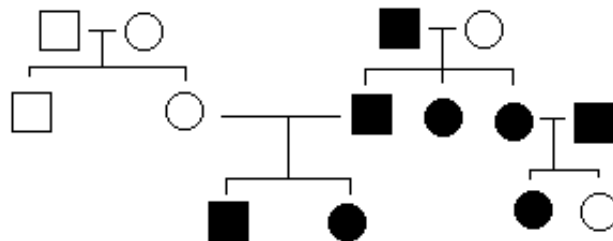


Inheritance

1. In human beings, cystic fibrosis (CF) is an autosomal recessive trait (*f*). Give the genotypic and phenotypic ratios for the following crosses:
 homozygous normal × heterozygous
 heterozygous × CF individual
2. Tay-Sachs disease occurs in individuals with the homozygous recessive condition. If a man whose father had Tay-Sachs disease marries a woman whose mother had Tay-Sachs disease, what is the probability that their first child will have the disease.
3. The presence of the Rh antigen is due to an autosomal dominant allele. Two Rh-positive parents have an Rh-negative child. What are the genotypes of these three people?
4. Schilder’s disease is a progressive degeneration of the central nervous system that leads to death at age 2 years. The disease is caused by a simple autosomal recessive mutation. A couple loses its first two children to Schilder’s disease. If they decide to have a third child, what is the probability that it will have the disease?
5. A right-handed man whose father was right-handed and whose mother was left-handed married a left-handed woman whose father and mother were both right-handed. Assume right-handedness is dominant over left. The couple has a left-handed 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. Tuberous sclerosis occurs in persons who have a parent who was similarly afflicted, and they regularly transmit the disorder to about half of their children. Genetically, the disease is caused by a) an autosomal recessive allele; b) a X-linked recessive allele; c) a X-linked dominant allele; d) an autosomal dominant allele; e) none of the above.
7. Syndactyly is a trait that is inherited as an autosomal dominant. Suppose a normal woman marries an affected man whose mother was normal, what percentage of their children will be expected to express this trait?
8. This is a pedigree for a rare heart condition that causes the heart to stop beating when a person is in their 20s. Black symbols indicate affected persons. Squares indicate males and circles, females. What is the most likely mode of inheritance of this disease?



9. A woman carries an X-linked gene that is lethal to affected offspring long before they are born. She marries a normal man and they have 15 children. How many boys are they likely to have?
10. Two people with normal vision have two sons, one color-blind and one with normal vision. If the couple then creates two daughters, to add to the two daughters born prior to the birth of the sons, what proportion of the daughters will have normal vision?
11. How many Barr bodies will each of the following individuals have?

XX

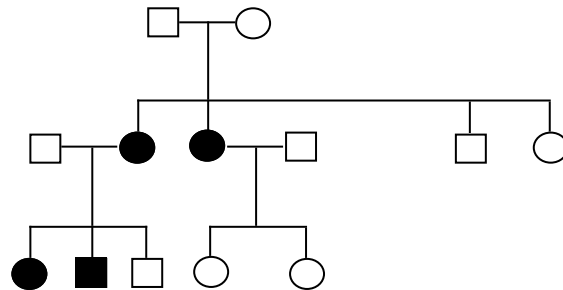
XY

XXX

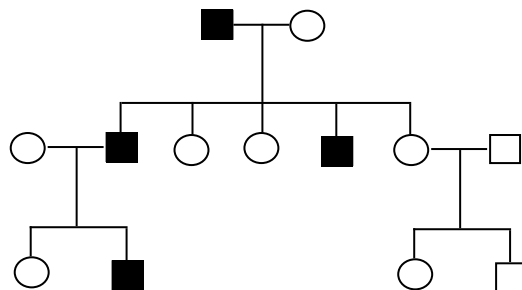
XXYY

XO

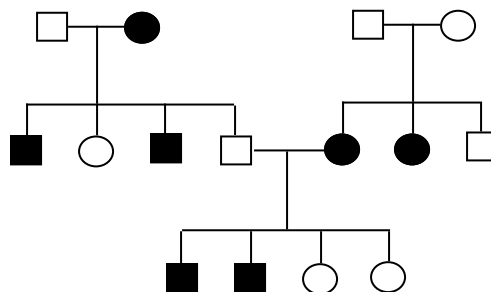
12. Families with Li-Fraumeni syndrome have a high incidence of breast cancer, connective tissue cancer, and brain cancer. Disease may occur at any time from childhood to old age. Use this pedigree for a family afflicted with Li-Fraumeni syndrome to determine the method of inheritance of the disease.



13. How is the condition shown in the pedigree below inherited?



14. The diagram shows three generations of the pedigree of deafness in a family. How is deafness in this family inherited?



The Birds and Bees

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 Z-linked dominant. Set up a cross showing the sex of all chicks to be determined when they hatch. (In birds: males are homozygous ZZ and females are hemizygous ZW.)

Males bees are known to develop parthenogenically from unfertilized eggs and are therefore haploid. Females (both workers and queens) originate from fertilized (diploid) eggs. Sex chromosomes are not involved in this mechanism of sex determination which is characteristic of the insect order Hymenoptera. The quantity and quality of food available to the diploid larvae determine whether that female will become a sterile worker or a fertile queen. Thus environment here determines sterility or fertility but does not alter the genetically determined sex. The sex ratio of the offspring is under the control of the queen. Most of the eggs laid in the hive will be fertilized and develop into worker females. Those eggs which the queen chooses not to fertilize (from her store of sperm in the seminal receptacle) will develop into fertile haploid males. Queen bees usually mate only once during their lifetime. If the diploid number of the honey bee is 16, **(a)** how many chromosomes will be found in the somatic cells of the drone, **(b)** how many tetrads* will be seen during the process of gametogenesis in the male, **(c)** how many tetrads* will be seen during the process of gametogenesis in the female?

*Tetrad refers to aligned homologous chromosomes in prophase I of meiosis.