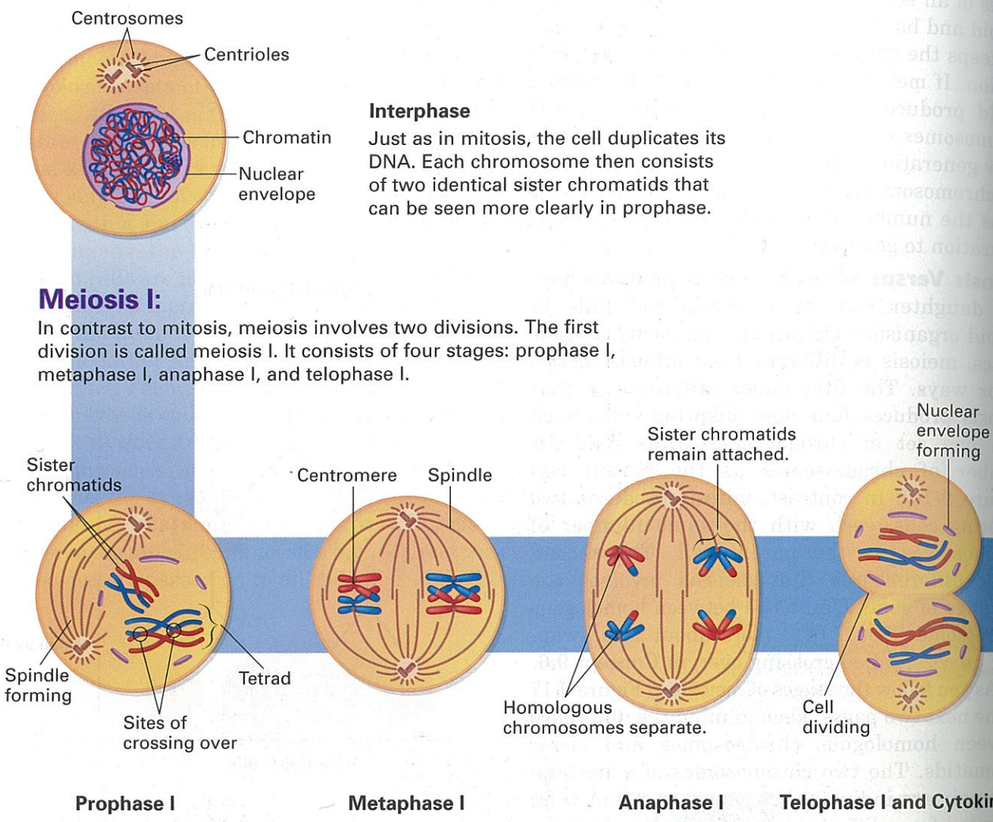
**Figure 9-17** The stages of meiosis begin after interphase. (This example starts with a cell that has two homologous pairs of chromosomes, $2n = 4$.)




**Interphase**
Just as in mitosis, the cell duplicates its DNA. Each chromosome then consists of two identical sister chromatids that can be seen more clearly in prophase.

## Meiosis I:

In contrast to mitosis, meiosis involves two divisions. The first division is called meiosis I. It consists of four stages: prophase I, metaphase I, anaphase I, and telophase I.

**Prophase I:** In prophase I, meiosis adds two new steps to the mitosis dance routine. One new step is that proteins cause the homologous chromosomes to actually stick together along their length. The paired chromosomes, now consisting of four chromatids, are referred to as **tetrads.** The tetrads attach to the spindle. The second new step is that the sister chromatids in the tetrads exchange some genetic material in the process known as crossing over. The different colors in this illustration indicate that one chromosome in the tetrad was originally inherited from the male parent and the other from the female parent.

**Metaphase I:** During metaphase I, the tetrads move to the middle of the cell and line up across the spindle.

**Anaphase I:** In this stage, homologous chromosomes separate as they migrate to opposite poles of the spindle. Notice that the sister chromatids migrate together—each chromosome is made up of two copies. Although this cell started with four chromosomes, there are only two chromosomes (each with two copies) moving to each pole.

**Telophase I and Cytokinesis:** In telophase I, the chromosomes arrive at the poles. Each pole now has a *haploid* daughter nucleus because it has only one set of chromosomes, even though each chromosome consists of two sister chromatids. Cytokinesis usually occurs along with telophase I, forming two haploid daughter cells. The chromosomes in each daughter cell are still duplicated.



**Prophase II:** In each haploid daughter cell, a spindle forms, attaches to the centromeres, and moves the individual chromosomes to the middle of the cell.

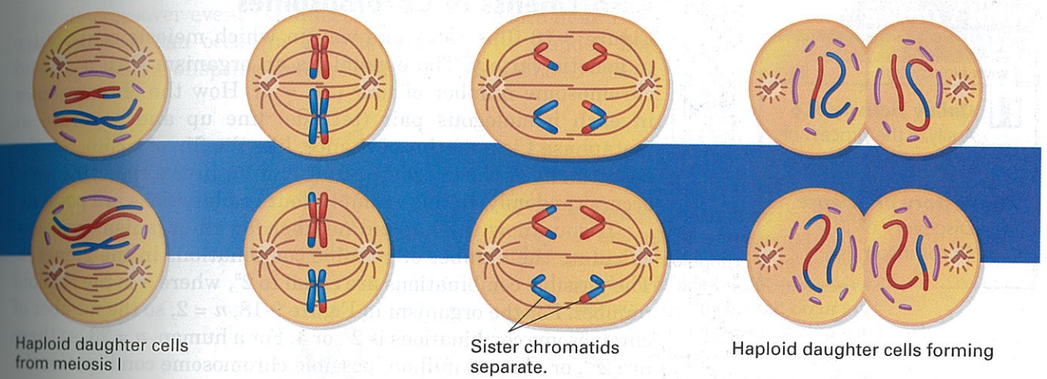
**Metaphase II:** The chromosomes line up in the middle of the cell with spindle microtubules attached to each sister chromatid.

**Anaphase II:** The sister chromatids separate and move to opposite poles.

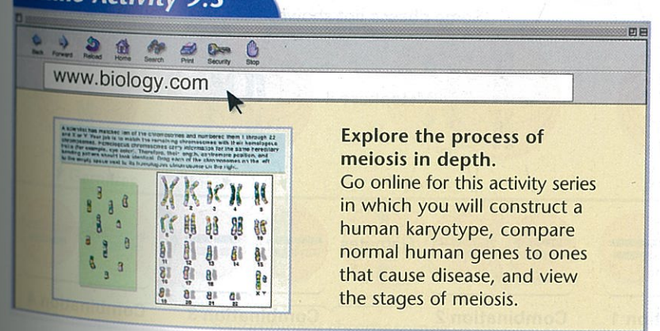
**Telophase II and Cytokinesis:** The chromatids, now considered individual chromosomes, arrive at the poles. Cytokinesis splits the cells one more time. The process of meiosis is completed, producing four haploid daughter cells as a-final result.

## Meiosis II:

The steps of meiosis II are very similar to the steps of mitosis. The difference is that instead of starting with a diploid cell, meiosis II starts with a haploid cell.




### Online Activity 9.5




**Explore the process of meiosis in depth.**
Go online for this activity series in which you will construct a human karyotype, compare normal human genes to ones that cause disease, and view the stages of meiosis.

### Concept Check 9.5

1. Describe how homologous chromosomes are different from sister chromatids.
2. Compare the number of sets of chromosomes in human gametes with the number of sets in other cells in the body.
3. How does meiosis I reduce the number of chromosomes in the daughter cells?
4. What is the final result of meiosis?