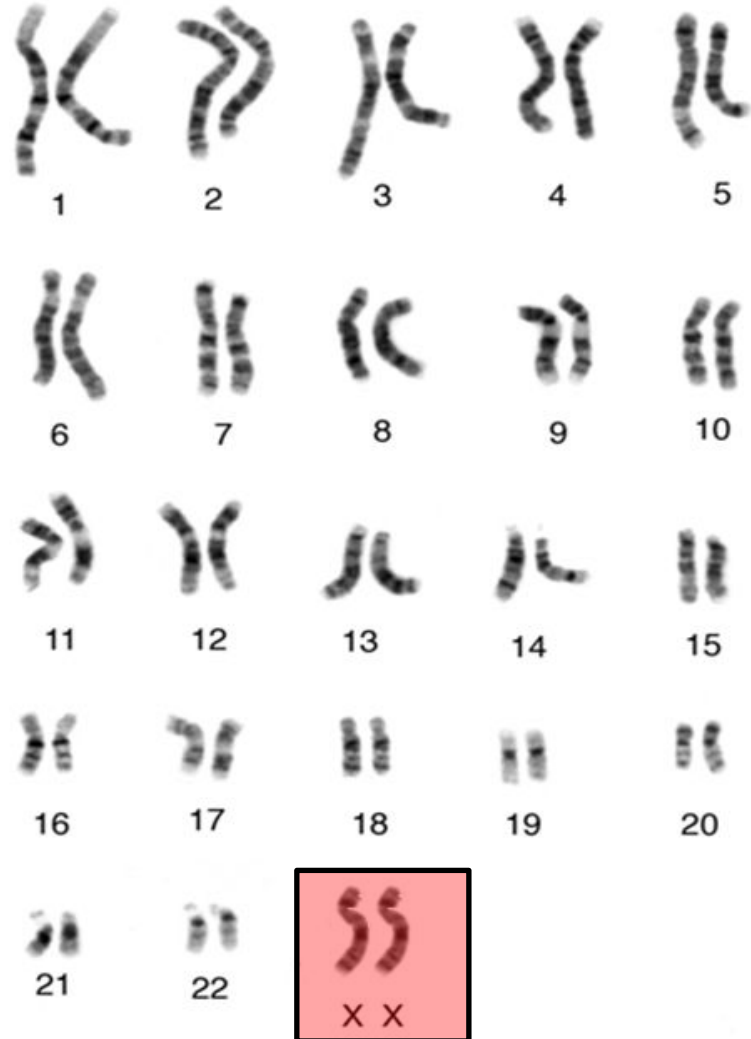


A glowing blue fiber optic cable is shown against a black background. The cable curves from the top left towards the center, where it ends in a textured, yellowish, fibrous-looking structure. The text "Sex-Linked Inheritance" is overlaid in bright yellow on the right side of the image.

Sex-Linked Inheritance

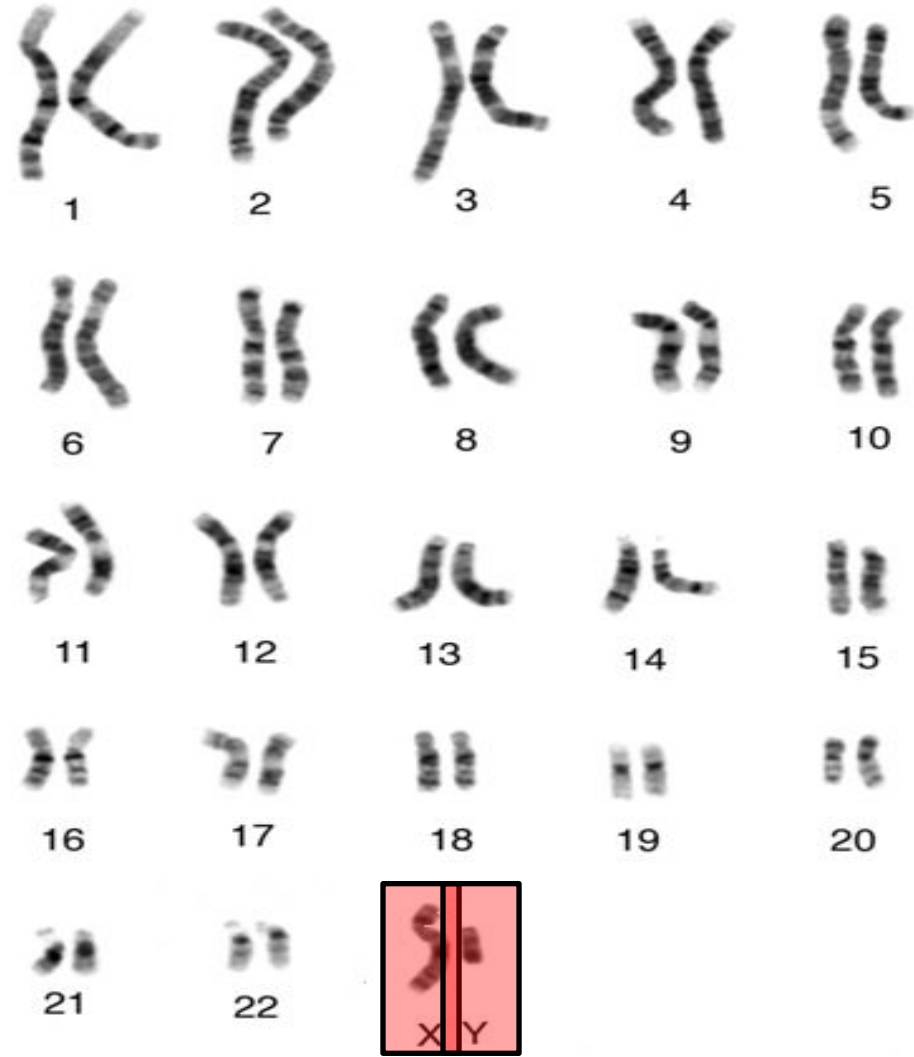
Sex Determination

- Sex is determined by genes found on the X and Y chromosomes
- Females: all eggs have X chromosome



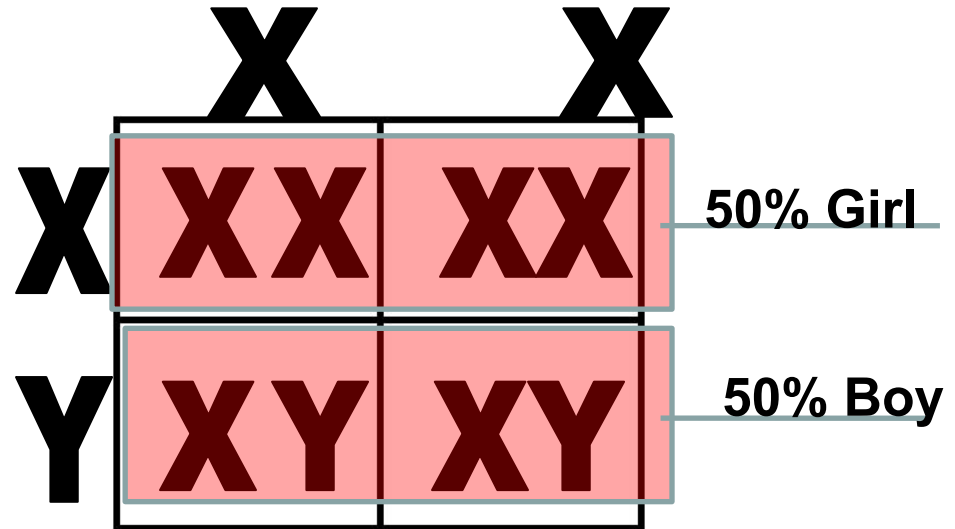
Sex Determination

- Sex is determined by genes found on the X and Y chromosomes
- Females: all eggs have X chromosome
- Males: $\frac{1}{2}$ sperm cells contain X; and the other $\frac{1}{2}$ contain Y



Sex Determination

- There is a 50/50 chance of child being a boy/girl



Sex-Linked Disorders

- **Defined:** Inherited conditions found on X chromosome

- **Usually recessive**

- Females: XX chromosomes

$X^H X^H$ = healthy

$X^H X^h$ = healthy carrier

$X^h X^h$ = disease

- Males: XY chromosomes

$X^H Y$ = healthy

$X^h Y$ = disease

- Rare in women (back-up X chromosome)



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

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

H = healthy h = disorder

Sex-Linked Disorders

- **Defined:** Inherited conditions found on X chromosome

- Usually recessive

- Females: XX chromosomes

$X^H X^H$ = healthy

$X^H X^h$ = healthy carrier

$X^h X^h$ = disease

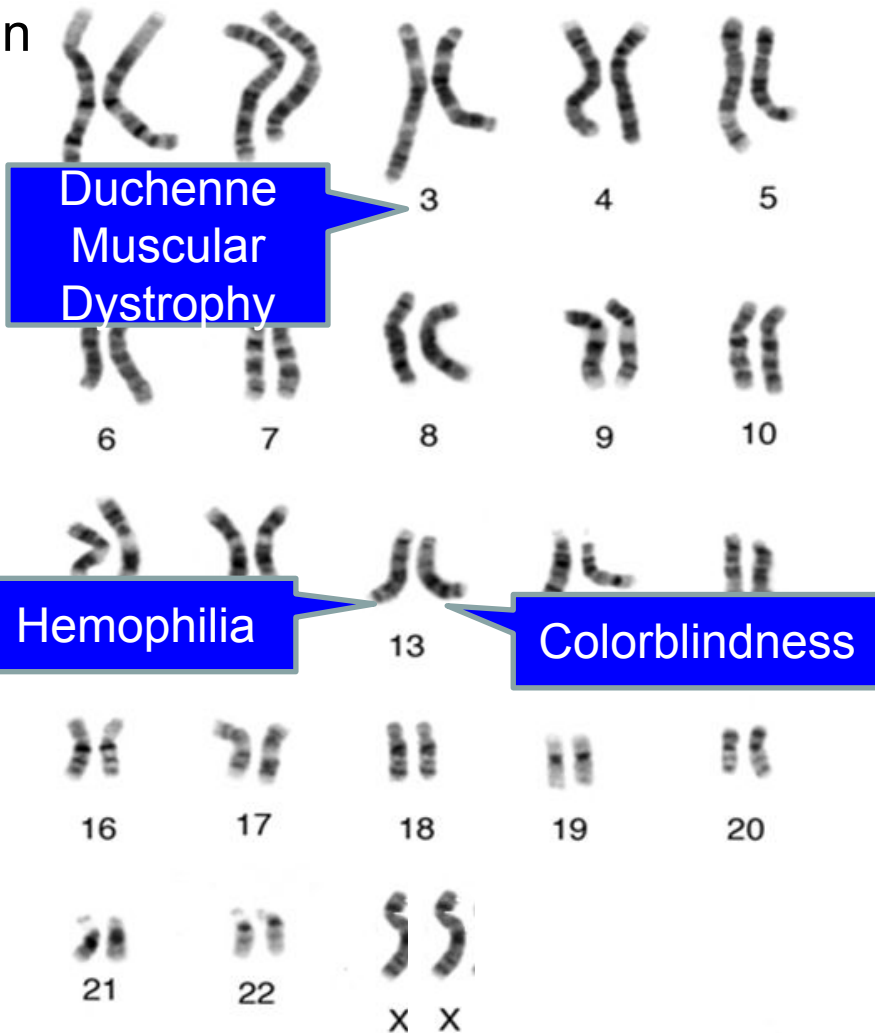
- Males: XY chromosomes

$X^H Y$ = healthy

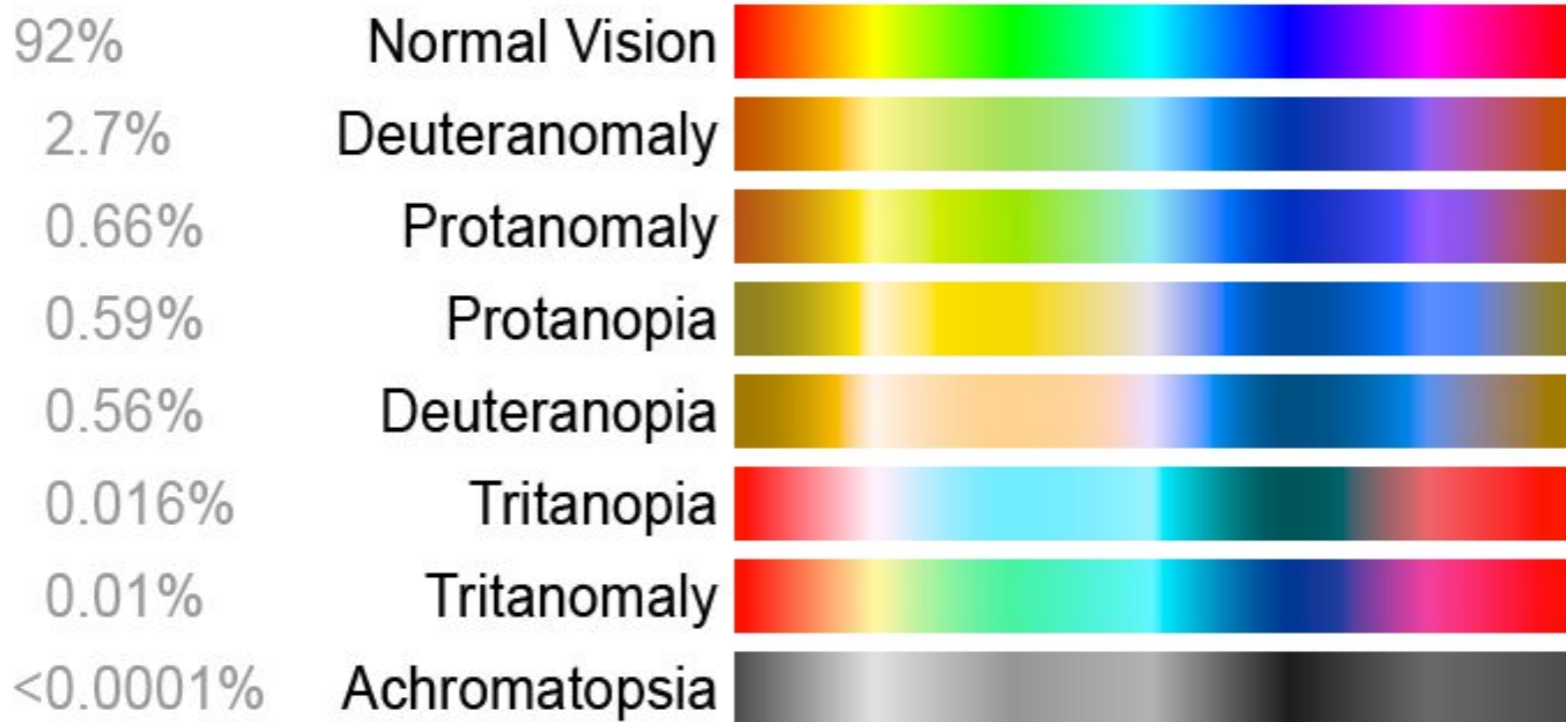
$X^h Y$ = disease

- Rare in women (back-up X chromosome)

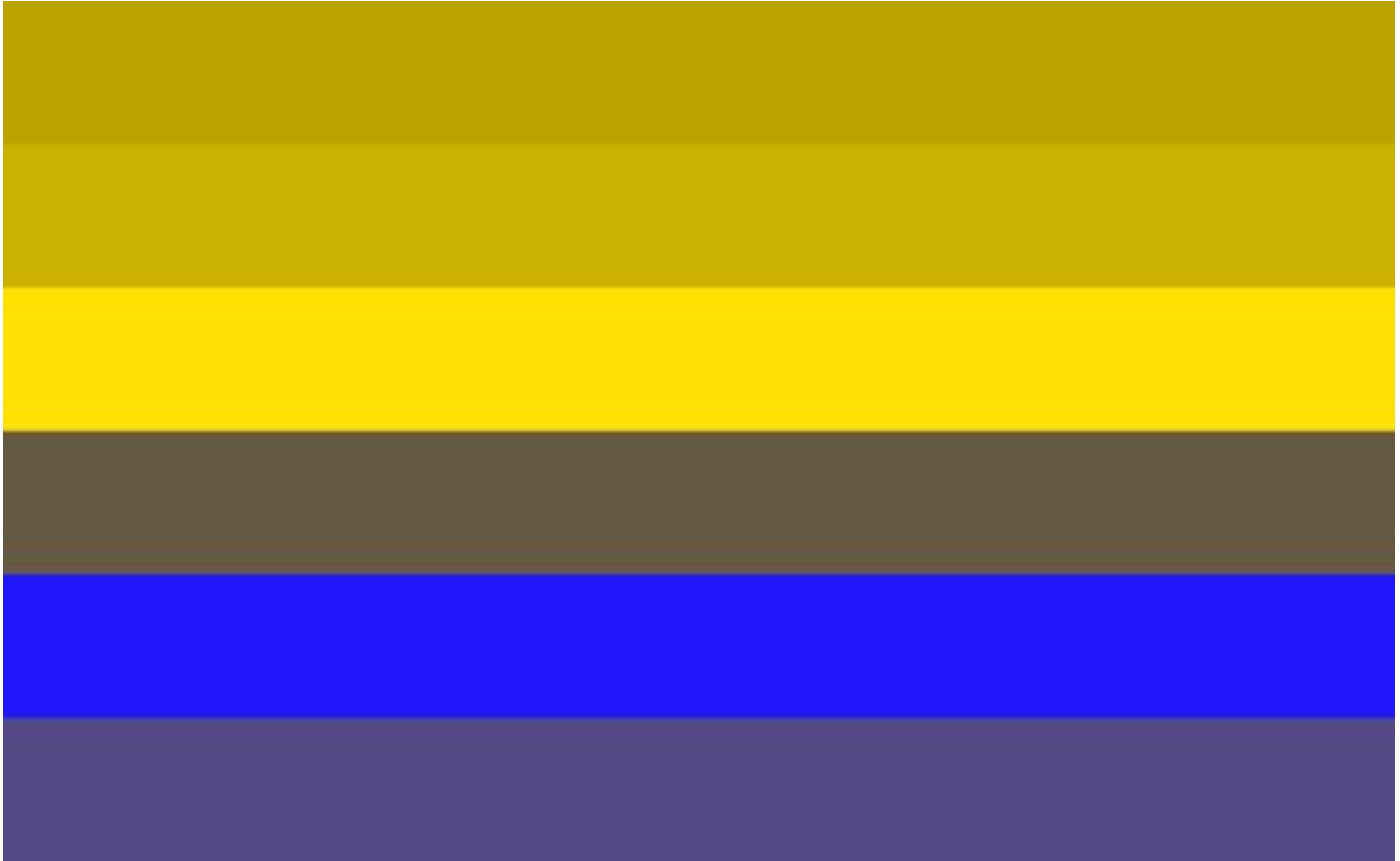
- **Examples of disorders:**



Types of Colorblindness



Deuteranopia (2.7%)



Protanopia (0.59%)

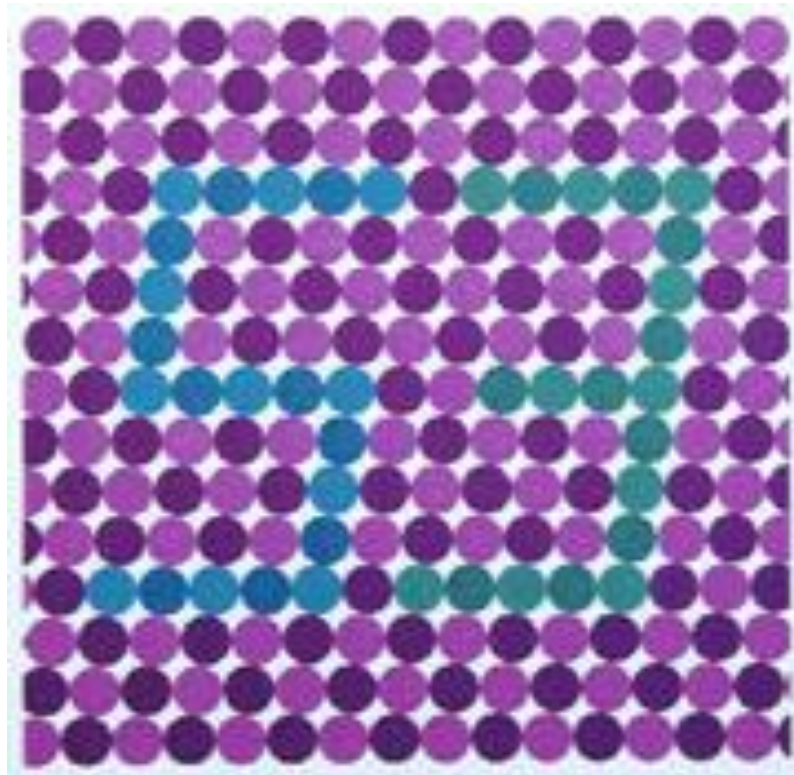


Tritandrom (ca. 16%)



Colorblind Test:

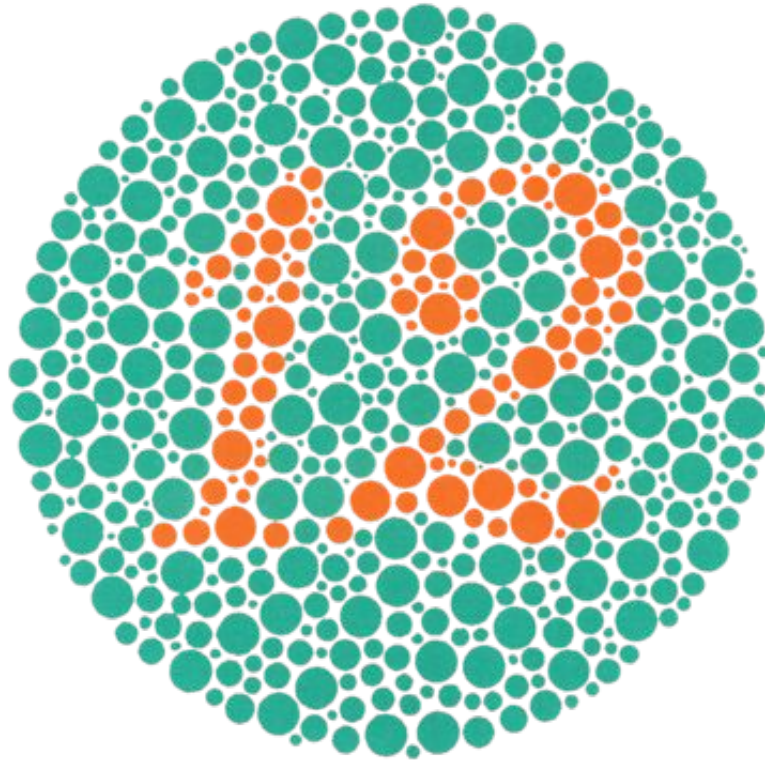
Do you see a number inside the picture?



53

Colorblind Test:

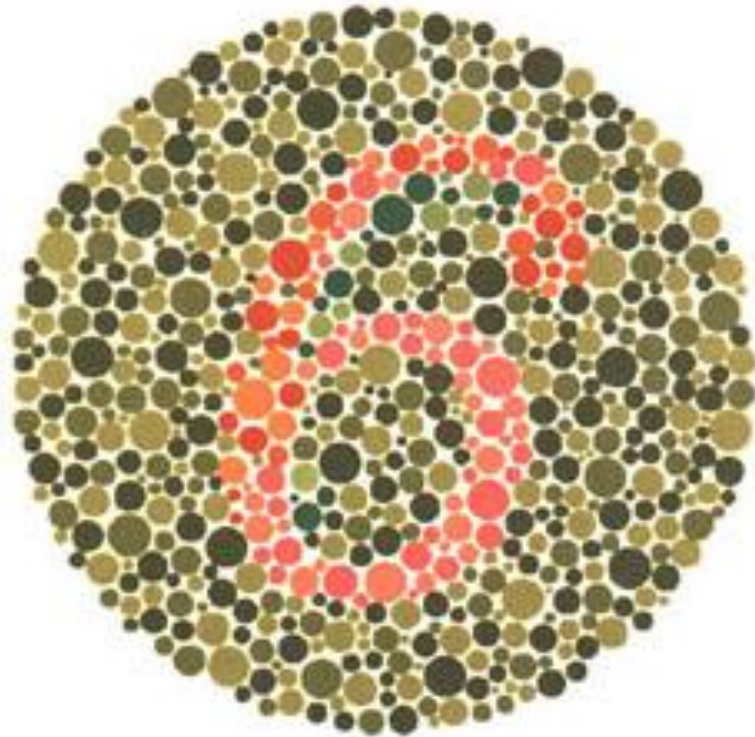
Do you see a number inside the picture?



12

Colorblind Test:

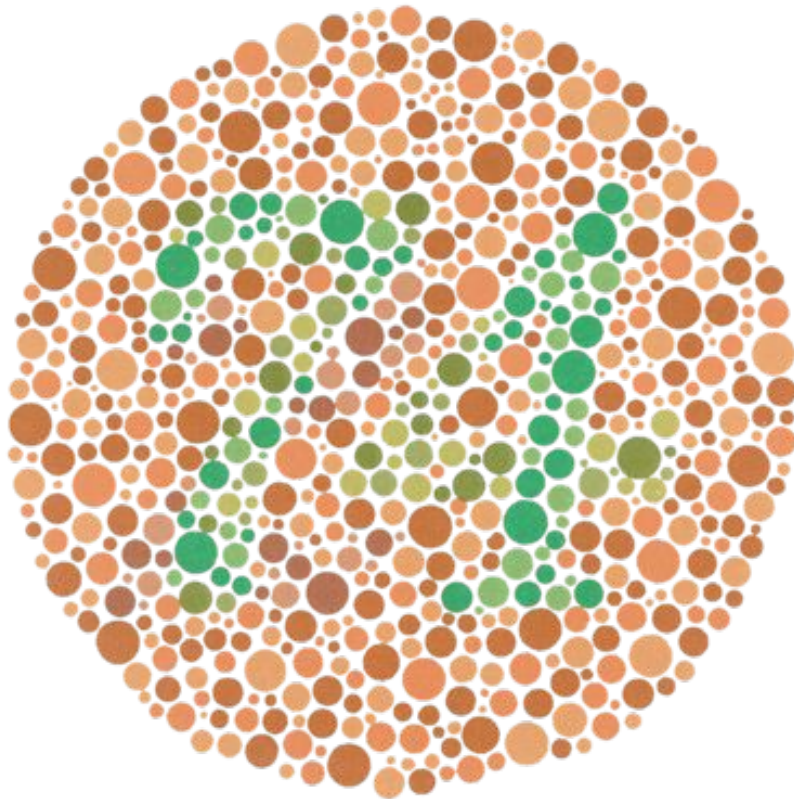
Do you see a number inside the picture?



6

Colorblind Test:

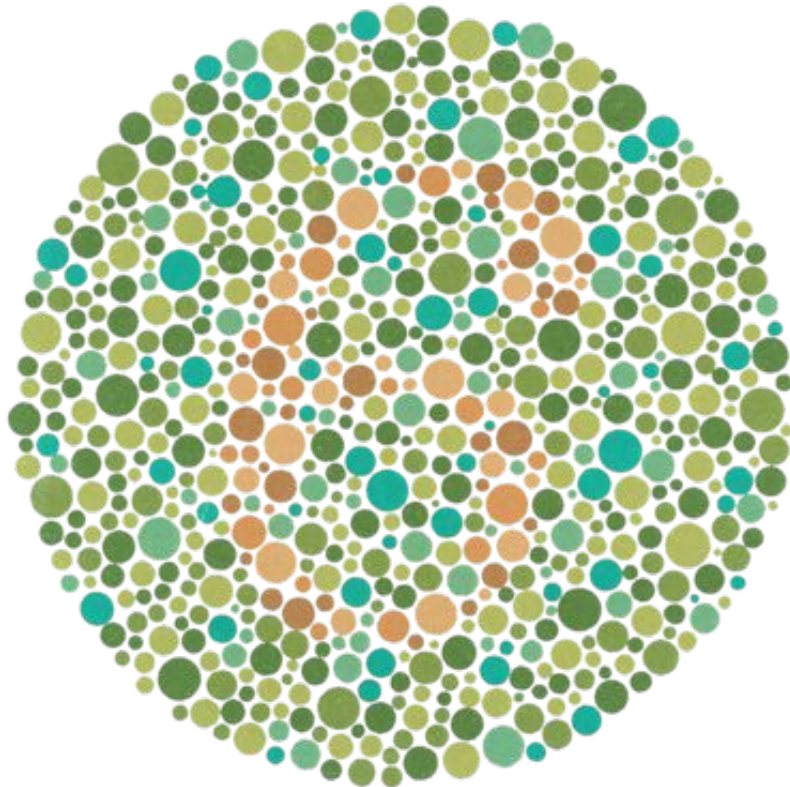
Do you see a number inside the picture?



74

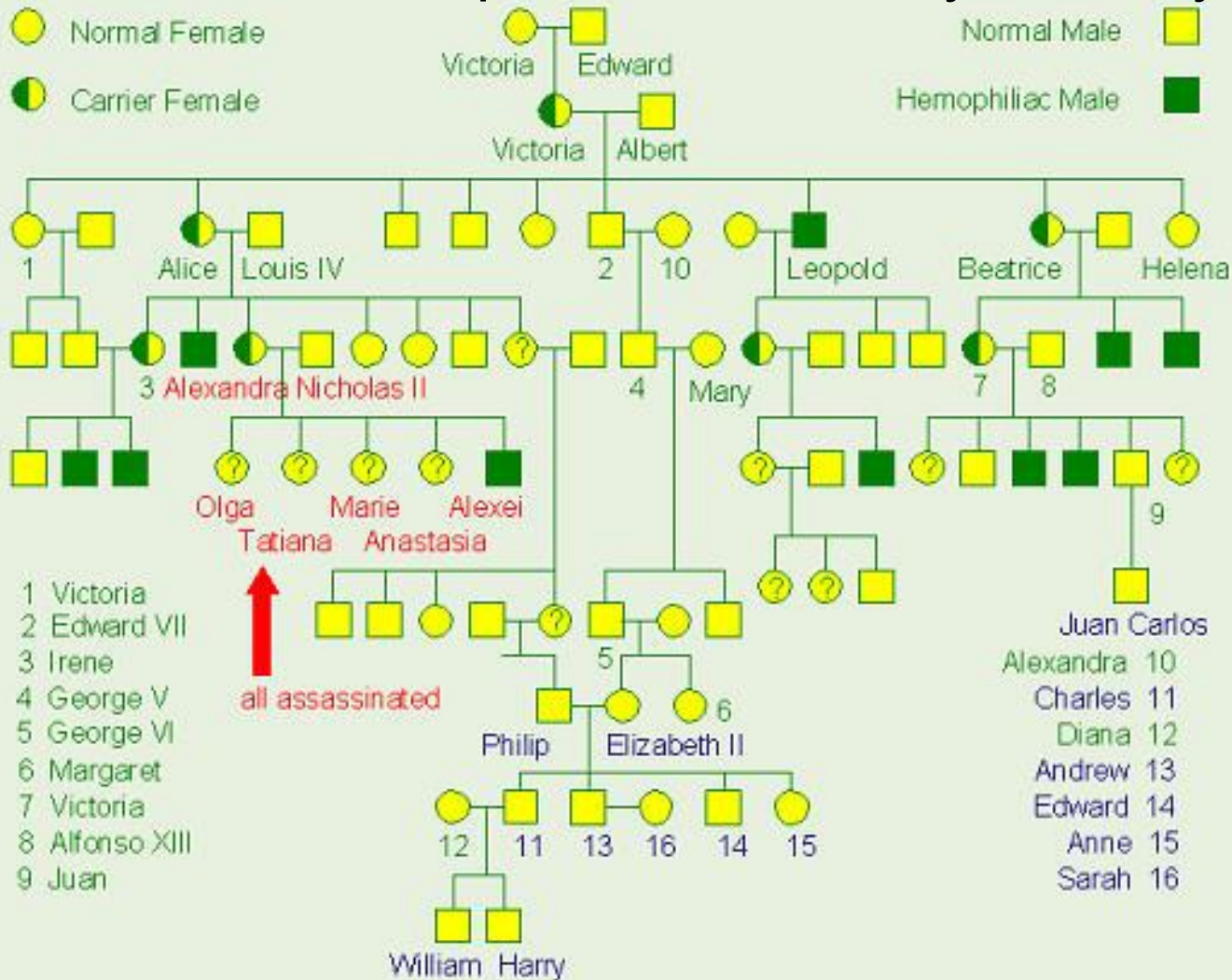
Colorblind Test:

Do you see a number inside the picture?



6

Hemophilia and the Royal Family



1 min: Discuss with your neighbor.

Jen is a healthy carrier ($X^H X^h$) of hemophilia and Adam has no history in his family ($X^H Y$).

	X^H	Y
X^H	$X^H X^H$ Healthy girl	$X^H Y$ Healthy boy
X^h	$X^H X^h$ Healthy girl (carrier)	$X^h Y$ Hemophiliac boy

What is the probability of:

a. Daughter with hemophilia?

0%

b. Carrier child?

25%

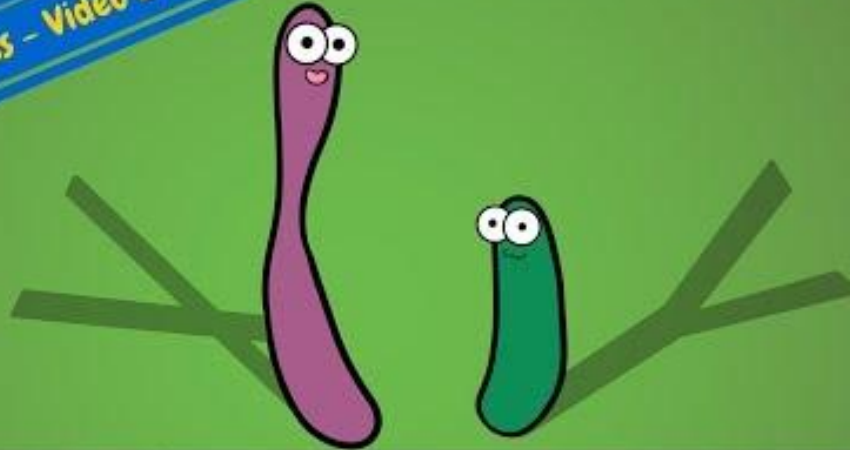
c. Child with hemophilia?

25%

d. Two healthy children?

9/16 (56%)

Genetic Series - Video 2



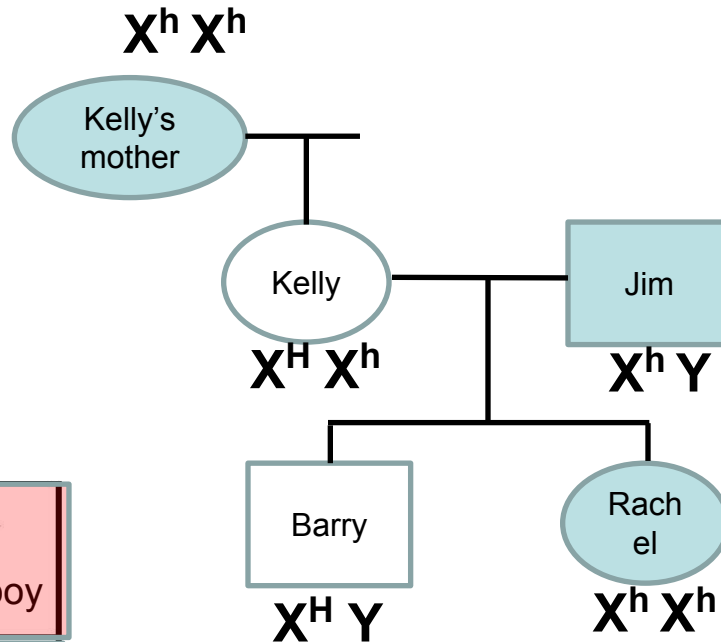
Sex-Linked Traits

with the Amoeba Sisters



edpuzzle

Hemophilia is a sex linked disorder. Kelly does not have hemophilia even though her mother did. Jim (Kelly's husband) is a hemophiliac. Their first child Barry is healthy but their other child Rachel is a hemophiliac. Draw a Pedigree for this family and a Punnett square for Jim and Kelly.



	X^h	Y
X^H	$X^H X^h$ Healthy girl (carrier)	$X^H Y$ Healthy boy
X^h	$X^h X^h$ Hemophiliac girl	$X^h Y$ Hemophiliac boy

What is the probability of getting a:

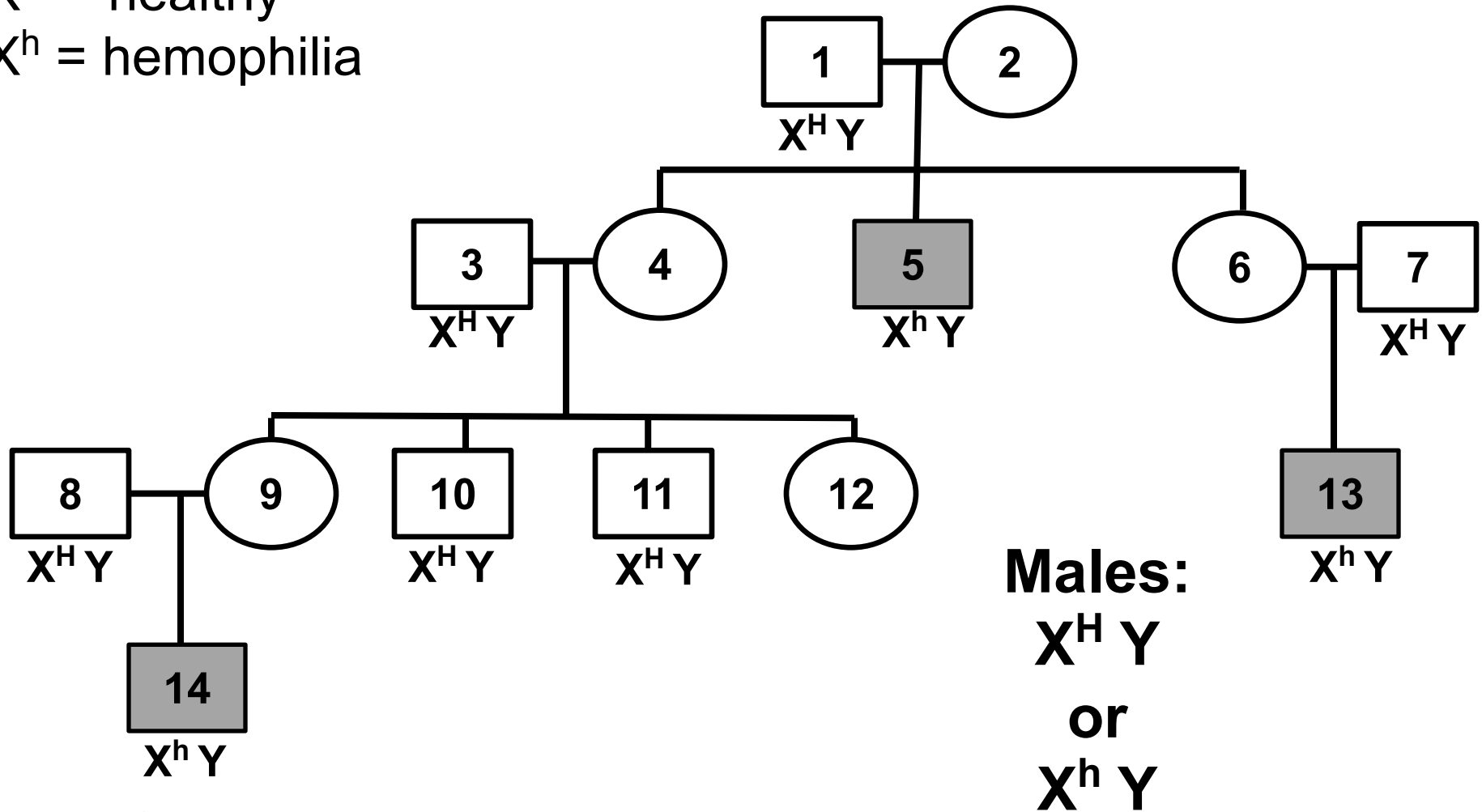
- Healthy son?
- Healthy daughter?
- Child with hemophilia?
50%
- Carrier child?
25%

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



Males:

$X^H Y$

or

$X^h Y$

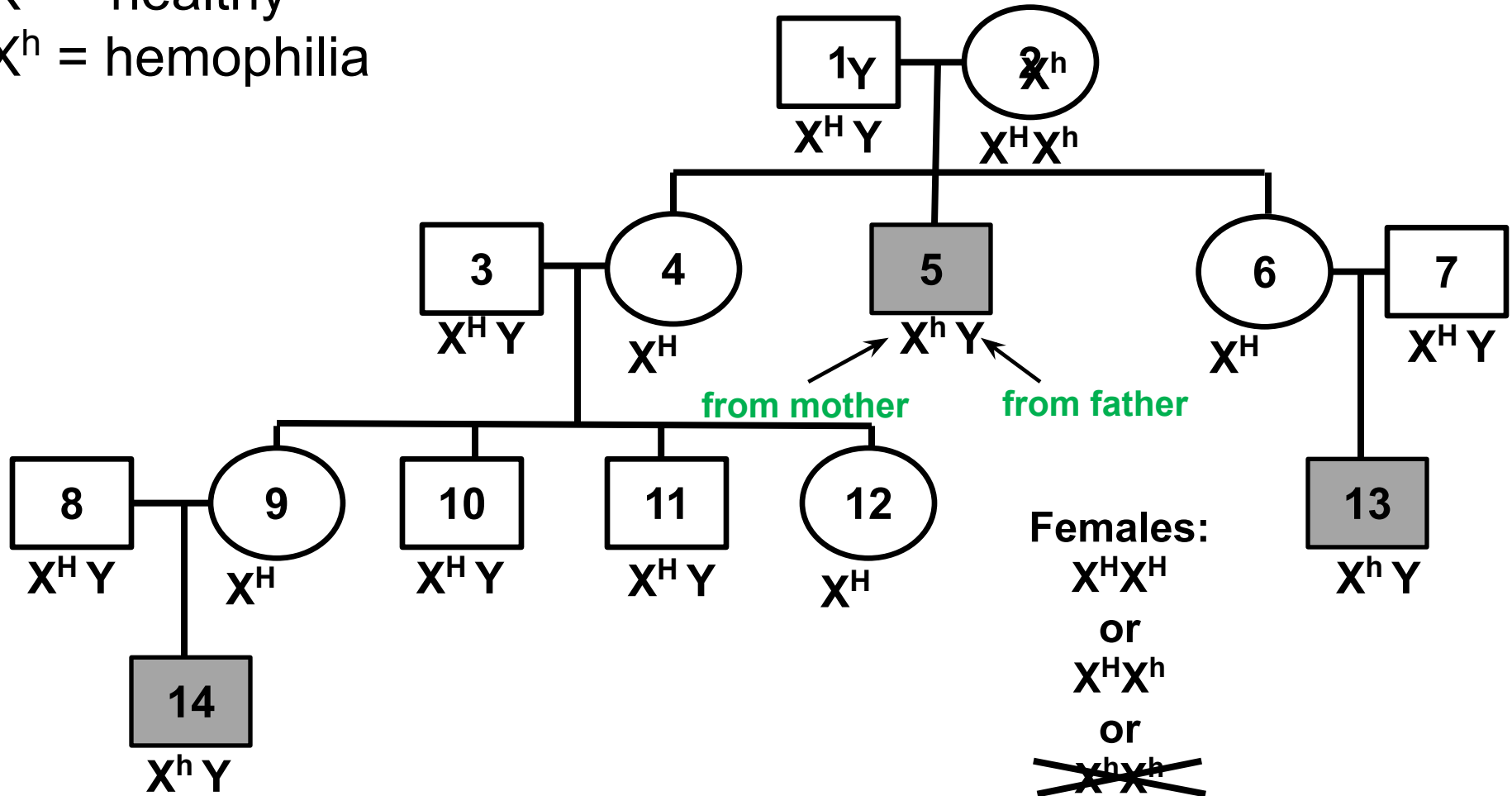
Hint: Only 1 person is unknown.

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



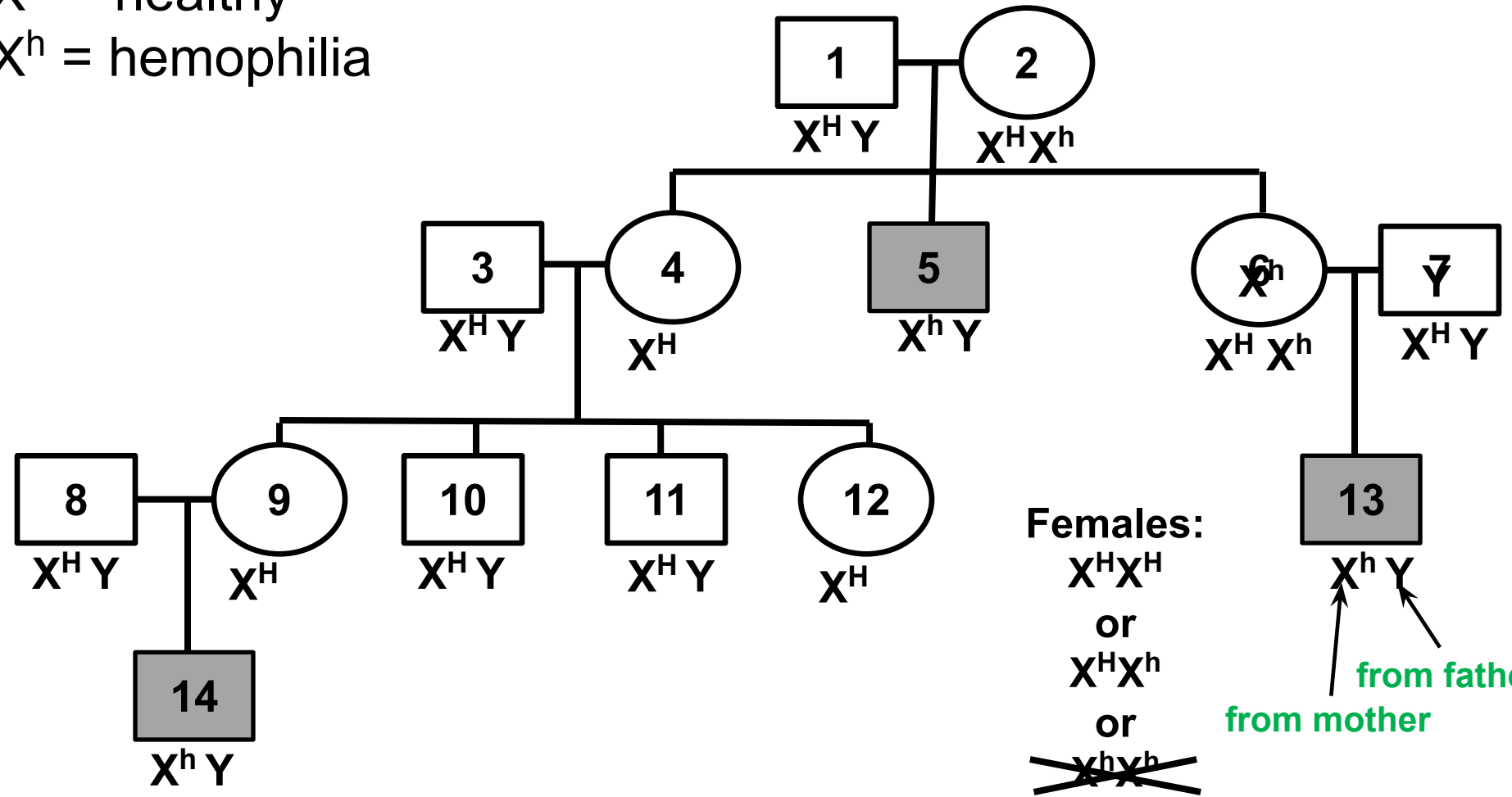
Hint: Only 1 person is unknown.

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



Females:

$X^H X^H$

or

$X^H X^h$

or

~~$X^h X^h$~~

from father
from mother

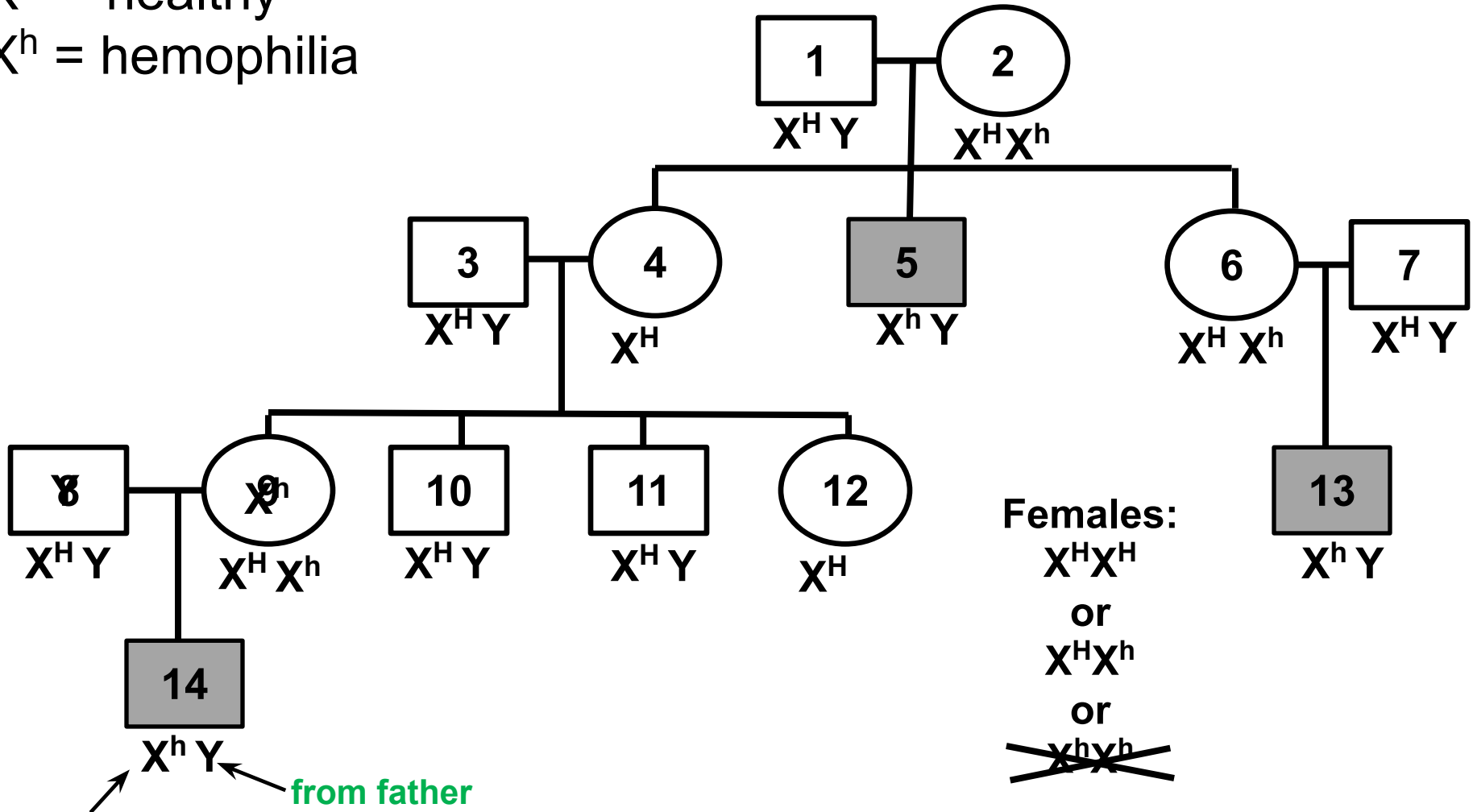
Hint: Only 1 person is unknown.

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



Females:

$X^H X^H$

or

$X^H X^h$

or

~~$X^h X^h$~~

from mother

from father

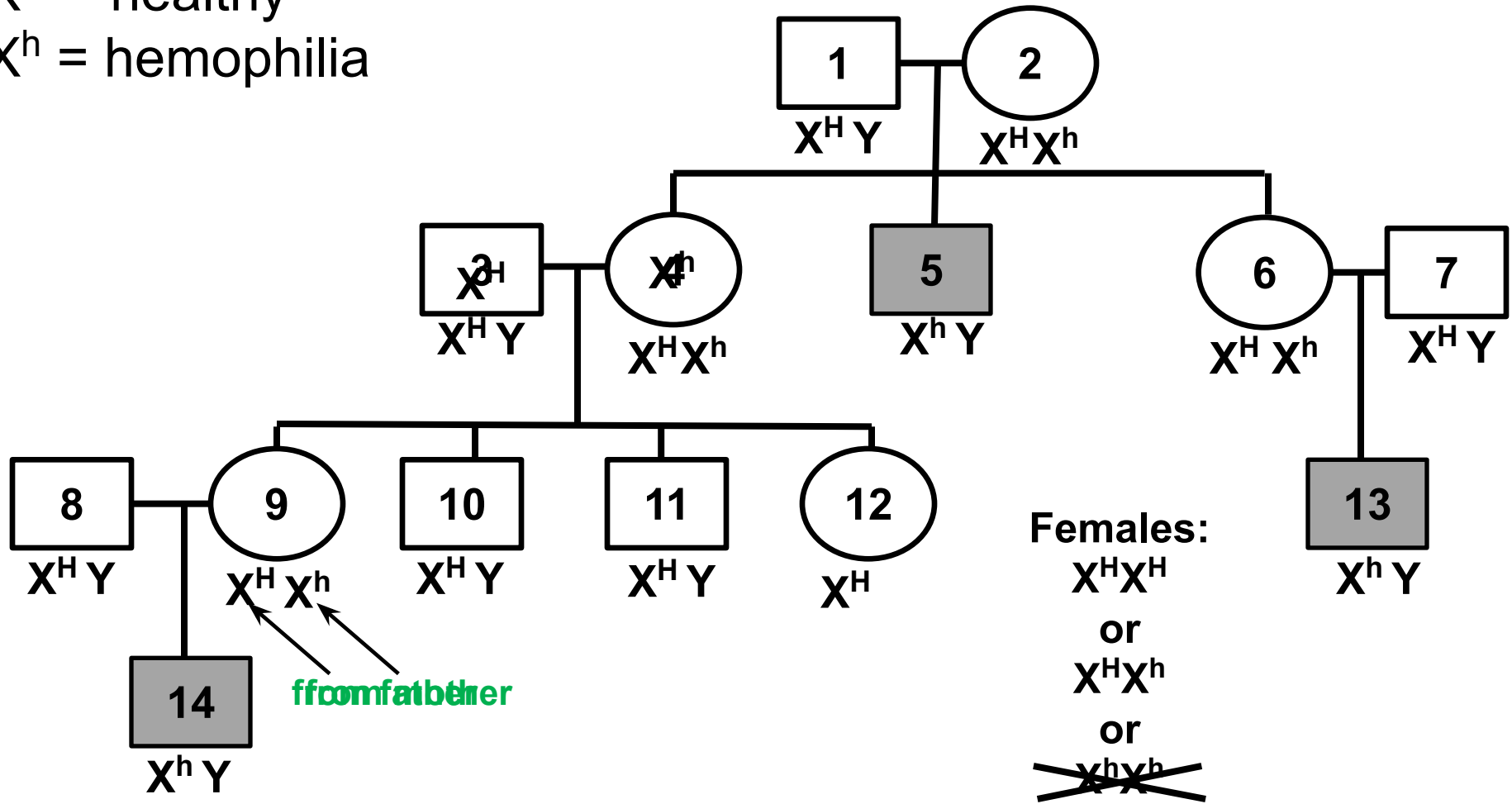
from mother

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



Females:

$X^H X^H$

or

$X^H X^h$

or

~~$X^h X^h$~~

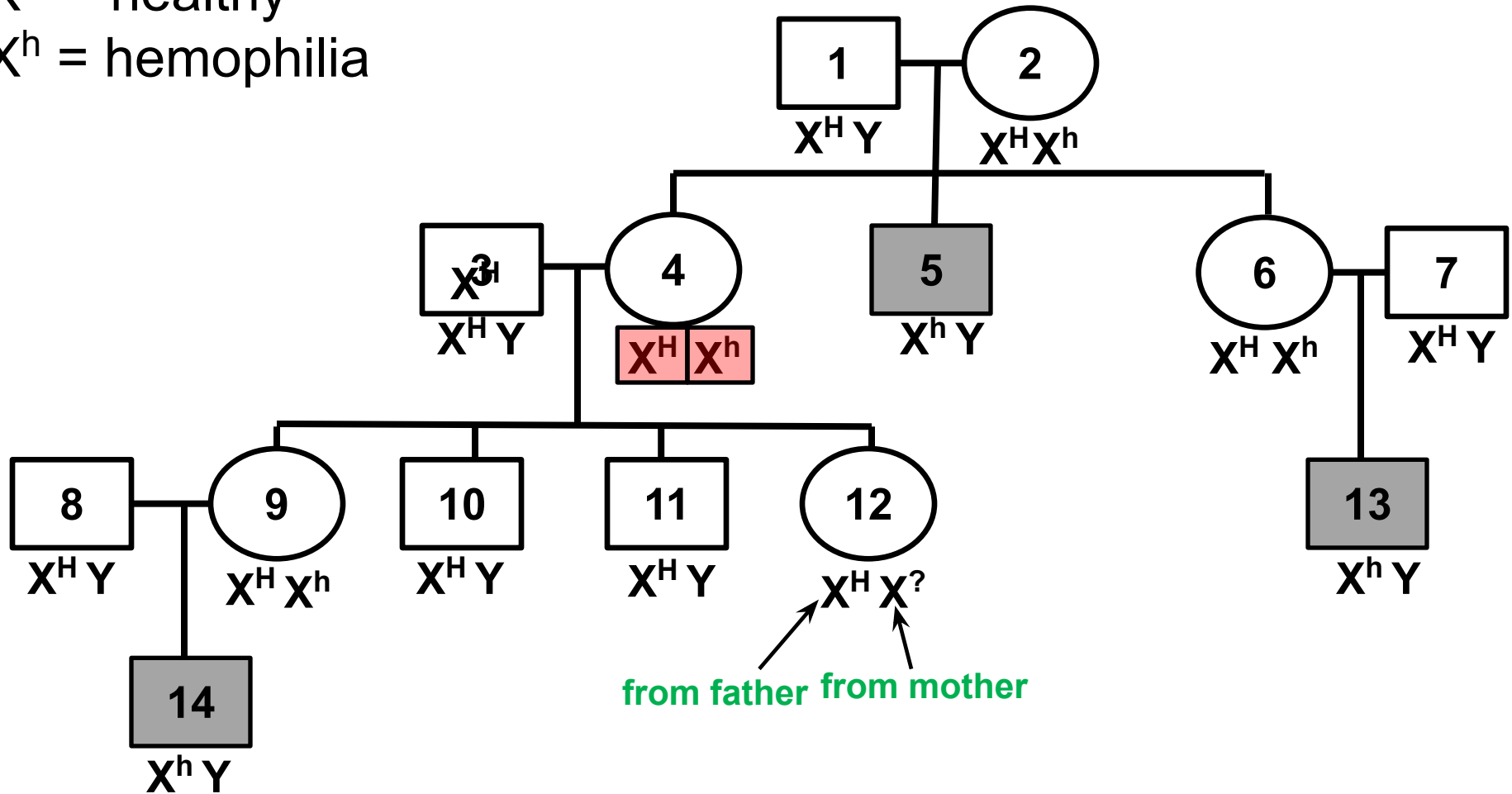
Hint: Only 1 person is unknown.

Sex linked recessive: Hemophilia

Key

X^H = healthy

X^h = hemophilia



from father from mother

Hint: Only 1 person is unknown.

Practice Questions

- 1) How are sex-linked disorders different from autosome disorders?
- 2) Why are sex-linked disorders more common in males?
- 3) Write the genotype of a heterozygous female.
- 4) Write the genotype of a carrier female.
- 5) Examine Kelly and Jim's Punnett square. What are the chances they would have three children, all of whom are healthy?