Meiosis and Sexual Life Cycles
Chapter 13

1. Describe how traits from parents are transmitted to their offspring. (Parents pass genes to their offspring by passing chromosomes via gametes.)
2. Describe how an asexually reproducing eukaryotic organism produces offspring that are genetically identical to each other and to the parents. (Such organisms reproduce by mitosis, which generates offspring whose genomes are exact copies of the parent's genome (in the absence of mutation).)
3. Define somatic cell, gamete, zygote, fertilization, homologous chromosome, sex chromosome, autosome, haploid, and diploid.
4. A horticulturalist is breeding orchids, trying to obtain a plant with a unique combination of desirable traits. After many years, she finally succeeds and wants to produce more plants like the successful one. Make a claim about whether she should crossbreed it with another plant or clone it. Justify your claim. (She should clone it. Crossbreeding it with another plant would generate offspring that have additional variation, which she no longer desires now that she has obtained her ideal orchid.)
5. Describe how the alternation of meiosis and fertilization maintain the normal chromosome number between generations. (Meiosis produces gametes with half the number of chromosomes as the parent cell. During fertilization, two gametes fuse, restoring the diploid chromosome number.)
6. Make a drawing to show how meiosis reduces the chromosome number.
7. Describe how independent assortment, crossing over and random fertilization increase genetic diversity through sexual reproduction. (During metaphase of meiosis I, each pair of homologous chromosomes is oriented independently of the other pairs. This results in maternal and paternal homologs of each pair assorting into separate gametes chromosomes independently of every other pair. This is independent assortment. Crossing over results in short pieces of maternal and paternal chromosomes trading places, resulting in chromosomes with new combinations of maternal and paternal alleles. Any male gamete could fertilize any female gamete. This random fertilization means that the possible combinations in a gamete is the product of the total possible maternal and paternal combinations.)
8. Although meiosis results in genetic diversity, identify the source of all original variation among alleles of any given gene. (All new alleles arise by mutation.)
9. Fruit flies have a diploid number of 8, and honeybees have a diploid number of 32. Assuming no crossing over, is the genetic variation among offspring from any two parents likely to be greater in fruit flies or honeybees. Support your answer. (Without crossing over, independent assortment of chromosomes produces 2n possible haploid gametes, and random fertilization produces $2n \times 2n$ possible diploid zygotes. Because the haploid number (n) of grasshoppers is 23 and that of fruit flies is 4, two grasshoppers would be expected to produce a greater variety of zygotes than would two fruit flies.)
10. Predict the amount of genetic variation that would result from crossing over if maternal and paternal chromatids had the same alleles for every gene. (If the segments of the maternal and paternal chromatids that undergo crossing over are genetically identical, then the recombinant chromosomes will be genetically equivalent to the parental chromosomes.)