

SELECTED KEY TERMS

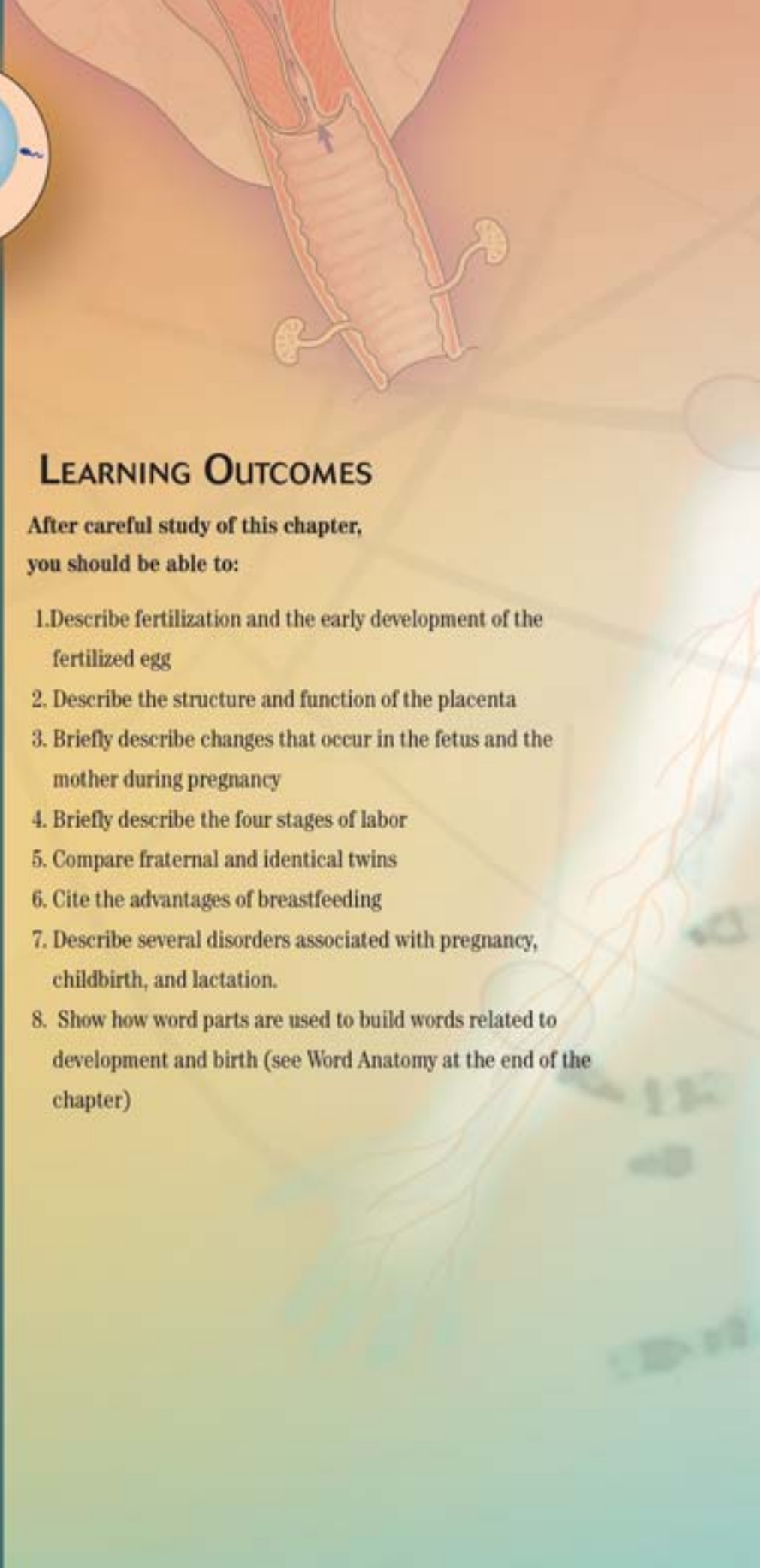
The following terms and all other boldface terms in the chapter are defined in the Glossary

abortion
amniotic sac
embryo
fertilization
fetus
gestation
human chorionic gonadotropin (hCG)
implantation
lactation
oxytocin
parturition
placenta
prolactin
umbilical cord
zygote

LEARNING OUTCOMES

After careful study of this chapter, you should be able to:

1. Describe fertilization and the early development of the fertilized egg
2. Describe the structure and function of the placenta
3. Briefly describe changes that occur in the fetus and the mother during pregnancy
4. Briefly describe the four stages of labor
5. Compare fraternal and identical twins
6. Cite the advantages of breastfeeding
7. Describe several disorders associated with pregnancy, childbirth, and lactation.
8. Show how word parts are used to build words related to development and birth (see Word Anatomy at the end of the chapter)



chapter

24

Development and Birth



► Pregnancy

Pregnancy begins with fertilization of an ovum and ends with delivery of the fetus and afterbirth. During this approximately 38-week period of development, known as **gestation** (jes-TA-shun), all fetal tissues differentiate from a single fertilized egg. Along the way, many changes occur in both the mother and the developing infant.

Fertilization and the Start of Pregnancy

When semen is deposited in the vagina, the many spermatozoa immediately wriggle about in all directions, some traveling into the uterus and oviducts (Fig. 24-1). If an egg cell is present in the oviduct, many spermatozoa cluster around it. Using enzymes, they dissolve the coating around the ovum, so that eventually one sperm cell can penetrate its plasma membrane. The nuclei of the sperm and egg then combine. (See Box 24-1 on artificial methods to assist conception.)

The result of this union is a single cell, called a **zygote** (ZI-gote), with the full human chromosome number of 46. The zygote divides rapidly into two cells and then four cells and soon forms a ball of cells. During this time,

the cell cluster is traveling toward the uterine cavity, pushed along by cilia lining the oviduct and by peristalsis (contractions) of the tube. After reaching the uterus, the little ball of cells burrows into the greatly thickened uterine lining and is soon implanted and completely covered. After **implantation** in the uterus, a group of cells within the dividing cluster becomes an **embryo** (EM-bre-o), the term used for the growing offspring in the early stage of gestation. The other cells within the cluster will differentiate into tissue that will support the developing offspring throughout gestation.

Checkpoint 24-1: What structure is formed by the union of an ovum and a spermatozoon?

The Placenta

For a few days after implantation, the embryo gets nourishment from the endometrium. By the end of the second week, however, the outer cells of the embryonic cluster form villi (projections) that invade the uterine wall and maternal blood channels (venous sinuses). Gradually, tissue in the outer embryonic layer and in the uterine lining together form the **placenta** (*plah-SEN-tah*), a flat, circular organ that consists of a spongy network of blood-filled channels and

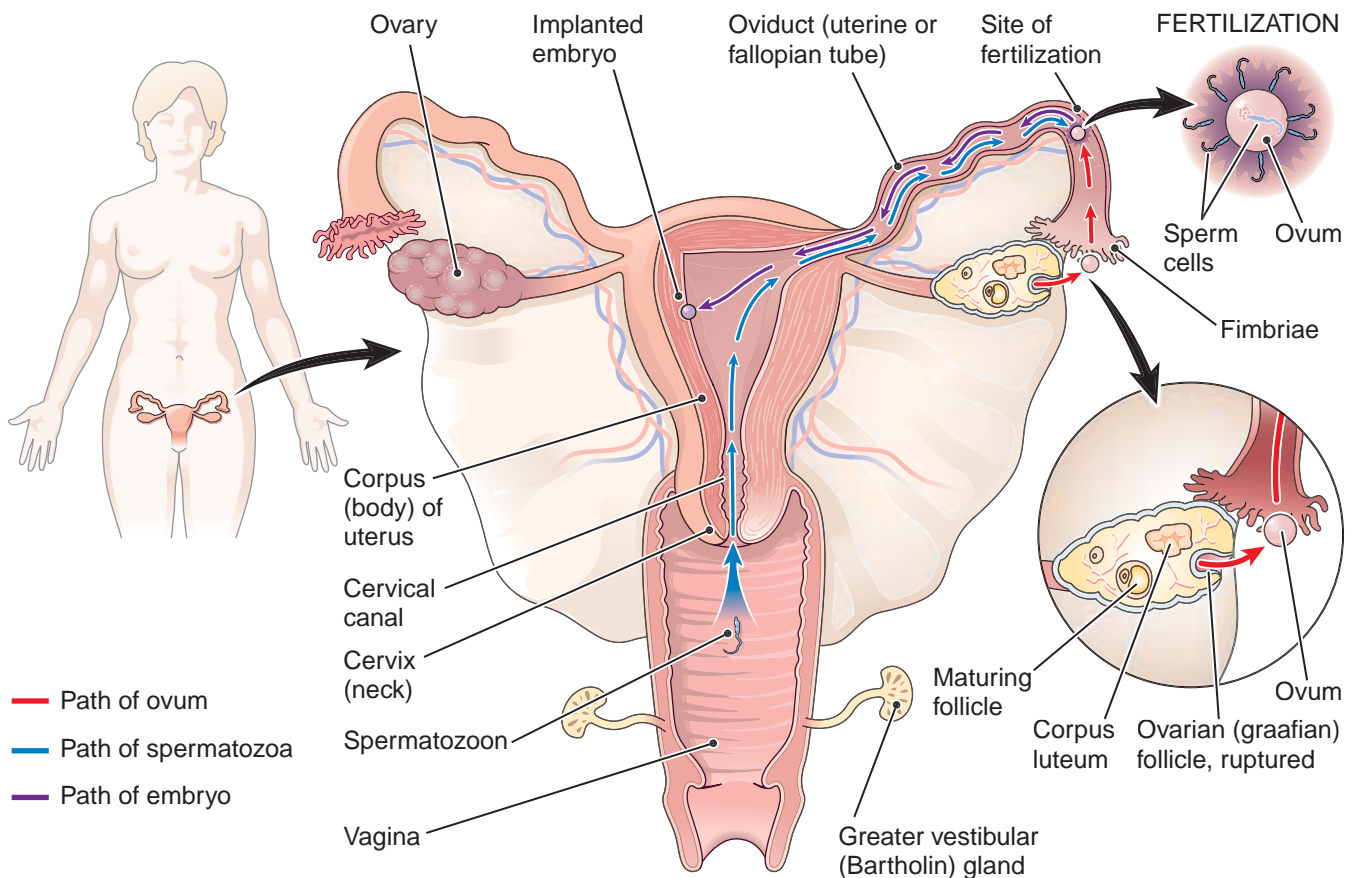


Figure 24-1 The female reproductive system. Arrows show the pathway of the spermatozoa and ovum and also of the fertilization and implantation of the fertilized ovum. **ZOOMING IN ♦ Where is the ovum fertilized?**

Box 24-1 Clinical Perspectives

Assisted Reproductive Technology: The “Art” of Conception

At least one in ten American couples is affected by infertility. Assisted reproductive technologies such as in vitro fertilization (IVF), gamete intrafallopian transfer (GIFT), and zygote intrafallopian transfer (ZIFT) can help these couples become pregnant.

In vitro fertilization refers to fertilization of an egg outside the mother’s body in a laboratory dish, and it is often used when a woman’s fallopian tubes are blocked or when a man has a low sperm count. The woman participating in IVF is given hormones to cause ovulation of several eggs. These are then withdrawn with a needle and fertilized with the father’s sperm. After a few divisions, some of the fertilized eggs are placed in the uterus, thus bypassing the fallopian tubes. Additional fertilized eggs can be frozen to repeat the procedure in case of failure or for later pregnancies.

GIFT can be used when the woman has at least one normal fallopian tube and the man has an adequate sperm count. As

in IVF, the woman is given hormones to cause ovulation of several eggs, which are collected. Then, the eggs and the father’s sperm are placed into the fallopian tube using a catheter. Thus, in GIFT, fertilization occurs inside the woman, not in a laboratory dish.

ZIFT is a combination of both IVF and GIFT. Fertilization takes place in a laboratory dish, and then the zygote is placed into the fallopian tube.

Because of a lack of guidelines or restrictions in the United States in the field of assisted reproductive technology, some problems have arisen. These issues concern the use of stored embryos and gametes, use of embryos without consent, and improper screening for disease among donors. In addition, the implantation of more than one fertilized egg has resulted in a high incidence of multiple births, even up to seven or eight offspring in a single pregnancy, a situation that imperils the survival and health of the babies.

capillary-containing villi (Fig. 24-2). (Placenta is from a Latin word meaning “pancake.”) The placenta is the organ of nutrition, respiration, and excretion for the developing offspring throughout gestation. Although the blood of the mother and her offspring do not mix—each has its own blood and cardiovascular system—exchanges take place through the capillaries of the placental villi. In this manner, gases (CO₂ and O₂) are exchanged, nutrients are provided to the developing infant, and waste products are released into the maternal blood to be eliminated.

The Umbilical Cord The embryo is connected to the developing placenta by a stalk of tissue that eventually be-

comes the **umbilical** (um-BIL-ih-kal) **cord**. This structure carries blood to and from the embryo, later called the **fetus** (FE-tus). The cord encloses two arteries that carry deoxygenated blood from the fetus to the placenta, and one vein that carries oxygenated blood from the placenta to the fetus (see Fig. 24-2). (Note that, like the pulmonary vessels, these arteries carry blood low in oxygen and this vein carries blood high in oxygen.) The fetus has special circulatory features used to carry blood to and from the umbilical cord. Chapter 14 describes several adaptations in the fetal heart that allow blood to bypass the lungs, which are not functional in the fetus (see Fig. 14-13 and Box 24-2).

Box 24-2 A Closer Look

Fetal Circulation: Routing Blood to Miss the Lungs

The developing fetus has several adaptations in the cardiovascular system that change at birth. These adaptations serve to bypass the lungs, which in the fetus are not functional. Fetal blood is oxygenated instead by the placenta (see Fig. 24-2).

Oxygenated blood comes from the placenta to the fetus via the **umbilical vein**, which is contained in the umbilical cord. Most of this blood joins the inferior vena cava by way of a small vessel, the **ductus venosus**, and is carried to the heart. The rest is delivered to the liver. Once in the right atrium, some of the blood flows directly into the left atrium through a hole in the atrial septum called the **foramen ovale**. This blood bypasses the right ventricle and the pulmonary circuit. Blood that does enter the right ventricle is pumped into the pulmonary artery. However, most of this blood shunts directly

into the systemic circulation through a small vessel, the **ductus arteriosus**, which connects the pulmonary artery to the aorta. A small portion of blood remains in the pulmonary artery and is delivered to the lungs. Blood returns to the placenta through two **umbilical arteries**.

After birth, when the baby’s lungs are functioning, these circulatory adaptations begin to close. The foramen ovale seals to become a depression called the fossa ovalis in the septum between the atria. The various vessels constrict into fibrous cords. Only the proximal parts of the umbilical arteries persist as arteries to the urinary bladder. Except for the foramen ovale, the circulatory adaptations close within 30 minutes after birth. The foramen ovale completely closes within one year. Certain congenital heart defects occur when the foramen ovale or ductus arteriosus fails to close.

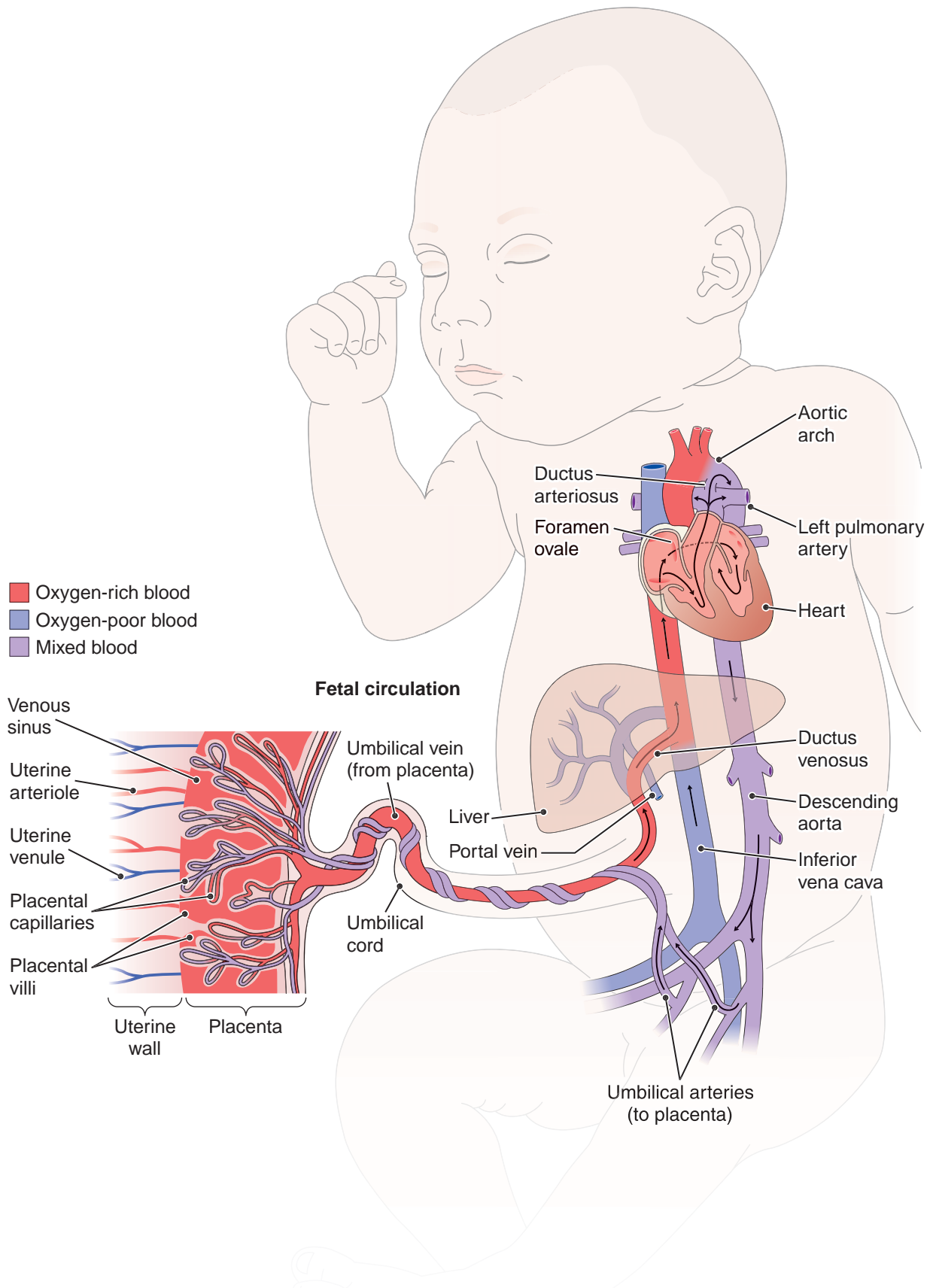


Figure 24-2 Fetal circulation and section of placenta. Colors show relative oxygen content of blood. *ZOOMING IN ♦ What is signified by the purple color in this illustration?*

Placental Hormones In addition to maintaining the fetus, the placenta is an endocrine organ. Beginning soon after implantation, some embryonic cells produce the hormone **human chorionic gonadotropin** (ko-re-ON-ik gon-ah-do-TRO-pin) (**hCG**). This hormone stimulates the ovarian corpus luteum, prolonging its life-span to 11 or 12 weeks and causing it to secrete increasing amounts of progesterone and estrogen. It is hCG that is used in tests as an indicator of pregnancy.

Progesterone is essential for the maintenance of pregnancy. It promotes endometrial secretion to nourish the embryo, maintains the endometrium and decreases the ability of the uterine muscle to contract, thus preventing the embryo from being expelled from the body. During pregnancy, progesterone also helps prepare the breasts for milk secretion.

Estrogen promotes enlargement of the uterus and breasts. By the 11th or 12th week of pregnancy, the corpus luteum is no longer needed; by this time, the placenta itself can secrete adequate amounts of progesterone and estrogen, and the corpus luteum disintegrates. Miscar-

riages (loss of an embryo or fetus) frequently occur during this critical time when hormone secretion is shifting from the corpus luteum to the placenta.

Human placental lactogen (hPL), is a hormone secreted by the placenta during pregnancy, reaching a peak at term, the normal conclusion of pregnancy. HPL stimulates growth of the breasts to prepare the mother for production of milk, or **lactation** (lak-TA-shun). More importantly, it regulates the levels of nutrients in the mother's blood to keep them available for the fetus. This second function leads to an alternate name for this hormone: human chorionic somatomammotropin.

Relaxin is a placental hormone that softens the cervix and relaxes the sacral joints and the pubic symphysis. These changes help to widen the birth canal and aid in delivery.

Checkpoint 24-2: What organ nourishes the developing fetus?

Checkpoint 24-3: What is the function of the umbilical cord?

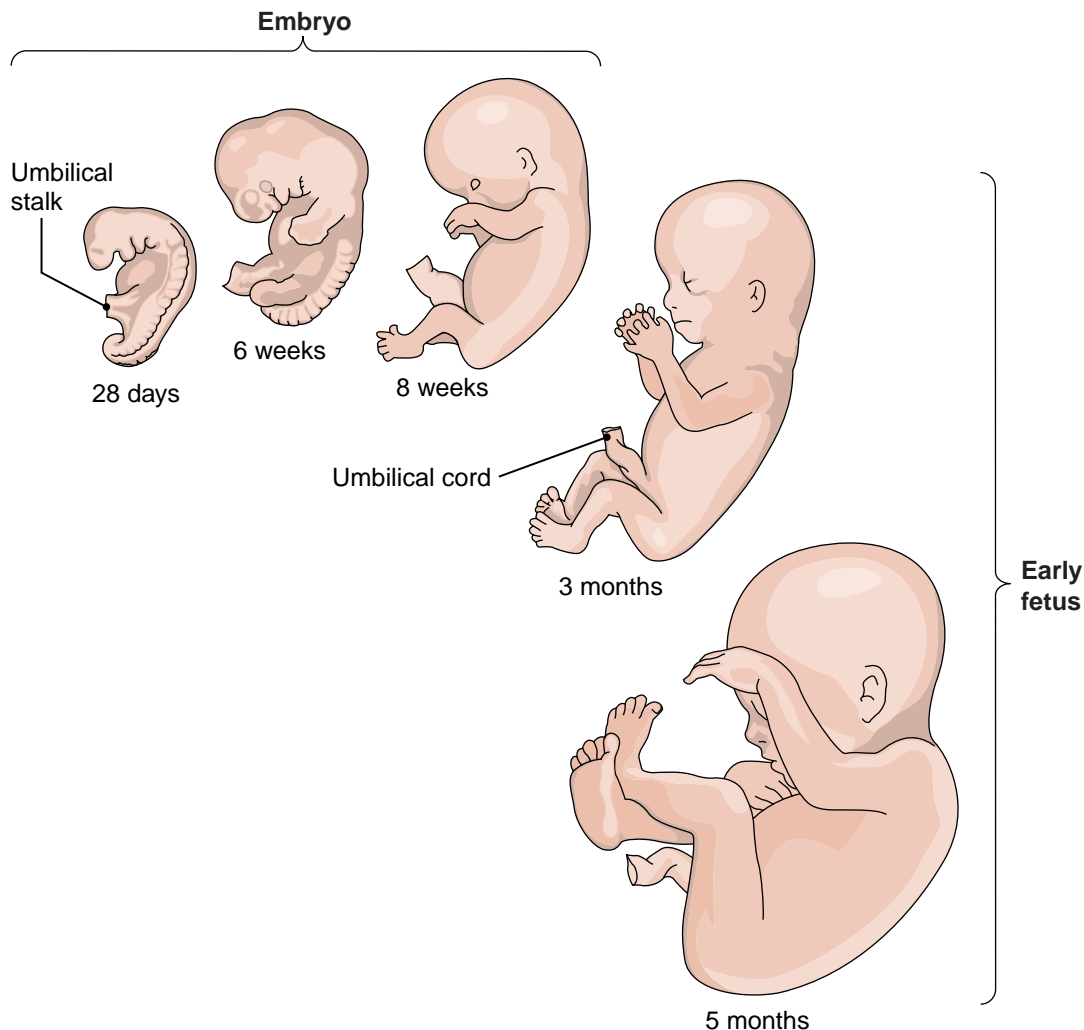


Figure 24-3 Development of an embryo and early fetus.

Development of the Embryo

The developing offspring is referred to as an embryo for the first 8 weeks of life (Fig. 24-3), and the study of growth during this period is called **embryology** (em-bre-OL-o-je). The beginnings of all body systems are established during this time. The heart and the brain are among the first organs to develop. A primitive nervous system begins to form in the third week. The heart and blood vessels originate during the second week, and the first heartbeat appears during week 4, at the same time that other muscles begin to develop.

By the end of the first month, the embryo is approximately 0.62 cm (0.25 inches) long, with four small swellings at the sides called **limb buds**, which will develop into the four extremities. At this time, the heart produces a prominent bulge at the anterior of the embryo.

By the end of the second month, the embryo takes on an appearance that is recognizably human. In male embryos, the primitive testes have formed and have begun to secrete testosterone, which will direct formation of the male reproductive organs as gestation continues. Figure 24-4 shows photographs of embryonic and early fetal development.

Checkpoint 24-4: All body systems originate during the early development of the embryo. At about what time in gestation does the heartbeat first appear?

The Fetus

The term *fetus* is used for the developing offspring from the beginning of the third month until birth. During this period, the organ systems continue to grow and mature. The ovaries form in the female early in this fetal period, and at this stage they contain all the primitive cells (oocytes) that can later develop in mature ova (egg cells).

For study, the entire gestation period may be divided into three equal segments or **trimesters**. The most rapid growth of the fetus occurs during the second trimester (months 4–6). By the end of the fourth month, the fetus is almost 15 cm (6 inches) long, and its external genitalia are sufficiently developed to reveal its sex. By the seventh month, the fetus is usually about 35 cm (14 inches) long and weighs approximately 1.1 kg (2.4 pounds). At the end of pregnancy, the normal length of the fetus is 45 to 56 cm (18–22.5 inches), and the weight varies from 2.7 to 4.5 kg (6–10 pounds).

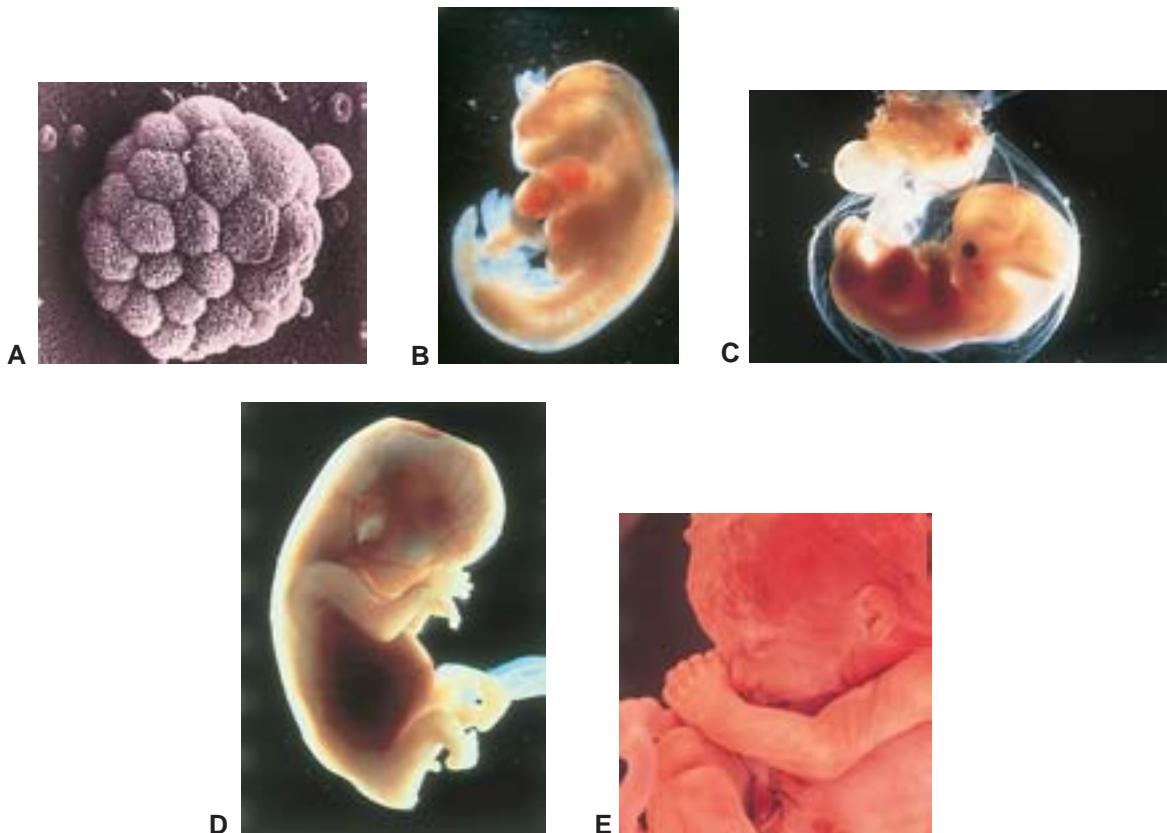


Figure 24-4 Human embryos at different stages and early fetus. (A) Implantation in uterus 7 to 8 days after conception. (B) Embryo at 32 days. (C) At 37 days. (D) At 41 days. (E) Fetus between 12 and 15 weeks. (Reprinted with permission from Pillitteri A. Maternal and Child Health Nursing, 4th ed. Philadelphia: Lippincott Williams & Wilkins, 2003.)

The **amniotic** (am-ne-OT-ik) **sac**, which is filled with a clear liquid known as **amniotic fluid**, surrounds the fetus and serves as a protective cushion for it (Fig. 24-5). The amniotic sac ruptures at birth, an event marked by the common expression that the mother’s “water broke.”

During development, the fetal skin is protected by a layer of cheeselike material called the **vernix caseosa** (VER-niks ka-se-O-sah) (literally, “cheesy varnish”).

Checkpoint 24-5: What is the name of the fluid-filled sac that holds the fetus?

The Mother

The total period of pregnancy, from fertilization of the ovum to birth, is approximately 266 days, also given as 280 days or 40 weeks from the last menstrual period (LMP). During this time, the mother must supply all the food and oxygen for the fetus and eliminate its waste ma-

terials. To support the additional demands of the growing fetus, the mother’s metabolism changes markedly, and several organ systems increase their output:

- The heart pumps more blood to supply the needs of the uterus and the fetus.
- The lungs provide more oxygen by increasing the rate and depth of respiration.
- The kidneys excrete nitrogenous wastes from both the fetus and the mother.
- The digestive system supplies additional nutrients for the growth of maternal organs (uterus and breasts) and growth of the fetus, as well as for subsequent labor and milk secretion.

Nausea and vomiting are common discomforts in early pregnancy. These most often occur upon arising or during periods of fatigue, and are more common in women who smoke cigarettes. The specific cause of these symptoms is not known, but they may be a result of the

great changes in hormone levels that occur at this time. The nausea and vomiting usually last for only a few weeks to several months.

Urinary frequency and constipation are often present during the early stages of pregnancy and then usually disappear. They may reappear late in pregnancy as the head of the fetus drops from the abdominal region down into the pelvis, pressing on the rectum and the urinary bladder.

Checkpoint 24-6: What is the approximate duration of pregnancy in days?

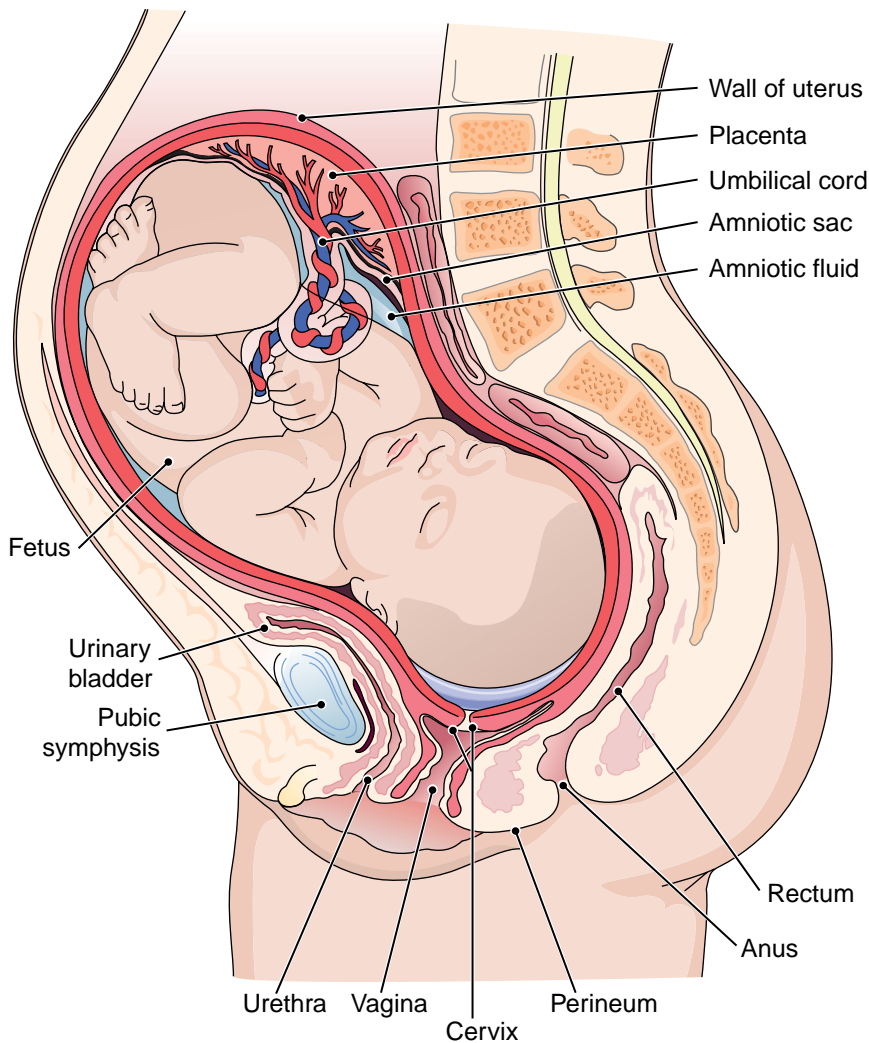


Figure 24-5 Midsagittal section of a pregnant uterus with intact fetus. **ZOOMING IN** ♦ What structure connects the fetus to the placenta?

The Use of Ultrasound in Obstetrics Ultrasonography (ul-tra-hon-OG-rah-fe) is a safe, painless, and noninvasive method for studying soft tissue. It has proved extremely valuable for monitoring pregnancies and deliveries.

An ultrasound image, called a **sonogram**, is made by sending high-frequency sound waves into the body (Fig. 24-6). Each time a wave meets an interface between two tissues of different densities, an echo is produced. An instrument called a **transducer** converts the reflected sound waves into electrical energy, and a computer is used to generate an image on a viewing screen.

Ultrasound scans can be used in

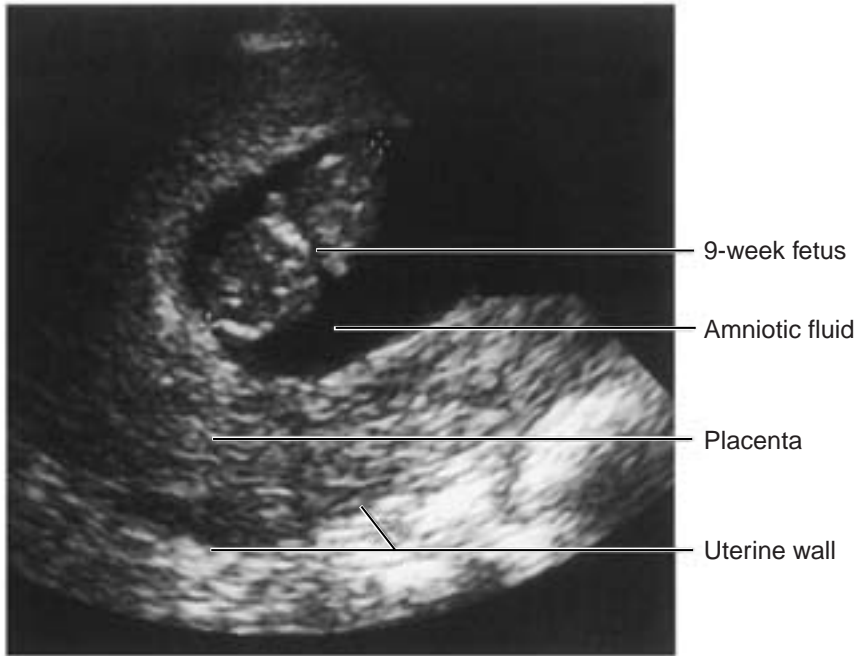


Figure 24-6 Sonogram showing a 9-week-old fetus. (Reprinted with permission from Erkonen WE. *Radiology 101: Basics and Fundamentals of Imaging*. Philadelphia: Lippincott Williams & Wilkins, 1998.)

obstetrics to diagnose pregnancy, judge fetal age, and determine the location of the placenta. The technique can also show the presence of excess amniotic fluid and fetal abnormalities.

Childbirth

The exact mechanisms that trigger the beginning of uterine contractions for childbirth are still not completely known. Some fetal and maternal factors that probably work in combination to start labor are:

- ▶ Stretching of the uterine muscle stimulates production of prostaglandin, which promotes uterine contractions.
- ▶ Pressure on the cervix from the baby stimulates release of **oxytocin** (ok-se-TO-sin) from the posterior pituitary. The uterine muscle becomes increasingly sensitive to this hormone late in pregnancy.
- ▶ Changes in the placenta that occur with time may contribute to the start of labor.
- ▶ Cortisol from the fetal adrenal cortex inhibits the mother's progesterone. Increase in the relative amount of estrogen as compared to progesterone stimulates uterine contractions.

After labor begins, stimuli from the cervix and vagina produce reflex secretion of oxytocin, which in turn increases the uterine contractions (an example of positive feedback.)

The Four Stages of Labor

The process by which the fetus is expelled from the uterus is known as **labor and delivery**; it also may be called **parturition** (par-tu-RISH-un). It is divided into four stages:

1. The **first stage** begins with the onset of regular uterine contractions. With each contraction, the cervix becomes thinner and the opening larger. Rupture of the amniotic sac may occur at any time, with a gush of fluid from the vagina.
2. The **second stage** begins when the cervix is completely dilated and ends with the delivery of the baby. This stage involves the passage of the fetus, usually head first, through the cervical canal and the vagina to the outside.
3. The **third stage** begins after the child is born and ends with the expulsion of the **afterbirth**. The afterbirth includes the placenta, the membranes of the amniotic sac, and the umbilical cord, except for a small portion remaining attached to the baby's **umbilicus** (um-BIL-ih-kus), or navel. (Box 24-3 discusses the medical uses of cord blood.)
4. The **fourth stage** begins after expulsion of the afterbirth and constitutes a period in which bleeding is controlled. Contraction of the uterine muscle acts to close off the blood vessels leading to the placental site. To prevent tissues of the pelvic floor from being torn during childbirth, as often happens, the obstetrician may cut the mother's perineum just before her infant is born and then repair this clean cut immediately after childbirth; such an operation is called an **episiotomy** (eh-piz-e-OT-o-me). The area between the vagina and the anus that is cut in an episiotomy is referred to as the *surgical* or *obstetrical perineum* (see Fig. 23-12 in Chapter 23).

Checkpoint 24-7: What is parturition?

Cesarean Section

A **cesarean** (se-ZAR-re-an) **section** (C section) is an incision made in the abdominal wall and in the uterine wall for delivery of a fetus. A cesarean section may be required for a variety of reasons, including placental abnormalities, abnormal fetal position, disproportion between the head of the fetus and the mother's pelvis that makes vaginal de-

Box 24-3 Hot Topics

Umbilical Cord Blood: Giving Life After Birth

Following childbirth, the umbilical cord and placenta are usually discarded. However, research suggests that blood harvested from these structures could save lives. Like bone marrow, umbilical cord blood contains stem cells capable of differentiating into all blood cell types. Cancer patients whose bone marrow is destroyed by chemotherapy often require stem cell transplants, as do those with leukemia, anemia, or certain immune disorders.

Stem cells obtained from umbilical cord blood offer some important advantages over those acquired from bone marrow. These advantages include:

- ▶ Greater ease of collection and storage. Whereas bone marrow collection is a surgical procedure, cord blood can be collected immediately after the umbilical cord is cut. The blood can then be stored frozen in a blood bank.
- ▶ No risk to the donor. Because cord blood is collected after the cord is cut, the procedure is not dangerous to the donor.

- ▶ Lower risk to the recipient. Since cord blood is immature, it does not have to match the recipient's tissues as closely as bone marrow does, so there is less chance of transplant rejection and graft-versus-host disease than with bone marrow. In addition, umbilical cord blood is less likely to contain infectious organisms than is bone marrow.
- ▶ Higher chance of finding a donor. Since umbilical cord blood need not closely match a recipient's tissues, the likelihood of finding a match between donor and recipient is higher.

Although umbilical cord blood is a promising stem cell source, only enough cells to treat a child or small adult can be harvested from a single donor. Scientists hope that improved collection techniques and advances in cell culture will increase the number of stem cells available from a single donor, enabling all patients to benefit from this treatment.

livery difficult or dangerous, and other problems that may arise during pregnancy and delivery.

Checkpoint 24-8: What is a cesarean section?

Multiple Births

Until recently, statistics indicated that twins occurred in about 1 of every 80 to 90 births, varying somewhat in different countries. Triplets occurred much less frequently, usually once in several thousand births, whereas quadruplets occurred very rarely. The birth of quintuplets represented a historic event unless the mother had taken fertility drugs. Now these fertility drugs, usually gonadotropins, are given more commonly, and the number of multiple births has increased significantly. Multiple fetuses tend to be born prematurely and therefore have a high death rate. However, better care of infants and newer treatments have resulted in more living multiple births than ever.

Twins originate in two different ways, and on this basis are divided into two types:

- ▶ **Fraternal twins** are formed as a result of the fertilization of two different ova by two spermatozoa. Two completely different individuals, as distinct from each other as brothers and sisters of different ages, are produced. Each fetus has its own placenta and surrounding sac.
- ▶ **Identical twins** develop from a single zygote formed from a single ovum fertilized by a single spermatozoon. Sometime during the early stages of development, the

embryonic cells separate into two units. Usually, there is a single placenta, although there must be a separate umbilical cord for each fetus. Identical twins are always the same sex and carry the same inherited traits.

Other multiple births may be fraternal, identical, or combinations of these. The tendency to multiple births seems to be hereditary.

Termination of Pregnancy

A pregnancy may end before its full term has been completed. The term **live birth** is used if the baby breathes or shows any evidence of life such as heartbeat, pulsation of the umbilical cord, or movement of voluntary muscles. An **immature** or **premature** infant is one born before the organ systems are mature. Infants born before the 37th week of gestation or weighing less than 2500 grams (5.5 pounds) are considered **preterm**.

Loss of the fetus is classified according to the duration of the pregnancy:

- ▶ The term **abortion** refers to loss of the embryo or fetus before the 20th week or weight of about 500 grams (1.1 pound). This loss can be either spontaneous or induced.
- ▶ **Spontaneous abortion** occurs naturally with no interference. The most common causes are related to an abnormality of the embryo or fetus. Other causes include abnormality of the mother's reproductive organs, infections, or chronic disorders, such as kidney disease or hypertension. **Miscarriage** is the lay term for spontaneous abortion.

- ▶ **Induced abortion** occurs as a result of artificial or mechanical interruption of pregnancy. A **therapeutic abortion** is an abortion performed by a physician as a treatment for a variety of reasons. More liberal access to this type of abortion has dramatically reduced the incidence of death related to illegal abortion.
- ▶ The term **fetal death** refers to loss of the fetus after the eighth week of pregnancy. **Stillbirth** refers to the delivery of an infant who is lifeless.

Immaturity is a leading cause of death in the newborn. After the 20th week of pregnancy, the fetus is considered **viable**, that is, able to live outside the uterus. A fetus expelled before the 24th week or before reaching a weight of 1000 grams (2.2 pounds) has little more than a 50% chance of survival. One born at a point closer to the full 40 weeks stands a much better chance of living. Increasing numbers of immature infants are being saved because of advances in neonatal intensive care.

Checkpoint 24-9: What does the term *viable* mean with reference to a fetus?

▶ The Mammary Glands and Lactation

The **mammary glands**, or breasts, of the female are accessories of the reproductive system. They provide nourishment for the baby after its birth. The mammary glands are similar in construction to the sweat glands. Each gland is divided into a number of lobes composed of glandular tissue and fat, and each lobe is further subdivided. Secretions from the lobes are conveyed through **lactiferous** (lak-TIF-er-us) **ducts**, all of which converge at the papilla (nipple) (Fig. 24-7).

The mammary glands begin developing during puberty, but they do not become functional until the end of a pregnancy. Placental lactogen (hPL) helps to prepare the breasts for lactation, and the hormone **prolactin** (PRL), produced by the anterior pituitary gland, stimulates the secretory cells of the mammary glands. The first mammary gland secretion is a thin liquid called **colostrum** (ko-LOS-trum). It is nutritious but has a somewhat different composition from milk. Milk secretion begins within a few days following birth and can continue for several years as long as milk is frequently removed by the suckling baby

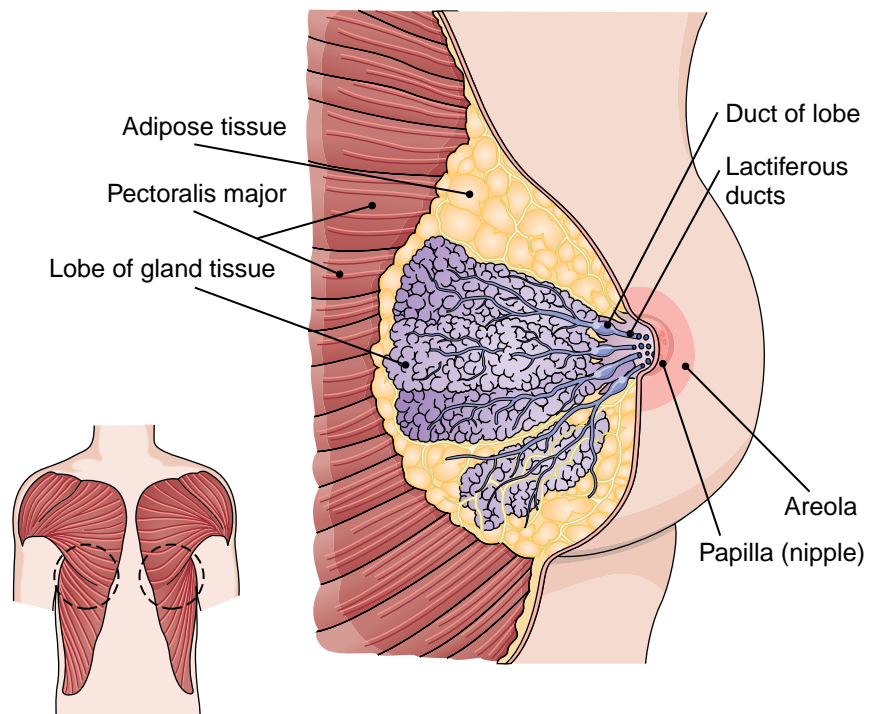


Figure 24-7 Section of the breast (mammary gland). **ZOOMING IN** ♦ What muscle underlies the breast?

or by pumping. Stimulation of the breast by the suckling infant causes oxytocin release from the posterior pituitary. This hormone causes the milk ducts to contract, resulting in the ejection, or *letdown*, of milk.

The digestive tract of the newborn baby is not ready for the usual adult mixed diet. Mother's milk is more desirable for the young infant than milk from other animals for several reasons, some of which are listed below:

- ▶ Infections that may be transmitted by foods exposed to the outside air are avoided by nursing.
- ▶ Both breast milk and colostrum contain maternal antibodies that help protect the baby against pathogens.
- ▶ The proportions of various nutrients and other substances in human milk are perfectly suited to the human infant. Substitutes are not exact imitations of human milk. Nutrients are present in more desirable amounts if the mother's diet is well balanced.
- ▶ The psychological and emotional benefits of nursing are of infinite value to both the mother and the infant.

Checkpoint 24-10: What is lactation?

▶ Disorders of Pregnancy, Childbirth, and Lactation

A pregnancy that develops in a location outside the uterine cavity is said to be an **ectopic** (ek-TOP-ik) **pregnancy** (Fig. 24-8). The most common type is the tubal ectopic

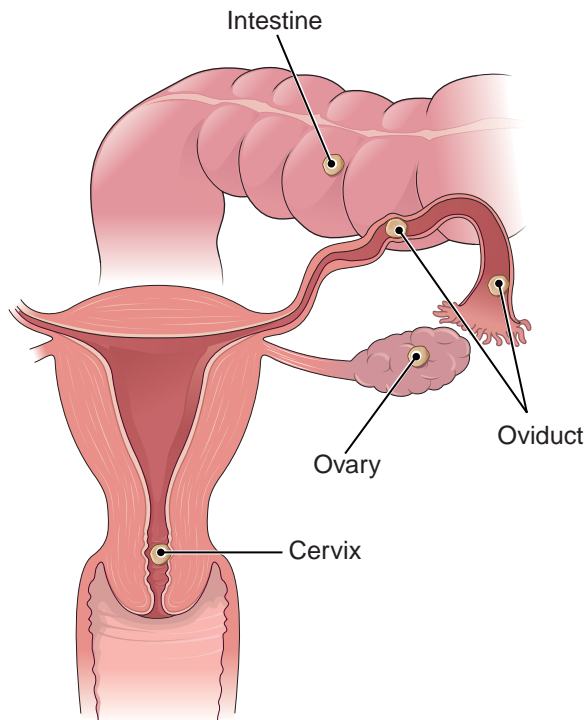


Figure 24-8 Ectopic pregnancy sites. The most common site is the oviduct, in which case it is a tubal ectopic pregnancy. (Reprinted with permission from Cohen BJ. *Medical Terminology*. 4th ed. Philadelphia: Lippincott Williams & Wilkins, 2004.)

pregnancy, in which the embryo begins to grow in the oviduct. This structure cannot expand to contain the growing embryo and may rupture. Ectopic pregnancy may threaten the mother's life if it does not receive prompt surgical treatment.

In **placenta previa** (PRE-ve-ah) the placenta, which is usually attached to the superior part of the uterus, instead becomes attached at or near the internal opening of the cervix. The normal cervical softening and dilation that occur in later pregnancy separate part of the placenta from its attachment. The result is painless bleeding and interference with the fetal oxygen supply.

Sometimes the placenta separates from the uterine wall prematurely, often after the 20th week of pregnancy, causing hemorrhage. This disorder, known as **abruptio placentae** (ab-RUP-she-o plah-SEN-te), or placental abruption, occurs most often in multigravidas (mul-te-GRAY-ih-dahz), meaning women who have had more than one pregnancy, older than 35 years of age. Placental abruption is a common cause of bleeding during the second half of pregnancy and may require termination of pregnancy to save the mother's life.

Pregnancy-Induced Hypertension

A serious disorder that can develop in the latter part of pregnancy is **pregnancy-induced hypertension (PIH)**,

also called *preclampsia* (pre-eh-KLAMP-se-ah) or *toxemia of pregnancy*. Symptoms include hypertension, protein in the urine (proteinuria), general edema, and sudden weight gain. The cause of this disorder is a hormone imbalance that results in constriction of blood vessels. It is most often seen in women whose nutritional state is poor and who have received little or no health care during pregnancy. If PIH remains untreated, it may lead to **eclampsia** (eh-KLAMP-se-ah) with the onset of kidney failure, convulsions, and coma during pregnancy or after delivery. The result may be the death of both the mother and the infant.

Checkpoint 24-11: What is an ectopic pregnancy?

Postpartum Disorders

Childbirth-related deaths are often due to infections. **Puerperal** (pu-ER-per-al) **infections**, those related to childbirth, were once the cause of death in as many as 10% to 12% of women going through labor. Cleanliness and sterile techniques have improved the chances of avoiding such outcomes of pregnancies. Nevertheless, in the United States, puerperal infection still develops in about 6% of maternity patients. Antibiotics have dramatically improved the chances of recovery for both the mother and the child.

A **hydatidiform** (hi-dah-TID-ih-form) **mole**, or hydatid mole, is a benign overgrowth of placental tissue. The placenta dilates and resembles grapelike cysts. The growth may invade the wall of the uterus, causing it to rupture.

A very malignant tumor that is made of placental tissue is **choriocarcinoma** (ko-re-o-kar-sih-NO-mah). Although rare, this tumor spreads rapidly, and if the mother is not treated, it may be fatal within 3 to 12 months. With the use of modern chemotherapy, the outlook for cure is very good. If metastases have developed, irradiation and other forms of treatment may be necessary.

Checkpoint 24-12: What is puerperal infection?

Lactation Disturbances

Disturbances in lactation may have a variety of causes, including the following:

- Malnutrition or anemia, which may prevent lactation entirely
- Emotional disturbances, which may affect lactation (as they may affect other glandular activities)
- Abnormalities of parts of the mammary glands or injuries to these organs, which may cause interference with their functioning
- **Mastitis** (mas-TI-tis), or “inflammation of the breast,” which is caused by infection. Antibiotic treatment usually allows for the continuation of nursing.

Word Anatomy

Medical terms are built from standardized word parts (prefixes, roots, and suffixes). Learning the meanings of these parts can help you remember words and interpret unfamiliar terms.

WORD PART	MEANING	EXAMPLE
Pregnancy		
zyg/o	joined	An ovum and spermatozoon join to form a <i>zygote</i> .
chori/o	membrane, chorion	Human <i>chorionic</i> gonadotropin is produced by the outermost cells (chorion) of the embryo and acts on the corpus luteum in the ovary.
somat/o	body	Human chorionic <i>somatotrophin</i> controls nutrients for the body and acts on the mammary glands (mamm/o).
Childbirth		
ox/y	sharp, acute	<i>Oxytocin</i> is a hormone that stimulates labor.
toc/o	labor	
Disorders of Pregnancy, Childbirth, and Lactation		
ecto-	outside, external	An <i>ectopic</i> pregnancy occurs outside of the uterine cavity.

Summary

I. Pregnancy (gestation)—lasts about 38 weeks

- A. Fertilization and the start of pregnancy
 1. Fertilization occurs in oviduct
 2. Zygote (fertilized egg)—formed by fusion of egg and sperm nuclei
 - a. Divides rapidly
 - b. Travels to uterus
 - c. Implants in lining and becomes embryo
- B. The placenta
 1. Formed by tissue around embryo and in lining of uterus
 2. Functions
 - a. Nourishment
 - b. Gas exchange
 - c. Removal of waste
 - d. Production of hormones
 - (1) Human chorionic gonadotropin (hCG)—maintains corpus luteum for 11-12 weeks
 - (2) Human placental lactogen (hPL)
 - (3) Relaxin—relaxes birth canal
 3. Umbilical cord—connects fetus to placenta
- C. Development of the embryo
 1. First 8 weeks
 2. All body systems begin to develop
- D. The fetus
 1. Third month to birth
 2. Amniotic sac
 - a. Surrounds fetus
 - b. Contains fluid to cushion and protect fetus
- E. The mother
 1. Increased demands on heart, lungs, kidneys
 2. Increased nutritional needs
 3. Ultrasound used to monitor pregnancy and delivery

II. Childbirth- initiated by changes in uterus, placenta, fetus

- A. Four stages of labor
 1. Contractions
 2. Delivery of baby
 3. Expulsion of afterbirth
 4. Contraction of uterus
- B. Cesarean section
 1. Incision to remove fetus
- C. Multiple births
 1. Fraternal twins formed from two different ova
 2. Identical twins develop from a single zygote
 3. Larger multiples follow either pattern or a combination
 4. Increased by fertility drugs
- D. Termination of pregnancy
 1. Immature (premature) infant—born before organ system mature
 2. Preterm—born before 37th week or weighing less than 2500 grams
 3. Abortion—loss of fetus before 20th week or weighing less than 500 grams
 4. Fetal death—loss of fetus after 8 weeks of pregnancy

III. Mammary glands and lactation

1. Lactation—secretion of milk
 - a. Colostrum—first mammary secretion
2. Hormones
 - a. HPL—prepares breasts for lactation
 - b. Prolactin—stimulates secretory cells
 - c. Oxytocin—promotes letdown (ejection) of milk
3. Advantages of breastfeeding
 - a. Reduces infections
 - b. Transfers antibodies

- c. Provides best form of nutrition
- d. Emotional satisfaction

IV. Disorders of pregnancy, childbirth, and lactation

1. Ectopic pregnancy—pregnancy outside of uterus; commonly in oviduct
 2. Placenta previa—improper attachment of placenta to uterus
 3. Placental abruption—separation of placenta from uterus
- A.** Pregnancy-induced hypertension (PIH)
1. Also called preeclampsia, toxemia of pregnancy
 2. Eclampsia—results from untreated PIH
- B.** Postpartum disorders
1. Puerperal infection
 2. Hydatidiform mole—benign overgrowth of placenta
 3. Choriocarcinoma—malignant tumor of placental tissue
- C.** Lactation disturbances
1. Possible causes
 - a. Malnutrition
 - b. Emotional disturbances
 - c. Abnormalities of mammary glands
 - d. Mastitis—inflammation of the breast

Questions for Study and Review

Building Understanding

Fill in the blanks

1. Fetal skin is protected by a cheeselike material called _____.
2. The first mammary secretion is called _____.
3. Sound waves can be used to safely monitor pregnancy with a technique called _____.
4. A pregnancy that develops in a location outside the uterine cavity is said to be a(n) _____ pregnancy.
5. Inflammation of the breast due to infection is named _____.

Matching

Match each numbered item with the most closely related lettered item.

- | | |
|---|---------------------------------|
| ___ 6. A placental hormone that stimulates the ovaries to secrete progesterone and estrogen | a. human placental lactogen |
| ___ 7. A placental hormone that regulates maternal blood nutrient levels | b. prolactin |
| ___ 8. A placental hormone that softens the cervix, which widens the birth canal | c. oxytocin |
| ___ 9. A pituitary hormone that stimulates uterine contractions | d. relaxin |
| ___ 10. A pituitary hormone that stimulates maternal milk production | e. human chorionic gonadotropin |

Multiple choice

- ___ 11. For a few days after implantation, the embryo is nourished by the
 - a. endometrium
 - b. placenta
 - c. yolk sac
 - d. umbilical cord
- ___ 12. By what month can the sex of the fetus be accurately determined?
 - a. second
 - b. third
 - c. fourth
 - d. fifth
- ___ 13. The total period of pregnancy, from fertilization to birth, is about
 - a. 240 days
 - b. 260 days
 - c. 280 days
 - d. 300 days
- ___ 14. With regards to identical twins, which of the following statements is incorrect?
 - a. they develop from a single zygote
 - b. they each have their own placenta
 - c. they are always the same sex
 - d. they carry the same inherited traits
- ___ 15. The earliest that a fetus could survive outside of the uterus is after the
 - a. 20th week
 - b. 24th week
 - c. 28th week
 - d. 30th week

Understanding Concepts

16. Distinguish among the following: zygote, embryo, and fetus:
17. Explain the role of the placenta in fetal development.
18. Is blood in the umbilical arteries relatively high or low in oxygen? In the umbilical vein?
19. Describe some of the changes that take place in the mother's body during pregnancy.
20. What is the major event of each of the four stages of parturition?
21. List several reasons why breast milk is best for baby.

22. What is a cesarean section? List several reasons why it may be required.
23. Compare and contrast the following disease-related terms:
 - a. fetal death and still birth
 - b. spontaneous abortion and induced abortion
 - c. placenta previa and abruptio placentae
 - d. pregnancy-induced hypertension and eclampsia
 - e. hydatidiform mole and choriocarcinoma

Conceptual Thinking

24. Why is the risk of miscarriage highest at week 12 of pregnancy?
25. Although it is strongly suggested that a woman not drink alcohol during her entire pregnancy, why is this advice particularly important during the first trimester?

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