

Semester 2 Exam Review

Your semester two exam is scheduled for Friday the 5th of June from 8:00 to 9:00 am. It is your responsibility to check the posted schedules to determine in what room your section will be taking this exam and to be there on time ready to take the exam. Read the school policy for making up this exam if you are absent. There are severe penalties for an unexcused absence from this exam or failing to make prompt arrangements for a makeup. Do not miss this exam!

The semester 2 exam will consist of the following sections:

1. Odd Word Out Questions. Eight questions worth two points each.
2. True & False Questions. Ten questions worth two points each.
3. Multiple Choice Questions. Twelve questions worth two points each.
4. Mendelian Genetics Questions. Five questions worth two points each.
5. DNA Transcription/Translation Questions. Five questions worth three points each.
6. Short Answer Questions. Three questions worth five points each.

This exam will cover material from chapters 7 to 12. The following information is intended to give you some idea of the most important material you should concentrate on as you prepare for this exam. It is not intended to be a complete or comprehensive list of every point covered on the semester exam. You should also use your chapter tests, chapter syllabi, and homework assignments as study guides. Don't forget your lab work. Information from these labs will be incorporated in to the semester exam.

Chapter 7: Cell Structure and Function

- Be able to state the tenants of the cell theory and give examples of scientists who made important contributions to the cell theory.
- Have a general understanding of how a light microscope works and examples of other types of microscopes.
- Distinguish between prokaryote and eukaryote cells. Be able to describe important differences between the two types of cells and give examples of prokaryote and eukaryote organisms.
- Know the structure and function of the important organelles of a typical eukaryote cell. See Figure 7-6, page 175.
- In particular, understand the functional relationship among the organelles such as the nucleus, ER, ribosomes, and Golgi apparatus.
- Understand the functions of the cytoskeleton and be able to name and describe different protein filaments that make up the cytoskeleton, flagella, and cilia.
- Compare the similarities and differences between typical animal and plant cells.
- Be able to describe the lipid bilayer or fluid mosaic composition of cell membranes. In particular, be able to recognize and describe the function of phospholipid molecules in the lipid bilayer and the various types of proteins in membranes.
- Compare passive and active transport of material across membranes including energy requirements and the direction of movement relative to concentration gradients.
- Be able to describe examples of passive transport, especially diffusion, osmosis, and facilitated diffusion.
- Be able to described examples of active transport; especially Na/K pumps, H ion pumps, endocytosis, and exocytosis.
- Be aware of the various levels of organization in multicellular organisms such as cells, tissues, organs, and organ systems. Be able to give examples of each.

Chapter 8: Energy and Life

- Distinguish between autotrophs and heterotrophs. Be able to give examples of each. Understand how these two types of organisms are related to one another as energy passes through an ecosystem.
- Be able to identify an ATP molecule and its constitute parts. Be able to explain how ATP functions as an energy "carrier" in the cell.
- Be able to briefly describe the early experiments of Van Helmont, Priestly, and Ingenhouz and their contribution to our understanding of photosynthesis.
- Be able to write the complete balance equation for photosynthesis.
- Understand the relationship between the light dependent and the light independent reactions.

- Be able to recognize and describe the chloroplast organelle and its function. Understand the important function of the stroma, lumen, and thylakoid membranes.
- Understand the role of the photo pigments in photosystems 2 and 1 and their relationship to one another.
- Understand the function of water, NADP, the electron transport systems and ATP synthase in the light dependent reactions.
- Understand how CO₂ is incorporated in to the Calvin cycle and the important role of RUBP in this process.

Chapter 9: Chemical Pathways

- Understand the central role of ATP as the energy-carrying molecule of cells.
- Distinguish between anaerobic and aerobic respiration and the role of oxygen in each.
- Be able to describe the important events of glycolysis, the Krebs cycle, and the electron transport system.
- For each stage of cell respiration have a general understanding of where the process takes place, the role of oxygen if any, the amount of ATP used or produced.
- Be able to explain how the double membrane structure of the mitochondria is used during the electron transport system.
- Understand the role of electron carriers such as NAD and FAD linking glycolysis and the Krebs cycle to the electron transport system.
- Be able to write the balance overall equation for cell respiration.
- Understand the role of membrane proteins such as proton pumps and ATP synthase in the production and use of electro-chemical gradient of H⁺ in the mitochondria during the production of ATP.
- Be aware of the anaerobic lactic acid and alcohol fermentation process. Know the circumstances under which they occur and how they are modifications of glycolysis.

Chapter 10: Cell Growth.

- Distinguish between the processes of mitosis and meiosis, be able to compare and contrast these two processes in terms of location, changes in chromosome number, number of daughter cells produced, and function.
- Be aware of the limits on cell growth and the role surface area vs. volume of cells plays in this process.
- Distinguish between germ cells and somatic cells and their relationship to the processes of mitosis and meiosis.
- Be able to list in order the steps of a typical cell cycle and describe the important events in each phase.
- Be able to list in order the steps of mitosis and describe the important events in each phase; in particular the location and arrangement of the chromosomes, chromatids, and spindle fibers.
- Be able to describe the basic events of cytokinesis and the differences between this process in plants and animals.
- Understand the general function of cyclin and kinase proteins in the regulation of the cell cycle and the medical implications of errors in these regulators.

Chapter 11: The Work of Gregor Mendel.

- Distinguish between asexual and sexual reproduction and understand the important function of meiosis in sexual reproduction.
- Understand the concept of homologous chromosomes and their role in providing pairs of alleles for each gene in the genotype of an organism.
- Be able to list in chronological order the steps of meiosis I and meiosis II and describe the important events in each phase; in particular the location of the chromosomes, the chromatids, and spindle fibers. Be able to compare the phases of meiosis to those of mitosis.
- Understand the role of tetrad formation in prophase I and its significance in terms of crossing over and genetic variation.
- Appreciate the scientific approach that Mendel brought to the study of genetics with his experiments with pea plants and the revolutionary significance his work brought to biology.
- Be especially careful to distinguish between the terms gene and allele, genotype and phenotype, homozygous and heterozygous, chromosome and chromatid.
- Be able to use the Punnett-square method to calculate the probabilities associated with monohybrid, dihybrid, and X linked crosses.
- Understand how test crosses are used to determine the genotype of organisms.
- Understand how Mendel's work can be summarized in his laws of segregation and independent assortment.
- Be able to describe and identify variations in the simple dominant/recessive relationships between alleles such as in cases of codominance and multiple alleles.
- Understand how linkage of genes on the same chromosome alters the expected Punnett Square results and how this can be used to map the location of genes on chromosomes.

Chapter 12: DNA Structure and Function.

- Be familiar with the experiments of Griffith, Avery, and Hershey and Chase as examples of experiments that demonstrated that DNA is the genetic material.
- Appreciate the importance of using bacteria, viruses (bacteriophages), and radioisotopes in these experiments.
- Be able to describe the overall structure of the DNA molecule. In particular understand its double helix structure of alternating phosphate and deoxyribose sugars with the matched pairs of nitrogenous nucleotide bases, adenine, cytosine, guanine, and thymine.
- Know how the bases match in very predictable pairs of adenine to thymine and cytosine to guanine.
- Appreciate the contributions of Watson, Crick, Wilkins, and Franklin to the discovery of the structure and function of DNA.
- Be able to describe the general process of DNA replication, especially the pattern of base pairing of the four different nucleotides and the role of DNA polymerase.
- Appreciate that the genotype represented by the sequence of bases in DNA will ultimately be expressed as a phenotype represented by the sequence of amino acids in protein molecules.
- Understand that this transition from DNA to protein is a two-step process that includes transcription and translation. Be able to compare these two processes in terms of their location in the cell, the role of DNA and the various RNA molecules, and the important events that take place in each step.
- Be able to describe the differences and similarities between DNA and RNA molecules in terms of the number of sugar-phosphate backbone, the types of nucleotide bases, and the types of sugars in each type of molecule.
- Understand the general function of mRNA, rRNA, and tRNA in the processes of transcription and translation.
- Be able to describe the basic steps of transcription. Understand the role of DNA as the template for the production of the mRNA molecule and the role of RNA polymerase and promoter region of DNA.
- Be able to describe the basic steps of translation including the interaction between mRNA and the ribosomes. In addition, understand the function of tRNA in the placement of the correct amino acids in the growing polypeptide.
- Learn how to read the genetic code table on page 204. Understand why mRNA codons must have at least three bases in order to code for all twenty essential amino acids. Appreciate the special role of the START and STOP codons in the process of translation.
- Be aware of the addition modifications of mRNA in eukaryotic cells such as the presence of introns and exons.
- Know what a mutagen is and how various types of mutations will affect the process of protein synthesis. In particular, be able to recognize and describe base substitutions, deletion and inversion, insertions, frame shift, transposon, and neutral mutations.