AP Biology – Spring 2020 Edward R. Murrow High School
Exam 1 Review Sheet Mr. Sprague

Format:

Section I 23 multiple choice questions
Section II 4 short free response questions

Reading: Hillis chapters 11–14 (and all readings from Semester I: Hillis chapters 1–10 and 41)

Concepts to Review:

- EVERYTHING FROM SEMESTER I

- Protein Synthesis
  - Understand how DNA controls all cell activities, as well as an organism's characteristics.
  - Know the RNA base pair rules.
  - Be able to explain the processes of *transcription* and *translation*, including the roles of the enzymes *RNA polymerase* and *tRNA synthetase*.
  - Be able to describe how mRNA is processed after transcription, including the roles of *introns*, *exons*, *spliceosomes* (*snRNPs*), *GTP caps*, and *poly-A tails*.
  - Be able to use the *genetic code table* to translate a string of mRNA codons into a sequence of amino acids.
  - Be able to explain what a *virus* is and how it reproduces.
  - Be able to explain what a *retrovirus* is, how it takes over a cell, and the role of *reverse transcriptase*.
  - Be able to explain how changes in DNA affect the resulting protein.
  - Be able to describe the experimental evidence showing that mRNA is read in triplet codons.
  - Be able to describe how and why polypeptides may be processed after being synthesized.

- Gene Regulation
  - Be able to compare how prokaryotes and eukaryotes regulate gene expression.
  - Understand the differences between *inducible* vs. *repressible genes*, *positive* vs. *negative regulation*, and genes that are *constitutively* expressed.
  - Be able to describe the structure of a prokaryotic gene and the structure of a eukaryotic gene, including the *promoter*, *operator*, *enhancer*, *repressor*, *TATA box*, *coding region*, and *noncoding region*.
  - Understand how an *operon* works (specifically, the *lac* operon and the *trp* operon).
  - Understand how *transcription factors* work.
  - Understand the term *epigenetics*, and be able to explain the roles of *methylation* and *acetylation* (*histone modification*) in gene expression.
  - Be able to explain how *alternative splicing* regulates gene expression after transcription.
  - Be able to explain how *ubiquitin* regulates gene expression after translation.

- Biotechnology and Evolutionary-Developmental Biology
  - Understand stand the terms *recombinant DNA* and *restriction enzyme* and those they are used in labs.
  - Be able to describe the processes of *gene sequencing*, *genetic engineering*, *cloning*, and *gel electrophoresis*.
  - Be able to interpret data and diagrams of bacterial transformation experiments.
  - Be able to discuss the benefits to society and concerns about genetic technology.
  - Be able to explain how changes in gene expression leads to *cell differentiation*.
  - Be able to explain how the spatial location of cells influences gene expression.
  - Be able to explain the role of developmental genes in evolutionary history.

- Labs
  - Be able to graph data, including labeling both axes with units.
  - Be able to explain the processes of *polymerase chain reaction* (*PCR*) and *gel electrophoresis*.
  - Be able to write a null hypothesis and use a chi-square test to reject or fail to reject the null hypothesis.

Overarching Questions to Consider:

Suggestion: Answer all of these questions in writing, then compare answers with a classmate. I promise that taking the time to do so will be well worth it and much more useful then memorizing facts and definitions.

1. What is the difference between a nucleotide, a codon, an allele, a gene, a chromosome, and a genome? What does a gene code for? What does a codon code for?
2. How do conjugation, transformation, and transduction contribute to variation in prokaryotes?
3. Why do loss-of-function mutations tend to be recessive alleles and gain-of-function alleles tend to be dominant alleles?
4. What is the relationship between nucleotides and polypeptides? What does a gene code for? What does a codon code for?
5. What does it mean for a gene to be expressed? What steps are necessary for gene expression to occur? How can gene expression be prevented at each of these steps?
6. How are the steps required for a gene to be expressed different in prokaryotes and eukaryotes? How is the regulation of those steps different in prokaryotes and eukaryotes?
7. What does a gene look like? That is, what are the parts of a gene? How is coding DNA different from noncoding DNA? Why is noncoding DNA so important if it is not expressed?
8. How do mechanisms for regulating the expression of a gene provide organisms with an evolutionary advantage?
9. How does the splicing of introns provide eukaryotes with an evolutionary advantage?
10. Why is it that bacteria can synthesize human insulin when transformed with DNA that contains human insulin genes even though bacteria and humans are so different? How is it that all humans share over 99 percent of our DNA even though we are all so different?
11. How does PCR take advantage of processes that naturally occur in a cell? Why does PCR require each of the following: DNA polymerase, RNA primers, nucleotides? Why is it necessary to heat and cool the DNA during PCR?
12. How can we control which genes or loci get amplified during PCR?
13. How does DNA gel electrophoresis take advantage of the chemical and physical properties of DNA?

Practice Exam Questions:

Visit the course website and click on the "Multiple Choice Practice" link. Complete all practice questions for the relevant chapters and check your work against the answer key. Note: these items are password protected.

Practice multiple choice and partial versions of free response questions are also available through the College Board by logging into AP Central with the class code.

A Note About Molecular Genetics:

The ability to comprehend any concept in modern genetics requires a deep understanding of how proteins are synthesized. Be sure that you understand what a gene is and what it looks like, can explain why the different parts of a gene are important, and describe step-by-step how the information coded in a gene is used to synthesize proteins.