

BIOL 112
Exam 1 (Chapters 14, 15, & 22-24) Version 1
January 27, 2003

Name _____

Total Possible: 102 Points.

1. A couple is hoping to have four children, two girls and two boys. They already have a girl. What is the chance that their next three children will include a girl and two boys. (Remember that the children may be born in any order.)
 - a. 1/16.
 - b. 1/8.
 - c. 1/4.
 - d. 3/8.
 - e. 1/2.

2. Dr. McCoy has discovered that tribbles (cute little furry creatures from some distant planet) have blood types like humans. They have the typical ABO blood system and Rh factor (Rh⁺ being dominant). He is trying to develop some purebreeding strains for further study. He takes a Type O⁻ tribble and crosses it with a type B⁺ tribble and gets the following results: 63 B⁺ and 60 B⁻. What is the most probable genotype of the B⁺ parent?
 - a. I^BI^BRR.
 - b. I^BI^BRr.
 - c. I^BiRR.
 - d. I^BI^Brr.
 - e. I^BiRr.

3. Dr. McCoy takes another type B⁺ tribble and mates it with an O⁻ tribble and gets the following results: 32 B⁺, 27 B⁻, 30 O⁺, and 31 O⁻. What is the most probable genotype of the B⁺ parent?
 - a. I^BiRR.
 - b. I^BI^BRr.
 - c. I^BI^BRR.
 - d. I^BI^Brr.
 - e. I^BiRr.

4. Robert's father died of Huntington's disease, a dominant genetic defect. what is Robert's chance of dying of the same thing?
 - a. 0
 - b. 1/8
 - c. 1/4
 - d. 1/2
 - e. 3/4
 - f. 1

5. Reggie and Penelope both come from families with a history of Tay-sachs disease and genetic tests have revealed that they are both carriers. What is the chance that their first child will be a girl with Tay-sachs disease?
 - a. 0
 - b. 1/8
 - c. 1/4
 - d. 1/2
 - e. 3/4
 - f. 1

6. Vitamin D-resistant rickets is an **X-linked dominant** disorder. If a normal woman marries a man with the disease which of the following statements would be true?
 - a. All the sons and none of the daughters would be affected.
 - b. Half the sons and half the daughters would be affected.
 - c. All the daughters and none of the sons would be affected.
 - d. All of the children would be affected.

7. George has very thick, gorgeous hair that just makes the girls go crazy. Unfortunately, George's grandfather on both his father's and mother's side have male pattern baldness, a **sex-influenced trait**. His father doesn't have male pattern baldness and neither does his mother. One of his friends told him that if either of his grandfathers was bald that George is doomed to be bald too. George is so concerned that he decides to visit a genetics counselor. After telling the counselor his whole family history the counselor tells George that his chances of developing male pattern baldness appear to be (Hint: Determine the probability that George's mother is a carrier and the probability that if she is a carrier that she has passed the gene on to George.)
- 0.
 - 1/4.
 - 1/2.
 - 3/4.
 - 1.
8. As a cat lover you can't stand seeing any cat without a good home, so when a stray calico-tortoise shell kitten shows up on your doorstep you immediately adopt it. After you have had it for several days you are surprised to discover that it is a male. You are somewhat relieved because you know that you won't have to get him neutered because male tortoise shell cats are sterile. Why is this so?
- Male tortoise shell cats have no Y chromosome.
 - This male kitten must have more than one X chromosome.
 - The tortoise shell trait inhibits sperm production because it inhibits testosterone.
 - Tortoise shell is sex-linked and in males one copy of the gene also confers sterility.
9. Nondisjunction during meiosis I in male germ cells could result in which of the following complements of sex chromosomes in the sperm produced? (NOTE: an O means no sex chromosomes present.)
- XX & O.
 - XX, YY, O.
 - XY & O.
 - XX & YY.
 - X, XY, & Y.
10. Jill's father has hemophilia. Although Jill, not surprisingly, is free of hemophilia, she is concerned that she is a carrier. What is the probability that Jill is a carrier?
- 1/3
 - 1/4
 - 1/2
 - 2/3
 - 1
11. The earliest test that can be used for detecting many genetic defects is
- Ultrasound
 - Amniocentesis
 - Chorionic villus sampling
 - Endoscopy
12. Assume that a population is in Hardy-Weinberg equilibrium. At a particular genetic locus, the frequency of the *a* allele is 0.5. What proportion of the individuals in the population should be heterozygous?
- 0.10
 - 0.25
 - 0.40
 - 0.50
 - 0.75
13. In a population of fruit flies that is in Hardy-Weinberg equilibrium, 75% of the individuals have wild type eyes, while 25% have scarlet eyes. What is the frequency of the wild type allele?
- 0.10
 - 0.25
 - 0.40
 - 0.50
 - 0.75

14. Environmentalists are often very concerned when populations of a rare species get too low, which can lead to the bottleneck effect. This effect causes
 - a. rapid loss of genetic variation.
 - b. increased mutations in the gene pool.
 - c. greater heterozygosity at most loci.
 - d. an increase in polymorphisms.

15. Which of the following would typically lead to greater similarity of the gene pools of two populations?
 - a. Elevated mutation rates.
 - b. Similar selection pressures.
 - c. High gene flow.
 - d. Genetic drift.

16. Which of the following would be most indicative of a high rate of outbreeding in a population?
 - a. High genetic diversity.
 - b. Low heterozygosity.
 - c. Low gene flow
 - d. Small population size.

17. One of the primary reasons that recessive lethal alleles are lost so slowly from populations is that
 - a. diploidy hides them from natural selection.
 - b. mutation rates are usually high enough to maintain them.
 - c. they are often adaptive in a different environment.
 - d. genetic drift tends to preserve recessive alleles better than dominant alleles.

18. One model that has been proposed to account for the fossil record, primarily as a result of a worldwide flood in the recent past, is called the ecological zonation model. What does this model propose?
 - a. the flood was not worldwide, and therefore fossils vary around the world.
 - b. the smallest organisms were buried first because they sink faster.
 - c. organisms less able to escape and those closer to existing water were buried first.
 - d. organisms would be buried at random, causing confusion in the fossil record.

19. Which of the following is true of Darwin's theory of natural selection that is not true of Lamarck's theory of evolution?
 - a. organisms best suited to the environment pass on the traits that make them better able to survive.
 - b. in order for evolution to take place, organisms must reproduce.
 - c. organisms can only pass on traits they already have by inheritance from their parents.
 - d. organisms are incapable of adapting to conditions in the environment.

20. The fundamental unit that undergoes change as the result of natural selection is the
 - a. individual
 - b. gene
 - c. species
 - d. population

21. Why is the Cambrian explosion such a problem for evolutionary theory?
 - a. So many major groups of organisms arose simultaneously with no apparent ancestors.
 - b. The extinction of so many organisms at once seems to violate natural selection.
 - c. The fossils of this period in the record are extremely jumbled and difficult to interpret.
 - d. Because of such terrible conditions, few fossils survive from this period.

22. A type of pre-zygotic reproductive barrier that involves seasonal differences in reproduction is
 - a. Habitat Isolation
 - b. Behavioral Isolation
 - c. Temporal Isolation
 - d. Mechanical Isolation
 - e. Gametic Isolation

23. Fossil species are a particular problem for the biological species concept. What is a good species concept to use for fossil species?
- Morphological Species Concept
 - Recognition Species Concept
 - Cohesion Species Concept
 - Ecological Species Concept
 - Evolutionary Species Concept
24. The most well documented type of sympatric speciation is
- Adaptive radiation
 - Polyplody
 - Host-race formation
 - Assortative mating
25. Which of the following is most crucial to prevent for allopatric speciation to occur?
- Mutations.
 - Genetic drift.
 - Gene flow.
 - Random mating.
 - Communism.

II. Matching. 1 point each.

- | | | |
|----------|--|---------------------------|
| 1. _____ | A dominant genetic disease that always causes death between 20 and about 50 years of age. | a. Fragile X syndrome |
| 2. _____ | A genetic trait caused by possessing three copies of chromosome 21. | b. Down syndrome |
| 3. _____ | A sex-linked recessive trait that causes excessive bleeding because of abnormal blood clotting. | c. Patau syndrome |
| 4. _____ | A genetic condition caused by having a single X chromosome and no Y chromosome. | d. Huntington's disease |
| 5. _____ | A recessive genetic trait that causes death in very young children and is common among Ashkenazic Jews. | e. Metafemale |
| 6. _____ | A form of mental retardation caused by a deletion of part of chromosome 5. | f. Klinefelter syndrome |
| 7. _____ | A genetic disorder believed to display genomic imprinting. | g. Turner syndrome |
| 8. _____ | A genetic anomaly that results in extra Barr bodies in women. | h. Hemophilia |
| 1. _____ | The "father" of taxonomy and the originator of binomial nomenclature. | i. Cri du chat syndrome |
| 2. _____ | Although Darwin is usually given credit, this person developed the theory of natural selection independently. | j. Tay-Sachs disease |
| 3. _____ | Developed the theory of inheritance of acquired traits. | k. Sickle-cell anemia |
| 4. _____ | Developed the science of paleontology, but adhered to catastrophism. | l. XYY syndrome |
| 5. _____ | A botanist and one of the developers of the neo-Darwinian synthesis. | a. Alfred Wallace |
| 6. _____ | A geologist who developed the concept of uniformitarianism and greatly influenced Darwin through his book <i>Principles of Geology</i> . | b. Carolus Linnaeus |
| 7. _____ | A geneticist, who studied fruit flies, and was one of the shapers of the neo-Darwinian synthesis. | c. Georges Cuvier |
| 8. _____ | A clergyman whose essay on population growth greatly influenced Darwin. | d. James Hutton |
| | | e. Charles Lyell |
| | | f. Jean Baptiste Lamarck |
| | | g. Thomas Malthus |
| | | h. Theodosius Dobzhansky |
| | | i. Ernst Mayr |
| | | j. George Gaylord Simpson |
| | | k. G. Ledyard Stebbins |

III. True or False. 2 points each.

- T or F At the biochemical level, many genes are codominant.
- T or F The same genotype always produces the same phenotype.

3. T or F A sex-linked trait in chickens would typically be more common in roosters (males) than in hens (females).
4. T or F The allele frequencies will remain the same from generation to generation in the gene pool of a population that meets all the Hardy-Weinberg assumptions.
5. T or F In Darwin's day, a number of scientists believed in some form of evolution, but no one had a good explanation for how it took place.
6. T or F Genetic drift only occurs in small populations.
7. T or F Mutations are rare and generally detrimental.
8. T or F Evolution is, by definition, adaptive and leads to better and better organisms as time progresses.
9. T or F Irreducibly complex organs or systems challenge the theory of evolution because there appears to be no way to evolve them by gradual steps.
10. T or F Evolutionists have no realistic model for the origin of the first living cells that is consistent with known chemical and physical laws.
11. T or F The one thing that creationists and evolutionists have in common is a faith that certain of their theories are true, even though there is no unequivocal scientific support for them.
12. T or F The mule, a hybrid between a horse and donkey, is a good example of hybrid breakdown because it is sterile.
13. T or F Fossils for evolution of most of the major groups are well represented in the fossil record.

IV. Problems.

1. James and Phoebe both come from families with a sex-linked form of color blindness, although neither of them is affected. Phoebe's father was color blind and so was James' father.
 - a. What is the chance they could have a boy that is color blind? (2)
 - b. What is the chance they could have a girl that is color blind? (2)
 - c. If they decide to have two children, what is the chance that at least one of them will be color blind? (2) **Bonus Question.**
2. The data in the table below are from a dihybrid cross in *Drosophila*. The male was homozygous for *vestigial wings* (*vg*) and *black body* (*bl*) and the female was heterozygous wild for both traits. Note that this cross is a dihybrid test-cross.

Are these two genes linked? Defend your answer. If they are linked, determine the map distance between the two genes. (6)

Phenotype	Number
Wild	4,252
Vestigial winged	854
Black body	771
Black body & vestigial winged	4,225
Total	10,102

"Peace I leave with you, my peace I give unto you: not as the world giveth, give I unto you. Let not your heart be troubled, neither let it be afraid." John 14:27