Sex-Linked Genetics Practice Problems

For the following problems on sex-linked traits remember to show all work (using Punnett Squares) and to write your answers in complete sentences.

1. A boy, whose parents and grandparents have normal vision, is color-blind. What are the genotypes for his mother and his maternal grandparents (mom's parents)? Use X^B for normal vision and X^b for color-blind.

boy is

The boy's mother is X^BX^b.

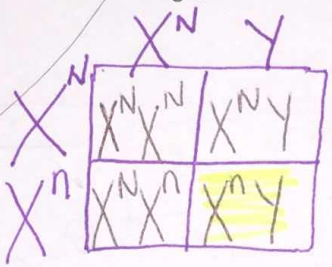
The boy's grandparents are X^BX^b and X^BY

2. In bison there is a defect known as "rabbit hock" where the knee of the back leg is malformed. A normal bull (X^NY) makes with a carrier female.
   a. What is the probability of producing a normal son?

50%

   b. What is the probability of producing normal daughters?

50%

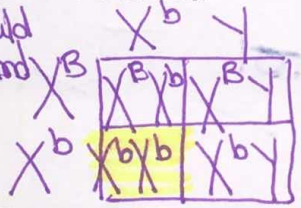


3. A woman with red-green color-blindness has a mother with normal vision. Knowing that color-blindness is a sex-linked recessive gene, can you determine what her father's phenotype is? If so, what is it?

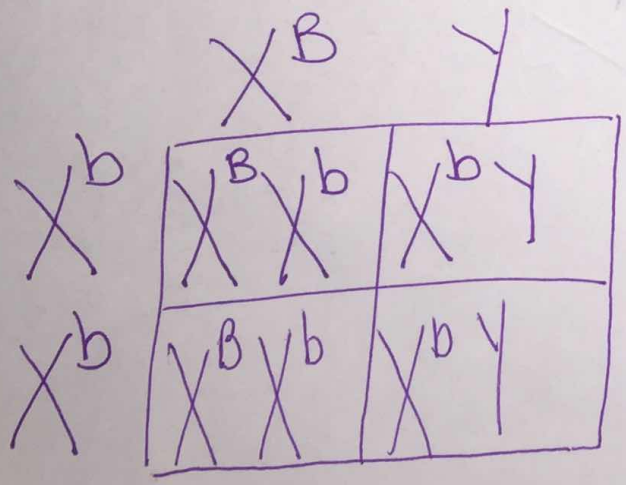
Woman is X^bX^b

Here mother has normal vision, but would be a carrier X^BX^b

Dad would be colorblind X^bY

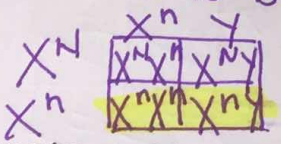


4. The woman from #3 marries a man with normal vision. What is the probability they will have sons who are red-green color-blind?



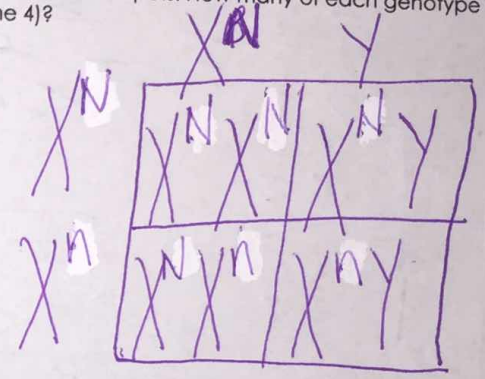
5. Clouded leopards are a medium sized, endangered species of cat, living in the very wet cloud forests of Central America. Assume that the normal spots (X^N) are a dominant sex-linked trait and that dark spots are the recessive counterpart. Suppose as a Conservation Biologist, you are involved in a clouded leopard-breeding program. One year you cross a male with dark spots and a female with normal spots. She has four cubs and, conveniently, two are male and two female. One each of the male and female cubs has normal spots and one each have dark spots.
   a. What is the genotype of the mother?

Mom has to be a carrier X^NX^n

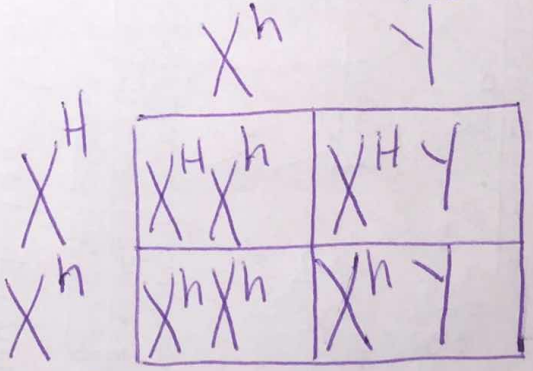


   b. Suppose a few years later, you cross the female cub that has normal spots with a male that also has normal spots. How many of each genotype will be found in the cubs (assume 4)?

X^NX^N 1
X^NX^n 1
X^nX^n 0
X^NY 1
X^nY 1



6. Princess Eugenie, who was a carrier for hemophilia, married her cousin Prince Albert who was a hemophiliac.
   a) All their children would be hemophiliacs No
   b) Half their children of both sexes would be hemophiliacs Yes
   c) All their girls would be hemophiliacs No
   d) All their sons would be carriers No
   e) Two of the above No



← Prince Albert

↑ Princess Eugenie

7. The hemophilia gene is located on the same chromosome as the red-green colorblindness gene on the X chromosome. Red-green colorblindness is recessive to normal color vision. A woman with normal blood clotting and normal color vision, but whose father was a hemophiliac and whose mother was red-green colorblind, marries a man who is not a hemophiliac and is not colorblind. What is the probability of their children being colorblind and having hemophilia? Use B for normal vision and H for normal blood clotting.

First Make a Key (B → Normal Vision / b → color blind | H - Not hemophiliac / h - hemophiliac)

Woman $X^H X^h$ / $X^B X^b$ ← mom gave recessive

Woman's mother $X^b X^b$

Woman's father $X^h Y$ dad gives recessive

Man $X^H Y$ / $X^B Y$

Vision

	X^B	Y
X^B	$X^B X^B$	$X^B Y$
X^b	$X^B X^b$	$X^b Y$

Hemophilia

	X^H	Y
X^H	$X^H X^H$	$X^H Y$
X^h	$X^H X^h$	$X^h Y$

25% chance being Colorblind

25% chance having hemophilia

8. Mom suffers from a disorder of the eye called retinoblastoma caused by a dominant sex-linked gene (D). Dad does not. Half of their daughters and half of their sons do not inherit the disease. Figure out the cross and the Punnett square.

dominant trait → person must have dominant allele to 'show' trait

If ½ daughters + ½ sons do not inherit, means must have recessive allele

	X^d	Y
X^D	$X^D X^d$	$X^D Y$
X^d	$X^d X^d$	$X^d Y$

do not have