**AP BIOLOGY REVIEW – DAY 4**

**GENETICS, MUTATIONS, BIOTECHNOLOGY, GENE REGULATION**

1. List the tools and techniques of DNA technology......................................................................................................................
   1. Explain the use of restriction enzymes in both RFLP analysis and recombinant DNA technology
   2. How can DNA be sequenced? .......................... Amplified? ...................... Analyzed?.........................................
2. Describe the three major types of mutations.
   1. .......................................
   2. .......................................
   3. .......................................
3. Describe three causes of mutations
   1. .......................................
   2. .......................................
   3. .......................................

You cross a true-breeding yellow-bodied, smooth-winged female fly with a true-breeding red-bodied, crinkle-winged male. The red body phenotype is dominant to the yellow body phenotype and smooth wings are dominant to crinkled wings. Use ***B*** or ***b*** for body color alleles, and ***W*** or ***w*** for wing surface alleles.

1. What are the genotypes of the P generation flies?

1. What will be the genotype(s) and phenotype(s) of the F1 offspring?

1. You discover that the genes for body color and wing surface are linked. You perform a dihybrid test cross between the F1 flies from part (b) with a true-breeding yellow-bodied, crinkle-winged fly. Use the following F2 results to determine the recombination frequency (%) between the body color and wing surface genes. (Remember that the recombinants are the ones that do not resemble the parental types from the P generation.)

|  |  |  |
| --- | --- | --- |
| Body Color | Wing Surface | # of Individuals |
| red | smooth | 102 |
| yellow | smooth | 404 |
| red | crinkled | 396 |
| yellow | crinkled | 98 |

You decide to turn your attention to a different gene, one that controls wing length. This gene has two alleles, "L or l" where long wings are dominant to short wings. Remember that the red body phenotype is dominant to the yellow body phenotype. You again mate two true-breeding flies:

P: red-bodied, short wing male X yellow-bodied, long wing female

F1: All red-bodied, long wing

1. You perform a test cross between the F1 flies above with true-breeding yellow-bodied, short-winged flies. You get the following F2 results. What is the recombination frequency (%) between the genes for body color and wing length?

|  |  |  |
| --- | --- | --- |
| Body Color | Wing Length | # of Individuals |
| red | long | 45 |
| red | short | 460 |
| yellow | long | 440 |
| yellow | short | 55 |

1. Based on the information in (c) and (d), what are the two possible arrangements of these three genes: body color, wing surface and wing length? Draw two linkage maps to show the possible arrangements of these genes and the map distance between genes.
2. **Draw and Label:** the lac operon in bacteria
3. **Draw and Label:** a T chart comparing prokaryotic and eukaryotic genes and regulation of gene expression
4. DNA fingerprinting is a method used to identify individuals by locating unique base sequences in their DNA molecules. Before researchers refined the method, attorneys often relied on ABO blood-typing to settle disputes over paternity. Suppose that you, as a geneticist, are asked to testify during a paternity case in which the mother has type A blood, the child has type O blood, and the alleged father has type B blood. How would you respond to the following statements?

* 1. Attorney for the alleged father: “The mother’s blood is type A, so the child’s type O blood must have come from the father. My client has type B blood; he could not be the father.”

* 1. Mother’s attorney: “Further tests show that the man is heterozygous. Therefore, he must be the father.”

1. John can roll his tongue and is heterozygous for this dominant trait (*Rr*). John’s second toe is shorter than his first. His wife Rita cannot roll her tongue and has a longer second toe. Rita is heterozygous for this dominant trait (*Tt*). Use a Punnett square to predict the possible genotype(s) and phenotype(s) of their first child.
2. Red-green color blindness is a recessive, X-linked condition. A color-blind man marries a woman who is a carrier for color-blindness. What is the probability that they will have color-blind sons? What is the probability of color-blind daughters?

1. Wisconsin Fast Plants have two very distinctive visible traits (stems and leaves). Each plant will either have a purple (P) or green (p) stem and also have either have green (G) or yellow (g) leaves. Suppose that we cross a dihybrid heterozygous plant with another plant that is homozygous purple stem and heterozygous for the leaf trait.
2. Make a Punnett square to figure out the expected ratios for the phenotypes of the offspring.
3. Suppose a class observed that there were 234 plants that were purple stem/green leaves and 42 that were purple stem/yellow leaves. Does this provide good evidence against the predicted phenotype ratio? Use Chi Square analysis to determine your answer.
4. Using your understanding of genetics, what might be one reason why the class got these results?
5. In a heterozygous, heterozygous dihybrid cross, the following data was obtained: dominant for both traits: 570; dominant for trait 1, recessive for trait 2: 185; recessive for trait 1, dominant for trait 2: 190; recessive for both traits: 55. Perform Chi-square analysis to determine if the data agrees with the predicted outcome of this cross.