Unit 1 Genetics 3tto – answers 2021/2022

1.1 Basic genetics

1. *Textbook*
2. It's the fusion of the sperm cell and the egg cell. 23 + 23 chromosomes are combined, and a new individual is formed (starting with one cell).
3. A molecule DNA (one of the 46 of a human being).
4. To make all processes work, to determine the way we function and look.
5. The process by which genetic information is passed from parents to their children.

1.2 Single traits

1. Genotype is about the genes (the chromosomes), the information (AA, Aa, aa) and phenotype is what you can see, the observable characteristics/traits
2. Genotype and environment (circumstances) together determine the phenotype

3. male = Yy female = YY → chance of orange baby (yy) = 0%
4. male = Pp female = Pp → chance of baby with homozygous recessive genotype (pp) = 25%
5. male = rr female = Rr → chance of baby looking like mom - e.g. having 3 rings (RR or Rr) = 50%
6. male = YY female = yy → chance of baby having hybrid genotype (Yy) = 100%
7. male = aa female = Aa → chance of baby with recessive phenotype - e.g. 1 antenna (aa) = 50%
8. male = Ee female = Ee → chance of baby wearing glasses (EE or Ee) = 75%
9. male = rr female = Rr → chance of genetically pure baby (RR or rr) = 50%

10. All tall
TT x tt

	T	T
t	Tt	Tt
t	Tt	Tt

11. 25%
TT x tt

	T	t
T	TT	Tt
t	Tt	tt

12. 1/2 or 50%
13. a. RR x rr **b.** 0%
14. All white
15. pp x Pp, 50% purple
16. a. Pp x Pp , 75% purple **b.** 25% white
17. a. Hh **b.** hh **c.** HH
18. HH x hh, all
19. Hh x Hh
a. 75%
b. 25%
20. Hh x Hx

	H	h
H	HH	Hh
h	Hh	hh

21. With a recessive cow. If you get red cows, the black cow it heterozygous, if not, it's homozygous.

22. You should notice that the F1 shows 100% long winged flies and the F2 shows a 3:1 ratio, which is 75% long winged and 25 short winged fruit flies. The only way to get this ration is by Tt x Tt (which is the F1) and you'll get the F1 by crossing two homozygous fruit flies: TT x tt.

1.2 Applied questions

23. Not every cell has the same functions, there are a lot of cell types and they all need different proteins and enzymes to function, so they do not need the same genes. Also, a cell doesn't need a specific gene all the time.

24. To use DNA, it must be read, it has to be translated into enzymes and after that it will be expressed. Our environment has also a big effect on our characteristics which makes it even more vague.

25. Sun, accidents, food, sickness.

26. *All the terms of page 24. Different possibilities. Let me check your answer.*

27. a. The chance to get a boy is 50%. The chance to get to boys is 50% x 50% = 25% or ½ x ½ = ¼ .

b. Two girls is the same answer, but a boy and a girl is 50%. There are 4 possibilities: BB, GG, BG, GB (B: boy, G: girl). So you have two possibilities to get a boy and a girl and both have a chance of 25%.

28. a. 75%
b. ¼ x ¼ x ¼ x ¼ = 1/256
c. ¾ x ¾ x ¾ x ¾ = 81/256
d. Four possibilities: BBBR, BBRB, BRBB, RBBB, all of them are ¼ x ¾ x ¾ x ¾ = 27/256 x 4 = 108/256
e. You already did 6 out of 16 possibilities. Do the other 10, like BBRR and so on. Do it until you have them all adding up to a chance of 1.

29. a. Tt (Manx female) and tt (normal male)
b. The ratio of ⅔ and ⅓, taking into account the TT genotype which will never be born, it looks a 75% 25% ratio, which you would expect in a heterozygous crossing Tt x Tt. But, the chance getting this ration with their own cats, Tt x tt, is possible, so without further data it's impossible to determine.

30.
a) ½
b) ½
c) ¼
d) ¼
e) ½
f) 3/8
g) 3/8

1.3 Family trees

1. *Textbook*
2. **a.** Dominant, 8 must be aa, parents must be Aa, so 8 is recessive and healthy. So the disease is dominant.
   b. 1, 5, 6, 8: aa 2, 3, 4: Aa 7 and 9 can be AA or Aa
   c. It's aa x AA or aa x Aa. In total a 6/8 = ¾ chance to a child with the disease.
   d. 27/64
3. **a.** Recessive: it is hidden in the parents
   b. p(aa)= ¼ (both parents must be Aa)
4. Parents both Aa. Children with CF aa, others AA/Aa
5. Blonde will be recessive (like in Q 1) > parents broth Bb. Blonde girl bb marries Bb (some children blonde so bb). Siblings of the blonde girl can be BB or Bb (like in Q 1), but all her children get at least a b from her so all black haired ones will be Bb.
6. First family tree the same as in Q 2. Second: mother aa so all children Aa. Father can be AA or Aa.

1.3 Applied questions

7. **b.** Bb x Bb
   c. 25%
   d. 25%
8. **a.** 5 and 6 are carriers, because 10 has CF
   b. 1, 2 and 10: aa 2, 5, 6, 7: Aa 3, 8, 9, 11: AA or Aa
   c. 25%

1.3 Practice questions

9. **a.** Curly: AA or Aa Straight: aa
b. All children Aa (curly).
10. A

11. **a.** Aa x aa
b. ¼
12. **a.** Aa x aa
b. Both rough and smooth, Aa and aa
13. **a.** Aa x aa
b. Aa can produce gametes (reproductive cells) with A or a, aa can only produce cells with an a.
14. **a.** ¼
b. 9/64

1.4 Practice questions

1. *Textbook*
2. D
3. II
4. **a)** Xy **b)** XX **c)** X or y **d)** X **e)** Xy **f)** XX **g)** XX or Xy
5. 26
6. XX
7. **a)** woman **b)** no extra chromosomes, no missing chromosomes
8. A male can never be carrier, so a lot of women could be carriers, but when a male receives the X^a, he will be sick.
9. They get their Y-chromosome from their father
10. See Q1
11. The mother has both alleles because she has a colour-blind son and a healthy one: X^AX^a. The chance to a colour-blind daughter is 50%.
12. **a)** Recessive, both parents carry the allele for deafness, but it's not visible **b)** No, male: X^Ay
13. Two possible genotypes for the mother: X^AX^a or X^AX^A Chance to colour blindness for the male is 8% → so two genotypes for the man: X^Ay or X^ay → 4 Punnett squares
a) Two out of four that have no chance to a colour-blind son, but two do (because of the mother). In total: 2 out of 16, which is 1/8.
b) Three out of four squares don't have a chance to a colour-blind daughter, but one square has a chance of 1 in 4: X^AX^a x X^ay. So, one in 16, but the chance the male has colour blindness was 8%, so 1/16 x 0,08 = 0,005.
14. Writing down the genotypes gives both fathers of 1 and 2: X^ay. The mother of one has X^AX^a because of her father. The mother of 2 has two possibilities.
a) 50%
b) You only have to look at the mother. She has two possible genotypes, colour blind or heterozygous, which gives a ¾ chance to colour blindness for her sons.
c) Chance to haemophilia for 2 is ¼ (two Punnett squares, only 1 out of 4 sons is colour blind). So the chance for both 2 and 1 to give a X^a is ¼ x ¾ = 3/16.