Answers to Ch. 2 Homework Problems

2. PFGE separates DNA molecules by size. When DNA is carefully isolated form *Neurospora* (which has seven different chromosomes), seven bands should be produced with the use of this technique. Similarly the pea has seven different chromosomes and will produce seven bands (homologous chromosomes will comprise a single band).

5. The key function of mitosis is to generate two daughter cells genetically identical with the original parent cell.

6. Two key functions of meiosis are to halve the DNA content and to reshuffle the genetic content of the organism to generate genetic diversity among the progeny.

9. As cells divide mitotically, each chromosome consists of identical sister chromatids that are separated to form genetically identical daughter cells. Although the second division of meiosis appears to be a similar process, the "sister" chromatids are likely to be different from each other. Recombination in earlier meiotic stages will have swapped regions of DNA between sister and nonsister chromosomes such that the two daughter cells of this division are typically not genetically identical.

13. Yes. Half od our genetic makeup is derived from each parent, half of each parent's genetic makeup is derived from half of each of their parents, etc.

17. (5) Synapsis (chromosomal pairing)

22. The progeny ratio is approximately 3:1, indicating classic heterozygous-by-heterozygous mating. Because black (B) is dominant over white (b),

Parents: B/b X B/b
Progeny: 3 black: 1 white (1 B/B: 2 B/b: 1 b/b)

26. The fact that about half of the F_1 progeny are mutatnt suggests that the mutation that results in threee cotyledons is dominant and the original mutant was heterozygous. If C = the mutant allele and c = the wild-type allele, the cross is as follows:

P C/c X c/c
F_1 C/c three cotyledons
c/c two cotyledons

31. Pr(child has galactosemia) = pr(John is G/g) x pr(Martha is G/g) x pr(both parents passed *g* to the child) = (2/3)(1/4)(1/4) = 2/48 = ½4

37. a. The disorder appears to be dominant because all affected individuals would have an affected paretn. If the trait were recessive, then I-1, II-2, III-1, and III-8 would all have to be carriers (heterozygous for the rare allele).

b. With th assumption of dominance, the genotypes are:

I: d/d, D/d

II: D/d, d/d, D/d, d/d

III: d/d, D/d, d/d, D/d, d/d, d/d, D/d, d/d

IV: D/d, d/d, D/d, d/d, d/d, d/d, d/d, D/d, d/d

c. The probability of an affected child (D/d) equals ½ , and the probability of an unaffected child (d/d) also equals ½. Therefore, the chance of having four unaffected children (since each is an independent event) is: ½ x ½ x ½ x ½ = 1/16.

43. a. Sons inherit the X-chromosome from their mothers. The mother has earlobes; the son does not. If the allele for earlobes is dominant and the allele for lack of earlobes is recessive, then the mother could be heterozygous for this trait and the gene could be X-linked.

b. It is not possible from the data given to decide which allele is dominant. If lack of earlobes is dominant, then the father would be heterozygous and the son would have a 50% chance of inheriting the dominant "lack-of-earlobes" allele. If lack of earlobes is recessive, then the trait could be autosomal or X-linked, but, in either case, the mother could be heterozygous.

47. Let H=hypophosphatemia and h=normal. The cross is H/Y x h/h, yielding H/h (females) and h/Y (males). The answer is 0%.

52. a. XC/Xc, Xc/Xc

b. p (color-blind) x p (male) = (½)(½) = (1/4)

c. The cross is XC/Xc x Xc/Y, yielding 1 normal:1 color-blind for both sexes.

60. a. The inheritance pattern for red hair suggested by this pedigree is recessive because most red-haired individuals are from parents without this trait.

b. Observation of those around us makes the allele appear to be somewhat rare.