

Biology 150: Principles of Cellular and Molecular Biology

December 16, 2010
Final Exam

Please fill in your name and ID no. on the answer sheet. Be sure to darken the circles beneath your name and ID number.

Please enter the code for this exam (provided at the bottom on the last page of the exam) on your scantron sheet (left most column of CODES section). The code will either be the number 1, 2, 3 or 4. It is critical that you darken the appropriate circle so that your exam will be scored correctly.

Provide all answers on the scantron answer sheet. Choose the **best** answer from the responses that are given. Darken the circle on the answer sheet completely. (2 points per question)

Part I (Unit IV). 50 multiple choice questions, 2 points each

Questions 1 and 2 refer to a monohybrid cross between true breeding purple flowered plants and true breeding white flowered plants.

1. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates

- a. that crossing over contributes to genetic variation of offspring
- b. true-breeding in plants
- c. dominance
- d. the blending model of genetics

2. If P is the designation for the dominant allele for purple flowers in pea plants and p is the designation for the recessive allele for white flowers in pea plants, what would be the genotype of the pea plants with purple flowers?

- a. PP only
- b. Pp only
- c. PP or Pp
- d. pp

3. A true breeding plant with yellow (YY) and smooth (RR) seeds is crossed with a plant that is true breeding for green (yy) and wrinkled (rr) seeds. Assume that the two genes are not linked. Which of the following statements correctly describes the offspring or F_1 generation?

- a. 50% of the offspring will have yellow and wrinkled seeds
- b. The genotype of all offspring will be $YYRR$
- c. The genotype of all offspring will be $YyRr$
- d. 25% of the offspring will have green and wrinkled seeds

4. Which of the following combination of alleles could not occur within gametes from the F1 generation?

- a. YR
- b. Yy
- c. Yr
- d. yR
- e. yr

Questions number **5 through 7** refer to the information provided below:

Consider the following breeding experiment in fruit flies.

- Absence of hair on the legs is the wild type dominant phenotype (h^+) / recessive mutant phenotype is hairy legs (h)
- Smooth wings is the wild type dominant phenotype (n^+) / recessive mutant phenotype is notched wings (n)

A test cross is carried out where a heterozygote for these two characteristics ($h^+h n^+n$) is mated with an organism that is a double mutant (i.e., homozygous recessive) for both characteristics. Four combinations of phenotypes (labeled as A, B, C, and D below) appear in the offspring:

- A. absence of hair on the legs / smooth wings
- B. absence of hair on the legs / notched wings
- C. hairy legs / smooth wings
- D. hairy legs / notched wings

5. Which of the above phenotypes are considered recombinant phenotypes?

- a. A and B
- b. A and C
- c. B and C
- d. C and D
- e. B and D

6. Which of the following statements would support the hypothesis that these two genes are linked?

- a. the frequency of total offspring with phenotype A is greater than the frequency of offspring with phenotype D
- b. the frequency of total offspring with phenotype B is less than the frequency of offspring with phenotype A or D
- c. the frequency of total offspring with phenotype B is greater than the frequency of offspring with phenotype D
- d. the frequency of total offspring with phenotype A is equal to the frequency of offspring with phenotype D

7. Assume that the genes for the two characteristics referred to above are linked. If an organism that is heterozygous for the two characteristics has both wild type alleles on one chromosome and both mutant alleles on the homologous chromosome, which of the following genotypes are possible for gametes produced by this parent assuming recombination takes place?

- a. $h^+ n^+$
- b. $h n$
- c. $h^+ n$
- d. $h n^+$
- e. all of the above

8. Recombination of linked genes occurs by

- a. independent assortment of homologous chromosomes during meiosis
- b. crossing over between non-sister chromatids of a homologous pair of chromosomes
- c. crossing over between sister chromatids of a homologous pair of chromosomes

9. Genes A and B are linked on Chromosome I while genes C and D are linked on Chromosome II. The distance between A and B on Chromosome I is twice the distance between C and D on Chromosome II. If a test cross similar to that described above is carried out, which genes will yield the higher frequency of recombinant phenotypes?

- a. genes A and B
- b. genes C and D
- c. the frequency of recombinant phenotypes would be the same for A and B versus C and D

10. A DNA sample is analyzed and it is determined that 24% of the nucleotides contain the nitrogenous base thymine. What percentage are cytosine nucleotides?

- a. 48%
- b. 24%
- c. 52%
- d. 26%
- e. 12%

11. A single strand of DNA has the following base sequence (AGCTTAAGCA). What is the percentage of guanine nucleotides in the complementary strand of DNA?

- a. 5%
- b. 10%
- c. 20%
- d. 40%
- e. 50%