2. Peas are diploid and $2n = 14$. *Neurospora* is haploid fungus and $n = 7$. If it were possible to fractionate genomic DNA from both by using pulsed field electrophoresis, how many distinct DNA bands would be visible in each species?

5. Name the key function of mitosis.

6. Name two key functions of meiosis.

9. In what ways does the second division of meiosis differ from mitosis?

13. Francis Galton, a geneticist of the pre-Mendelian era, devised the principle that half of our genetic makeup is derived from each parent, one-quarter from each grandparent, one-eighth from each great-grandparent, and so forth. Was he right? Explain.

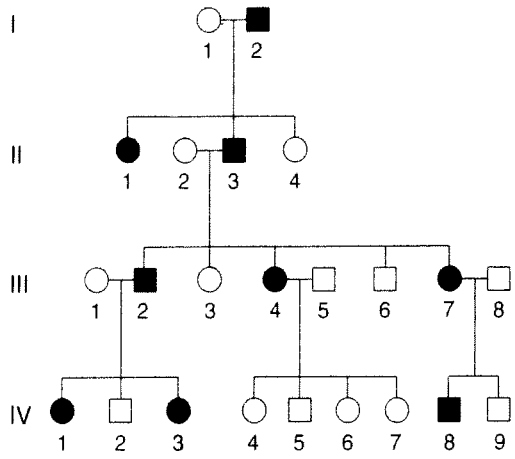
17. Four of the following events are part of both meiosis and mitosis, but only one is meiotic. Which one? (1) Chromatid formation, (2) spindle formation, (3) chromosome condensation, (4) chromosome movement to poles, (5) synapsis.

22. Two black guinea pigs were mated and over several years produced 29 black and 9 white offspring. Explain these results, giving the genotypes of parents and progeny.

26. From a large-scale screen of many plants of *Collinsia grandiflora*, a plant with three cotyledons was discovered (normally, there are two cotyledons). This plant was crossed with a normal pure-breeding wild-type plant, and 600 seeds from this cross were planted. There were 298 plants with two coltyledons, and 302 with three cotyledons. What can be deduced about the inheritance of three cotyledons? Invent gene symbols as part of your explanation.

31. John and Martha are contemplating having children, but John's brother has galactosemia (an autosomal recessive disease) and Martha's great-grandmother also had galactosemia. Martha has a sister who has three children, none of whom have galactosemia. What is the probability that John and Martha's first child will have galactosemia?

37. The accompanying pedigree is for a rare, but relatively mild, hereditary disorder of the skin.



a. How is the disorder inherited? State reasons for your answer.

b. Give genotypes for as many individuals in the pedigree as possible. (Invent your own defined allele symbols.)

c. Consider the four unaffected children of parents III-4 and III-5. In all four-child progenies from parents of these genotypes, what proportion is expected to contain all unaffected children?

43. A man lacks earlobes, whereas his wife does have earlobes. Their first child, a boy, lacks earlobes.

a. If the phenotypic difference is assumed to be due to two alleles of a single gene, is it possible that the gene is X linked?

b. Is it possible to decide if the lack of earlobes is dominant or recessive?

47. An X-linked dominant allele causes hypophosphatemia in humans. A man with hypophosphatemia marries a normal woman. What proportion of their sons will have hypophosphatemia?

52. A sex-linked recessive allele c produces a red-green color blindness in humans. A normal woman whose father was color-blind marries a color-blind man.

a. What genotypes are possible for the mother of the color-blind man?

b. What are the chances that the first child from this marriage will be a color-blind boy?

c. Of the girls produced by these parents, what proportion can be expected to be color-blind?

d. Of all the children (sex unspecified) of these parents, what proportion can be expected to have normal color vision?

60. Red hair runs in families, and the illustration below shows a large pedigree for red hair. (Pedigree from W. R. Singleton and B. Ellis, *Journal of Heredity* 55, 1964, 261.)

a. Does the inheritance pattern in this pedigree suggest that red hair could be caused by a dominant or a recessive allele of a gene that is inherited in a simple Mendelian manner?

b. Do you think that the red-hair allele is common or rare in the population as a whole?