Antelope Valley College
Fall 2020

Biology 110- General Molecular Cell Biology
ONLINE through Zoom
Mondays and Wednesdays 1030-1235
Course # 76953

Instructor: Dr. Jedidiah Lobos
Office Hours: MW 0925-1025 & 1300-1400, TR 1630-1800 through Zoom
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Sheriff Department Emergency Contact Number

- Dial direct: 661-722-6399
- From campus phone #4444 or #6399

Textbook: Molecular Biology of the Cell by Bruce Alberts, 6th Edition, ISBN: 9780815345244 or Essential Cell Biology, 5th Edition, ISBN: 9780393680386; The Double Helix: A Personal Account of the Discovery of the Structure of DNA 9780743216302

Materials Needed: You will need paper, colored pencils, and a computer with functioning webcam. The computer with webcam is absolutely required on the first day of class. If you do not have one, you may need to contact AVC to obtain a loaner. You need these materials in order to interact through Zoom and for Proctorio.

Course Description: A comprehensive and in-depth introduction for all biology majors (as well as physics, chemistry, engineering, computer science, and math majors who will concern themselves with biology) to the unifying principles of modern cellular biology, molecular biology and biochemistry. Topics include the structure of the atom, quantum mechanics, the nature of the chemical bond, general principles of thermodynamics and equilibrium, prokaryotic and eukaryotic cell structure, lipid chemistry and membrane biology, protein structure and function, photosynthesis and cellular respiration, nucleic acids (DNA and RNA) and their role in protein synthesis, principles of classical and molecular genetics, the control of gene expression, cell signalling systems, molecular embryology, evolutionary developmental biology, and biotechnology. Lab work includes investigations with live bacteria, protists, flowering plants and fruit flies as model organisms, and includes experiments in photosynthesis, enzymology, gel electrophoresis, genetics and biotechnology. This course stresses evolutionary mechanisms.

Course Objectives: At semester's end, the student will be able to demonstrate a general understanding of the true impact that each organism has on one another. Other goals include:

1. Describe the nuclear and electronic structure of any atom given its atomic number and mass.
2. Define in wave and quantum mechanical terms what atomic and molecular electron orbitals are, and what conditions must be met for an orbital to gain or emit light.
3. Explain with a labeled diagram of a Morse potential function the nature of a chemical bond, and list the energies of covalent, ionic, hydrogen and Van der Waals bonds.
4. Construct a complete structural diagram of any organic molecule given its simplified line diagram, and predict what regions of the molecule would be flexible as opposed to rigid, and hydrophobic as opposed to hydrophilic.
5. Draw from memory the structures of glucose, ATP, a membrane phospholipid, an amino acid, a polypeptide chain, and an A-T and G-C base pair of a DNA double helix.
6. State from memory, define the variables of, describe the intuitive meaning of, and solve simple problems with four key equations from thermodynamics.
7. Illustrate with a labeled diagram the primary, secondary, tertiary and quaternary structure of a protein.
8. Construct a diagram showing the internal structure of a bacteria, a plant cell, and an animal cell.
9. Construct a diagram showing in broad outline the presumed evolutionary lines of descent which have allowed living cells to give rise to all the kingdoms of life on earth.
10. Sketch a diagram showing how a plant cell uses the energy of sunlight to generate ATP through the reactions of photosynthesis, glycolysis, and cellular respiration.

11. Describe with a labeled diagram the central dogma of biology, including the roles of DNA, RNA polymerase, messenger RNA, the ribosome, and transfer RNA.
12. Describe with labeled diagrams the process of DNA replication in both prokaryotes and eukaryotes, including the key enzymes, and discuss the ramifications of the error rates of DNA polymerase and the DNA repair system for disease, aging, and evolution.
13. Transcribe on paper a sequence of base-pairs in DNA into mRNA, use the genetic code to translate the mRNA into a protein, and predict the effect of various mutations to the DNA on the functionality of the resulting protein.
14. Describe with a labeled diagram the biochemistry of the lactose operon, and predict how various mutations to genes in the operon would affect a bacteria's ability to grow on lactose as a sole carbon source.
15. Design a diagram showing how looped DNA domains containing genes are organized in a eukaryotic chromosome, and describe the mechanisms which control gene expression in eukaryotes.
16. Describe the major themes of classical animal embryology, including cleavage, blastulation, gastrulation, cell junctions, extracellular matrix material, cell-signaling systems, and the role of morphogens and selector genes in development.
17. Appraise the ability of the new field of evolutionary-developmental biology ("Evo-Devo") to explain macroevolutionary events.
18. Demonstrate an ability to formulate meaningful research questions in molecular-cell biology, design controlled scientific experiments to investigate those questions, perform those experiments, and write up the results in publishable format.
19. Conduct laboratory investigations which include: identification under the optical microscope of bacteria, protists, and plant and animal tissues; culture and classic genetics of fruit flies; measurement of a diffusion coefficient of a molecule in agar; performance of color titrations on dilutions of acids and bases; culture of bacteria and performance of a DNA transformation experiment; simple enzyme assays; culture of a photosynthetic protist; performance of a restriction enzyme digest of DNA and agarose gel electrophoresis of the fragments; isolation and ethanol precipitation of DNA from a tissue; isolation of photosynthetic pigments using paper chromatography and analysis of their absorption spectra with a visible spectrophotometer; and isolation of a protein using column chromatography.

Student Learning Outcomes:

1. Describe the components of living cells, and demonstrate how they interact to allow the state of being alive.
2. Describe the methods used to culture bacteria, protists, fruit flies, and flowering plants in the laboratory. Employ major experimental laboratory techniques, sometimes in a team context, including centrifugation and gel electrophoresis.
3. Demonstrate an ability to formulate meaningful research questions in molecular-cell biology, design controlled scientific experiments to investigate those questions, and write up the results in publishable form. Demonstrate an understanding of the scientific method.

Concurrent Enrollment & Course Prerequisites: Completion of MATH 102 and Completion of CHEM 110. Advisory: Completion of a general biology course is recommended. Eligibility for College Level Reading and ENGL 101/ENGL 101SL

Student's E-mail Address: Each student **must** provide their e-mail address by the **second** class meeting. To do this, students must send an e-mail to jlobos@avc.edu or LobosBiology@gmail.com from each e-mail address that they check regularly (e.g. yahoo, hotmail, gmail, AVC). On the subject line enter "**Bio 110**". The body of the message should list the student's name. Students are advised to check their e-mail frequently. Advise the instructor of any changes or corrections to your e-mail address.

Disruptive or Disrespectful Behavior: Disruptive or disrespectful behavior will not be tolerated in the class. Examples of such behavior may include talking while others in the class (including the instructor) are talking and disregard of any of the policies that are outlined in this syllabus. If you need to step away or speak to someone while in class, please ensure that your microphone/camera is off and then step away.

Cell Phone Policy: Use of cell phones is disruptive to the class (including an online class). Please turn your cell phone completely off or silence it during class. Advise people who might call you that they should not do so during the

scheduled class time. Cell phones may not be answered during a class session, unless it is during an instructor authorized break. It is also not permitted to send text messages while class is in session.

Tardiness and Attendance: Regular and prompt attendance to class is essential both for learning and active participation in the class. Each student needs to be present to hear about any schedule changes, general information about the class, and the lecture itself. In addition, quizzes will be scheduled at the beginning of a class session and you must take the quiz during the scheduled time. Attendance may be taken at any time during class and in any manner as deemed appropriate by the instructor. **If a student's absences in a specific class exceed the number of hours the class meets per week, the student may be prohibited from further attendance in the class.** The first two days of class are important, therefore missing any one of these days means the student might be dropped from the class.

Evaluation: Your grade will be computed based on the following criteria:

Participation= 100 pts
In-class writing assignments= 50 pts
Quizzes= 100 pts
Midterm= 120 pts x 2= 240 pts
Final= 160 pts
Total lecture points= 650 pts

Your final grade will be determined as follows:
90-100% =A
80-89% =B
70-79% =C
60-69% =D
<59% =F

Preparation and Participation: Every student is expected to be actively involved in the lecture sessions and to come to each session prepared (having thoroughly read and studied the corresponding chapters or handouts assigned). Each student should also participate by contributing ideas or information, and asking questions. The instructor will ask questions periodically to evaluate the participation of individuals in class. **The answers to these questions will not be graded based on if they are correct or not.** Rather, the answers will be counted for participation points for that day. Answers will either be verbally communicated or primarily done through the Zoom chat box. **Participation is KEY especially in an online learning environment.**

Quizzes and Exams: The quizzes and exams may consist of multiple choice, short answer, or essay questions and the format may vary from quiz to quiz. The format of exams and quizzes will be explained in class. **Except for excused medical or certified family emergencies or recognized religious holidays, no makeup quizzes or exams will be given.** Quizzes and exams will be given on the day scheduled. At the discretion of the instructor, additional short quizzes may be given on any class day. The instructor reserves the right to adjust testing conditions, randomize and assign seating for a quiz or exam, rearrange students during a quiz or exam, or to immediately terminate the quiz or exam of any student who, in the opinion of the instructor, is caught cheating. **Proctorio will be used to monitor your testing sessions.**

Extra Credit: At the instructor's discretion, extra credit opportunities **may** be offered to all students in the class, however students should not assume that "extra credit" opportunities will automatically be given, and there will be no "individualized" extra credit assignments.

Withdrawal Information: It is the student's responsibility to withdraw from a class. If you fail to withdraw by the appropriate date, you will receive the letter grade you would have earned at the end of the semester. For this term, the last day to drop with a "W" is **11/6/2020**.

Incompletes
A grade of "I" (Incomplete) will not be given simply due to poor performance in the course. An "I" is to be used only when a portion of the required coursework has not been completed and evaluated in the prescribed time period due to unforeseen but fully justified reasons. A substantial portion of the course requirement must have been completed with a passing grade and there is still the possibility of earning credit. The work that is incomplete normally should be of such a nature that it can be completed independently by the student for later evaluation by the instructor. An incomplete will not be assigned when a student would be required to attend a major portion of the course when it is next offered. Students who believe they meet the necessary conditions to be assigned an incomplete arrange to meet in person with the instructor. The process should be completed in person prior to submission of final grades by the

instructor. Students are encouraged to read and understand the statement on incompletes in the current Antelope Valley College Catalog.

Reasonable Accommodations: If you have a legally protected disability under the Americans with Disabilities Act (ADA) or California discrimination law, and you believe you need reasonable accommodation to participate fully in this class, please make an appointment to see me during office hours to discuss your need(s).

Academic Honesty: Cheating of any kind will not be tolerated. If a student is caught cheating, the instructor reserves the right to assign the assignment, quiz, or exam a grade of "F" to the student caught cheating. **From the 2016-2017 AVC Catalog: (a)** Violation of the Academic Honesty Policy: Dishonesty, including but not limited to, cheating or plagiarism. Plagiarism – from the Latin word for "kidnap" – involves using another's work without giving proper credit, whether done accidentally or on purpose. This includes not only works and ideas, but also graphs, artwork, music, maps, statistics, diagrams, scientific data, software, films, videos and the like. Plagiarism is plagiarism whether the material is from published or unpublished sources. It does not matter whether ideas are stolen, bought, downloaded from the internet, or written for the student by someone else – it is still plagiarism. Even if only bits and pieces of other sources are used, or outside sources reworded, they must still be cited. To avoid problems, students should cite any source(s) and check with the instructor before submitting an assignment or project. Students are always responsible for any plagiarism in their work. An instructor who determines that a student has cheated or plagiarized has the right to give an "F" grade for the assignment or examination. Antelope Valley College reserves the right to utilize electronic means to investigate possible academic violations. Enrollment in any class implies student agreement and consent that all assignments are subject to submission for textual similarity review to an electronic database. **(b)** Violation of class assignments, examination rules, e.g., communicating or transferring information to another student, using any materials such as books, notes, etc., other than those expressly allowed for the exam, looking at another student's exam, etc. **(c)** Unauthorized preparation, giving, selling, transfer, distribution, or publication, for any commercial purpose, of any contemporaneous recording of an academic presentation in a classroom or equivalent site of instruction, including, but not limited to, handwritten or typewritten class notes, except as permitted by any college policy or administrative procedure.

AB 705: Based on statewide research and the newly enacted AB 705 legislation, Antelope Valley College students are eligible to begin English and mathematics courses at the transfer-level. This is a new process for AVC students that uses high school coursework, grades and grade point average to place students into English and mathematics courses. We want to remind you of the various resources available for academic assistance including workshops and tutoring in the Learning Center and arithmetic to calculus support in the Math Computer Lab in ME 100. To see a complete list of English, reading and mathematics workshops, visit https://www.avc.edu/studentservices/lc/. We encourage you to visit the Math Computer Lab and use these resources for support with your courses. Do not hesitate to ask for help, and we hope you have a great semester!

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Week	**Date**	**Topic**	**Lecture #**
1	8/17	**Introduction**	1
	8/19	**Chemical foundations for cells**	2
2	8/24	**Chemical foundations for cells, Proteins, Cell structure and function**	2,3,4
	8/26	**Cell structure and function (cont), Key cellular processes**	4,5,6
3	8/31	**Key Processes (cont), Cell Division and Mitosis**	5,6,7
	9/2	**Mitosis (cont), Meiosis**	7,8
4	9/7	**Labor Day**	
	9/9	**Meiosis, Chemical reactions & enzymes**	8,9
5	9/14	**Chemical reactions & enzymes, Photosynthesis**	9,10
	9/16	**Midterm #1**	
6	9/21	**Cellular respiration**	11
	9/23	**Cellular respiration (con't)**	11
7	9/28	**Introduction to Genetics**	12
	9/30	**Introduction to Genetics (cont), DNA**	12,13
8	10/5	**The Central Dogma of Biology**	13
	10/7	**The Central Dogma of Biology (cont)**	13
9	10/12	**Genetics of viruses & prokaryotes**	14
	10/14	**Genetics of viruses & prokaryotes (cont)**	14
10	10/19	**Eukaryotic genomes & regulation**	15
	10/21	**Midterm #2**	
11	10/26	**Cell signaling**	16
	10/28	**Cell signaling (cont)**	16
12	11/2	**Recombinant DNA Technology**	17
	11/4	**Recombinant DNA Technology (cont)**	17
13	11/9	**Molecular Biology and Medicine**	18
	11/11	**Veteran's Day**	
14	11/16	**Molecular Biology and Medicine (cont)**	18
	11/18	**The Immune System**	19
15	11/23	**The Immune System (cont)**	19
	11/25	**The Immune System (cont)**	19
16	11/30	**The Immune System (cont)**	19
	12/2	**Final Examination**	
		Topics and dates are subject to change with notice	

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Important dates to make note of!

Date	
8/26	**Quiz #2**
9/7	**Labor Day**
9/14	**Quiz #1 Due**
9/16	**Midterm #1**
9/28	**Quiz #3**
10/7	**Quiz #4**
10/21	**Midterm #2**
11/6	**Last day to drop with a "W"**
11/11	**Quiz #5; Veteran's Day**
11/25	**Quiz #6 due**
12/2	**Final Examination**

Topics and dates are subject to change with notice