

Unit 3 Study Guide, BIOL 180, Fall 2015

Use this as a **study aid only**. This is intended to get you thinking about the major lecture topics. Do not assume exam questions will be limited to the material seen here.

1. What is the Cell Theory?
2. What is binary fission? In what type of cells/organisms does it occur? Be able to describe the processes that occur during binary fission, and know what results from it. Understand the nature of prokaryotic chromosomes. Explain how binary fission is different from mitosis.
3. What is mitosis? In what types of cells/organisms does mitosis occur? What happens during mitosis? Be able to describe the processes that occur during mitosis, and know what results from it.
4. What are chromosomes? Where are chromosomes located in eukaryotic cells? How many chromosomes are in human somatic cells? What is chromatin? Also know: sister chromatid, centromere, and kinetochore.
5. Understand the four phases of mitosis, and know what occurs during each. Know the events of prophase, metaphase, anaphase, telophase, and interphase. Be able to recognize these stages in pictures or diagrams of cells, or be able to produce diagrams of dividing cells in these stages.
6. What is cytokinesis? How does cytokinesis differ between plant and animal cells? What are daughter cells?
7. Describe the processes that occur during the cell cycle. Diagram the process and understand what happens in each phase. Know: G₁, G₀, S, G₂, and M. Where does interphase fit into this? Also know factors that can influence rates of cell division.
8. What conditions must be met for a normal cell division to occur? What are growth factors?
9. What is cancer? Be able to point out differences between normal cells and cancer cells. What is a tumor?
10. What are telomeres? How are they thought to be important in the regulation of the cell cycle? With regard to cancer cells, what is transformation? What causes cancer? Why is cancer more common now than a few generations ago? What are some risk factors associated with cancer?
11. Define oncogene, proto-oncogene, and tumor suppressor gene. Understand the role of each in the development of cancer cells.
12. Differentiate between benign tumors and malignant tumors. What is metastasis? What is the likelihood of successful surgical removal of each type of tumor?

13. What are the four classes of cancers? What types of cancer fit into each class? How are cancers named?
14. What three processes are used to treat cancer? Describe why each is done, and also point out the consequences of the processes on non-cancer cells in the body.
15. What is a karyotype? What are homologous pairs of chromosomes? Why do chromosomes occur in pairs in sexually-reproducing organisms?
16. Differentiate between the terms diploid and haploid. What are somatic cells? What are sex cells?
17. What is meiosis? How does it differ from mitosis? In what types of cells/organisms does meiosis occur? What happens during meiosis? Be able to describe the processes that occur during meiosis, and know what results from it.
18. Understand the phases that occur during meiosis. Primarily understand differences between meiosis I and meiosis II. Which is the reduction division? What is synapsis? What are tetrads? When do homologous chromosomes pair up? When does crossing over occur? Understand the outcomes that result.
19. What are chromosomes? What are homologous chromosomes? Be able to differentiate between autosomes and sex chromosomes. How many autosomes and sex chromosomes occur in human cells?
20. What is genetic recombination? Why is it advantageous? What four processes contribute to genetic recombination? Does this occur from mitosis or meiosis?
21. What is nondisjunction? Provide examples of chromosome abnormalities that result from nondisjunction. Describe how such an event might happen. Compare the severity of nondisjunction between autosomes and sex chromosomes. What is a polyploid organism?
22. What are genes? What is genetics? Who is credited as the father of genetics?
23. Explain the difference between a genotype and a phenotype. Be able to interpret genotype and phenotype information from a Punnett square. Also be able to explain the terms: dominant, recessive, allele, homozygous, heterozygous, and locus (plural loci). What is a “pure line”? Also know the generations: P, F₁, and F₂.
24. Chromosomes in humans (and other sexually-reproducing organisms) occur in homologous pairs. Why? Relate this to the processes that occur during gamete (sex cell) formation and fertilization. Be able to use this understanding to set up rows and columns on a Punnett square. Be able to interpret results from Punnett squares. Be able to perform monohybrid and dihybrid crosses in a Punnett square.
25. What is Mendel’s Law of Independent Assortment? What is Mendel’s Law of Segregation?

26. What is a test cross? What can we learn from doing a test cross?
27. What are pedigrees? What can we learn from constructing pedigrees? What are some common genetic defects that might be studied in such a fashion? Be able to discern genotype and phenotype information from a pedigree.
28. Why are fatal genetic disorders almost always recessive alleles? What would be the only way to explain a dominant fatal allele? What is a carrier?
29. In peas, tall alleles (T) are dominant to short alleles (t). If two heterozygous plants (Tt) are crossed, and 100 short offspring are obtained, then how many tall offspring should we expect?
30. If two short pea plants are crossed, then how many tall offspring should we expect?
31. In Mendel's peas, the allele for tall (T) is dominant over short (t). If two tall plants are crossed and both tall and short offspring are observed, then what are the genotypes of the parents?
32. Know the basic phenotype ratios that we expect from standard monohybrid and dihybrid crosses.
33. Know some of the ways genes can interact with each other: What are supplementary factors? What are complementary factors? What is polygenic inheritance? What is pleiotropy? What is incomplete dominance? What is codominance? Be able to give examples of each.
34. What are multiple alleles? What are the different alleles involved in human blood type? Which are dominant to the others? Who can safely donate/receive blood from others? Why? What is the Rh factor in blood? Why is it important between a mother and a fetus she is carrying?
35. How often does the environment play a role in the expression of phenotypes? Be able to give an example.
36. What is gene linkage? What does it mean to say genes are linked? Understand the concept of multiple genes on a chromosome, and how the frequency of crossing over can be used to map locations of genes on chromosomes.
37. What is the Chromosomal Theory of Inheritance? What are its important points?
38. Differentiate between the male and female sex chromosomes. Which carries more genetic information? What is a sex-linked trait? Be able to construct Punnett squares for sex-linked traits. What is a carrier?

39. In humans, hemophilia is a sex-linked trait. A hemophiliac woman has children with a man who is not hemophiliac. They have one son and one daughter. What is the probability their son has hemophilia? What is the probability their daughter has hemophilia?
40. What is X chromosome inactivation? What is a Barr body? What is a mosaic? Give an example.
41. What is DNA? Where is DNA in the cell? What does “DNA” stand for?
42. Have an understanding of the three famous experiments that established the role of DNA as the genetic molecule. You do not need to know the minutiae of the experiments, but you will need to know who conducted each and the findings of each study.
43. Know that transformation is the transfer of DNA between organisms (**not** the same transformation as in cancer cells!).
44. Who proposed the structure for DNA? What is this structure? What components exist, and how are they arranged? How does this structure enable DNA to function? Also know: nucleotide, sugar-phosphate backbone, nitrogenous base. What are the four nitrogenous bases in DNA? What are Chargaff’s Rules?
45. Know the pairing of nitrogenous bases in DNA, and understand the convention of the 3’ and 5’ ends of a nucleic acid. What does antiparallel mean? In what ways is RNA different from DNA?