LB: Biology Genetics worksheet - 1997 revision

In snouters (a fictitious animal) **the following inheritance schemes exist:**

The first 4 are complete dominance inheritance pattern

A = Acute or pointed ears
a = Rounded ears (not acute)

B = Black coat color
b = White coat color

C = Curly tail
c = Straight tail

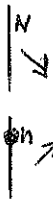
R = Rough Coat
r = Smooth Coat

This trait works by an incomplete dominance inheritance pattern

l = Long ears
s = Short ears

ls = Medium ears

Sex-Linkage (X-Linkage) inheritance pattern



or X^N = Normal blood clotting gene
or X^n = Hemophilia, abnormal blood clotting

1. Show a cross between two acute-eared snouters both of whom are heterozygous for the trait. Predict their offspring. Show all your work.

2. Show a cross between a snouter with acute ears who is homozygous for the trait and a snouter with acute ears who is heterozygous for the trait. Predict their offspring. Show all your work.

3. An acute-eared snouter who is heterozygous for the trait is mated with a round-eared snouter. Predict their offspring. Show all your work.

4. Predict the results of a mating between two snouters of medium ear length. Show all your work.

5. Predict the results of a mating between two snouters, one with medium length ears and one with short ears. Show all your work.

6. Predict the results of mating two snouters; one with medium length ears and one with long ears. Show all your work.

7. Predict the results of mating two snouters; one with short ears and one with long ears. Show all your work.

8. An acute-eared snouter is dropped on the doorstep of our lab. We do not know his genotype. How do we proceed to find his genotype? What is this procedure called?

9. We have an acute-eared snouter of unknown genotype. Let's call him Fred. We mate him with a round- eared snouter. Litter #1 yields three little snouters all of whom have acute ears. At this point, what conclusions would you care to draw regarding the genotype of our acute- eared snouter, Fred?

10. Not being absolutely certain of Fred's genotype (see problem #9) we mate him again. We again mate him with a round-eared snouter. This litter yields the following:

    2 acute-eared male snouters; 1 round-eared male snouter; 3 round-eared female snouters; 2 acute-eared female snouters;

    Give the genotypes of everyone involved.

11. A male snouter with hemophilia is mated to a female snouter who has normal blood clotting ability. However, her father was a hemophiliac. Predict their offspring in regard to this trait. Show all your work.

12. An acute-eared snouter with a black coat who is heterozygous for both traits. She is breed to a white-coated male who is heterozygous for ear shape. Predict their offspring. Show all your work.

13. An acute-eared snouter with a black coat is heterozygous for ~~both traits~~. She is bred to a white-coated male who is heterozygous for ear shape. Predict their offspring. Show all your work.

(Homozygous for Acute-ears) (Black coat color)

14. A black female snouter with hemophilia, whose mother was white, is mated to a black male snouter who has normal blood clotting ability. The male snouter's mother, like the female's mother, is white. Predict the color and blood clotting ability of the offspring of this mating. Show all your work.

15. A male snouter is a hemophiliac. He has acute ears and is heterozygous for the trait. A female snouter has normal clotting ability. She is, however, a carrier of the hemophiliac gene. She has rounded ears. The two are mated. Predict their offspring in regard to blood clotting ability and ear shape.

16. A male snouter has normal blood clotting ability. He has medium length ears. He is mated to a female. She is a carrier of the hemophiliac gene. She also has medium length ears. Predict their offspring in regard to blood clotting ability and ear length.

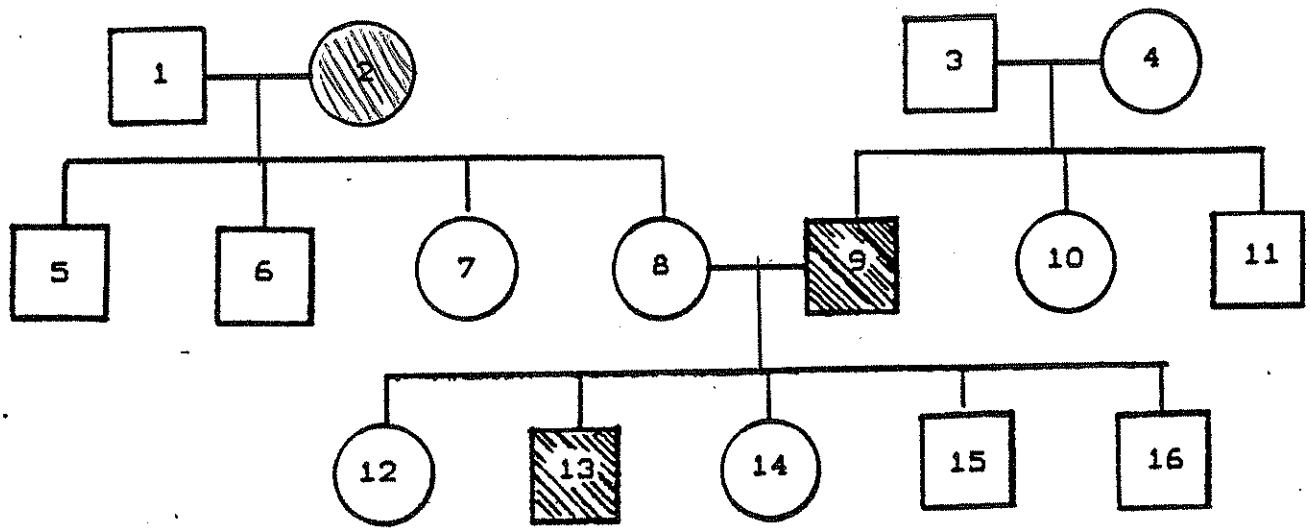
17. When snouters were first discovered it was found that some were very furry or had thick coats. Others had thin coats. Ten matings were made. Twenty snouters, ten male and ten female were chosen. Ten pairings and matings were made. Always a thick coated animal was mated to a thin coated animal. The results of the matings are given below. You are to draw as many conclusions as possible! What type of inheritance pattern are we dealing with? Could there be more than one inheritance pattern? What are the genotypes of the individuals in the crosses? Interesting one!

#1	#2	#3	#4	#5
4 thick	0 thick	0 thick	3 thick	0 thick
2 thin	8 thin	6 thin	1 thin	12 thin
#6	#7	#8	#9	#10
3 thick	0 thick	0 thick	0 thick	5 thick
4 thin	6 thin	9 thin	7 thin	5 thin

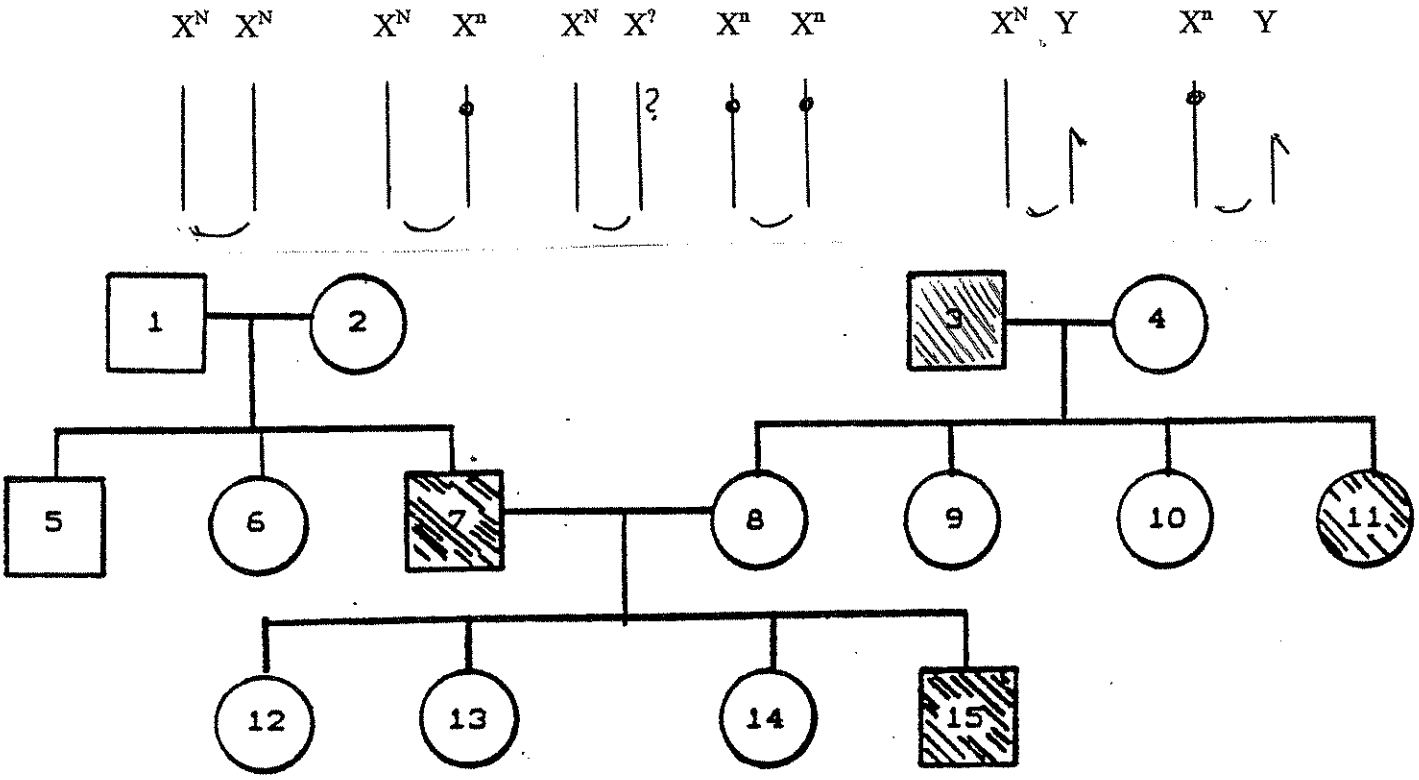
Explaination should be a minimum of ½ side of paper.

There could be 2 completely different possibilities for these results. At least do one!

18. The following is a pedigree of snouters. Recall the inheritance pattern in regard to ear shape (acute and rounded). Males are squares. Females are circles. Shaded indicates an expression of the recessive phenotype. Give the **correct** genotype of all snouters. Use "AA", "Aa", "aa", or "A?".



19. Shown below is a pedigree regarding hemophilia in snouters. Shaded individuals indicate those exhibiting the sex-linked trait, in this case hemophilia. You are to give the genotype for everyone. The following symbolic representations should give you the idea. You can use the symbols or the letters X and Y.



Multiple alleles:

20. One page one of this series we gave you much information concerning genes in snouters. In the South American species (similar but different kind of snouter) the black and white color genes are no longer operational due to certain mutations that occurred though the years. Instead their color is determined by a series of multiple alleles. Multiple alleles refers to a situation in which more than two possibilities exist for the possible genes located at a specific locus on a chromosome. Even though one individual only inherits two of the alleles from their parents, there are more than 2 possibilities throughout the population. In South American snouters we have the following alleles for coat color:

C = **full color** - this gene is dominant over the other alleles in the series. It produces a dark brown wild color similar to what one sees in say a wild rabbit.

C^{ch} = **chinchilla** - this gene is recessive to full color but dominant over the other alleles in the series. The gene causes a lighter colored animal by making the tips of the body hairs white or with no color at all (albinoism).

C^{e} = **extreme dilute** - this gene is recessive to the full color gene and to the chinchilla gene. In these animals, only a very small amount of pigment is produced and deposited in the hairs. They are very light in color, a tinting of brownish/grey.

c = **albino** - this gene is recessive to all the other three genes in the series. This gene doesn't product any pigment at all. These snouters have pure white hair and pinkish eyes. There is no pigment anywhere in their body.

Given below are some genotypes. In each case indicate the phenotype.

A. C C = B. C C^{ch} = C. C^{ch} C^{ch} =

D. C^{ch} C^{e} = E. C^{e} C^{e} = F. C^{e} c =

G. c c = H. C C^{e} = I. C^{ch} c =

21. A full color South American male snouter who is homozygous for the trait is mated to a female South American. She is extreme dilute and is homozygous for the condition. Predict the color of their offspring. Show all your work.

22. One of the male offspring from the previous cross (question #29) is mated to a female S.A. snouter who is chinchilla colored and is homozygous for the trait. Predict the offspring. Show all your work.

23. Predict the results of a cross between the following South American snouters:
Male - extreme dilute and his mother was an albino
Female - chinchilla colored and her father was an albino
Show all your work.

24. A full color South American snouter whose father was an albino is mated to an extreme dilute snouter whose father was an albino. Predict the color of their offspring and give the genotypes of the grandparents to the extent we know them. Make a pedigree!

25. We find a litter of abandoned snouters. (South American species) Their phenotypes are as follows:

2 males - chinchilla colored	1 male - albino
4 females - chinchilla colored	1 female - albino
2 males - extreme dilute	

What were the genotypes of the parents?

26. In South American snouters the same genes apply as in regular snouters (see page #1) except for the multiple alleles for color as explained in question #20. Via fractions (use the fraction method) predict the offspring of the following cross:

The male snouter has acute ears and rough coat and is heterozygous for both traits. He has a chinchilla colored coat. His mother was an albino.

The female to which he is mated also has acute ears and rough coat. She is also heterozygous for both ear shape and coat texture. She is an albino. Again, predict the probabilities of their offspring by the fraction method.

27. In South American snouters the following cross is made: C^{ch} c x C^{ch} c

It yields these results: 5 albinos and 6 chinchillas

a. Does this approximate the expected ratio? YES or NO
b. What is the expected ratio?
c. What rationale is used to explain this event?
d. What is wrong with our sample?

3 Character crosses - keeping track of 3 genes at once:

28. Predict the results of a cross between 2 snouters with the following genotype: AaBbRr x AaBbRr Work using the fraction method. Show all your work.

29. Use the fraction method to predict the results of the following snouter cross:

Male:	Black coat (heterozygous)	Female:	Black coat (heterozygous)
	Straight tail		Curly tail (heterozygous)
	Long ears		Medium ears

Gene Linkage - when genes are carried on the same chromosome:

30. In fruit flies we have two pure strains. Strain means a certain type. Pure means they are homozygous for their trait. One strain shows the dominant traits A, B, & C. It is homozygous for all of these traits. The second strain shows traits a, b, & c. It is of course also homozygous for all of these traits. These 3 traits are all found on chromosome #1. That is, all these loci are linked together on the same chromosome. If you are having trouble with the idea of linkage - read about it in your book!

    Show a somatic cell of each strain. Be sure to show the linkage!

31. Show the possible gametes that the dominant strain could produce. (Yes, this is step #2)
Be sure to show the linkage!

32. Show the possible gametes that the recessive strain could produce. (Yes again, this is step #2)
Be sure to show the linkage!

33. Predict the results of a cross between these two pure strains. That is predict the phenotypes of the F_1.
(#30 is step #1; #31&32 is step #2; this question is step #3 & 4 of the same problem)
Be sure to show the linkage even in your punnett square!

34. Regarding these fruit flies, predict the F_2 generation. Be sure to show all 4 steps and show the linkage!

35. The following are the actual results from the F_2 generation:

Traits shown in individual flies	Number of flies with those traits
A B C	720
a b c	239
A B c	10
a b C	20
A b c	5
a B C	6

Remember these traits are linked. Explain these results?

Is gene at locus "B" closer to locus "A" or closer to locus "C"? Why?