**Learning Genetics Can Be Fun - Solutions**

1. Two black dogs could be homozygous black (BB) or heterozygous black (Bb). Yellow must be homozygous, therefore cannot be the same genotype as black.

2. P Cc x Cc — both parents are normal but "carry" the allele for CF. One in four children will
$F_1$ CC, Cc, Cc, cc — inherit it.

3. a) P Rr x rr
b) R, r and r, r
$F_1$ Rr, Rr, rr, rr — 1 round:1 wrinkled
$F_2$ RR, Rr, Rr, rr — 3 round:1 wrinkled

4. P Ll x ll
$F_1$ Ll, Ll, ll, ll — 1 long:1 short

5. P T_ x tt — almost 1:1 therefore unknown parent must be heterozygous.
$F_1$ 327 tall: 321 short Note: homozygous (TT) would give ALL tall plants in $F_1$.

6. The presence of all smooth in the offspring means smooth is dominant.
P SS x ss
$F_1$ Ss
$F_2$ 3:1

7. a) P Ss x Ss
$F_1$ SS, Ss, Ss, ss
b) P S_ x _ _
The female must be heterozygous as she produced non-spotted pups. The unknown male must be homozygous recessive (ss). If he were homozygous dominant, all pups would be spotted. If he were heterozygous, you would expect a 3:1 ratio in pups.

8. (i) P T_ x tt — The male must be heterozygous (Tt) to be able to produce
$F_1$ tt — both trotters and pacers. If he were homozygous dominant
(ii) P T_ x tt — he would produce only trotters.
$F_1$ Tt
(iii) P T_ x Tt
$F_1$ tt

9. Normal woman Pp (must be heterozygous because father was albino)
Husband pp
Husband's parents both Pp
Children Pp, Pp, pp

10. test cross W_ x ww

11. B - black; b - white; S - short; s - long
a) P BBSs x bbss
$F_1$ BbSs, Bbss 1 black, short:1 black, long

b) P BbSs x bbss
$F_1$ BbSs, Bbss, bbSs, bbss 1 black, short:1 black, long: 1 white, short:1 white, long

c) P BBss x BbSs
$F_1$ BBSs, BBss, BbSs, Bbss 1 black, short:1 black, long

d) i) (a) 1/2 (b) 1/4 (c) 1/2
ii) (a) 1/2 (b) 1/4 (c) 1/2
iii) (a) 0 (b) 1/4 (c) 0

12. B - black; b - white; S - solid; s- spotted
male female
a) P B_S_ x bbS_
$F_1$ 2 B<u>b</u>S_ , 2 bbS_
Some white pups so the male must be Bb. The absence of any non-spotted pups suggests that female A is SS but we can't say for sure.

b) P BbS<u>s</u> x B_S_
$F_1$ bbss the presence of white, non-spotted pups means that female B must be BbSs

c) P BbSs x bbss
$F_1$ bbS<u>s</u> , bbss , B<u>b</u>S<u>s</u> , B<u>b</u>ss
The genotype of female C can be determined from her phenotype.

13. P Pp x Pp
$F_1$ PP, Pp, Pp, pp chance of PKU is 1/4

14. P Bb x Bb
$F_1$ BB, Bb, Bb, bb
a) 1/4 (b) 1/4 (c) 1/2
d) 1 homozygous brown:2 heterozygous brown:1 homozygous blonde. Phenotype: 3 brown:1 blonde
e) not possible because blonde (b) is recessive
f) C = curly; c = straight
g) P Cc x cc
$F_1$ Cc, Cc, cc, cc
h) C, c (i) c, c (j) 0 (k) 1/2 (l) 1/2
m) 1 heterozygous:1 homozygous recessive. Phenotype: 1 curly:1 straight
n) No. Straight hair is recessive so individual MUST be homozygous (cc).

15. $S^R$ - round; $S^L$ – long
P $S^RS^R$ x $S^LS^L$
$F_1$ $S^RS^L$, $S^RS^L$, $S^RS^L$, $S^RS^L$
P $S^RS^L$ x $S^RS^L$
$F_2$ $S^RS^R$, $S^RS^L$, $S^RS^L$, $S^LS^L$ (incomplete dominance)

16. P $S^NS^M$ x $S^NS^M$

$F_1$ $S^NS^N$, $S^NS^M$ $S^NS^M$, $S^MS^M$ 25% chance of having homozygous recessive child

17. $C^RC^R$ - chestnut; $C^MC^M$ - cremello; $C^MC^R$ - palomino
P $C^MC^R$ x $C^MC^M$
$F_1$ $C^MC^M$, $C^RC^M$ 1 cremello:1 palomino

18. P $F^RF^W$ x $F^RF^W$
$F_1$ $F^RF^R$, $F^RF^W$, $F^RF^W$, $F^WF^W$
a) ½ pink
b) 1/4 red
c) 1/4 white
d) 1:2:1

19. woman $I^B\_$ x man $I^A\_$
$F_1$ ii is possible if mother and father were both heterozygous. The facts are inconclusive.

20. P ♂ ii x ♀ $I^AI^B$
$F_1$ $I^Ai$, $I^Bi$

AB ♀ could produce AB offspring if ♂ were type A, B, or AB; she could never produce type O in $F_1$ because she always donates either A or B.

21. a) P $C^hC^a$ x $C^aC^a$
$F_1$ $C^hC^a$, $C^aC^a$ 1 himalayan:1 albino

b) P $CC^a$ x $C^{ch}C^a$
$F_1$ 2 C_, $C^{ch}\_$, $C^aC^a$

c) P $C^{ch}C^{ch}$ x $C^{ch}C^a$
$F_1$ $C^{ch}C^{ch}$, $C^{ch}C^a$ 1 chinchilla:1 light gray

d) P $C^{ch}\underline{C^h}$ x $C^aC^a$ test cross
$F_1$ 5 $C^h\underline{C^a}$, 5 $C^{ch}\underline{C^a}$

22. a) 4 children
b) A is Dd, B is Dd
c) M is dd, N is dd

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