

Practice with Sex Linkage and Other Cool Stuff - Solutions

1. a) all red eyed, half male
- b) 1/4 red eyed female, 1/4 white eyed female, 1/4 red eyed male, 1/4 white eyed male
- c) half female, all red eyed; half male, all white eyed.
- d) half females are carriers; half males are white-eyed

2. a) $P \ X^H X^h \times X^H y$
 $F_1 \ X^h y$

- b) no because father is normal so cannot donate X^h

3. a) $P \ X^N X^n \times X^n y$
 $F_1 \ X^n X^n, X^n y, X^N X^n, X^N y$

- b) $X^N X^N$ individual would have to receive X^N from father who would be dead
 c) unlikely that X^N would live long enough to breed, also heterozygous individuals would be less common in nature.

4. b - brown; v - vermillion; $b+X^{v+}$ - wt; X^{bv} - white

a) $P \ b+b+X^{v+}X^{v+}$ (wild-type female) \times $bbX^{v+}y$ (white-eyed male)
 $F_1 \ b+b+X^{v+}X^v, b+b+X^{v+}y$ - all wild type

b) $P \ b+b+X^{v+}X^v$ (wild-type female) \times $b+bX^{v+}y$ (wild-type male)
 $F_1 \ b+b+X^{v+}X^{v+}, b+b+X^{v+}y, b+bX^{v+}X^{v+}, b+bX^{v+}y, b+b+X^{v+}X^v, b+b+X^v y, b+bX^{v+}X^v, b+bX^v y, b+bX^{v+}X^{v+}, b+bX^{v+}y, bbX^{v+}X^{v+}, bbX^{v+}y, b+bX^{v+}X^v, b+bX^v y, bbX^{v+}y, bbX^v y$
 - 9 wild type:3 brown:3 vermillion:1 white

c) $P \ bbX^{v+}X^{v+}$ (brown-eyed female) \times $b+bX^v y$ (vermillion-eyed male)
 $F_1 \ b+bX^{v+}X^v, b+bX^{v+}y, bbX^{v+}X^v, bbX^{v+}y$ - 2 wild type:2 brown

5. a) 0 - Jake always gives the normal allele

b) $P(X^h y) = 1/2 \times 1/2 = 1/4$

- c) 1/2 - Lauren gives the mutant allele half the time

d) $P(4 \ X^h y \text{ sons}) = 1/2 \times 1/2 \times 1/2 \times 1/2 = 1/16$

- e) Assuming her mother is normal and not a carrier, she would inherit the X^h allele from her father all the time, making her a carrier.

- f) 1/2 chance of being a carrier; 1/2 chance of having hemophilia. She must inherit the X^h from her father so she could not be free of the allele.

6. 1/4 to have a color blind daughter. 1/2 that first son will be color blind. Notice that we are told the child is a son so we do not have to consider the probability of that happening.

7. a) 1/4 (b) 1/2 (c) 1/4 (d) 1/2

8. a) $P \ X^B X^B \times X^O y$
 $F_1 \ X^B X^O, X^B y$ - calico females and black males

b) $P \ X^B X^O \times X^O y$
 $F_1 \ X^B X^O, X^O X^O, X^B y, X^O y$ - calico females, orange females, black males, orange males

c) $P \ X^B X^O \times X^B y$
 $F_1 \ X^B X^B, X^B y, X^O X^B, X^O y$ - 1/4 calico females

- d) Cross as above. No calico males unless nondisjunction occurs resulting in Klinefelter syndrome.

9. P $X^{Col}y \times X^{Col}X^{?}$
F1 Daughter is $X^{col}X^{col}$ so a recessive allele must have been donated by each parent. The mother must be heterozygous. The man cannot be the father of the child.