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**AP Biology: Human Genetics Exam Review Questions** Mr. Collea

**Ch. 14 - Multiple Choice**

**\_\_\_\_1. \_\_\_\_ 6. \_\_\_\_ 11. \_\_\_\_ 16. \_\_\_\_ 21.**

**\_\_\_\_2. \_\_\_\_ 7. \_\_\_\_ 12. \_\_\_\_ 17. \_\_\_\_ 22.**

**\_\_\_\_3. \_\_\_\_ 8. \_\_\_\_ 13. \_\_\_\_ 18. \_\_\_\_ 23.**

**\_\_\_\_4. \_\_\_\_ 9. \_\_\_\_ 14. \_\_\_\_ 19. \_\_\_\_ 24.**

**\_\_\_\_5. \_\_\_\_ 10. \_\_\_\_ 15. \_\_\_\_ 20. \_\_\_\_ 25.**

**\_\_\_\_ 26.**

**1.** A man with hemophilia (a recessive, sex-linked condition) has a daughter of normal phenotype. She marries a man who is normal for the trait. What is the probability that a daughter of this mating will be a hemophiliac? A son? If the couple has four sons, what is the probability that all four will be born with hemophilia?

**2.** Pseudohypertropic muscular dystrophy is a disorder that causes gradual deterioration of the muscles. It is seen only in boys born to apparently normal parents and usually results in death in the early teens.

**(a)** Is pseudohypertrophic muscular dystrophy caused by a dominant or recessive allele?

**(b)** Is its inheritance sex-linked or autosomal?

**(c)** How do you know? Explain why this disorder is always seen in boys and never girls.

**3.** Red-green color blindness is caused by a sex-linked recessive allele. A color-blind man marries a woman with normal vision whose father was color-blind.

**(a)** What is the probability that they will have a color-blind daughter?

**(b)** What is the probability that their first son will be color-blind?

*(Note: the two questions are worded a bit differently.)*

**4.** A wild-type fruit fly (heterozygous for gray body color and normal wings) was mated with a black fly with vestigial wings. The offspring had the following phenotypic distribution:

wild type = **778**

black / vestigial = **785**

black /normal = **158**

gray / vestigial = **162**.

What is the recombination frequency between these genes for body color and wing type?

**5.** In another cross, a wild-type fruit fly (*heterozygous for gray body color and red eyes*) was mated with a black fruit fly with purple eyes. The offspring were as follows:

wild-type = **721**

black / purple = **751**

gray / purple = **49**

black / red = **45**

**(a)** What is the recombination / crossover frequency between these genes for body color and eye color?

**6.** A space probe discovers a planet inhabited by creatures who reproduce with the same hereditary patterns as those in humans. Three phenotypic characters are: height (**T** = tall, **t** = dwarf), hearing appendages

(**A** = antennae, **a** = no antennae) nose morphology (**S** = upturned snout, **s** = downturned snout).

Since the creatures were not "intelligent" Earth scientists were able to do some controlled breeding experiments, using various heterozygotes in testcrosses.

For a tall heterozygote with antennae, the offspring were:

tall-antennae = **46**

dwarf-antennae = **7**

dwarf-no antennae = **42**

tall-no antennae = **5**

For a heterozygote with antennae and an upturned snout, the offspring were:

antennae-upturned snout = **47**

antennae-downturned snout = **2**

no antennae-downturned snout = **48**

no antennae-upturned snout = **3**

**(a)** Calculate the recombination / crossover frequencies for both experiments.

**7.** Using the information from problem 6, a further testcross was done using a heterozygote for height and nose morphology. The offspring were:

tall-upturned nose = **40**

dwarf-upturned nose = **9**

dwarf-downturned nose = **42**

tall-downturned nose = **9**.

**(a)** Calculate the recombination / crossover frequency from these data

**(b)** Use your answer from #6 to determine the correct sequence of the three linked genes.

**8.** What pattern of inheritance would lead a geneticist to suspect that an inherited disorder of cell metabolism is due to a defective mitochondrial gene?

**9.** Determine the sequence of genes along a chromosome based on the following recombination frequencies:

A-B = 8 map units A-C = 28 map units;

A-D = 25 map units B-C = 20 map units B-D 33 map units.

**10.** In Drosophila, the gene for white eyes and the gene that produces "hairy" wings have both been mapped to the same chromosome and have a crossover frequency of 1.5%. A geneticist doing some crosses involving these two mutant characteristics noticed that in a particular stock of flies, these two genes assorted independently; that is they behaved as though they were on different chromosomes. What explanation can you offer for this observation?

**11.** In pea plants, green color is dominant to albino. If we cross two pea plants that are heterozygous for

color, what would be the expected phenotype ratio of the offspring?

In the space below, do the Punnett square and write the EXPECTED phenotypic ratios.

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| --- | --- |
|  |  |
|  |  |

EXPECTED Phenotypic Ratios:

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Let’s say that you actually did cross two heterozygous pea plants and obtain the following data:

OBSERVED Phenotypic Ratios = **72** Green / **12** Albino

**(a)** Using the formula below to calculate a Chi-Square value for this data.

X2 = Σ

(observed – expected)2

expected

**(b)** Use the Chi-Square Table below and find out if you **ACCEPT** or **REJECT** the null hypothesis. (*Can the difference between what was observed and what was expected be explained by chance at a 95% (p = 0.05) confidence interval.*)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CHI-SQUARE TABLE** | | | | | | | | |
|  | **Degrees of Freedom** | | | | | | | |
| **p** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **0.05** | 3.85 | 5.99 | 7.82 | 9.49 | 11.07 | 12.59 | 14.07 | 15.51 |
| **0.01** | 6.64 | 9.32 | 11.34 | 13.28 | 15.09 | 16.81 | 18.48 | 20.09 |

***Remember that the Chi-Square value is a measure of the difference between the observed and expected numbers. We are using it to test whether the observed and expected numbers are close enough to accept the null hypothesis (that chance alone can explain the difference) or so far apart that the null hypothesis must be rejected and something else is going on.***

**12.** In pea plants, yellow seed color is dominant to green seed color and round shape seeds are dominant over wrinkled shape seeds. If we cross two pea plants that are heterozygous for color and shape, what would be the expected phenotype ratio of the offspring?

In the space below, do the Punnett square and write the EXPECTED phenotypic ratios along with the total number out of **556** seeds you would EXEPECT to show each of the phenotypes.

|  |  |  |  |
| --- | --- | --- | --- |
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**Expected Phenotype:**

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Let’s say that we actually did this dihybrid cross and obtained the following data:

**Observed Phenotype:** **315** Round, Yellow Seeds

**108** Round, Green Seeds

**101** Wrinkled, Yellow Seeds

**32** Wrinkled, Green Seeds

**(a)** Using the formula below and the table from **#13** to calculate a Chi-Square value for this data and determine if the observed data fits the expected ratio and any difference between what is observed and what is expected can be explained by chance alone **OR** *is something else going on here*.

X2 = Σ

(observed – expected)2

expected