How Sex-Linked, or X-Linked Traits are Inherited

Name_____Period_____Date_____

Purpose

To determine how X-linked traits are passed from parent to offspring

Background

Sex-linked genes are on the X and Y chromosomes. Traits controlled by these genes are called sex-linked traits. Two recessive X-linked traits include hemophilia and colorblindness. Hemophilia is a disorder where the blood clots slowly, or not at all. A person with one or two dominant alleles X^H has normal blood, and with the recessive allele X^h, the female would be a carrier and the male will have hemophilia.

Red and green colorblindness is a disorder where a person cannot see red and green colors correctly. A person with one or two dominant alleles X^C has normal vision, and with recessive allele X^c, the female would be a carrier and the male will be colorblind.

Both of these have been simplified for the purposes of this lab

Hypotheses

1. If a carrier Mom is crossed with a Healthy Dad, then daughters would be a carrier or normal, and sons would be normal or affected.
2. If a normal Mom is crossed with an affected Dad, then daughters would be a carrier, and sons would be normal.

Procedure

1. Keep in mind that only the X chromosome can carry the allele for colorblindness. A female can have genotypes of $X^c X^c$ or $X^C X^C$ or $X^C X^c$ and males $X^c Y$ or $X^C Y$
2. Print out the pogs and separate them by **X** and **Y**. Noting the parent combinations in the boxes, create a pile of those pogs that match the parents in your table. Flip over the pogs; draw a pair of parent pogs and record the resulting pair ***(you may tape & label coins if easier)***
3. Repeat step 2, 9 more times, recording your results. Repeat with the new allele combinations.

Results

Table 1. Cross of color blindness-carrier Mom & normal vision Dad

Parent Alleles **Mom $X^C X^c$ Dad $X^C Y$**	Offspring (tally for each result)	Qty. observed / % of total	**Phenotypes**
X^c X^c	XXXXXXXXXX	/	Colorblind female
X^C X^C	//	2 /20	Normal female
$X^C X^c$	////	4 /40	Normal female-carrier
$X^c Y$	//	2 /20	Colorblind male
$X^C Y$	0	/	Normal male
		10 / 100 %	

Table 2. Cross of Mom w/normal vision and colorblind Dad

Parent Allele **Mom $X^C X^C$ Dad $X^c Y$**	Offspring (tally for each result)	Qty. observed / % of total	**Phenotypes**
X^c X^c	XXXXXXXXXX	/	Colorblind female
X^C X^C	XXXXXXXXXX	/	Normal female
$X^C X^c$	//////	6 /60	Normal female-carrier
$X^c Y$	XXXXXXXXXX	/	Colorblind male
$X^C Y$	////	4 /40	Normal male
		10 / 100 %	

Conclusion

Complete your tables and answer these questions in the conclusion. Be specific and cite the reasons for your answers, with examples.

1. On which chromosomes are the alleles for sex-linked traits?

2. Describe a carrier of a trait in terms of genotype. Why can't a male be a carrier for an x-linked recessive trait?

3. How many alleles for color blindness must females have to be colorblind? How many must males have? Why is there a difference?

4. Which of the parents can pass the allele for colorblindness to a son? Explain.

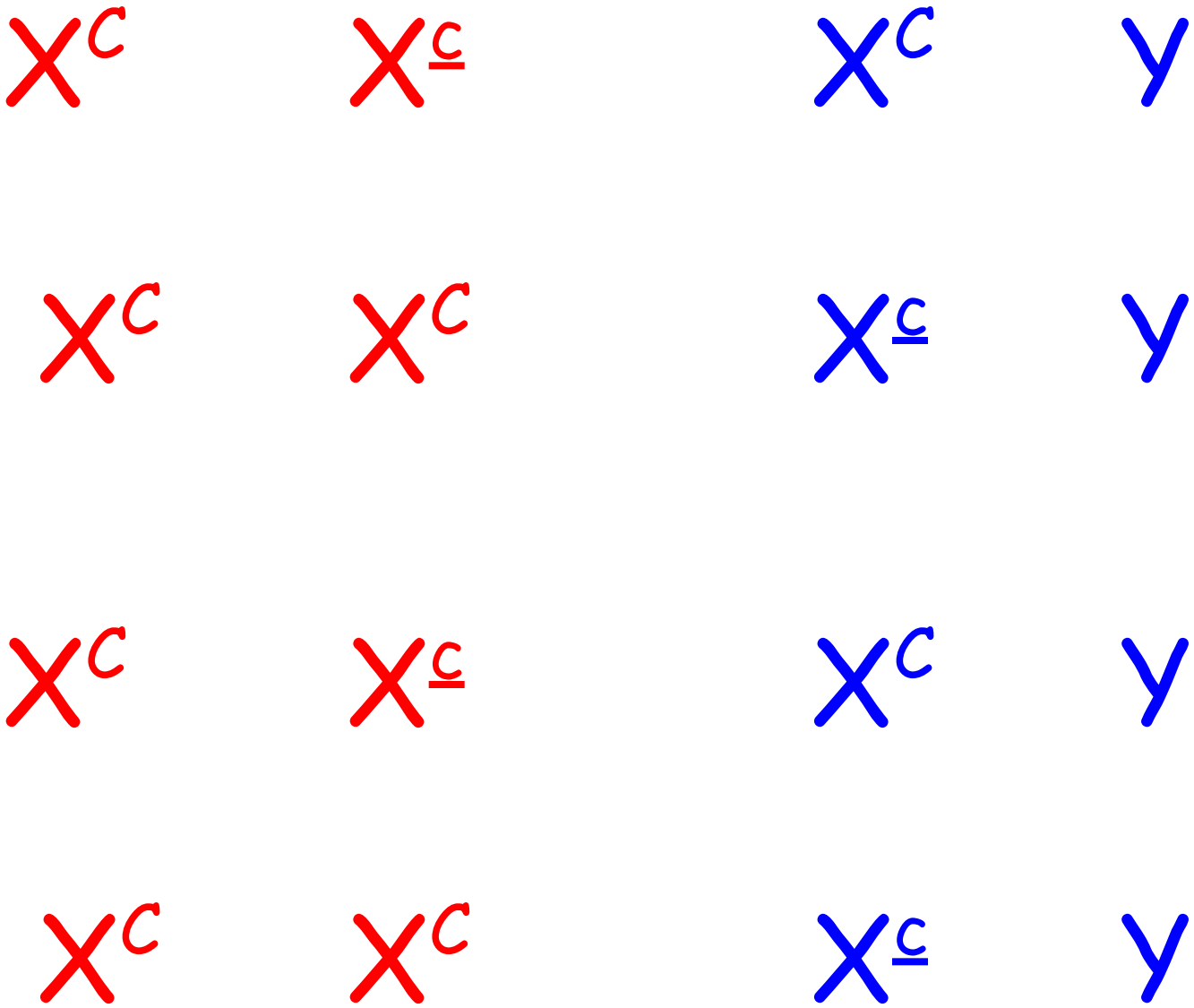
5. In the family of **table 2**, why are there no colorblind children even though the father is colorblind?

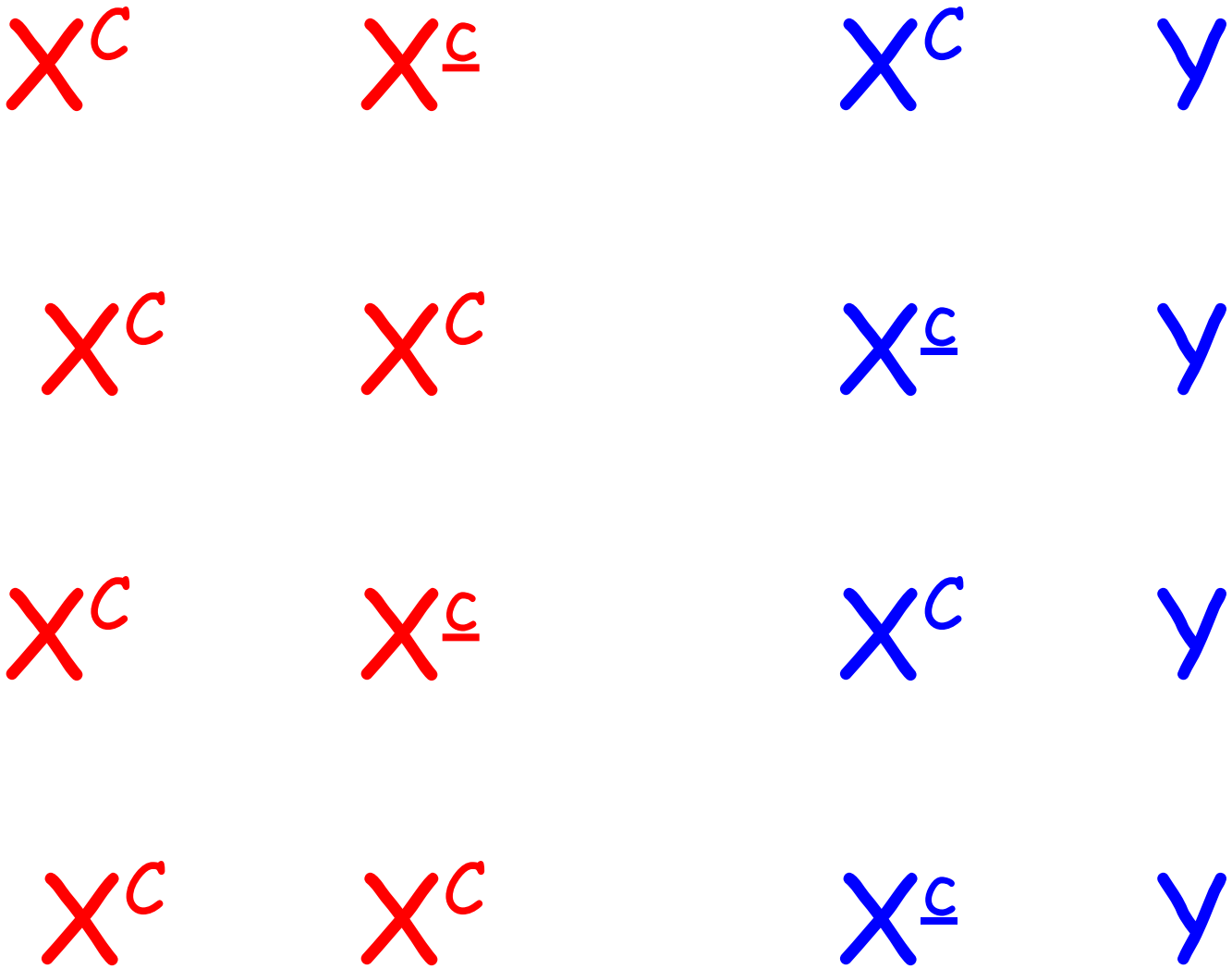
Extra Practice working with the sex-linked genetic disorder of hemophilia (h)

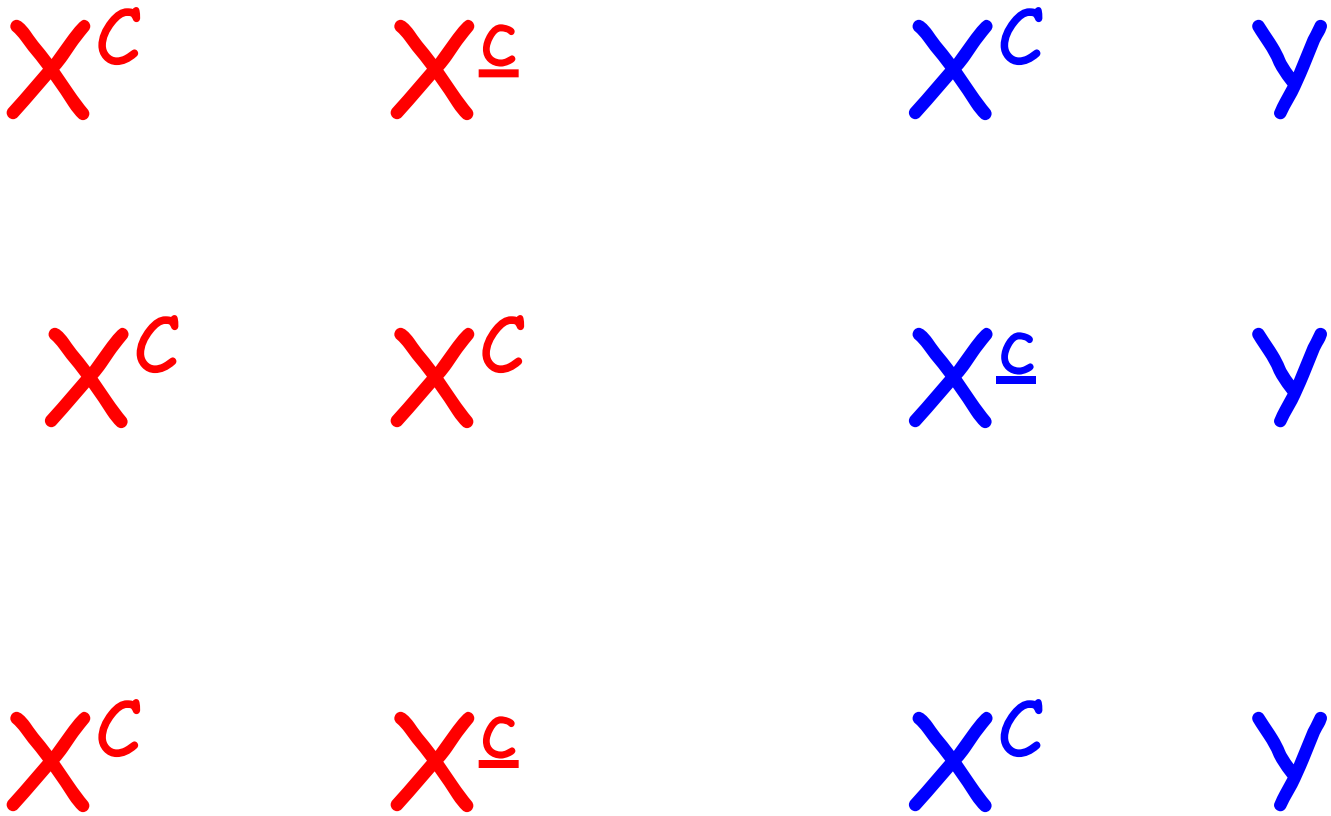
6. Parents have the following alleles for hemophilia: X^HX^h and X^HY. What is the probability that a son will have hemophilia? _____ That a daughter will have hemophilia? _____ Complete a Punnett square for this problem.

7. Parents have the following alleles for hemophilia: X^HX^h and X^hY. What is the probability that a son will have hemophilia? _____ That a daughter will have hemophilia? _____ Complete a Punnett square for this problem.

You can print these out & cut them into squares, or you can put tape on some chips/coins and label them with the possible genotype, or even use a marker on some coins.


X^C X^c X^C Y
X^C X^C X^c Y
X^C X^c X^C Y
X^C X^C X^c Y


X^C X^c X^C Y
X^C X^C X^c Y
X^C X^c X^C Y
X^C X^C X^c Y


X^C X^c X^C Y
X^C X^C X^c Y
X^C X^c X^C Y