Biology 164 Laboratory

Answers to Meiosis Problems.

1. How many different chromosomal combinations can result from meiosis in a species that has a diploid (2N) number of 8? Assume no crossing-over occurs.

   *Sixteen different combinations.*
   
   $ABCD$, $aBCD$
   $ABCd$, $aBCd$
   $AbcD$, $abCd$
   $AbCd$, $abCd$
   $AbcD$, $abcD$
   $Abcd$, $abcd$

2. Develop a mathematical formula that allows you to compute the answer to Question #1.

   a. What is the formula?

   $2^n$, where $n = \text{number of different chromosomes}$.

   b. Using that formula, how many chromosomal combinations can result from meiosis when the diploid number is 16?

   $2^8 = 256 \text{ different combinations}$.

   c. How about when the diploid number is 46 (as it is in humans)?

   $2^{23} = 8,388,608 \text{ different combinations!}$

3. The horse (*Equus caballus*) has a diploid complement of 64 chromosomes. The donkey (*Equus asinus*) has 62 chromosomes.

   a. What is the number of chromosomes that would be found in a hybrid offspring (mule) produced by mating a male donkey to a female horse?

   *63 chromosomes.*
b. Mules are usually sterile (incapable of producing viable gametes). During what phase of meiosis would problems occur in forming viable gametes? Why?

*Metaphase I because one chromosome will be unpaired resulting in some gametes being short one chromosome, while others will have one extra chromosome.*

4. Assume an organism with 2N number of 6 chromosomes. Draw diagrams comparing the appearance of the chromosomes:

a. In prophase I of meiosis and prophase of mitosis

![Prophase I of meiosis](image1) ![Prophase of mitosis](image2)

b. In metaphase II of meiosis and metaphase of mitosis

![Metaphase II of meiosis](image3) ![Metaphase of mitosis](image4)