Heredity

Tina looks very much like her mother. Frank looks a little like his mom and a little like his dad. These similarities occur because genetic material is passed from parent to child. When a sperm and an egg unite, the newly fertilized egg has a complete set of chromosomes. **Chromosomes**, located in the cell’s nucleus, are **threadlike structures that carry genes**. **Genes** are the basic units of heredity. They carry the codes for inherited traits.

A sperm has 23 chromosomes, and an egg also has 23 chromosomes. The fertilized egg contains 46 chromosomes, half from the mother and half from the father. This is shown in **Figure 12.7** on page 384.

▶ A zygote becomes an embryo and then a fetus. **When is an embryo first called a fetus?**
Fertilization and Human Development

A **cell** is the basic unit of life. Humans are made of millions of cells. A fertilized egg, however, is just one single cell. How, then, does a single cell become a person made of many cells? Soon after fertilization, the fertilized egg begins to divide and multiply. Soon, an organism made up of many cells is formed.

As the organism continues to develop, its cells form more and more complex body parts. Groups of cells make up tissues. A **tissue** is a group of similar cells that do a particular job. Tissues then make up organs. An **organ** is a body part made up of different tissues joined to perform a particular function. Eventually, an entire body system is formed. A **body system** is a group of organs that work together to carry out related tasks.

Cells, tissues, organs, and body systems are different levels of organization in the body. Cells are the most basic level of organization. Body systems are the most complex. The different levels of organization in the body are shown in **Figure 12.8**.

Development of the Fetus

A fertilized egg is first called a zygote. The zygote divides to form two cells about 24 hours after fertilization. Then these cells divide, forming more cells. After about a week, the zygote attaches itself to the lining of the uterus. After another week, the zygote is called an embryo. An **embryo** is the developing organism from two weeks until the end of the eighth week of development. Each time one of an embryo's cells divides, it produces two cells. The number of cells continues to multiply as the embryo develops. After the eighth week, the human embryo is called a fetus. A **fetus** is the developing organism from the end of the eighth week until birth. About
FIGURE 12.8

BUILDING BODY SYSTEMS

One fertilized egg cell will eventually develop into a complete human being with body systems that work together. **How are cells, tissues, organs, and body systems related?**

Cells come in different shapes and perform different tasks. Each type of cell has a particular function. This cell is from the lining of the stomach.

A body system is a group of organs that work together to carry out related tasks. The digestive system is the body system shown here.

An organ is a body part made up of different tissues joined together to perform a function. For example, the stomach is an organ made up of muscle, mucous membranes, and other types of tissue. These tissues work together to digest food.

A tissue is a group of similar cells that do a particular job. For example, the tissue that forms the stomach lining protects the stomach from the acid in gastric juice.

Nine full months after fertilization, birth takes place. During this nine-month period, the fetus develops the complex body systems needed for survival. The stages the fetus goes through are shown in Figure 12.9, on page 386.

The fetus gets nutrients and oxygen from its mother through the umbilical (uhm-BI-li-kuhl) cord. This is a tube that attaches to the abdomen of the fetus. At birth, the umbilical cord is cut.

Reading Check Compare How does an embryo differ from a fetus?

**Care During Pregnancy**

An expectant mother can do many things to create a healthy environment for her growing fetus. Since the fetus is inside her body, all the mother's health choices can also affect its health. Expectant mothers should practice these positive health behaviors.

- **Eat healthful foods.** The fetus gets its nourishment directly from its mother. Eating nutritious foods will greatly benefit the health of both the mother and the fetus,
**Figure 12.9**

**Stages of Fetal Development**

This diagram shows the stages of development a fetus goes through.

**When does a fetus develop eyebrows and fingernails?**

- **6 Months**
  - Length: 12 ½ inches
  - Weight: 1½ pounds
  - New Features: eyebrows, fingernails
  - Behavior: kicks, hears sounds

- **9 Months**
  - Length: 18–20 inches
  - Weight: 7–9 pounds
  - New Features: smooth skin
  - Behavior: eyes open, fingers can grasp, body organs and systems can work on their own

**3 Months**
- Length: 3 inches
- Weight: 1 ounce
- New Features: arms, legs, fingers, toes, brain, nerves, heartbeat
- Behavior: begins to move

- **Have regular checkups.** A female should see a doctor as soon as she suspects that she is pregnant. Her doctor will set up appointments throughout the pregnancy to monitor both the mother’s health and the fetus’s development. An expectant mother should also take prenatal vitamins as recommended by the doctor.

- **Beware of infections.** Some diseases are very dangerous to the fetus. For example, rubella (also called German measles) and some sexually transmitted diseases can cause problems. A vaccine can protect against rubella. A woman should consult a doctor on how to avoid such dangers.

- **Don’t use tobacco.** Smoking or chewing tobacco can harm a developing fetus. A pregnant female should also avoid being around smokers, since breathing secondhand smoke is harmful to the fetus.

- **Don’t drink alcohol.** Any alcohol a pregnant female drinks goes into the fetus’s body. This can cause a fetus to develop serious problems. These problems are known as fetal alcohol syndrome (FAS) or fetal alcohol effects. Sometimes...
the problems are mild, such as having a small size at birth. At other times, they are severe. The child may have brain damage, mental retardation, and severe emotional problems. Later, the child may have trouble with learning, memory, paying attention, problem solving, and social interactions.

- **Don't take any unnecessary drugs.** Any medicine can affect a developing fetus. Even OTC medicines can be dangerous. A pregnant female should take medication only if absolutely necessary and only as instructed by her doctor. She should avoid all illegal drugs. Pregnant females should also avoid consuming products containing caffeine. Caffeine is a drug that could negatively affect the developing fetus.

> An expectant mother gives her baby solid nourishment by eating a healthful diet. **How is eating healthfully important to a pregnant female and her baby?**

---

**Lesson 5 Review**

**After You Read**

Review this lesson for new terms, major headings, and Reading Checks.

**What I Learned**

1. **Vocabulary** Define chromosomes.

2. **Identify** List four levels of body organization from most complex to most basic.

3. **Describe** Describe the development of a human from the point of fertilization to birth.

4. **List** What are four ways that a pregnant female can care for her developing baby?

**Thinking Critically**

5. **Apply** A test of Ling's fetus shows that its cells each have one more chromosome than normal human cells. How many chromosomes does each of the fetus's cells have?

6. **Analyze** Using the information given in Figure 12.9, calculate the weight that the developing fetus gains at each three-month stage. During which stage does it gain the most weight?

**Applying Health Skills**

7. **Analyzing Influences** Imagine that your aunt is going to have a baby. Both she and her husband smoke cigarettes. However, your aunt has decided to quit during her pregnancy. Your uncle says he doesn't need to quit. What information or advice might you give your aunt and uncle?