**Genetics Intervention**

**Vocabulary:** Define the following terms on a separate piece of paper.

- allele
- autosome
- chromosome
- codominance
- dihybrid
- diploid
- dominant gene
- gamete
- haploid
- heterozygous
- homozygous
- incomplete dominance
- pedigree chart
- phenotype
- polygenic inheritance
- Punnett square
- recessive gene
- sex linked trait

**Simple Genetics Practice:** Solve the following problems.

1. For each genotype below, indicate whether it is **heterozygous (Het)** or **homozygous dominant (Hom. Dom.)** or **homozygous recessive (Hom. Rec.)**

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Heterozygous</th>
<th>Homozygous Dominant</th>
<th>Homozygous Recessive</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ee ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ii _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mm _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bb _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ff ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jj _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nn _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cc _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gg ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kk _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oo _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD _____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LL ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pp _____</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. For each of the **genotypes** below determine what **phenotypes** would be possible.

*Purple flowers are dominant to white flowers.*

- FF __________________
- Ff __________________
- ff  __________________

*Brown eyes are dominant to blue eyes*

- BB __________________
- Bb __________________
- bb  __________________

*Round seeds are dominant to wrinkled seeds.*

- RR __________________
- Rr __________________
- rr  __________________

*Bobtails in cats are recessive to long tail*

- TT __________________
- Tt __________________
- tt  __________________

3. For each **phenotype** below, list the **genotypes** (remember to use the letter of the dominant trait)

*Straight hair is dominant to curly.*

- ____ straight
- ____ straight
- ____ curly

*Pointed heads are dominant to round heads.*

- ____ pointed
- ____ pointed
- ____ round
**Monohybrid Crosses:** predicting the outcome of offspring ratios using only one trait.

4. A TT (tall) plant is crossed with a tt (short plant). Complete the Punnett Square.

What percentage of the offspring will be tall? ______

5. In pea plants purple flowers are dominant to white flowers. A white flowered plant is crossed with a plant that is heterozygous for the trait. Complete the Punnett Square.

What percentage of the offspring will have purple flowers?______

6. In guinea pigs, the allele for short hair is dominant.
   a. What genotype would a heterozygous short haired guinea pig have? ______
   b. What genotype would a pure breeding short haired guinea pig have? ______
   c. What genotype would a long haired guinea pig have? ______
   d. Show the cross for two heterozygous guinea pigs.
   e. What percentage of the offspring will have short hair? ______
   f. What percentage of the offspring will have long hair? ______

7. Two short haired guinea pigs are mated several times. Out of 100 offspring, 25 of them have long hair. What are the probable genotypes of the parents?

________ x __________

**Show the cross to prove it!**
Dihybrid Crosses: Read the passages and identify the genotypes of both parents. Then use the FOIL method to predict all possible gamete allele combinations. Do a Punnett square to find the phenotypic and genotypic ratios of the offspring.

8. In a breed of dogs, Brown fur is dominant and yellow fur is recessive. In addition, they can have fluffy tails, which is dominant or thin haired tails, which is recessive. If you cross a Mom heterozygous brown fur dog with a heterozygous fluffy tail and a Dad homozygous brown dog with a homozygous recessive tail. What are all the possible allele combinations for Mom and Dad? What would the children look like?

Mom Genotype: ___________________   Dad Genotype: ___________________
Mom Gametes: ____   ____   ___   ___   Dad Gametes: ____   ____   ____   ___

Genotype ratios:   Phenotype ratios:

9. Pansies can grow to be tall, which is dominant to short, which is recessive. They can also be Red, which is dominant, or white, which is recessive. If you cross a completely recessive female with a completely dominant male, what are all the possible allele combinations for Mom and Dad?

Mom Genotype: ___________________   Dad Genotype: ___________________
Mom Gametes: ____   ____   ___   ___   Dad Gametes: ____   ____   ____   ___

Genotype ratios:   Phenotype ratios:
Complex Genetics: Incomplete, Codominance and Multiple Alleles

10. A cross between a purebred animal with red hairs and a purebred animal with white hairs produces an animal that has both red hairs and white hairs.

   a. What type of inheritance pattern is involved?
   
   b. Draw a Punnett Square to show the cross mentioned above.

   

   c. Draw a Punnett Square to show the cross of two F₁ offspring.

   

   d. What are the genotypic ratios of the F₂ offspring?

   

   e. What are the phenotypic ratios of the F₂ offspring?

11. A red-flowered sweet pea plant is crossed with a white-flowered sweet pea plant. All of the offspring are pink.

   a. What type of inheritance pattern is involved?
   
   b. Draw a Punnett Square to show the cross mentioned above.

   

   c. Draw a Punnett Square to show the cross of two F₁ offspring.

   

   d. What are the genotypic ratios of the F₂ offspring?

   

   e. What are the phenotypic ratios of the F₂ offspring?
12. Cross a heterozygous B woman with an AB man.
   a. What type of inheritance pattern is involved?
   b. What are the parents’ genes?
   c. What gametes will come from each parent?
   d. Draw a Punnett Square for the cross.
   e. What are the genotype ratios of the offspring?
   f. What are the phenotype ratios of the offspring?

13. Cross a homozygous A woman with a heterozygous B man.
   a. What type of inheritance pattern is involved?
   b. What are the parents’ genes?
   c. What gametes will come from each parent?
   d. Draw a Punnett Square for the cross.
   e. What are the genotype ratios of the offspring?
   f. What are the phenotype ratios of the offspring?

14. If a child has type O blood and one parent in heterozygous for type B blood, what are the possibilities for the other parent’s genotype? Show the crosses to prove it!!
Complex Genetics: Sex-Linked Traits

Directions: Complete the following problems by doing the punnett square for each cross and answering the question(s) asked.

15. Complete a punnett square for the cross between a human female (XX) and a human male (XY). What is the chance that the parents will have a girl?

![Punnett Square]

16. If the same parents have four boys, what is the probability their fifth child will be a girl? Why?

17. Hemophilia is a recessive sex-linked disease carried on the X chromosome in humans.
   a. Write the genotype of a woman who does not have hemophilia. _______
   b. Write the genotype of a woman with hemophilia. _________
   c. Write the genotype of a woman who is a carrier (heterozygous) for hemophilia. __________
   d. Write the genotype of a man who has hemophilia. _________
   e. Write the genotype of a man who does not have hemophilia. __________
   f. A woman who is heterozygous for hemophilia marries a normal male. What are the possible phenotypes of their children? **Show the Punnett Square!**

![Punnett Square]

g. A woman who is a carrier for hemophilia marries a man with hemophilia. Could any of their children have hemophilia? If so, would the child be male or female? **Show the Punnett Square(s)!**

![Punnett Square(s)]
18. The pedigree below shows the inheritance of attached earlobes for four generations.

![Pedigree Diagram]

a. Is the trait for attached earlobes versus free earlobes dominant or recessive?

b. How do you know?

19. The pedigree shows the inheritance of colorblindness, a sex-linked trait.

![Pedigree Diagram]

a. Is the trait for colorblindness dominant or recessive?

b. How do you know?

c. Is the mother of the colorblind girl in the F4 generation colorblind, a carrier or a person with normal vision? Explain your answer.