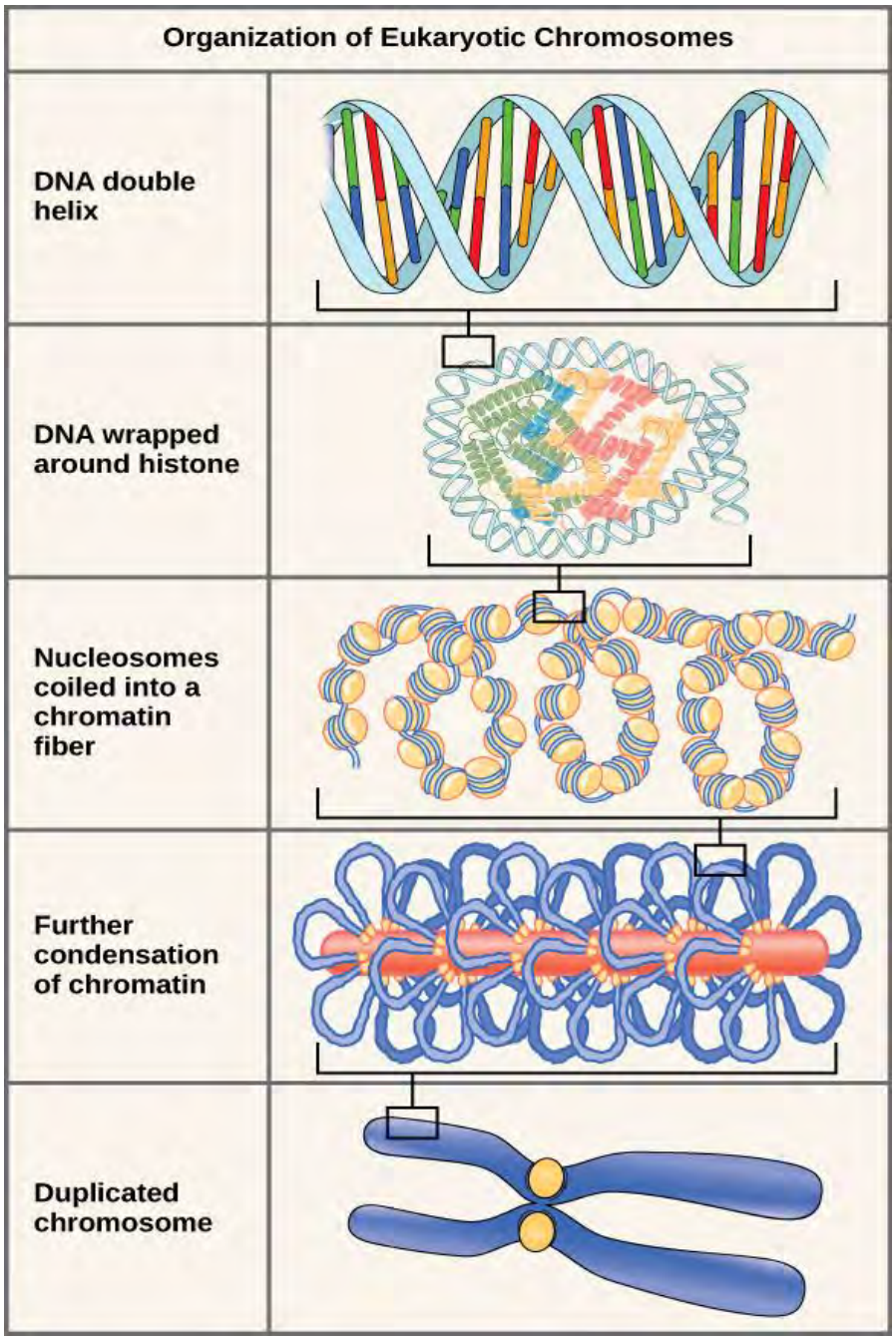

Figure 8.4 From top to bottom: The top panel shows a DNA double helix. The second panel shows the double helix wrapped around histone proteins, which makes a nucleosome. The middle panel shows multiple nucleosomes. The fourth panel shows that the chromatin fiber further condenses into the chromosome shown in the bottom panel. (credit: Clark et al. / Biology 2E OpenStax)

CONCEPTS IN ACTION - This animation illustrates the different levels of chromosome packing.

Section Summary

All the DNA found within the cell is called its genome. Prokaryotic and eukaryotic cells differ in both the quantity and organization of their genomes. Prokaryotes have a single loop chromosome, whereas eukaryotes have multiple linear chromosomes. Human cells, except for eggs and sperm, have 46 chromosomes.

Exercises

1. Chromatin is made of:
    a. DNA only
    b. DNA and protein
    c. DNA and carbohydrate
    d. DNA and lipid
2. A prokaryotic cell _____.
    a. has one circular chromosome
    b. has several linear chromosomes
    c. does not have chromosomes
    d. has homologous pairs of chromosomes
3. Contrast a prokaryotic chromosome and eukaryotic chromosomes.

Answers

1. (b)
2. (a)
3. In prokaryotes, the genome is typically composed of a single chromosome. The chromosome is made of a double-stranded DNA molecule organized in a loop or a circle. The circular chromosome is found in a region called the nucleoid. In eukaryotes, the genome is made up of several linear chromosomes. Chromosomes consist of double-stranded DNA molecules wrapped around proteins. Each eukaryotic species has a characteristic number of chromosomes in its nuclei.

Glossary

chromatin: DNA wound around proteins forming long fiber-like strands

chromosome: structures made of chromatin that are visible when the cell is dividing

genome: the entire genetic complement (DNA) of an organism

8.2 The Cell Cycle and Mitosis

Learning objectives

By the end of this section, you will be able to:

- *Describe the three stages of interphase*
- *Discuss the behavior of chromosomes during mitosis and how the cytoplasmic content divides during cytokinesis*
- *Explain why and how cytokinesis differs in plant and animal cells*
- *Define the G0 phase*
- *Explain how the three internal control checkpoints occur at the end of G1, at the G2–M transition, and during metaphase*
- *Describe how cancer is caused by uncontrolled cell growth*
- *Be able to define and explain all bolded terms*

The **cell cycle** is a series of events involving both cell growth and division. The cell cycle begins when a cell is first formed and continues until it divides and produces two new daughter cells. When a cell is dividing, it proceeds through a series of carefully timed and regulated stages of growth, DNA replication, and division.

Many multicellular organisms, including humans, reproduce sexually by the completing the process of meiosis. Meiosis is a process that produces specialized reproductive cells called eggs and sperm (Figure 8.5). **Sexual reproduction** requires the egg and sperm to come together to form a fertilized egg, also called a zygote. In humans, gametes are produced in the testes of males and the ovaries of females. The process of sexual reproduction and meiosis will be discussed in detail in section 8.5.

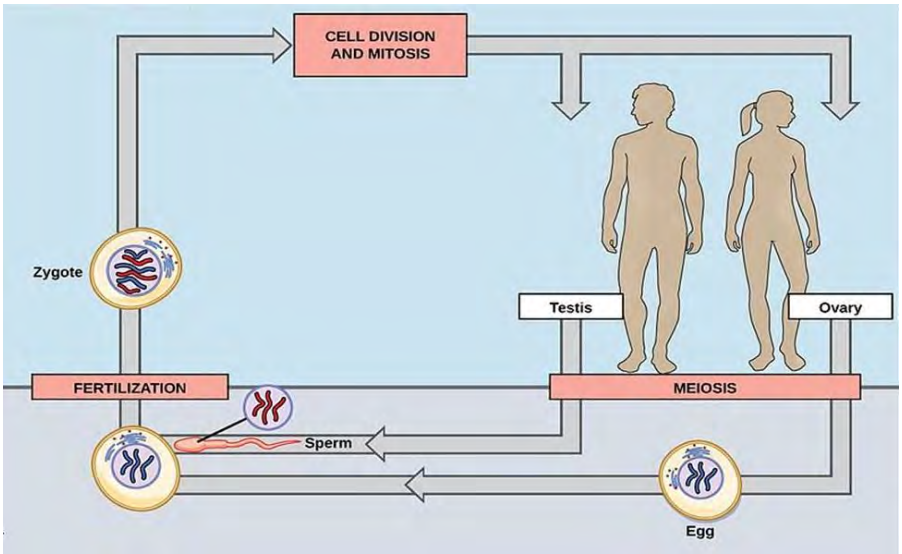

Figure 8.5 The human cell cycle includes two types of cell division: mitosis and meiosis. (credit: Biology OpenStax / Wikimedia Commons)