

## Genetics Problems Worksheet

1. In cattle, the hornless condition (H) is dominant and the horned condition (h) is recessive. A bull without horns is crossed with a cow with horns. Of the four offspring, one (1) is horned and three (3) are hornless. Determine the genotype of the bull and the cow.

$$Hh \times hh$$

	Hh	
h	Hh	hh
h	Hh	hh

H = hornless  
h = horned

2. In humans, widow's peak (W) is dominant over a continuous hairline (w), and short fingers (F) are dominant over long fingers (f). Two individuals with widow's peak and short fingers have a child with continuous hairline and long fingers. Determine the genotype of the parents.

W = widow's peak  
w = continuous  
F = short fingers  
f = long fingers

$$WwFf \times WwFf$$

9 widow's/short  
3 widow's/long  
3 continuous/short  
1 continuous/long

3. In humans, free ear lobes (E) is dominant over attached ear lobes (e), and brown eyes (B) is dominant over blue eyes (b). A man with free ear lobes and brown eyes marries a woman with attached ear lobes and brown eyes. Of four children, one has free ear lobes and brown eyes, one has free ear lobes and blue eyes, one has attached ear lobes and brown eyes, and one has attached ear lobes and blue eyes. Determine the genotypes of the parents.

E = free ear lobes  
e = attached  
B = brown eyes  
b = blue

$$EeBb \times eeBb$$

E - B -  
E - bb  
eeB -  
eebb

	EB	Eb	eB	eb
eB	EeBb	Eebb	eeBb	eebb
eb	EeBb	Eebb	eeBb	eebb

4. In humans, hemophilia is a sex-linked condition and normal blood clotting (H) is dominant to the condition of hemophilia (h). A woman with hemophilia marries a normal man. What are the probabilities of them having children with hemophilia and their sexes?

$X^H$  = normal  
 $X^h$  = hemophilia

$X^h X^h \times X^H Y$

	$X^h$	$X^h$	
$X^H$	$X^H X^h$	$X^H X^h$	0% girls
$Y$	$X^h Y$	$X^h Y$	100% boys

5. In humans, being right-handed (R) is dominant over being left handed (r), and normal vision is dominant over color blindness (which is sex-linked). Two right-handed parents with normal vision have a son who is left-handed and color-blind. Determine the genotypes of the son and both parents. What can you tell me about the phenotypes of the parents?

$R$  = right  
 $r$  = left  
 $X^N$  = normal  
 $X^n$  = colorblind

$Rr X^N X^N \times Rr X^N Y$

$rr X^n Y$

6. In horses, black coat color (B) is dominant over roan coat color (b), and a trotter (T) is dominant over a pacer (t). A black trotter mare was bred with a stallion to produce a roan pacer colt. Determine the genotypes of the colt and mare and all the possible genotypes for the stallion. Perform a cross between each stallion genotype and the mare. Which is the higher probability for the stallion's genotype?

$B$  = black  
 $b$  = roan  
 $T$  = trotter  
 $t$  = pacer

mare  $BbTt$

stallion =  $BbTt, bbTt, Bbtt, bbtt$

$bbtt$  colt

7. In guinea pigs, curly hair (H) is dominant over straight hair(h). Work out the F1 and F2 generations of a cross between a homozygous curly haired guinea pig and a homozygous straight haired guinea pig. SHOW ALL WORK! Include all possible genotypes and phenotypes.

H = curly  
h = straight

F1 = HH × hh  
100% Hh

F2 = Hh × Hh

1 HH : 2 Hh : 1 hh

3 curly : 1 straight

	H	h
H	HH	Hh
h	Hh	hh

8. Black hair (G) is dominant over white hair (g) in guinea pigs. A heterozygous black, straight haired guinea pig is mated with a white, heterozygous curly haired guinea pig. Write the genotype for each of the guinea pigs, set up a Punnett Square and show all possible genotypes that could result from the union of these two guinea pigs.

G = black  
g = white

Gghh × ggHh

	Gh	gh
gH	GgHh	ggHh
gh	Gghh	gghh

1 black/curly  
1 white/curly  
1 black/straight  
1 white/straight

9. What would be the best way to find out if a black, curly haired female guinea pig is homozygous or heterozygous for each trait?

mate to a gghh male

10. Some dogs bark when trailing, others are silent. The barking trait (B) is dominant over the silent trait (b). Erect ears (E) are dominant over drooping ears (e). An erect eared barker is crossed with a droop eared, silent trailer. Litter after litter produces pups all with erect ears, but some are barkers and some are silent. What are the probable genotypes of the parents? Perform a cross with them to check your assumptions.

B = barking  
 b = silent  
 E = erect  
 e = drooping

$EeBb \times eebb$

$EeBb, Eebb$

	EB	Eb
eb	EeBb	Eebb

11. A normal woman whose father was a hemophiliac marries a normal man. Determine the genotype of the woman and the man. Determine the possible genotypes for their children. What percent of male and female children would be hemophiliacs? What percent normal? Would any be carriers?

$X^H X^h \times X^H Y$

	$X^H$	$X^h$	
$X^H$	$X^H X^H$	$X^H X^h$	0% female 50% carrier
$Y$	$X^H Y$	$X^h Y$	50% male

12. Humans can have one of four possible blood types: O, A, B, and AB. These are the result of three alleles for blood proteins (multiple alleles) that are inherited as a single gene trait of two alleles. The possible genotypes and phenotypes are as follows: oo is type O; AA and Ao are type A; BB and Bo are type B; AB is type AB. A young man has type AB blood and his sister has type O blood. What are their genotypes and the genotypes of the parents?

AB, oo offspring

parents  
 $\rightarrow A \quad o$

B	AB	Bo
o	Ao	oo

13. A woman with type A blood marries a man with type O blood. They have six children, all of whom have type A blood. What are the probable genotypes of the parents? Could they possibly have a child with type O blood? -yes

$$AA \times oo$$

or

$$Ao$$



14. In summer squash, white fruit (Y) is dominant over yellow fruit (y), and disc shaped fruit (D) is dominant over sphere shaped fruit (d). A cross is made between a homozygous white, disc shaped squash and a yellow, sphere shaped squash. Show the genotypes for the parents and the genotypes and phenotypes for the F1 generation.

Y = white  
y = yellow  
D = disc  
d = sphere

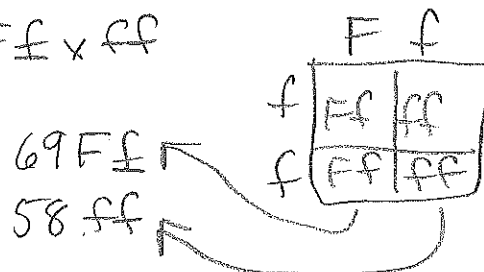
$$YYDD \times yydd - (P)$$

(YyDd) - (F1)  
white disc

15. In tomatoes, fuzzy skin (F) is dominant over smooth skin (f). A cross between a fuzzy skinned tomato and a smooth skinned tomato resulted in 69 fuzzy skinned tomatoes and 58 smooth skinned tomatoes. Determine the genotypes of the parents and double check with a cross.

F = fuzzy  
f = smooth

$$Ff \times ff$$



16. In Cocker Spaniels, black coat color (B) is dominant over red coat color (b), and solid color (S), either black or red, is dominant over spotted color (s), either black-white or red-white. A solid black male is mated with a solid red female. They produce a litter of six pups: 2 solid black pups; 2 solid red pups; 1 black spotted pup; and 1 red spotted pup. Determine the genotypes of the parents.

B = black  
 b = red  
 S = solid  
 s = spotted

$$Ss Bb \times Ss bb$$



$$2 S- B-$$

$$2 S- bb$$

$$1 ss B-$$

$$1 ss bb$$

17. In fruit flies, long wings (L) is dominant over vestigial wings (l). If a vestigial winged fly is crossed with a homozygous long winged fly, what genotype and phenotype possibilities are expected in the F1 generation? In the F2 generation?

L = long  
 l = vestigial

$$ll \times LL$$

	L	l
L	LL	Ll
l	Ll	ll

$$F_1 = 100\%$$

Ll = long

	L	l
L	LL	Ll
l	Ll	ll

$$1LL : 2Ll : 1ll$$

3 long : 1 vestigial

18. In hogs, a white belt around the middle (M) is dominant over being beltless (m), and syndactyly, or fused hooves (F) are dominant over split, or normal, hoof (f). A uniformly colored hog homozygous for fused hooves is mated with a homozygous belted hog with split hooves. Determine the genotypes of the parents and the possible genotypes and phenotypes of the offspring.

M = belted  
 m = beltless  
 F = fused  
 f = split

$mm FF \times MM ff$

Mf 

Mf
----

100% Mm Ff  
 Belted, fused

19. In rabbits, short hair (K) is dominant over long hair (k), and brown hair (B) is dominant over black hair (b). A short, black-haired rabbit was crossed with a long, brown-haired rabbit. In four litters, 38 rabbits were produced, all with brown, short hair. Determine the genotypes of the parents and the 38 offspring.

K = short  
 k = long  
 B = brown  
 b = black

$Kk bb \times kk BB$

$Bb Kk$

20. A woman with brown eyes, which has two brothers, marries a man with brown eyes, which has a brother and two sisters, and produces a boy with brown eyes. When their son marries a woman with blue eyes, they have a girl with blue eyes. All of the boy's aunts and uncles have brown eyes, as do his grandparents. However, his mother, the little girl's grandmother, has an uncle with blue eyes. Trace the family history of eye color and determine how the little girl could have blue eyes.

