Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring 2025
Year: 2025
Course Prefix: BIOL
Course and Section #: 1610-006
Course Title: College Biology I BB
Credits: 4

Course Description

Gives a broad exposure to many aspects of the life sciences. Covers topics of biochemistry, energetics, cell structure and function, genetics, and evolution.

Course Attributes

This course has the following attributes:
☐ General Education Requirements
☐ Global/Intercultural Graduation Requirements
☐ Writing Enriched Graduation Requirements
☒ Discipline Core Requirements in Program
☐ Elective Core Requirements in Program
☐ Open Elective
Other: *Click here to enter text.*

Instructor Information

Instructor Name: Amanda Lavelle

Student Learning Outcomes

1	Appropriately use key terms and concepts currently used in the study of biology.
2	Describe cell structure and function, energetics, and genetics.
3	Discuss natural selection and the scientific evidence of evolution.
4	Discuss the relevance of biology to society.
5	Apply the process of science by generating hypotheses, critically evaluating data, and solving problems.

Course Materials and Texts

1. **Codon Learning.** Codon Learning is an alternative to the traditional textbook designed to help you be prepared for class, focus on course learning objectives, and learn how to learn.
2. **Canvas** will be utilized to complete assignments and as a supplement to post handouts, quizzes, and PowerPoint presentations. Grades will be posted on Canvas.

Course Requirements

Course Assignments, Assessments, and Grading Policy

Grade item	Percentage	Grade scale
Readiness readings (Codon Learning)	5	A 94.0-100+%; A- 90.0-93.9%
Weekly homework (Codon Learning)	5	B+ 87.0-89.9%; B: 83.0-86.9%; B- 80.0-82.9%
Unit study path (Codon Learning)	5	C+ 77.0-79.9%; C 73.0-76.9%; C- 70.0-72.9%
In-class assignments	10	D+ 67.0-69.0%; D 63.0-66.9%; D- 60.0-62.9%
In-class midterms and final	75	E 0-59.9%
Extra credit	1.5	
Total	**101.5**	

Exams and assignments

1. **Readiness Reading (Codon Learning)**: Readiness Readings are completion based and designed to provide you with information on a given topic, along with check-in questions that you can complete as you read. Each readiness reading is due at 11:59 pm the day before we will cover the associated content in class. The lowest 3 scores will be dropped at the end of the semester. Please see Codon Learning for due dates. Late work will not be accepted.

2. **Weekly Homework (Codon Learning):** Homework assignments are graded assignments designed to help you stay on top of the material and check your comprehension of the weekly content. A 10% penalty will apply for incorrect answers. After two incorrect attempts, the question will lock, however points can be recaptured in the Study Path. Homework is due by 11:59PM of the date listed on Codon Learning. Late homework will be accepted up to 48 hours late with a 10% late penalty.

3. **Unit Study Path (Codon Learning):** The study path prep questions and practice test are designed to check your comprehension of the unit content and help you prepare for the exams. Study path questions are due by 11:59PM of the date listed on Codon Learning (usually the day before an exam). Grading varies by question type and late work will be accepted up to 48 hours late with a 10% late penalty.

4. **Group assignments (in class):** Biology is a social, hand-on discipline and working in groups provides the opportunity to engage problem solving, critical thinking, communication, and collaboration. Depending on the assignment, you will be graded on a group submission or on an individual basis via an in-class, closed note quiz at the end of each. In-class group activities will take place in class most days the

semester and cannot be made up outside of class time. The lowest 2 scores will be dropped at the end of the semester.

5. **Lecture exams (in class):** There will be 4 non-cumulative midterms and a cumulative final exam that will occur on the days specified in the syllabus; you are responsible for being in class on these days. Exams will be 50 minutes in length. Questions will consist of multiple choice, fill in the blank, matching, short answer, and labeling/drawing diagrams. Midterms will be given in 2 stages. The first stage (50 minutes; 100 points) will be taken individually. The second stage (20 minutes; extra credit) you will work in groups and complete the exam with classmates in groups of 3-4. **Late exams will not be given for any reason.**

   A higher final exam grade will replace a lower midterm score. If you are an athlete, have an official university commitment, or a documented, excused absence through student services AND have discussed with me PRIOR to missing an exam, we may be able to arrange for you to take it early. Due to the nature of the assignment, the second stage of an exam cannot be made up under any circumstance. Documentation must be provided for early exams and will be handled on a case-by-case basis.

6. **Extra credit:** You can earn up to 1.5% extra credit by completing one or more of the following extra credit opportunities. Each option is worth 0.5%.
   a. Attend office hours. Must be completed before midterm 3.
   b. Utilize BIOL 1610 support resources. Attend a minimum of 4 tutoring sessions across at least two units of the semester. Upload documentation to the Canvas drop box by the start of the final exam.
   c. Course evaluation. Complete the course evaluation at the end of the semester. If > 80% of the class completes the course evaluation, everyone will earn this extra credit.
   d. Other opportunities may be available to the class and will be announced in class and posted on Canvas. Individual opportunities that are not available to everyone will never be given.

Required or Recommended Reading Assignments

Readiness Reading assignments are located in Codon Learning following the schedule below. These assignments are completion based and designed to provide information on a given topic, along with check-in questions that you can complete as you read. Optional reading in OpenStax Biology 2e.

Week	Week of	Topic
Unit 1: The (bio)chemisty of life		
1	1/6	Introduction; Scientific method; Chemistry of life, Water **1610 assessment- bring a computer or tablet to class Thursday 1/9**
2	1/13	Macromolecules; Carbohydrates; Nucleic acids; Proteins; Lipids
3	1/20	Cell structure and function (membranes; prokaryotes; eukaryotes) **Martin Luther King Jr Day Monday 1/20**
4	1/27	Membrane transport **Midterm 1: The (Bio)chemistry of Life Thursday 1/30** **(Chemistry of life, Water, Macromolecules, Cell structure and function)**
Unit 2: Cellular Energy		
5	2/3	Enzymes; Metabolism; Cellular respiration
6	2/10	Cellular respiration; Fermentation; Photosynthesis
7	2/17	Photosynthesis **Presidents Day Monday 2/17**
8	2/24	**Midterm 2: Cellular Energy Tuesday 2/25** **(Membrane transport, Metabolism, Energy transformations)**

		Cell cycle/ Mitosis
Unit 3: Cell Division		
9	3/3	Cancer; Meiosis
10	3/10	**Spring Break**
11	3/17	Nucleotides and DNA structure; DNA replication
12	3/24	Mendelian genetics **Midterm 3: Cell Division Thursday 3/27** **(DNA structure, DNA replication, Mitosis, Meiosis)**
Unit 4: Genes and Gene Expression		
13	3/31	Inheritance; Gene expression (transcription)
14	4/7	Gene expression (translation and mutations)
15	4/14	Gene expression **Midterm 4: Genes and Gene Expression Thursday 4/15** **(Mendelian genetics, transcription, translation, mutations)**
16	4/21	Review for the final exam Tuesday 4/22 is the last day of classes **Cumulative final exam:** Thursday 4/24 at 11 am (BIOL 1610-006, TR 11:30 am)

General Description of the Subject Matter of Each Lecture or Discussion

Biochemistry

- Identify methyl, hydroxyl, carbonyl, carboxyl, amino, sulfhydryl, and phosphate functional groups.

- Distinguish between dehydration and hydrolysis reactions.

Water Biochemistry

- Draw the structure of several water molecules that are interacting with other molecules such as NaCl and indicate 1) the electron distributions in each covalent bond, 2) the partial charges on each atom, 3) each hydrogen bond, and (4) describe and identify ionic bonds.

- Compare hydrogen bonds and covalent bonds in terms of the mechanisms and strength of attraction between the atoms involved.

- Determine if a molecule is hydrophilic, hydrophobic, or amphipathic based on ionic, polar, and non-polar properties.

- Label covalent bonds as polar or nonpolar based on the difference in electronegativity between atoms.

- Discuss why water is biologically important as an excellent solvent and in terms of high heat capacity, cohesion, and adhesion.

Proteins

- Label the four components of an amino acid and explain the role of each in terms of how the molecule functions in a protein.
- Describe each of the four levels of protein structure and explain how each influences the protein's final size, shape, and chemical properties.
- Describe at least three functions that proteins serve in cells.
- Predict whether the R-group on an amino acid that you haven't seen before will interact with water.
- Label elements of primary, secondary, tertiary, and quaternary structure on a model of a protein that you haven't seen before.
- Fill in the following information for proteins in this table:

Monomer is called	Structure of the monomer	Diagram when two monomers link together	The polymer that is formed is called	The function of the polymer in cells

Nucleic Acids

- Describe at least three functions that nucleic acids serve in cells
- Define complementary base pairing and explain its connection to the observation that DNA strands are antiparallel.
- Use the pairing rules to 1) explain the observation that in DNA, %A = %T and %G = %C, 2) predict the sequence of a complementary strand of DNA when given one strand, and 3) calculate the percentage of each base in a DNA molecule when given the percentage of one base.
- Discuss the similarities and differences between DNA and RNA based on their structures, chemical composition, location, and functions in the cell.
- Label the components and directionality on a model of nucleic acid that you haven’t seen before

- Fill in the following information for nucleic acids in this table:

Monomer is called	Structure of the monomer	Diagram when two monomers link together	The polymer that is formed is called	The function of the polymer in cells

Carbohydrates

- Describe at least three functions that carbohydrates serve in cells.

- Rank the potential energy in the following bonds from highest to lowest C-C, C-H, C-O and C═O.

- Discuss how the structure of carbohydrates relate to the use of carbohydrates as energy storage molecules for the cell.

- Fill in the following information for carbohydrates in this table:

Monomer is called	Structure of the monomer	Diagram when two monomers link together	The polymer that is formed is called	The function of the polymer in cells

Lipids

- Use drawings, models, or other representations to compare the structures of fats, phospholipids, and steroids

- Label the hydrophilic head and hydrophobic tails on a drawing of a phospholipid, then make drawings that include water molecules to explain how phospholipids spontaneously form bilayers in water

- Draw the differences between a saturated and unsaturated fatty acid at the carbon bond level.

- Given a structural model of a lipid you've never seen before, 1) identify it as a fat, phospholipid, or steroid, 2) determine if it is saturated or unsaturated, and 3) predict its function in the cell.

- Given several models of membranes, predict how differences in phospholipid composition and cholesterol content will affect their relative fluidity and permeability, and explain your reasoning.

Comparing The Major Classes of Biological Molecules

- Compare the monomer subunit, bond responsible for polymerization, and important biological function(s) observed in proteins, nucleic acids, and carbohydrates.

- Compare the primary, secondary, and tertiary structures of proteins, RNA, and DNA.

- Analyze how the structure of biological molecules impacts their function, including explaining the connections among the following three statements: 1) amino acids are much more diverse in structure and chemical properties than nucleotides, 2) in terms of diversity in shape and chemical properties, proteins > RNA > DNA, and 3) in terms of diversity in function, proteins > RNA > DNA.

Membrane Structure and Transport

- Draw a cell membrane and label integral and peripheral proteins, carbohydrate components, and lipid components.

- Compare the processes of diffusion, osmosis, and facilitated diffusion, and provide biological examples that illustrate each process.

- Explain why ions and polar molecules do not move across plasma membranes efficiently without a transport protein.

- Define passive and active transport and explain the role of channels, carriers, and pumps in transport.

- Given several ions and molecules, predict the relative rates at which they will cross a plasma membrane in the absence of membrane proteins. Explain your reasoning.

Cell Structure and Organelles

- Compare key elements of prokaryotic versus eukaryotic cell structure.

- Compare key elements of plant versus animal cell structure.

- Make a flowchart showing how proteins are processed and packaged or unpackaged as they move from ribosomes to the interior of the rough ER to Golgi to motor proteins to their destination.

- Compare the structure and function of microtubules, actin filaments (microfilaments), and intermediate filaments.

- Propose hypotheses to explain 1) the adaptive significance of organelles (the advantages and disadvantages of having membrane-bound structures inside cells), and 2) why organelles are more common in eukaryotes than bacteria and archaea.

- Predict what would happen to a cell if a particular organelle or structure was altered in a specified manner.

- Predict the function of a cell when given a drawing of a cell, a micrograph, or a description of a cell's structure and organelle content. Explain your reasoning.

- Predict the structure of a cell and its organelle content when given a cell's function. Explain your reasoning.

- Predict whether photosynthesis and/or cellular respiration will occur in a specific plant or animal cell, based on information about the cell's structure and function.

- Predict what would happen to a particular protein or overall cell function if a specified element or process in the endomembrane system were altered.

DNA Replication

- Describe the function of major components of the replisome: helicase, topoisomerase, DNA polymerase, DNA ligase, and primase.

- Use a drawing that you create to explain the statement: "A newly synthesized DNA molecule is half old and half new."

- Given a diagram of a DNA molecule during replication, label the following: the origin of replication, directions of replication, replication fork, the leading strand, and lagging strands and their polarities, and the replisome.

- Explain how DNA damage and/or mismatches are detected and repaired.

- Explain 1) why lagging strand synthesis is an appropriate name, and 2) why Okazaki fragments occur.

Central Dogma

- Make a flow chart summarizing the flow of information in cells from gene to protein. Label arrows connecting mRNA, DNA, and proteins, and explain which gene expression process each arrow represents.

- Explain how the genetic code relates transcription to translation and why it is considered redundant.

- On diagrams of transcription initiation and transcription elongation, label the template and coding strands, initiation complex, promoter site, RNA polymerase, ribonucleotides, the direction of RNA polymerase movement, and direction of RNA synthesis.

- On diagrams of translation initiation, translation elongation, and translation termination, label the small and large ribosomal subunits, mRNA, tRNA, rRNA, reading frame, start codon, stop codon, release factor, and tRNA binding sites (E, A, and P). Circle and label the locations where codon- anticodon recognition and peptide bond formation occur.

- Add elements to your central dogma model that represent "exceptions" such as 1) production of rRNA, tRNA, and "other RNAs", 2) DNA replication, and 3) the action of an enzyme called reverse transcriptase, which catalyzes the synthesis of DNA from an RNA template.

- Given a specific change in a DNA coding strand or a specific error in transcription or translation, predict the consequences for the gene product.

- Use a copy of the genetic code to predict the sequence of the amino acids produced from a given mRNA or double stranded DNA fragment. Identify the start and stop codon.

<u>Enzymatic Reactions</u>

- Explain 1) why "active site" is an appropriate term, 2) the mechanisms responsible for the observation that enzymes lower activation energies, 3) why most enzymes catalyze one specific reaction, and 4) why enzymes increase reaction rates but do not make endergonic reactions exergonic.

- Explain 1) the general role of ATP in the cell, 2) what it means to say that two chemical reactions are coupled, and 3) why a large change in free energy level occurs when an enzyme or substrate is phosphorylated. (Recall that phosphorylation adds 3 tightly packed negative charges.)

- Distinguish between competitive inhibition and noncompetitive inhibition.

- Explain how enzyme activity can be regulated by cofactors and coenzymes.

- Explain how physical factors affect enzyme structure and reaction rate.

- Explain how feedback inhibition regulates metabolic pathways.

Photosynthesis

- Describe how chlorophyll molecules harvest light energy and transfer energy.

- Explain the relationship between the light-dependent reactions and the Calvin cycle.

- Make a chart summarizing the inputs and outputs of PSI, PSII, and the Calvin cycle using NADPH, Glucose, H_2O, O_2, CO_2, H^+ gradients, and ATP. Using this chart, explain the energy transformations that occur and the role of rubisco.

- Explain to a non-scientist how the CO_2 in "weightless" air is the source of mass in a redwood tree.

- Predict the possible consequences for the production of ATP and NADPH if a component or process in the photosynthesis pathway is altered.

Cellular Respiration

- Make a chart summarizing the inputs and outputs of glycolysis, pyruvate processing, the citric acid cycle, and oxidative phosphorylation, using NADH, $FADH_2$, Glucose, Acetyl CoA, Pyruvate, O_2, CO_2, H^+ gradients, and ATP. Using the chart, explain how energy is transferred or transformed in each stage.

- Explain how cells use fermentation pathways to obtain energy from glucose in the absence of oxygen.

- Predict the possible consequences if a step in the glucose oxidation (cellular respiration) pathway is altered.

- Predict the effects of altering specific parts of the electron transport chain or ATP synthase.

Overall

- Distinguish between catabolic and anabolic reactions

- Given the summary reactions for photosynthesis and respiration, compare 1) the reactants and products of each process, and 2) the energy transformations that occur.

Mutations

- Rank the following mutations in terms of greatest to least impact on the structure and function of genes and gene products: missense (change amino acids), nonsense (change to "stop"), frameshift (change reading frame), and silent (no change in the product). Explain your reasoning.

- Defend the statement "mutation is the ultimate source of genetic variation," and explain why mutation is random with respect to its impact on an individual's fitness.

- Explain why cancer is 1) associated with mutations that regulate the cell cycle, and 2) more common in older than younger people.

Mitosis

- Explain why chromosome replication has to occur before mitosis, in interphase.

- Diagram the sequence of stages in the eukaryotic cell cycle (M, G1, S, and G2) and label the major event or events that occur in each.

- Given a labeled drawing showing the phases of mitosis, explain what is happening to the chromosomes and how it helps ensure that each daughter cell gets a complete and identical set.

- Given a micrograph or drawing of a cell you've never seen before, label the chromosomes, chromatids, sister chromatids, and homologous chromosomes, if present, and determine the haploid number and ploidy.

- Given a micrograph or drawing of a cell you've never seen before that is undergoing mitosis, explain what is currently happening to the chromosomes.

- Predict the consequences of altering a given stage (M, G1, S, and G2) in the cell cycle in terms of the cell's structure or fate.

Meiosis

- Explain the differences between somatic cells and germ cells. Describe the outcomes of cell division between these two categories of cells.

- Explain why chromosome replication has to occur before meiosis, in interphase.

- Differentiate between the genetic information held on two homologous chromosomes, two nonhomologous chromosomes, two sister chromatids, and two non-sister chromatids.

- Explain why the segregation of homologous chromosomes in meiosis I leads to a reduction in ploidy.

- Explain why no two haploid cells that result from meiosis are alike in terms of genotype and why this is important in terms of offspring fitness.

- Given a micrograph or drawing of a cell you've never seen before that is undergoing meiosis, explain what is currently happening to the chromosomes.

- Given a specific error in meiosis, predict the haploid genotypes that result and discuss the consequences for offspring.

Genetic crosses and human pedigree analysis

- Set up Punnett squares for monohybrid crosses and dihybrid crosses. Label which elements in the Punnett square and dihybrid cross represent the genotypes of egg, sperm, and offspring. Explain how you can determine the frequency of each egg and sperm genotype and how you can use this information to calculate the frequencies of offspring genotypes and phenotypes.

- Define polygenic inheritance and explain why it produces traits with a continuous variation.

- Using a drawing that shows the phases of meiosis, label the events that explain Mendel's principles of segregation and independent assortment. Add drawings to show how independent assortment can generate genetic variation in offspring. In each case, explain your reasoning.

- On a pedigree, label 1) genetic males and females, 2) affected and unaffected individuals, and 3) generations.

- Given information on parental and offspring phenotypes, determine whether the dominance system involved is 1) in a complete dominance, codominance, or incomplete dominance system and 2) if it is an autosomal or sex-linked trait.

- Based on the data in a pedigree, predict 1) whether the trait in question is autosomal or sex-linked and 2) which alleles are dominant and recessive.

Relevancy

- Apply evidence-based reasoning and biological knowledge to inform health, environmental, and/or societal related decisions.

Required Course Syllabus Statements

Generative AI

Generative AI: AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to develop your own individual voice. At the same time, you should learn how to use AI and in what instances AI can be helpful to you.

The use of generative AI tools (e.g. ChatGPT, Google Gemini, etc.) is permitted in this course for the following activities:

- Brainstorming and refining your ideas.
- Fine tuning your research questions.

- Finding information on your topic.
- Drafting an outline to organize your thoughts.
- Checking grammar and style.

The use of generative AI tools is not permitted in this course for the following activities:

- Impersonating you in classroom contexts, such as by using the tool to complete assignments.
- Writing a draft of a writing assignment.
- Writing entire sentences, paragraphs or papers to complete class assignments.

You are responsible for the information you submit based on an AI query (for instance, that it does not violate intellectual property laws, or contain misinformation or unethical content). Your use of AI tools must be properly documented and cited in order to stay within university policies on academic honesty.

Any student work submitted using AI tools should clearly indicate what work is the student's work and what part is generated by the AI. If any part of this is confusing or uncertain, please reach out to me for a conversation before submitting your work.

Using Remote Testing Software

☒ This course does not use remote testing software.

☐ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities

Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity

At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX

Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation

UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.

To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.