

## Study Guide for Exam 2 – Biol-1, C. Briggs, rev. SP16

Test preparation suggestions: Same as before. Keep at it! Be able to:

### Cell Division, Mitosis, Meiosis

1. describe the following: binary fission, chromatid, chromatin, chromosome, genome, homologous, karyotype, microtubule, mitotic spindle, asexual and sexual reproduction.
2. label diagrams of major steps in mitosis and meiosis (interphase, prophase, metaphase, anaphase, telophase / cytokinesis).
3. distinguish between sexual and asexual reproduction of cells:
  - what are the purposes of each process?
  - how is meiosis different from mitosis?
4. explain why various steps of mitosis and meiosis must take place. This will require some inference, or thinking beyond the concrete information in our textbook.
  - for example, why does the nuclear membrane need to disintegrate?
  - why do chromosomes pair in a central line during the metaphase of mitosis?
  - why does DNA replication come before the chromosomes condense in prophase?
5. explain how the following contribute to genetic variation in sexual reproduction: independent assortment of chromosomes, random fertilization, crossing over.
6. Other big questions: *These are beyond the scope of our text, but are often compelling to citizens. You are unlikely to see these questions on an exam, but they can help pull together ideas.*
  - Why don't we look exactly like our parents?
  - Why do so many different living things have sex?

### Genetics

7. describe the following: diploid, haploid, gamete, sex chromosome, allele, dominant vs. recessive alleles, heterozygous, homozygous, codominance, incomplete dominance, polygenic inheritance, autosome, carrier, deletion, Down syndrome, nondisjunction, and polyploidy.
8. determine genotypic and phenotypic ratios for simple genetic crosses (example: Aa x Aa).
9. interpret results of a dihybrid cross.
  - what are the genotypic and phenotypic ratios of the offspring?
  - how do these results support the idea of independent assortment of chromosomes?

10. relate Mendel's observations to his conclusions.
  - why did the Law of Segregation arise from observations of his F2 generation with yellow and green peas?
  - why did the Law of Independent Assortment arise from observations of his dihybrid cross?
11. relate Mendel's observations to modern ideas about how meiosis works
  - mainly: random segregation of alleles during meiosis
12. explain what scientific qualities Mendel demonstrated in his behavior.
13. describe some modern impacts of Mendel's work.
14. use a pedigree to predict genotypes of previous generations.
15. explain why chromosomal abnormalities often lead to physical abnormalities.

### DNA, Protein Synthesis

16. describe the following: plasmid, PCR, recombinant DNA, restriction enzyme, genetic engineering, genetically modified organisms (GMOs), DNA profiling.
17. describe how the structure of DNA (double strand, matching bases) allows it to be copied simply.
18. contrast the processes of transcription and translation:
  - where does each occur?
  - starting and ending materials for each?
  - cell structures involved in each?
  - location problem, language problem
19. explain the roles of: DNA, types of RNA (mRNA, tRNA, rRNA), ribosomes, codons, anticodons, and alternative splicing.
20. distinguish among types of mutation (substitution, insertion, deletion), and describe various results of mutation (frame-shift; impacts on resultant protein, if any). *Not in textbook.*
21. explain how gene expression is regulated and why this is important (promoters + enhancers, micro-RNA, alternative splicing).
22. give several reasons for the value of cloning.
23. distinguish among different types of stem cells (embryonic, induced pluripotent, umbilical cord).
24. explain how mutations can lead to cancers.
25. explain how DNA fingerprinting works (including

gel electrophoresis, restriction enzymes).

26. Other big questions:
  - How can we limit chances of mutations in our own bodies?
  - Is cloning a good idea?
  - Is stem cell research a good idea?
  - How trustworthy is DNA evidence?

### **Evolution**

27. describe the following: homologous, morphology, radiometric dating, vestigial character, adaptation, evolution, biological fitness, macroevolution, microevolution, population, sexual selection, species, adaptive radiation, biological species concept, convergent evolution.
28. compare the use of the word "theory" in science to its general use in society.
29. intelligently evaluate the burden of evidence for various claims.
30. explain how these lines of evidence provide support for the idea of evolution: the fossil record, biogeography, comparative anatomy, comparative embryology, and molecular biology. *Some of these are not in textbook.*
31. describe the observations that led Darwin to develop his theory for evolution by natural selection (overproduction of offspring, individual variation).
32. give a description of the theory of natural selection.
33. compare and contrast the outcomes of the processes of mutation, sexual selection, and natural selection.
34. draw a diagram showing how natural selection can lead to pesticide resistance in insects or antibiotic resistance in bacteria.
35. compare and contrast the various reproductive isolating mechanisms
  - prezygotic: temporal, habitat, behavioral, mechanical, gametic
  - postzygotic: reduced hybrid viability, reduced hybrid fertility, hybrid breakdown- use your knowledge of these mechanisms to hypothesize which are playing a role in a given situation.
36. identify where or when adaptive radiation is most likely to occur.
37. Other big questions:
  - Why are there so many different living things?
  - Why have living things changed so much over time?
  - What constitutes "wise use" of tools like antibiotics and pesticides?

- Are there any reproductive isolation mechanisms that we need to be concerned about?

### **Plant Basics**

38. describe purposes of xylem and phloem in the plant vascular system.
39. describe transpiration, and its role in plant circulation and the water cycle.
40. describe distinguishing characteristics of mosses, ferns, gymnosperms (conifers), and angiosperms (multicellularity, vascular tissue, seeds, flowers).
41. describe how the major groups of plants are assumed to be related, based on the evidence of these characteristics.
42. build a phylogenetic tree based on a table of characteristics of different organisms.

### **Survey of Life**

43. From material introduced in class, supplemented by your outside reading, be able to:
  - describe the four stages hypothesized as necessary for the origin of life.
  - distinguish between "replicator-first" and "metabolism-first" theories for the origin of life.
  - describe an experiment meant to demonstrate some aspect of the origin of life. One option is the work by Miller and Urey, but there are other possibilities.
44. identify bacterial shapes and arrangements (cocci, bacilli, strepto-, and staphylo-).
45. name the three currently-accepted Domains of life.
46. explain why it is useful for a fungus to have a mycelium made of a branching mass of hyphae. (Think about surface area.)
47. explain why decomposition is an important service in an ecosystem, and name the main decomposers.
48. explain how algae and fungi benefit each other in lichen.
49. explain why specialization often increases the success of an organism.
50. name advantages of giving birth to fully-developed young.
51. explain why culture may be important to the success of *Homo sapiens*.
52. distinguish among major groups of arthropods (arachnids, crustaceans, insects), mammals (monotremes, marsupials, placental mammals), and primates (New World vs. Old World monkeys; lesser vs. greater apes).