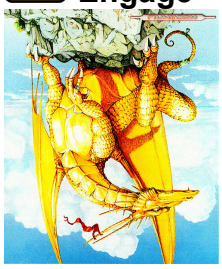
Lesson 6.7	Dragon Genetics: Incomplete Dominance, Sex-linked, and Polygenic *Make Up Assignment*	**Name** **Date** **Period**

Key Terms		
Incomplete dominance	Autosome	Sex chromosome
Sex-linked traits	Polygenic inheritance	

While studying dragons, explorers came across different dragons that did not seem to follow Mendel's rules. They saw dragons with traits demonstrating incomplete dominance, codominance and polygenic inheritance

Engage


Yellow Dragonette

x


Blue drake

=


Green Offspring

How do you think it would be possible for a yellow dragon and a blue dragon to have a green dragon? Explain your thoughts.

Explore I: Incomplete Dominance

Incomplete dominance refers to offspring that appear to be a mix of the two parental varieties. It is not considered blending, due to the implication hybrid offspring would never have offspring with the original parent phenotypes. For example, cross a white snapdragon (flower) with a red snapdragon and get pink. Later crossing pink offspring will result in the return of white and red offspring.

Explain I

Refer to lesson 6.12.

1) Cross a purple drake with a dark olive dragonette.

A. Use 6.12 to determine alleles: __ = _____ and __ = _____

B. What phenotype will a heterozygote exhibit? _____

C. Show the cross __ __ x __ __

D. Complete the Punnett square

E. List genotypic ratios

♀

♂

F. List phenotypic ratios

2) Cross a dark olive drake with a bright green dragonette.

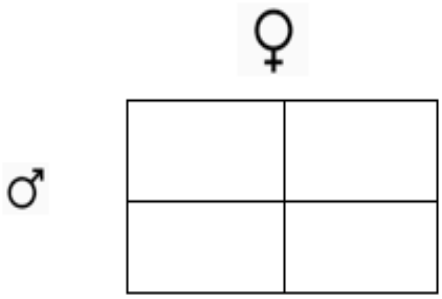
A. Assign Symbols (alleles): __ = _____ and __ = _____

B. What phenotype will a heterozygote exhibit? _____

C. Show the cross __ __ x __ __

D. Complete the Punnett square

E. List genotypic percentages



F. List phenotypic percentages

3) In your own words, explain incomplete dominance.

Explore II: Polygenic Inheritance

In **Polygenic Inheritance** "many" genes determine a trait. When learning about eye color, we typically compare Brown eyes (B allele) to Blue eyes (b allele). What about green, hazel and light brown eyes? How do we get that genetic combination? Take a look at the dragon genome worksheet and the genes for back spikes located on the C, J, and W. All three genes can contribute to the overall number of back-spikes on a dragon. If a dragon is homozygous dominant for all three genes, the maximum number of back spikes they can have is 6. If they are homozygous recessive for all three, they can have zero back spikes.

Explain II: Write down the number of back spikes for dragons with the following genotypes:

4) CcJjww _____
5) ccJJWw _____
6) CCJjWw _____

7) Mushu, a CCJJWW dragonette is crossed with a Pern drake, CcJjww. How many offspring will have each number of back spikes? *Hint: This is an example of a trihybrid cross. The best way to solve this is with three individual monohybrid crosses, one for each gene.*

CC x Cc = $^2/_4$ CC, $^2/_4$ Cc
JJ x Jj = $^2/_4$ JJ, $^2/_4$ Jj
WW x ww = $^4/_4$ Ww

To find out how many 6 spiked offspring you need CC x JJ x WW or $^2/_4$ x $^4/_4$ x 0 = 0. There are no 6 back spiked offspring. Now try find out how many have 5, 4, 3, 2, 1 or 0 back spikes. *Remember there are multiple gene combinations to give the same number of back spikes. CCJJww is the same number as CcJjWW. Both would be four.*

VIDEO REVIEW:
Please watch the You Tube video titled “Chromosomal Genetics” by Bozeman Biology, which can be found at http://www.youtube.com/watch?v=rIe7mPXkYhs ***OR on the class website*** with the resources under Lesson 6.6. As you watch, complete the following (attach more paper if needed):

- Non-Mendelian Genetics. Write a sentence discussing what you learn about non-mendelian genetics.

- Incomplete dominance: Write two sentences about Incomplete Dominance from the video. Then, sketch what you see on the screen during the description (except Mr. Andersen). USE COLOR!

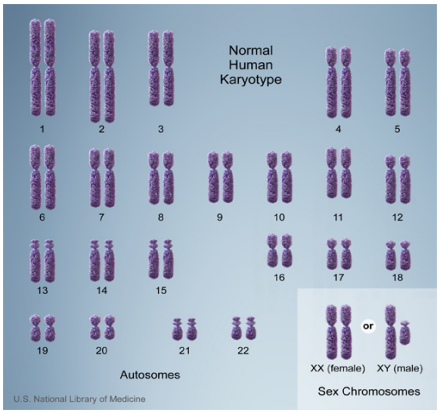
- Codominance: Write two sentences about Codominance from the video. Then, sketch what you see on the screen during the description (except Mr. Andersen). USE COLOR and just do your best to sketch the cow.

- What are multiple alleles? Give an example from the video.

- Write a few sentences about sex-linkage (sex-linked inheritance) – include who discovered it and how it affects inheritance.

- What example does Mr. Andersen use to demonstrate sex-linked inheritance in humans (which sex-linked trait does he show you a Punnett Square for)?

Explore III: Sex-linked inheritance



All genes on the sex chromosome are said to be **sex-linke**d. In humans the 23rd chromosome determines the sex of an individual (XY – male with one X chromosome and XX – female with two X chromosomes). The 23rd pair of chromosomes are called **sex chromosomes**. All other chromosomes, pairs 1 -22 are considered **autosomes**. Mostly males are affected by sex-linked disorders, frequently caused by recessive alleles. A male receives a single X-linked allele from his mother (Y from father), and will have the disorder, while a female has to receive the allele from both parents to be affected.

Hemophilia and colorblindness are examples of X-inked traits in humans. Use the Ameoba Sisters video "Punnett Squares & Sex Linked Inheritance" at https://www.youtube.com/watch?v=h2xufrHWG3E (link also on web site) to help you complete the following:

HEMOPHILIA (X-LINKED)

- **Alleles, Genotypes and Phenotypes for Hemophilia (Blood-Clotting Inability)**

  X^H – allele for normal blood clotting
  X^h – allele for hemophilia

♀
- _____ - genotype of normal, noncarrier female
- _____ - genotype of hemophiliac female
- _____ - genotype of carrier female (with normal blood-clotting ability, but carries the recessive allele and can pass it on to her children)

♂
- _____ - genotype of normal male
- _____ - genotype of hemophiliac male

8. A hemophiliac male (X^hY) marries a woman who is a carrier (X^HX^h). Make a Punnett square to predict the genotypes of their offspring. Then state the phenotypic ratios and percentages.

___/4 or ____% are normal females (include noncarrier and carrier)

___/4 or ____% are hemophiliac females

___/4 or ____% are normal males

___/4 or ____% are hemophiliac males

♂ \ ♀		

9. A hemophiliac female (X^hX^h) marries a normal male man (X^HY). Make a Punnett square to predict the genotypes of their offspring. Then state the phenotypic ratios and percentages.

___/4 or ____% are normal females (include noncarrier and carrier)

___/4 or ____% are hemophiliac females

___/4 or ____% are normal males

___/4 or ____% are hemophiliac males

♂ \ ♀		

RED-GREEN COLOR BLINDNESS (X-LINKED)

- **Alleles, Genotypes and Phenotypes for Color blindness**

X^N - allele for normal color vision
X^n - allele for color-blindness

♀
- _____ - genotype of normal, noncarrier female
- _____ - genotype of colorblind female
- _____ - genotype of carrier female (with normal color vision, but who can pass the colorblind allele to her children)

♂
- _____ - genotype of normal male
- _____ - genotype of colorblind male

10. A male with normal vision and a carrier female have children. Determine their genotypes and make a Punnett square to predict the genotypes of their offspring. Then state the phenotypic ratios and percentages.

___/4 or ____% are normal females (include noncarrier and carrier)

___/4 or ____% are colorblind females

___/4 or ____% are normal males

___/4 or ____% are colorblind males

♂ \ ♀		

11. In number 10, ***what percentage of females*** born are expected to be carriers?

12. A noncarrier female marries a colorblind male. Determine their genotypes and make a Punnett square to predict the genotypes of their offspring. Then state the phenotypic ratios and percentages.

___/4 or ____% are normal females (include noncarrier and carrier)

___/4 or ____% are colorblind females

___/4 or ____% are normal males

___/4 or ____% are colorblind males

♂ \ ♀		

13. In number 12, what ***percentage of females*** born are expected to be carriers?

Explain IV

1) If a human baby boy inherits a recessive allele from his mother, in which circumstance would he *most* likely show the trait coded for by the recessive allele?
    a) The baby inherits the dominant allele from his father.
    b) The allele is on the X chromosome.
    c) The allele is on the Y chromosome.
    d) The allele is on an autosomal chromosome and the baby is a twin.

2) A human male inherits
    a. an X-chromosome from his mother and a Y-chromosome from his father
    b. a Y-chromosome from his mother and an X-chromosome from his father
    c. an X-chromosome from his mother and an X-chromosome from his father
    d. a Y-chromosome from his mother and a Y-chromosome from his father

3) Most recessive sex-linked disorders are passed from mother to ____
    a) all children
    b) son
    c) daughter
    d) either son or daughter

4) The normal sex chromosomes of human males are ____, and the normal sex chromosomes of females are ____.
    a) XY, XX
    b) XX, XY
    c) X, Y
    d) Y, X

5) Which gamete determines gender (sex)?
    a. Egg
    b. Zygote
    c. Sperm
    d. None of the above

6) A red flower is crossed with a white flower. The first generation of flowers are pink. This demonstrates
    a. Incomplete dominance
    b. Codominance
    c. Polygenic inheritance
    d. Sex-linked inheritance

7) A dark brown horse and a white horse mate and produce offspring with areas of dark brown and areas of white. This is most likely an example of
    a. Incomplete dominance
    b. Codominance
    c. Polygenic inheritance
    d. Sex-linked inheritance

8) *In your own words,* explain the difference between an autosome and a sex chromosome.

9) *In your own words*, discuss the differences between Mendelian inheritance (simple dominant-recessive), codominance, and incomplete dominance.