1. In squash a gene for white color (W) is dominant over its allele for yellow color (w). Give the gcnotypic and phcnotypic ratios for the results of each of the following crosses:

   W/W × w/w
   W/w × w/w
   W/w × W/w

2. If pollen from the anthers of a heterozygous white-fruited squash plant is placed on the pistil of a yellow-fruited plant, show, using ratios, the genotypes and phenotypes you would expect the seeds from this cross to produce.

3 In human beings, brown eyes are usually dominant over blue eyes. Suppose a blue-eyed man marries a brown-eyed woman whose father was blue-eyed. What proportion of their children would you predict will have blue eyes?

4. If a brown-eyed man marries a blue-eyed woman and they have ten children, all brown-eyed, can you be certain that the man is homozygous? If the eleventh child has brown eyes, what will that show about the father's genotype?

5 A brown-eyed man whose father was brown-eyed and whose mother was blue-eyed married a blue-eyed woman whose father and mother were both brown-eyed. The couple has a blue-eyed son. For which of the individuals mentioned can you be sure of the genotypes? What are their genotypes? What genotypes are possible for the others?

6. If the litter resulting from the mating of two short-tailed cats contains three kittens without tails, two with long tails, and six with short tails, what would be the *simplest* way of explaining the inheritance of tail length in these cats? Show genotypes.

7. When Mexican Hairless dogs are crossed with normally-haired dogs about half the pups are hairless and half have hair. When, however, two Mexican Hairless dogs are mated, about a third of the pups produced have hair, about two thirds are hairless, and some deformed puppies are born dead. Explain these results.

8. In peas a gene for tall plants *(T)* is dominant over its allele for short plants *(t)*. The gene for smooth peas *(S)* is dominant over its allele for wrinkled peas *(s)*. Calculate both phenotypic ratios and genotypic ratios for the results of each of the following crosses:

   T/t S/s × T/t S/s
   T/t s/s × t/t s/s
   t/t S/s × T/t s/s
   T/T s/s × t/t S/S

9. In hogs a gene that produces a white belt around the animal's body is dominant over its allele for a uniformly colored body. Another independent gene produces fusion of the two hoofs on each foot (an instance of svn-dactyly); it is dominant over its allele, which produces normal hoofs. Suppose a uniformly colored hog homozygous for syndactyly is mated with a normal-footed hog homozygous for the belted character. What would be the phenolype of the F_1? If the F_1 individuals are allowed to breed freely among themselves, what genotvpic and phenotypic ratios would you predict for the F_2?

10. In watermelons the genes for green color and for short shape are dominant over their alleles for striped color and for long shape. Suppose a plant with long striped fruit is crossed with a plant hctcrozygous for both these characters. What phenotypes would this cross produce and in what ratios?

11. In the fruit fly *Drosophila melanogaseter,* vestigial wings and hairy body arc produced by two recessive genes located on different chromosomes. The normal alleles, long wings and hairless body, are dominant. Supposes vestigial-winged hairy male is crossed with a homozygous normal female. What types of progeny would be expected? If the F_1 from this cross are permitted to mate randomly among themselves, what progeny would be expected in the F_2? Show complete genotypes, phenotypes, and ratios for each generation.

12. Suppose a hairy female hctcrozygous for vestigial wing is crossed with a vestigial-winged male heterozygous for the hairy character. What will be the characteristics of the F_1?

13. In some breeds of dogs a dominant gene controls the characteristic of barking while trailing. In these dogs another independent gene produces erect ears; it is dominant over its allele for drooping ears. Suppose a dog breeder wants to produce a pure-breeding strain of droop-eared barkers, but he knows that the genes for silent trailing and erect ears are present in his kennels. How should he proceed?

14. A dominant gene. *A,* causes yellow color in rats. The dominant allele of another independent gene, *R,* produces black coat color. When the two dominants occur together (A/- *R/-),* they interact to produce gray. Rats of the genotype a/a *r/r* are cream-colored. If a gray male and a yellow female, when mated, produce offspring approximately $^{3}/_{8}$ of which are yellow, $^{3}/_{8}$ gray, $^{1}/_{8}$ cream, and $^{1}/_{8}$ black, what are the genotypes of the two parents?

15. What are the genotypes of a yellow male rat and a black female that, when mated, produce 46 gray and 53 yellow offspring?

16. In Leghorn chickens colored feathers are due to a dominant gene, C; white feathers are due to its recessive allele, c. Another dominant gene, *I*, inhibits expression of color in birds with genotypes *C/C* or C/c. Consequently both C/- *I*/- and *c/c -/-* are white. A colored cock is mated with a white hen and produces many offspring, all colored. Give the genotypes of both parents and offspring.

17. If the dominant gene *K* is necessary for hearing, and the dominant gene *M* results in deafness no matter what other genes are present, what percentage of the offspring produced by the cross *k/k M/m* × *K/k m/m* will be deaf?

18. What fraction of the offspring of parents each with the genotype *K/k M/m* will be *k/k m/m?*

19. Suppose two *D/d E/e F/f G/g H/h* individuals are mated. What would be the predicted frequency of *d/d E/e F/f g/g H/h* offspring from such a mating?

20. If' a man with blood type B, one of whose parents had blood type 0, marries a woman with blood type AB, what will be the theoretical percentage of their children with blood type B?

21. Both Mrs. Smith and Mrs. Jones had babies the same day in the same hospital- Mrs. Smith took home a baby girl, whom she named Shirley. Mrs. Jones took home a baby girl, whom she named Jane. Mrs. Jones began to suspect, however, that her child had been accidentally switched with the Smith baby in the nursery. Blood tests were made: Mr. Smith was type A, Mrs. Smith type B, Mr. Jones type A, Mrs. Jones type A, Shirley type 0, and Jane type B. Had a mixup occurred?

22. Suppose that gene *b* is X-linked, recessive, and lethal. A man marries a woman who is heterozygous for this gene. If this couple had many normal children, what would be the predicted sex ratio of these children?

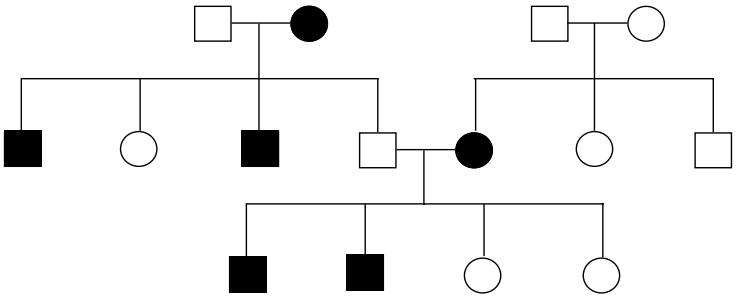
23. Red-green color blindness is inherited as a X-linked recessive. If a color-blind woman marries a man who has normal vision, what would be the expected phenotypes of their children with reference to this character?

24. A man and his wife both have normal color vision, but a daughter has red-green color blindness, a X-linked recessive trait. The man sues his wife for divorce on grounds of infidelity. Can genetics provide evidence supporting his case?

25. Suppose a pigeon breeder finds that about one fourth of the eggs produced by one of his prize pairs do not hatch. Of the young birds produced by this pair, two thirds are males. Give a possible explanation for these results. (In birds: males are homozygous ZZ and females are hemizygous ZW.)

26. It is exceedingly difficult to determine the sex of very young chickens, but it is easy to tell, by visual observation, whether or not they are barred. The barred pattern is inherited as a X-linked dominant. Set up a cross showing the sex of all chicks to be determined when they hatch. (Remember that chickens are birds.)

27. In cats short hair is dominant over long hair; the gene involved is autosomal. Another gene, B^1, which is X-linked, produces yellow coat color; its allele B^2 produces black coat color; and the heterozygous combination B^1/B^2 produces tortoise-shell coat color. If a long-haired black male is mated with a tortoise-shell female homozygous for short hair, what kind of kittens wi11 be produced in the F_1? If the F_1 cats are allowed to interbreed freely, what are the chances of obtaining a long-haired yellow male?



28. The diagram shows three generations of the pedigree of deafness in a family. Black circles indicate deaf persons. An arrow on a circle indicates a male, a cross below a circle a female. Stale whether the condition of deafness in this family is inherited as

    a. a dominant autosomal characteristic
    b. a recessive autosomal characteristic
    c. a X-linked dominant characteristic
    d, a X-linked recessive characteristic
    e. a holandric characteristic

29. In *Drosophila melanogaster* there is a dominant gene for gray body color and another dominant gene for normal wings. The recessive alleles of these two genes result in black body color and vestigial wings respectively. Flies homozygous for gray body and normal wings were crossed with flies that had black bodies and vestigial wings. The F, progeny were then test-crossed, with the following results:

Gray body, normal wings	236
Black body, vestigial wings	253
Gray body, vestigial wings	50
Black body, normal wings	61

    Would you say that these two genes are linked? If so, how many units apart are they on the chromosome?

30. In rabbits a dominant gene produces spotted body color, and its recessive allele solid body color. Another dominant gene produces short hair, and its recessive allele long hair. Rabbits heterozygous for both characteristics were mated with homozygous recessive rabbits. The results of this cross were as follows:

Spotted, short hair	96
Solid, short hair	14
Spotted, long hair	10
Solid, long hair	80

    What evidence for linkage is shown in this cross? Give the percentage of crossing-over and the map distance between the genes.

31. In *Drosophila melanogaster* the genes for normal bristles and normal eye color are known to be about 20 units apart on the same chromosome. Individuals homozygous dominant for these genes were mated with homozygous recessive individuals. The F_1 progeny were then test-crossed. If there were 1,000 offspring from the test cross, how many of the offspring would you predict would show the crossover phenotypes?

32. The crossover frequency between linked genes A and *B* is 40%; between *B* and *C,* 20%; between *C* and *D,* 10%; between C and A, 20%; between *D* and *B,* 10%. What is the sequence of the genes on the chromosome?

33. Suppose that nondisjunction resulted in the production of new individiduals with the following chromosomal abnormalities: XO, XXX, XYY, **XXXX,** XXXY, XXXXY. Indicate the expected phenotypic sex corresponding to each of these chromosomal combinations if it occurred (a) in a human; *(b)* in a *Drosophila.* How many Barr bodies would there be in human cells showing each of these combinations?