AP Biology – Fall 2018 Edward R. Murrow High School
Exam 4 Review Sheet Mr. Sprague

Format:

Section I 21 multiple choice questions
Section II 1 essay question and 3 short free response questions

Reading: Hillis chapters 7 and 8 (and all previous readings)

Concepts to Review:

- EVERYTHING FROM EXAMS 1–3

- Cell Cycle and Its Regulation
  - Know the stages of the *cell cycle* and what happens during each stage.
  - Be able to compare the processes of *mitosis* and *meiosis*.
  - Be able to explain the role of *cyclins* and *cyclin-dependent kinases* in cell cycle regulation.
  - Understand the terms *haploid* and *diploid* and the symbols *n* and 2*n*.
  - Be able to compare plant and animal life cycles and understand the terms *alternation of generations*, *zygote*, *gamete*, and *spore*.
  - Be able to explain what *apoptosis* is, how it occurs in a eukaryotic cell, and why it is necessary.
  - Be able to explain how malfunctions in cell cycle regulation can lead to *cancer*.

- Patterns of Inheritance
  - Understand the terms *gene*, *allele*, *dominant*, *recessive*, *homozygous*, *heterozygous*, *genotype*, and *phenotype*.
  - Be able to solve genetics problems/calculations using a *Punnett Square*.
  - Understand the following modes of inheritance: *autosomal dominant*, *autosomal recessive*, *incompletely dominant*, *codominant*, *multiple alleles*, *sex-linked*, *cytoplasmic*, *epistatic*, and *polygenic*.
  - Understand how blood types are inherited and be able to solve genetics problems involving blood type.
  - Understand the role of *crossing over* in meiosis.
  - Be able to use data on the *frequency of recombination* (crossing over) to determine how the order of a set of genes on a chromosome.
  - Be able to determine the mode of inheritance of a particular gene from a pedigree or data set.
  - Be able to determine the probability of two or more simultaneous events.
  - Be able to recognize the ratio of phenotypes associated with a *monohybrid cross* and *dihybrid cross*.

- Labs
  - Be able to graph data, including labeling both axes with units.
  - Be prepared to discuss the following labs: *Timing the Cell Cycle* and *Probability and Statistics*.
  - Be able to write a null hypothesis and use a chi-square test to accept or 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. Why is mitosis necessary in multicellular organisms?
2. How is the genetic make-up of a cell different in the G_1, S, and G_2 phases of the cell cycle?
3. What are some conditions under which a cell might divide? What are some conditions under which a cell would not divide? How is the decision to divide or not divide regulated?
4. What are some evolutionary advantages of a cell cycle checkpoint system?
5. How does mitosis ensure that the number of chromosomes is conserved from parent cells to daughter cells?
6. Why does Mr. Sprague claim that cancer is like a case of natural selection among the cells of an individual?
7. How were we able to time the cell cycle without watching it proceed? Why does this technique work?
8. Why is meiosis necessary? Why does the creation of gametes require a different mechanism than the creation of other cells?
9. What events in mitosis and meiosis are similar? What events in mitosis and meiosis are different?

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10. What is meant by "independent assortment" of chromosomes? How does this lead to genetic variation?
11. How does crossing over lead to genetic variation?
12. Why does an X-ray technician care more about protecting your gonads than your vital organs?
13. How is an alternation of generations life cycle different than a typical animal life cycle? What are the advantages of alternation of generations?
14. What is a gene? What does it mean for a gene to be expressed? How is an allele different from a gene?
15. How is a dominant allele different from a recessive allele? How would you be able to tell if an allele is dominant or recessive?
16. What does a Punnett square represent? How is the number of boxes in the square determined?
17. How is it possible for a trait to "skip generations" (i.e., one of your traits was also in one of your grandparents, but not in either of your parents) when every piece of DNA in you was also in one of your parents? How do meiosis and fertilization play a role in this phenomenon?
18. How is the dihybrid cross phenotype ratio (9:3:3:1) related to the monohybrid cross ratio (3:1)? How are the incomplete dominance and codominance ratios (1:2:1) related to the monohybrid cross ratio (3:1)?
19. Why is it that males are more likely to get a sex-linked disorder?
20. What would you look for in a pedigree to determine if a particular gene was autosomal or sex-linked? What would you look for in a pedigree to determine if a particular gene was found in nuclear or mitochondrial DNA? What would you look for in a pedigree to determine if a particular gene was dominant or recessive?
21. Why is it that Punnett squares are not good for making predictions about most complex animal traits?
22. Why do linked genes not follow the expected Mendelian frequencies? What is the role of crossing over in gene linkage?
23. Mr. Sprague's lovely wife, Mrs. Sprague, is the youngest of four sisters. Using a Punnett square, we would predict that in a family of four children, we expect approximately two girls and two boys. Why is it NOT that strange that the observed sex ratios in Mrs. Sprague's family do not fit the predicted ratios?

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.

Essay Question Sneak Peak:

Read each question carefully and completely. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

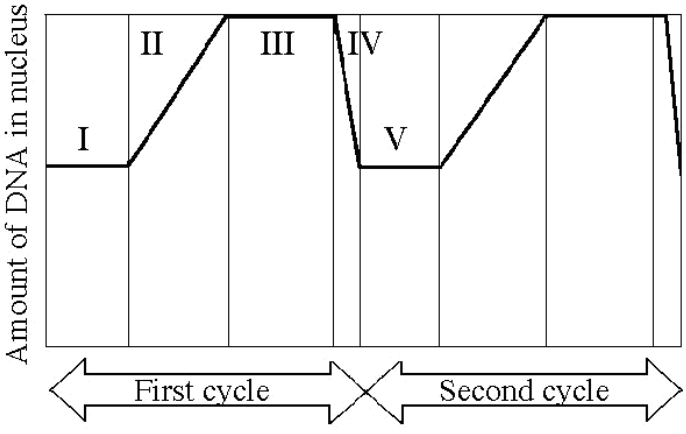

Figure 1. Changes in the amount of DNA in the nucleus of a cell over two rounds of the cell cycle

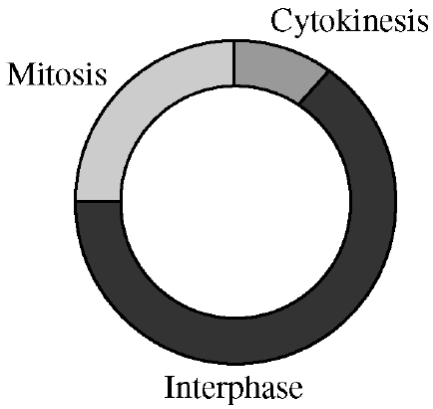

Figure 2. Phases of the cell cycle

1. The DNA content of an individual cell can be measured by applying a DNA-specific dye to the cell and then passing it through an instrument that measures the staining intensity. Using the technique, the amount of DNA in the nucleus of a newly created cell was monitored as it progressed through two rounds of the cell cycle. Changes in DNA content are shown in Figure 1. Dividing cells proceed through the phases of the cell cycle shown in Figure 2.

Parts (a), (b), and (c) are not shown.