Biology 150: Final examination **Name**_____
May 13, 2014

Indicate the lab you are registered in:

Monday, 1-2:50 _____ ; Tuesday, 10-11:50 _____; Tuesday, 1-2:50 _____ ; Tuesday, 3-4:50 _____

Answer the questions in the space provided and you may also use the back of the page to complete your response. There are 15 questions worth a total of 50 points (plus four bonus questions). The point value of individual questions appears in parentheses.

1. In order, what are the steps of the scientific method? (1)

2. In science, what is the difference between an hypothesis and a theory? (1)

3. Charles Darwin saw in nature three processes that explained the evolutionary change. Name (or describe) all three. (3)

4. Proteins are polymers of _____, of which 20 different ones occur in proteins. Of these _____ have non-polar variable groups (or side chains), while _____ have polar, _____ have acidic, and _____ have basic variable groups. (5)

5. Draw the central sugar of a nucleotide. Number the carbons. Indicate where the purine or pyrimidine base is attached, the location of the phosphate(s), the carbon bound to the phosphate of the next nucleotide in a nucleic acid, and the carbon missing an O in one type of nucleic acid. (4)

6. Draw a mitochondrion. Label membranes, cristae, and matrix. (1)

7. Draw a chloroplast. Label membranes, thylakoids, stroma, and grana. (1)

8. What does a lysosome contain? (1)

9. What are proplastids? (1)

10. Briefly, what does the Endosymbiosis Theory propose? What evidence supports this idea. (4)

11. Describe the function sodium/potassium pump. What is moved where? How is it "electrogenic"? (3)

12. What does the second law of thermodynamics state? (1)

13. If, for a specific reaction where A↔B, Keq has a value of 0.5: (2)
    a) Is the reaction considered spontaneous?

    b) If, once this reaction is at chemical equilibrium, and the concentration of the product (B) equals 1 M, what will the concentration of A be?

14. Contrast competitive enzyme inhibition and non-competitive inhibition. How do they differ? Which of these is a form of allosteric regulation? (3)

15. ATP hydrolysis is frequently used to provide the energy to drive otherwise energetically unfavorable reactions in so called "coupled reactions". Explain, and/or diagram, how this actually occurs. (3)

16. Outline glycolysis. Indicate the starting molecule, the use and production (and how many) of energy and electron carrier molecules. Name at least one intermediate molecule and the resulting partially oxidized product molecule(s). (4)

17. What function does fermentation serve? (1)

18. Describe the composition of a light harvesting complex. (1)

19. The role of DNA in heredity was demonstrated most unambiguously by Martha Chase and Alfred Hershey in 1952. Briefly describe their experiment(s). (4)

20. Distinguish between a point mutation and a frameshift mutation. (1)

21. Distinguish between a missense mutation and a nonsense mutation. (1)

22. Define codon. (1)

23. Some proteins end up in the endoplasmic reticulum. Describe how they get there? (4)

24. Name and describe the four phases of mitosis. What happens in each? (5)

25. How does cytokinesis differ between plants and animals? (2)

26. What is a phragmoplast and where do you find it? (2)

27. Besides mitosis and development, eukaryote lifecycles feature only two events. What are they? (2)

28. Lifecycles differ between animals, plants, and protists. Name the lifecycle types typical of each of these groups and indicate how they differ from each other. (4)

29. What is a gametophyte? What is a sporophyte? (2)

30. How do haploid and diploid cells differ? (1)

31. In Meiosis, Prophase I differs from prophase in mitosis. How so? (3)

32. Meiosis mixes genetic material in two ways so that gametes contain hereditary information from both parents. Name and describe the ways this happens. (2)

33. Gregor Mendel conducted his experiments with peas in what decade? (1)

34. What does Mendel's first law state? (1)

35. Describe Mendel's test cross experiment. (2)

36. Why are some alleles recessive and others dominant? (2)

37. What is incomplete dominance? Give an example. (2)

38. When Mendel crossed true breeding plants with yellow round seeds with true breeding plants that with green and wrinkled seeds: (4)
    a) What was(were) the phenotype(s) (in what proportions) of the F1 generation?

    b) What was(were) the genotype(s) (in what proportions) of the F1 generation?

    c) What was(were) the phenotype(s) (in what proportions) of the F2 generation?

    d) What was(were) the genotype(s) (in what proportions) of the F2 generation?

39. R.C. Punnett (creator of the Punnett square) was the first to demonstrate what genetic phenomenon? Why was he able to understand his results? (2)

40. Who invented gene mapping? (1)

41. In an experiment involving unlinked genes, you cross AaBbCcDd with AaBbCcDd. What proportion of the progeny would be expected to be: (2)
    a) heterozygous for all traits?

    b) show the dominant phenotype of all traits?

42. You experimentally cross a true-breeding begonia with long internodes and deep red flowers with another with short internodes and pink flowers. All the progeny (i.e. the F1) have long internodes and deep red flowers. You allow these plants to reproduce by self-pollination. The resulting F2 consist mostly of a 3:1 ratio of plants with long internodes and deep red flowers to plants with short internodes and pink flowers but there was also a few individuals with either long internodes and pink flowers or short internodes and deep red flowers.
    a) What F2 result would Mendel's second law have predicted (i.e. which phenotypes in what proportions)? (2)

    b) What would appear the likely explanation for your "non-Mendelian" results? (2)

    c) Which of your F2 progeny are the genetic recombinant class(es)? (2)

43. You perform a second experiment with the plants from the previous question. You cross a plant of the F1 generation with more another plant with short internodes and pink flowers. The result in the progeny is a total of 1000 plants: 450 with long internodes and deep red flowers, 450 with short internodes and pink flowers, 50 with long internodes and pink, and 50 with short internodes and deep red flowers. (3)
    a) Which are the genetic recombinant class(es)?

    b) How far apart are the loci?

Bonus question:

It is often said that Mendel was lucky not to encounter the confusing complication of linkage in his dihybrid crosses. He experimented with seven traits (i.e. flower color, flower position, seed color, seed shape, pod shape, pod color, and stem length) and the pea has only seven chromosomes. Some have said that had he experimented with just one more trait, he would have had problems. It is probably not that simple. We will never know with certainty the identity of Mendel's gene pairs due to zealous office cleaning following his death, but it is likely that he worked with three genes on chromosome 4, two genes on chromosome 1, and one gene in each of chromosomes 5 and 7.

a. Soooooooo.....Why didn't Gregor Mendel find linkage? (1)

b. If he had found linkage why would it have been so much more confusing for him than it was for Punnett? (1)