

**SADDLEBACK COLLEGE**  
**BIOLOGY 20**  
**EXAMINATION 3 STUDY GUIDE**

The exam will consist of multiple choice, true-false, "fill-in", and a few short answers. Please bring a pencil and a good eraser. Review your lecture notes in detail. Highlight new terms & concepts. Use the text to complete and correct your notes. Don't forget to use your text glossary & index to help define terms and find subjects. This exam will focus on lecture on DNA Replication, DNA technology, Protein Synthesis, Genetic and Evolution.

**MEIOSIS**

- What is the difference between sexual and asexual reproduction?
- Where does meiosis occur? When does it occur? Why does it occur? When does it occur?
- What is spermatogenesis and oogenesis? Products of each?
- Know the following terms and how they relate to meiosis: homologous chromosomes, diploid, haploid, gametes, zygote, syngamy.
- Be able to label a diagram of the different phases - refer to your text.
- Know the different phases of meiosis and how they are different from mitosis?
- What are the sexual sources for variation? Crossing over? Independent assortment?
- What is nondisjunction? Trisomy? Monosomy?
- What are the five control factors for cell division? What is the problem with cancer cells? What p53 and p 21? Tumor suppressors. What is tumor (benign & malignant)? What is metastasis? How do we fight cancer cells?

**GENETICS (Chapter 9)**

- Know the following terms: character; trait, monohybrid and dihybrid crosses, P<sub>1</sub>, F<sub>1</sub> & F<sub>2</sub> generations, test cross, genotype, phenotype, homozygous, heterozygous, complete dominance, incomplete dominance, codominance, multiple alleles, polygenic inheritance, consanguinity.
- Know how to do the genetic problems on the worksheets - there will be some problems on the exam.
- What are sex-linked genes?
- Know the genotypic and phenotypic ratios discussed in class.
- Know the dominantly and recessively inherited disorders discussed in class.
- **DNA replication** - where, when & why does it occur (**Chapter 10**)
  - structure of DNA - nitrogenous bases, 5 carbon sugar, phosphate group
  - types of bonds
  - Chargoff's rule - base pairing of the nitrogenous bases (A = T and C ≡ G)
  - enzymes involved in DNA replication and the correct sequence
  - What is priming? What is the primer composed of? 5' → 3' direction
  - parent strand, leading strand, lagging strand (Okazaki's fragments) - what joins the fragments together
  - proofreading, DNA repair, repair enzymes and excision repair
- **DNA technology (Chapter 12, pp. 239 - 242 & 245)**
  - What is recombinant technology? Plasmid technology?
  - Know how genes are produced (copied) in mass quantities (plasmids of bacteria).
  - Know the difference between PCR and RFLP
  - What are restriction enzymes? Would PCR or RFLP utilize restriction enzymes?
  - Be able to interpret an electrophoresis gel.
- **Protein synthesis** - where, when & why does it occur? (**Chapter 10**)
  - define triplet, codon, anticodon - how are they formed and how they function
  - explain all the steps of protein synthesis, including transcription steps and translation steps
  - Transcription - where does it occur and what is involved
    - RNA polymerase, pre-mRNA, mRNA, tRNA, rRNA
  - RNA processing, RNA splicing -- what are introns and exons; 5' cap, poly-A tail
    - Alternative splicing – what is it and possible outcomes
  - Translation- where does it occur and what is involved
    - tRNA, anticodon, triplet, amino acid attachment site, amino acids
    - mRNA role - binding site, How are the P & A sites used?
    - What is the role of ribosomes?
  - Know the difference between point mutation (substitution or deletion) vs a frameshift mutation.

**EVOLUTION (Chapter 13-15)**

- Who is Lamarck and what were his theories?
- Who is Charles Darwin and where did he sail to? Name of his book and the two points that he made.
- What is natural selection? Differential reproduction? Wallace?
- What is Darwinian fitness?
- What are the evidence for evolution (5 were given).
- Know the 5 conditions for Hardy-Weinberg equilibrium. Know how to calculate the frequencies of alleles and genotypes.

- What are the 5 causes of microevolution?
- What are the three types of natural selection? Sexual selection?
- Know the different reproductive barriers (5 pre-zygotic & 3 post-zygotic)
- What is speciation? Know what are allopatric and sympatric speciation. What is adaptive radiation?
- What is macroevolution? Co-evolution?

**Possible short answer questions on Exam III:**

These short answer questions will be chosen randomly so be prepared to answer them all.

1. Compare and contrast PCR and RFLP. When would one be used over another?
2. Compare and contrast DNA and RNA.
3. What is HIV and the disease that it causes? Discuss what type of virus HIV is, the types of cell the virus attacks and why?
4. Be prepared to replicate a given DNA molecule into two molecules (this is the easy one, don't screw it up!)
5. Genetic Problems: (these will be similar to the ones that you've been working on)
  - monohybrid cross, dihybrid cross, sex linked cross, blood type
6. This question is in reference to Figure 9.23A on page 179 in your textbook. A female student was not able to see the number 7 in figure 9.23A and was surprised to discover she suffered from red-green colorblindness. She told her biology professor, who said, "Your father is color blind too, right?" How did her professor know this? Why did her professor not say the same thing to the color-blind males in the class?
7. Why are there more men than women with color blindness?
8. Briefly explain how the 5 causes of microevolution can lead to a change in the gene pool.
9. Explain how differential reproduction drives natural selection.
10. List and briefly discuss the 5 pre-zygotic barriers that help to maintain species.
11. The mating of a horse (female) and a donkey (jackass) produces a mule. Does this mean that horses and donkeys are the same species? Explain why or why not.
12. Hardy-Weinberg calculation for equilibrium (bring a calculator)