E - Bio Worksheet

Introduction To Mendelian Monohybrid Genetics

1. In one of Gregor Mendel's crosses a female plant homozygous smooth for the pod coat was crossed with a plant having a homozygous wrinkled coat. It is known that smooth pod coat is dominant to wrinkled coats. Following this cross two of the F1 generation were crossed resulting in an F2 generation.
   (A) If the male parent is homozygous for wrinkled seeds, what kind of gene will be present in each sperm cell ?
   (B) The female parent is homozygous for smooth seeds, what kind of gene will each egg contain?
   (C) What is the genotype of the plants in the F1generation?
   (D) What is the phenotype of the F1 plants?
   (E) What is the genotype ratio of the F2 generation?
   (F) What is the phenotype ratio of the F2 generation?
   (G) What are the phenotype and genotype ratios of a cross between the homozygous smooth parent and one of the F1 plants ?
   (H) What are the phenotype and genotype ratios of a cross between the homozygous wrinkled parent and one of the F1 plants ?

2. Mendel crossed parent plants to analyze the position of the flowers. Axial flowers grow along the stem while terminal flowers grow at the tips of the stem. A homozygous dominant axial plant is crossed with a homozygous recessive terminal plant.
   (A) Diagram the cross resulting in the F1 generation?
   (B) What is the possibility of obtaining a homozygous plant in this generation? Why or why not?
   (C) What is the possibility of obtaining a heterozygous plant in this generation ? Why or why not?
   (D) What is the possibility of obtaining a terminal plant in the F2 generation?
   (E) What is the possibility of obtaining an axial plant in the F2 generation ?

3. In snapdragons, red flower color is incompletely dominant to white flower color, the heterozygous condition being pink. A red flowered plant is crossed with a white one.
   (A) Diagram the cross resulting in the F1 generation.
   (B) What is the probability of obtaining a white or red plant in the F1 generation? Explain.
   (C) What is the probability of obtaining a pink plant?
   (D) What is the probability of obtaining a white or red plant in the F2 generation?
   (E) What would be the genotype and phenotype ratios of the F2 generation?

4. In Andalusian fowls, the heterozygous condition for the alleles of black plumage and white plumage is blue plumage. What offspring will a blue Andalusian rooster have if bred to birds of the following plumage (A) black (B) blue (C) white
   (A) **Diagram the three crosses**. List the probability of each of the three types of plumage occurring as a result of each cross.

5. In the shorthorn breed of cattle, the red and white coat colors are codominant with each other with the resulting heterozygous condition being roan. A breeder has some white, some roan and some red cattle and a roan bull.
   (A) What color cow would be bred to the bull to guarantee the best chance of having red offspring? Explain by showing your cross.
   (B) What is the probability of a white cow crossed with the bull resulting in a red calf? Explain by showing your cross.
   (C) Is there any possible way that the farmer can guarantee that no roan animals will appear through breeding his current stock ?
   (D) What is one possible way that the farmer can guarantee having all white offspring by going outside of his breeding stock ?

6. A pet store owner mated two guinea pigs with the following results
   22 black offspring
   5 white offspring
   He then mated two of the black offspring and got the following results:
   16 black offspring
   3 white offspring
   (A) What is the genotype of the parents used in the first cross?
   (B) What is the genotype of the parents used in the second cross?
   (C) What is the chance of obtaining a totally homozygous offspring in the second cross?
   (D) If a white offspring was crossed with the original parents, what would be the probability of obtaining white offspring? What would be the chance of obtaining a homozygous black offspring ?

7. For Dalmation dogs the spotted condition is dominant to non-spotted.A spotted female Dalmation dog mates with an unknown father. From the appearance of the pups, the owner concludes that the male was a Dalmation. The owner notes that the female had six pups, three spotted and three non-spotted. What is the phenotype of the unknown male?

8. Two black female mice are crossed with a brown male. In several litters female #1produced 9 black and 7 brown mice; female #2 produced 17 blacks. What deductions can you make concerning inheritance of black and brown coat color in mice. What are the genotypes of the parents in this case?

9. A purple flowered Jimsen weed when self-fertilized gives thirty purple-flowered and nine white-flowered offspring. What can you conclude from this as to the inheritance of flower color in this species? What proportion of the purple flowered offspring may be expected to breed true to purple ?

10. Two white-fruited squash plants when crossed produce about three-fourths white and one-fourth yellow offspring. What are the genotypes of the two parents? What will each produce if crossed with a yellow-fruited plant ?

11. Two rough coated guinea pigs were bred together produce eighteen rough and four smooth offspring. What proportion of the rough offspring may be expected to be homozygous for the trait?

12. Here is one for the Star Trek fans. In tribbles coat texture is an inherited trait with two phenotypes known to occur as follows:1) stiff; 2) soft short fine hairs. As a geneticist, you are doing the following cross: male parental phenotype is soft short fine hairs; female parental phenotype is stiff bristles. In looking at the offspring of these matings you note that all F1are show stiff bristles. Were the parents heterozygous or homozygous? Which is the dominant allele? Are the F1 heterozygous or homozygous? If you now mate males to females within the F1 generation, what would expect the phenotype ratio to be?

13. In Venetian violets three phenotypes occur with respect to flower color: a deep violet - almost black(Midnight); a white; a pale lavender. Two pale lavendar flowered individuals have been crossed. The F1 from this cross has individuals with pale lavender flowers but also individuals with Midnight flowers and individuals with white flowers. What would the expected phenotype ratio be in these F1 plants? Indicate the genotypes for flower color.

14. A woman has a rare abnormality of the eyelids called ptosis, which makes it impossible for her to open her eyes completely. The condition is caused by the single dominant gene (P). The woman's father had ptosis, but her mother had normal eyelids. Her father's mother had normal eyelids. (A) What are the probable genotypes of the woman, her father and mother ? (B) What proportion of her children will be expected to have ptosis if she marries a man with normal eyelids ?