explain how impaired lysosomal function can cause the symptoms of storage diseases.
- Compare the structures and functions of mitochondria and chloroplasts.
- Compare the structures and functions of microfilaments, intermediate filaments, and microtubules.
- Explain how the structure of cilia and flagella relate to their functions.
- Compare the structures and functions of cell surfaces and intercellular junctions of plant and animal cells.
- Describe the four functional categories of eukaryotic organelles, noting which organelles are in each group.
- Describe the properties we would expect to find in extraterrestrial life.
- Compare the designs and images produced by a light microscope, scanning electron microscope, and transmission electron microscope. In addition, distinguish between magnification and resolving power.
- Define cell theory and briefly describe the discoveries that led to its development.
- Explain why cell size and shape varies.
- Explain the relationships between nanometers, micrometers, millimeters, centimeters, and meters.

HOMEWORK

- read Ch 4 and study lecture notes

WEEK 5: 3 lec

CONTENT: Energy and the cell

STUDENT PERFORMANCE - the student will be able to:

- Define and compare kinetic energy, potential energy, chemical energy, and heat.
- Define and compare endergonic and exergonic reactions. Explain how cells use these reactions to survive.
- Explain how ATP functions as an energy shuttle.

- Explain how enzymes speed up chemical reactions.
- Describe the structure of an enzyme-substrate interaction.
- Explain how the cellular environment affects enzyme activity.
- Explain how competitive and noncompetitive inhibitors alter an enzyme's activity.
- Explain how certain pesticides and antibiotics work by inhibiting enzymes.
- Explain how membranes help organize the chemical activities of a cell.
- Relate the structure of phospholipid molecules to the structure and properties of cell membranes.
- Describe the fluid mosaic structure of cell membranes.
- Describe the diverse functions of membrane proteins.
- Describe the process of passive transport. Explain why osmosis is the passive transport of water.
- Distinguish between hypertonic, hypotonic, and isotonic solutions.
- Explain how plant and animal cells change when placed into a hypertonic or hypotonic solution.
- Compare the processes of facilitated diffusion and active transport.

HOMEWORK

- Read Ch 5, study lecture notes

WEEK 6: 3 lec

CONTENT: Photosynthesis and cell respiration

STUDENT PERFORMANCE - the student will be able to:

- Summarize the overall equation for cell respiration and photosynthesis.
- Identify the different stages of each process and describe where they happen in the cell.

HOMEWORK

- read Ch 6+7, study lecture notes

WEEK 7: 3 lec

CONTENT: Mitosis and the cell cycle

STUDENT PERFORMANCE - the student will be able to:

- Describe the phases of mitosis. List the events that occur at each phase.
- Describe the cell cycle.
- Differentiate between mitosis and meiosis.
- Describe how gametes are made in humans.

HOMEWORK

- read Ch 8, study lecture notes

WEEK 8: 3 lec

CONTENT: Meiosis, errors in meiosis, such as nondisjunction

STUDENT PERFORMANCE - the student will be able to:

- Define nondisjunction and explain how it can occur.
- Describe the consequences of abnormal numbers of sex chromosomes.

HOMEWORK

- read Ch 8, study lecture notes

WEEK 9: 4 lec

CONTENT: Mendelian and non-Mendelian genetics

STUDENT PERFORMANCE - the student will be able to:

- Define and distinguish between true-breeding organisms, hybrids, the P generation, the F1 generation, and the F2 generation.
- Define and distinguish between the following pairs of terms: genotype vs. phenotype, dominant allele vs. recessive allele, and heterozygous vs. homozygous. Also define a monohybrid cross and a Punnett square.
- Describe the relationship between alleles for the same gene on separate homologous chromosomes.
- Explain how recessive and dominant disorders are inherited. Provide examples of each.
- Describe the inheritance patterns of incomplete dominance, multiple alleles, and pleiotropy.

HOMEWORK

- read Ch 9, study lecture notes

WEEK 10: 3 lec

CONTENT: Chromosome theory of inheritance, gene linkage, sex determination in humans, sex-linked inheritance

STUDENT PERFORMANCE - the student will be able to:

- Explain how a single characteristic can be influenced by many genes.
- Define the chromosome theory of inheritance. Explain the chromosomal basis of the principles of segregation and independent assortment.
- Explain how linked genes are inherited differently from other, nonlinked genes.
- Explain how sex is genetically determined in humans.
- Describe the patterns of sex-linked inheritance.

HOMEWORK

- read Ch 9, study lecture notes

WEEK 11: 3 lec

CONTENT: The structure of nucleic acids, characteristics of DNA/RNA, DNA replication, and transcription

STUDENT PERFORMANCE - the student will be able to:

- Compare the structure of DNA and RNA.
- Explain how the structure of DNA facilitates its replication (hint: complementary base pairing).
- Describe the process of DNA replication.
- Describe the locations, reactants, and products of transcription and translation.
- Explain how RNA is produced.
- Explain how eukaryotic RNA is processed before leaving the nucleus.

HOMEWORK

- read Ch 10, study lecture notes

WEEK 12: 3 lec

CONTENT: Translation during gene expression

STUDENT PERFORMANCE - the student will be able to:

- Explain how tRNA functions in the process of translation.
- Describe the structure and function of ribosomes.
- Explain how translation begins.
- Diagram the overall process of transcription and translation.
- Describe the major types of mutations and their possible consequences.

HOMEWORK

- Read Ch 10, study lecture notes

WEEK 13: 3 lec

CONTENT: Regulation of gene expression

STUDENT PERFORMANCE - the student will be able to:

- Explain how selective gene expression yields a variety of cell types in multicellular eukaryotes.
- Explain how DNA is packaged into chromosomes.
- Explain the cause of the tortoiseshell pattern (calico) of a cat.
- Explain how eukaryotic gene expression is controlled.

HOMEWORK

- read Ch. 11, study lecture notes

WEEK 14: 3 lec

CONTENT: Differential gene expression via transcriptional, post transcriptional, translational, and post-translational control

STUDENT PERFORMANCE - the student will be able to:

- Describe the process and significance of alternative pre-mRNA splicing.
- Explain how mRNA breakdown, initiation of translation, protein activation, and protein breakdown can each regulate gene expression.
- Describe homeotic genes.
- Describe the roles of cell-to-cell signaling and signal transduction pathways in development.

HOMEWORK

- read Ch 11, study lecture notes

WEEK 15: 3 lec

CONTENT: Introduction to recombinant DNA technology, model organisms

STUDENT PERFORMANCE - the student will be able to:

- Describe how are some vaccines produced.
- Define recombinant DNA technology.
- Describe how genes are cloned.
- Explain how restriction enzymes are used to "cut up" DNA.
- Describe the different types of vectors.

HOMEWORK

- read Ch 12, study lecture notes

WEEK 16: 3 lec

CONTENT: Techniques used in biotechnology

STUDENT PERFORMANCE- the student will be able to:

- Describe important properties of a host organism.
- Explain how gel electrophoresis is used to sort DNA.
- Explain how the polymerase chain reaction (PCR) works and how this process is useful to biologists.

HOMEWORK

- read Ch 12, study lecture notes

WEEK 17: 3 lec

CONTENT: How populations evolve

STUDENT PERFORMANCE - the student will be able to:

- Briefly describe the history of evolutionary thought.
- Explain how Darwin's voyage on the Beagle influenced his thinking.
- Describe the ideas and events that resulted in Darwin's 1859 book.
- Explain how fossils form, noting examples of each process.
- Explain how the fossil record provides some of the strongest evidence of evolution.
- Explain how biogeography, comparative anatomy, comparative embryology, and molecular biology document evolution.
- Describe Darwin's assumptions in developing the concept of natural selection.
- Explain how artificial selection supports natural selection.
- Describe two examples of natural selection that are known to occur.
- Note three key points about how natural selection works.
- Define a population and a species.
- Explain the significance of the modern synthesis.
- Explain how microevolution occurs.
- Explain how the bottleneck effect, the founder effect, gene flow, and mutation influence microevolution.
- Explain why only some variation is heritable.
- Explain how mutation and sexual recombination produce genetic variation.
- Explain why multiple-drug "cocktails" are more likely to be effective against HIV than single-drug treatments.
- Explain why genetic bottlenecks threaten the survival of certain species.

- Define Darwinian fitness. Explain why "survival of the fittest" can be misleading.
- Describe the three general outcomes of natural selection.
- Explain why antibiotic resistance has evolved.

HOMEWORK

- Read Ch 13, study lecture notes

WEEK 18: 2 lec

METHODS OF INSTRUCTION:

Lecture and laboratory, with use of computer animations, video, powerpoint presentations, and the internet.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours: 108

Assignment Description:

A five page research paper (APA format) on the Drosophila genetics lab. The paper will include an abstract, introduction, materials and methods, results, discussion and conclusion as well as cited references.

METHODS OF EVALUATION:

Objective examinations

Percent of total grade: 60.00 %

Percent range of total grade: 60 % to 80 % Multiple Choice True/False Completion

Writing assignments

Percent of total grade: 15.00 %

Percent range of total grade: 15 % to 20 % Lab Reports Term or Other Papers

Problem-solving assignments

Percent of total grade: 15.00 %

Percent range of total grade: 15 % to 20 % Lab Reports Quizzes

Skill demonstrations

Percent of total grade: 2.00 %

Percent range of total grade: 2 % to 5 % Class Performance/s Field Work Performance Exams Other: Demonstrate the use of the microscope

Other methods of evaluation

Stoichiometry in chemistry, Chi-squared test in experimentation

REPRESENTATIVE TEXTBOOKS:

Lisa A. Urry, Michael L. Cain, Steven A. Wasserman. Campbell's Biology 11th ed.. Pearson,2017.

Updated textbook to 5-year recency for articulation purposes.

ISBN: ISBN: 9780134093413

Reading Level of Text, Grade: Reading level of text, Grade: 17 Verified by: Verified by:D. Young

REQUIRED OTHER TEXTS AND MATERIALS

Kurushima. Cell and Molecular Biology Lab Manual, 2018 edition.

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:
GAV B2, effective 201330
GAV B3, effective 201330
CSU GE:
CSU B2, effective 201330
CSU B3, effective 201330
IGETC:
IGET 5B, effective 201330
IGETC 5C, effective 201330
CSU TRANSFER:
Transferable CSU, effective 201330
UC TRANSFER:
Transferable UC, effective 201330

SUPPLEMENTAL DATA:
Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: BIOL2
CAN Sequence: BIOL SEQ A
CSU Crosswalk Course Department: BIO
CSU Crosswalk Course Number: 1
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000597136
Sports/Physical Education Course: N
Taxonomy of Program: 040100