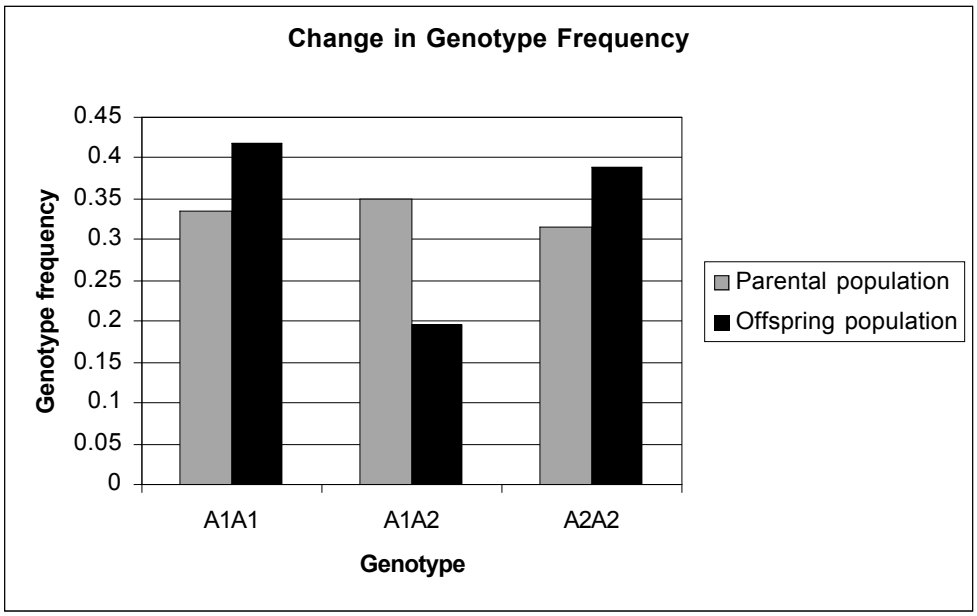
Answers to Exercise 41

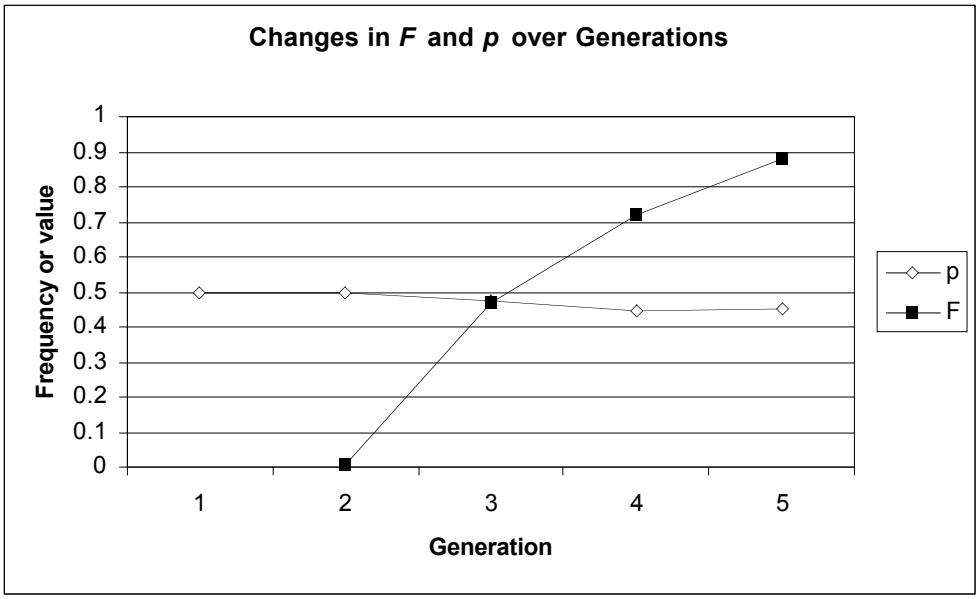
Inbreeding, Outbreeding, and Random Mating

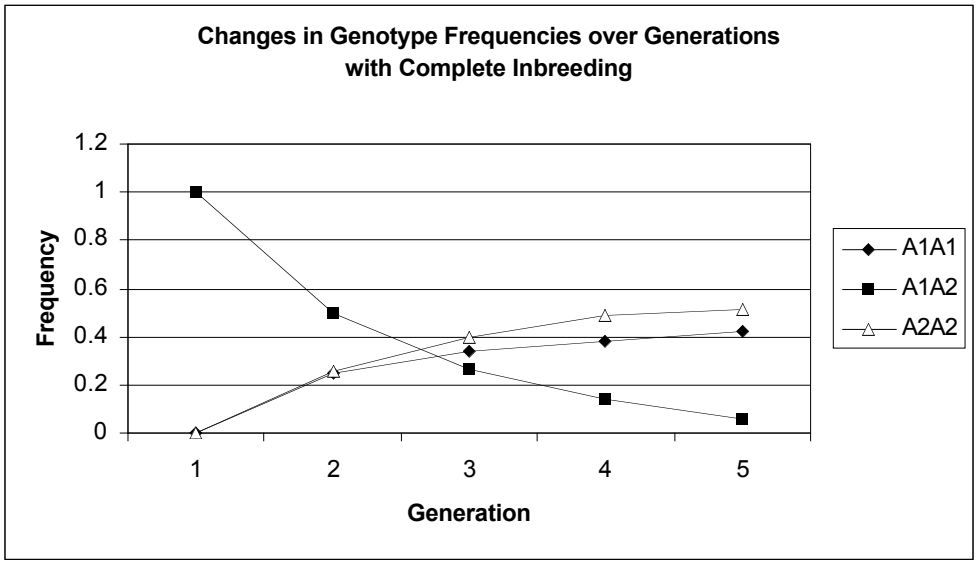
1. The allele frequencies should remain relatively unchanged. However, given that individuals will mate with other individuals of the same genotype (probability of 1 for mating with similar genotypes), the population tends to be inbred and homozygosity increases. This is true also when the genotype frequencies in the adult population are freq(A_1A_1) = 0.33, freq(A_1A_2) = 0.34, and freq(A_2A_2) = 0.33. The general result is that inbreeding tends to increase homozygosity without changing allele frequencies.



2. When you press F9, the calculate key, Excel generates new random numbers. This action generates new cell values in three parts of the spreadsheet: the genotype frequencies of the adult population changes, the random numbers for mate assignment changes, and the gamete contributions from the parental population changes. All of these add stochasticity to the model. The general results, however, will be more or less the same because the population is large (N = 1000) and such sampling "problems" are less severe in large populations.

3. When you continue to inbreed your population, F will increase, as will the frequency of the A_1A_1 and A_2A_2 homozygotes. However, the frequency of the A_1 allele, p, will remain more or less constant. With continued inbreeding, eventually the population will consist of only homozygotes, and F will equal 1.





4. You should see that when the probability of mating with the same genotype increases, F increases. F is negative when the population is outbreeding, and positive when the population is inbreeding. The frequency of the A_1 allele, p, however, remains unchanged from one generation to the next.