



Living organisms such as microbes, plants and humans, are made from **cells**. Believe it or not, even the largest organisms start out as a single cell. Living cells grow and create new cells as the organism reproduces and, in the case of **multicellular** organisms, adds cells as it grows and develops and replaces lost or damaged cells.



How does a cell create another cell?

Cell division

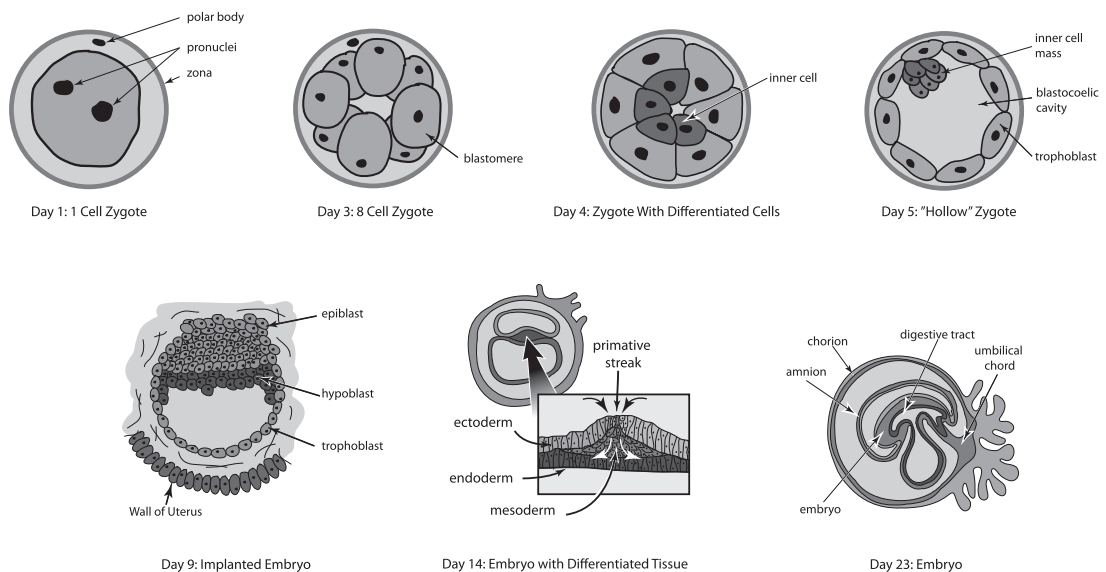
In order for new organisms to form and begin life and for already living organisms to grow, make all their different parts, and repair damaged parts, new cells must be produced. New cells are created from existing cells during the process of cell division, when a parent cell divides into two or more daughter cells. Cell division is **asexual reproduction**. When unicellular organisms such as the amoeba, undergo cell division an entire new organism is created. For unicellular organisms cell division is reproduction. Cell division in eukaryotes, organisms with a **nucleus**, is called **mitosis**. Cell division in prokaryotes, organisms without a nucleus, is called **binary fission**. For most cell components, growth is a steady, continuous process which is interrupted only briefly, near the end of cell division. This growth is put on hold while the **DNA** is replicated right before the cell divides into two identical cells called the “mother” and “daughter” cells.

A primary concern of cell division is DNA replication. Before cell division can occur, the genetic information stored in the DNA of the **chromosomes** must be duplicated and then separated, so that both the original “mother” cell and the new “daughter” cell contain identical DNA sequences.

Cell division is more complex in eukaryotes than in other organisms. Most eukaryotic cell division involves mitosis but for organisms that reproduce sexually there is also a more complex process called **meiosis**. During meiosis, the “mother” cell splits into four “daughter” cells, called gametes. Each **gamete** has only half the amount of DNA because during sexual reproduction a male gamete (sperm) and a female gamete (egg) can then combine a single cell (zygote) which again has the normal amount of DNA. During meiosis, there are two cell division steps that together produce the four daughter cells.

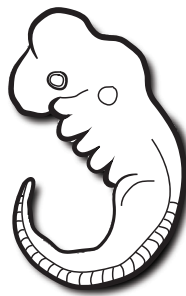
Fertilization and Growth of an Organism

Fertilization is this first step in the reproductive process for all organisms that reproduce sexually. Fertilization occurs when an egg and a sperm combine to create a zygote. After fertilization, the zygote begins the first of many cell divisions that eventually result in the growth of a new organism. As shown in the diagrams below, the single cell divides several times until a small cluster of cells forms. These cells then begin to specialize and create the earliest forms of the basic tissues of an embryo. As the growth process continues, the embryo further develops all the specialized tissues and organs required by the multicellular organism its DNA is coded to produce. When all the needed organs and tissues have been produced, the new organism is ready to be born.



Activity 38B • Processes and Purposes of Cell Division

In humans, fertilization typically occurs in a female's uterus. Each sperm and each egg contain 23 chromosomes (haploid) and the zygote formed when the sperm and the egg combine contains the full set of 46 chromosomes (diploid). The DNA contained in the chromosomes of the single-celled zygote contains all the information needed to produce all the specialized tissues and organs of an adult human. Much of this remarkable process of cell division and specialization takes place during the nine months between fertilization and birth. In the several days after fertilization, the zygote divides by mitosis. After about four days, a morula forms that is a "ball" of 16 or more cells. As mitosis continues, a blastocyst forms that is a hollow ball of 70 to 100 cells that has an inner and an outer layer. Around six to seven days after fertilization the zygote attaches to the uterine wall. Once this implantation occurs, the developing organism is called an **embryo**. As an embryo, the cells of the organism continue to divide and differentiate. Eight weeks after fertilization, the embryo has developed enough to be called a **fetus**. About nine months after fertilization, the fetus is ready to be born. Although children can be born much earlier than nine months after fertilization, these births are considered premature.



WEEK 4: Embryo



WEEK 6: Embryo



WEEK 9: Fetus

ANALYSIS

1. Explain why cells need to divide.
2. What are the
 - a. names of the three methods cells use to produce new cells.
 - b. similarities and differences between the three methods.
3. Compare and contrast the terms zygote, embryo, and fetus.