

CONCEPT 2

Reproductive cells are formed by a cell-dividing process called meiosis.

Activity

Halves of a Whole

Humans have 46 chromosomes in cells that make up the body. For fertilization to occur, the genetic material in male and female gametes combines to form a single cell. What does that tell you about the number of chromosomes in human gametes? Explain why mitosis of body cells could not produce gametes.



Each species has a particular number of chromosomes in its cells. Humans have 46 chromosomes that are organized into 23 pairs. Chromosomes that are paired are called *homologous chromosomes* (Figure 1.18). They have similar features and carry similar genetic information. During fertilization, each parent contributes one chromosome of each pair.

Because gametes combine in sexual reproduction, each must have half the number of chromosomes of other body cells. This ensures the correct number of chromosomes in each offspring and from one generation to the next (Figure 1.19).



Figure 1.18 In a pair of homologous chromosomes, the female parent contributes one chromosome, and the male parent contributes the other.

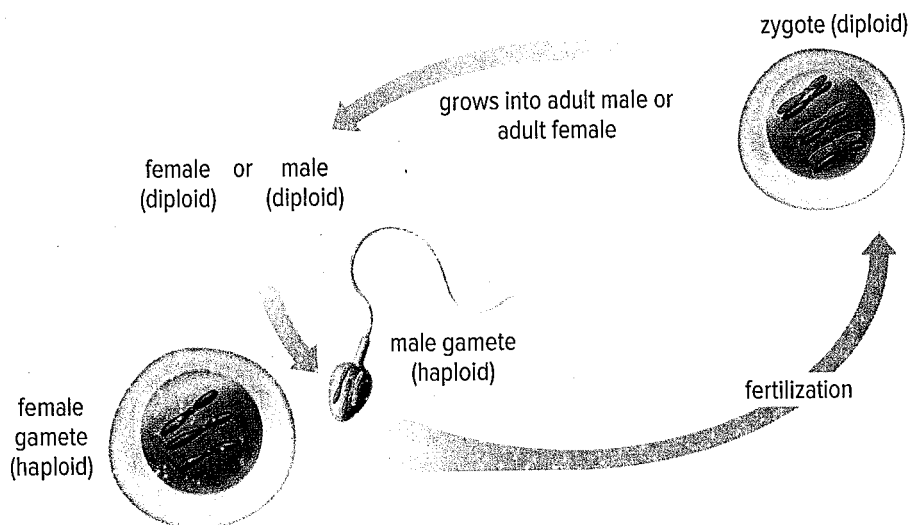


Figure 1.19 When haploid gametes combine together, they form the diploid zygote. How many chromosomes are in a human gamete?

Cells with half the normal number of chromosomes, such as gametes, are called **haploid** cells. Our body cells, which have a full number of chromosomes, are called **diploid** cells. How do diploid organisms produce haploid gametes? The answer involves a type of cell division called meiosis.

haploid a cell with half the number of chromosomes as the parent cell

diploid a cell with a complete set of chromosomes

Connect to Investigation
1-H on page 58

Meiosis Produces Unique Gametes

Special cells that produce gametes undergo a similar cell cycle to the one that you saw in Topic 1.2. However, instead of cell division by mitosis, these cells undergo meiosis. *Meiosis* involves a diploid cell dividing twice to produce four haploid cells (**Figure 1.20**).

Offspring are genetically different from their parents and from one another because the gametes that a parent produces are not all genetically the same.

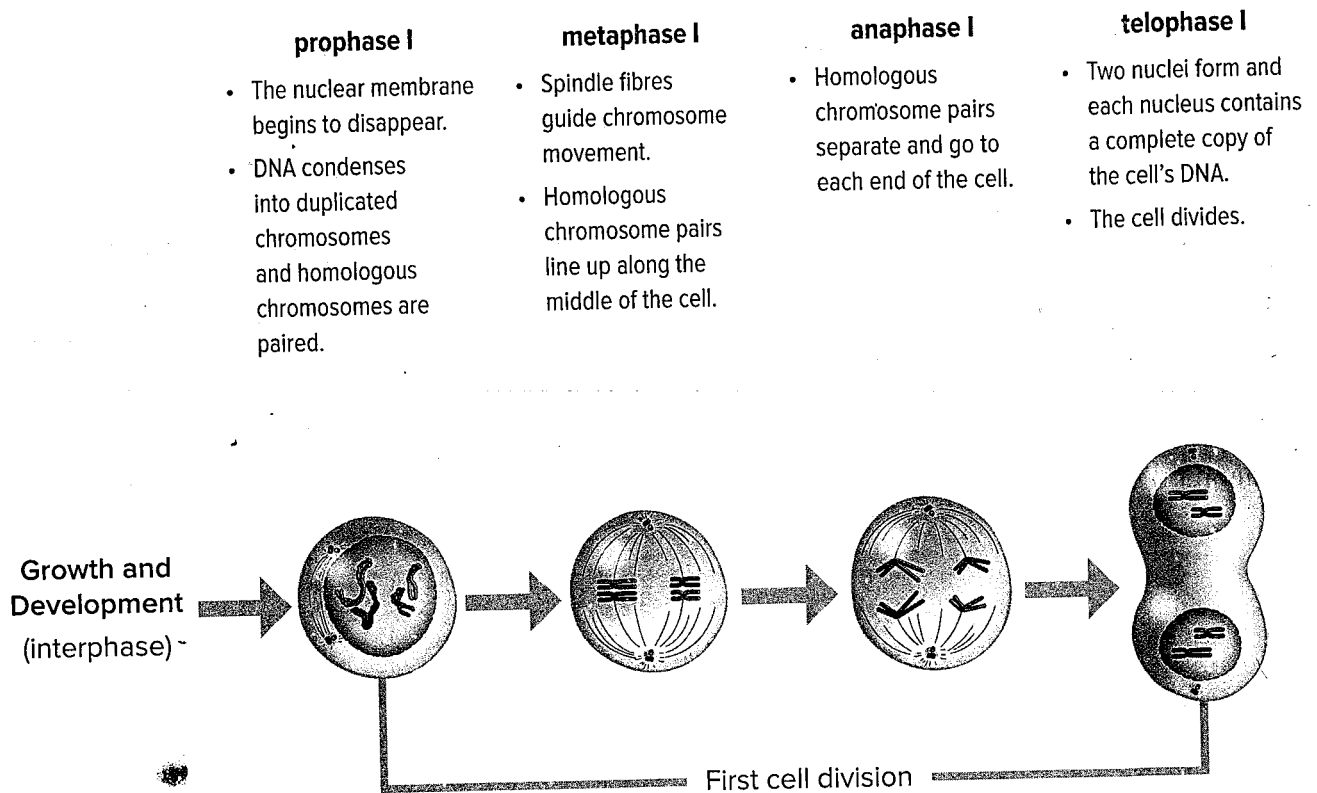


Figure 1.20 Meiosis produces four haploid cells from one diploid cell. These haploid cells are the gametes that take part in sexual reproduction.

Activity

It's in the Cards

Your teacher will provide you and a partner with a shuffled deck of cards. Each card contains an image of a phase in mitosis or meiosis. Arrange the cards in a sequence showing the steps that occur during mitosis and a separate sequence showing the steps that occur during meiosis.

Prenatal Development

Some of the major events that occur in prenatal development are described in Table 1.2.

Table 1.2 Human Prenatal Development

Month	Mass at End of Month (g)	Some Key Developments
1	< 1	<ul style="list-style-type: none"> • Spinal column and central nervous system start to form • Appendages are represented by small limb buds • Heart begins beating (around day 22)
2	1	<ul style="list-style-type: none"> • Eyes form, but eyelids are fused shut • Brain waves are detectable • Limb buds form paddle-like hands and form ridges
3	30	<ul style="list-style-type: none"> • Eyes are well developed, but eyelids are fused • Limbs are well-formed, with nails on fingers and toes • Fetus moves but too weakly for mother to feel it
4	100	<ul style="list-style-type: none"> • Face looks more distinctly human • Heartbeat can be heard with a stethoscope • Scalp begins to grow hair
5	200–450	<ul style="list-style-type: none"> • Body covered with fine hair (lanugo) • Mother can feel fetal movements • Fetus is now bent forward into “fetal position”
6	500–800	<ul style="list-style-type: none"> • Eyes are open • Skin is wrinkled, pink, and translucent
7	1100–1350	<ul style="list-style-type: none"> • Fetus turns to an upside-down position • Fetus can usually survive if born prematurely
8	2000–2300	<ul style="list-style-type: none"> • Fetus has a “babyish” appearance, with less wrinkled skin
9	3200–3500	<ul style="list-style-type: none"> • More fat deposits • Nails extend to or beyond fingertips • Birth is imminent

Activity

Show Development

Plan and create a multimedia presentation to show prenatal development from a fertilized egg until just before birth.

Before you leave this page . . .

1. During which parts of human development are cells dividing by meiosis? by mitosis?
2. On page 52, the words *divides* and *multiplies* are both used in describing prenatal development. Explain why this isn't as confusing as it might seem at first.