BB2920 Problem Set 6

Problem 1 (10 points) Is a trisomic organism best described as an aneuploid or a polyploid? Briefly explain.

Problem 2 (15 points) A woman with Turner syndrome is found to be color-blind (an X-linked recessive phenotype). Both her mother and her father have normal vision.

a. Which parent carried the mutation for colorblindness? Briefly explain.

b. Is it possible to distinguish whether the nondisjunction event that resulted in Turner syndrome occurred in the father or the mother? Briefly explain.

c. Is it possible distinguish whether the abnormal chromosome behavior occurred at the first or second division of meiosis? Briefly explain.

Problem 3(20 points) You identify a population of mice (*Peromyscus maniculatus*) on an island. Their coat color is controlled by a single gene: *BB* mice are black, *Bb* mice are gray, and *bb* mice are white. You take a census of the population and record the following numbers of mice.

|  |  |  |
| --- | --- | --- |
|  | Black | 200 |
|  | Gray | 160 |
|  | White | 40 |

a) What are the frequencies of the two alleles?

b) What are the Hardy-Weinberg equilibrium frequencies for these three phenotypes?

c) A heat wave hits the island. All 200 mice with black fur die from heat stroke, but the other mice survive. What are the new allele frequencies for the population?

d) If the population suffers no further cataclysms after the heat wave, and the surviving animals mate randomly, what will be the frequency of mice with black fur in the next generation?

Problem 4 (15 points) Consider a population where 64% of the people are blue-eyed (a homozygous recessive trait) and the population is in Hardy-Weinberg equilibrium. Show your calculations for the questions below:

a) What are the allele frequencies of the recessive (blue) and dominant (brown) alleles?

b) What is the percentage of heterozygotes in the population?

c) What is the percentage of brown-eyed individuals in the population?

Problem 5 (25 points) The frequency of the recessive allele that causes phenylketonuria (PKU, and autosomal recessive condition) is about 0.01 in European and American populations. (Assume HW equilibrium).

a) What is the estimated heterozygote frequency in these populations? (Assume that people mate randomly with respect to PKU, and that the mutant allele does not have any effects on fitness.)

A man whose maternal aunt has PKU marries a woman with no known family history of PKU.

b) Draw the relevant pedigree for this family.

c) Calculate the probability that this man and woman will have a child affected by PKU. (Remember, we are given the recessive allele frequency! Do not assume the mother of the unborn child is not a carrier!) Show all of your work!

Problem 6 (15 points): Suppose that you are a genetic counselor, and a couple seeks your advice about BHT tasting. People who can taste BHT in processed food are recessive homozygotes for the “taster” allele (t/t) and nontasters are homozygous dominant or heterozygous for the “nontaster” allele (T/t or T/T). Both prospective parents are nontasters, but a careful analysis of the husband’s pedigree reveals that he is a carrier of the taster allele. The two alleles are in Hardy-Weinberg equilibrium, and the proportion of BHT tasters in the population is 16 percent. What is the probability that the couple’s first child will be a *nontaster* of BHT? Show your work.