DRAFT - Chromosome Connections Kit©: Constructing Punnett Squares Student Answer Sheet

Date: _____ Student Name: _____

Modes of Inheritance: Sickle Cell Disease - An Example of Recessive Inheritance

1. Compare the maternal (red) and paternal (blue) DNA beta-globin gene sequences and identify any differences.

2. Use the mRNA codon chart to determine for which amino acid **GAG** is the code. _____
3. **GTG** (mRNA codon **GUG**) is the DNA code for what amino acid? _____
4. Given what you have read in the introduction, which chromosome, maternal or paternal contains the mutation for sickle cell disease? _____
5. What are each of their amino acid properties? _____
_____
6. How might this affect the resulting protein? _____
_____
_____
7. If the chromosomes you just constructed were in the same cell, what would be the person's phenotype for sickle cell disease? Explain your answer. _____
_____
8. Construct a traditional Punnett square to show a cross between two carrier parents using capital **S** for the dominant normal beta-globin allele and a lower-case **s** to represent the recessive sickle cell allele.

	S	**s**
S		
s		

9. Complete the Punnett square writing in the DNA nucleotide sequences. The first square has been done for you.

	G – C A – T G – C	G – C T – A G – C
G – C A – T G – C	G – C A – T G – C G – C A – T G – C	
G – C T – A G – C		

10. What is the probability of a child with sickle cell disease from a cross of two heterozygous parents? How do you know?

11. What is the probability of a child that is a carrier from a cross of two heterozygous parents?

12. Write a definition of "allele". Provide an example of different allelic sequences using the sickle cell disease example. _____

_____

_____

13. Using the traditional Punnett square notation, write the cross between a heterozygous carrier parent and a homozygous affected parent. _____

14. Using the DNA sequences complete the Punnett square for a cross between a heterozygous carrier parent and a homozygous affected parent.

15. What is the probability of a child with sickle cell disease from this cross? Circle the offspring with sickle cell disease in the Punnett square you have completed.

16. Using the traditional Punnett square notation, write the cross between a homozygous normal parent and a homozygous affected parent. _____

17. Using the DNA sequences construct the Punnett square for a cross between a heterozygous carrier parent and a homozygous affected parent.

18. What is the probability of a child with sickle cell disease from this cross? Circle the offspring with sickle cell disease in the Punnett square you have completed.

Modes of Inheritance: Huntington Disease - An Example of Dominant Inheritance

19. Using traditional Punnett square notation where capital **H** represents the dominant Huntington disease allele and lower-case **h** represents the recessive normal huntingtin allele**,** write the cross between a heterozygous affected parent and a homozygous normal parent. _____

20. Construct a Punnett square using the traditional notation.

21. Using the DNA sequences construct the Punnett square for a cross between a parent that is heterozygous for Huntington disease where the affected chromosome shows a **CAG** repeat of **<u>75 times</u>** and a homozygous normal parent.

22. What is the probability of having an unaffected child? _____

23. Circle the offspring in the Punnett square that will be affected with Huntington disease.

Modes of Inheritance: Hemophilia - An Example of Sex-linked Inheritance

24. Using the notation indicated, write the genotypes for each of the following individuals:

    A female that carries the hemophilia allele _____

    A homozygous non-hemophilia female _____

    A non-hemophiliac male _____

    A hemophiliac male _____

    A hemophiliac female _____

25. Why are there no carrier males? _____

_____

26. Use the Genetic Codon Chart© to determine the amino acid change that has occurred in the F8 gene. _____

27. Using the DNA sequences and Y chromosome construct the Punnett square for a cross between a female who is heterozygous for hemophilia and a non-hemophiliac male.

28. What is the probability of having a male child with hemophilia? _____

29. What is the probability of having a female child that is a carrier of hemophilia? _____

30. Explain why male children are more likely to be affected by X-linked genetic conditions.

_____

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