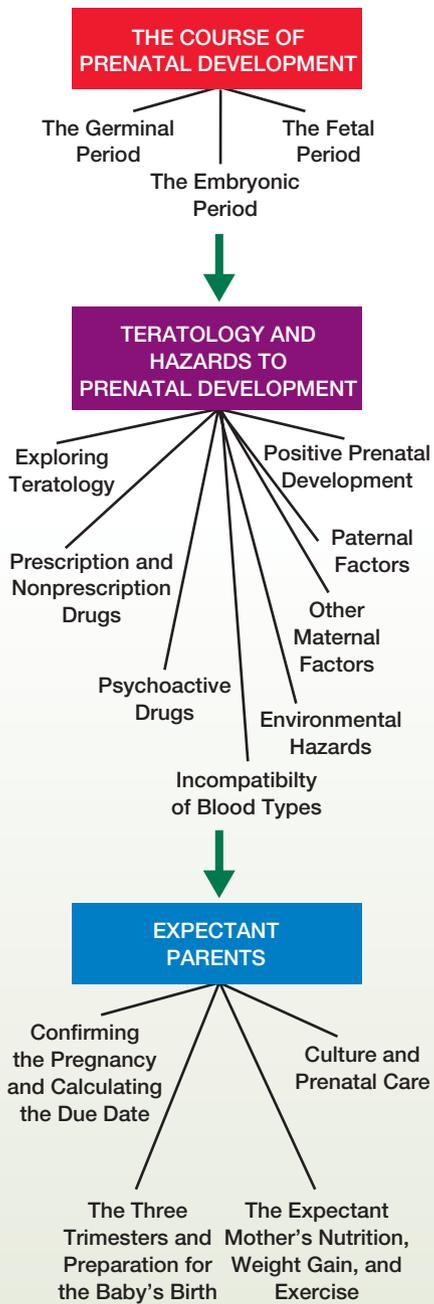


Chapter

4

Chapter Map



Prenatal Development

The Story of Bibinello

Although Jim and Sara did not plan to have a baby, they did not take precautions to prevent it, and it was not long before Sara was pregnant. Jim and Sara read the popular pregnancy book *What to Expect When You're Expecting* (Eisenberg, Murkoff, & Hathaway, 1991). They found a nurse-midwife they liked and invented a pet name—Bibinello—for the fetus. They signed up for birth preparation classes, and each Friday night for eight weeks they faithfully practiced simulated contractions. They drew up a birth plan that included their decisions about such matters as the type of care provider they wanted to use, the birth setting they wanted, and various aspects of labor and birth. They moved into a larger apartment so the baby could have its own room and spent weekends browsing through garage sales and secondhand stores to find good prices on baby furniture—a crib, a high chair, a stroller, a changing table, a crib mobile, a swing, a car seat.

Jim and Sara also spent a lot of time talking about Sara's pregnancy, what kind of parents they wanted to be, and what their child might be like. They also discussed what changes in their life the baby would make. One of their concerns was that Sara's maternity leave would last only six weeks. If she wanted to stay home longer, she would have to quit her job, something she and Jim were not sure they could afford. These are among the many questions that expectant couples face.

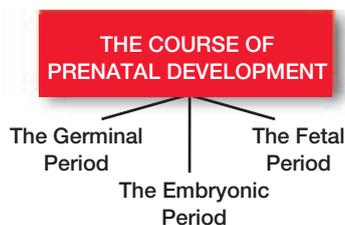


How much do you know about prenatal development and maintaining a healthy pregnancy?

LEARNING GOALS FOR THIS CHAPTER

THIS CHAPTER CHRONICLES the truly remarkable changes that take place from conception to birth. Imagine . . . at one time you were an organism floating around in a sea of fluid in your mother's womb. By the time you have completed this chapter, you should be able to reach these learning goals:

- Learning Goal 1** Name and Describe the Three Prenatal Periods
- Learning Goal 2** Define the Concept of Teratology
- Learning Goal 3** Describe How Different Types of Drugs Affect Prenatal Development
- Learning Goal 4** Explain Incompatibility of Blood Types and Environmental Hazards to Prenatal Development
- Learning Goal 5** Discuss How Other Maternal Factors and Paternal Factors Influence Prenatal Development
- Learning Goal 6** Provide a Balanced Discussion of the Positive and Negative Aspects of Prenatal Development
- Learning Goal 7** Describe How Pregnancy Is Confirmed and How to Calculate the Due Date
- Learning Goal 8** Discuss Changes in the Expectant Mother in the Three Trimesters of Pregnancy and Preparation for the Baby's Birth
- Learning Goal 9** Know About the Expectant Mother's Nutrition, Weight Gain, and Exercise
- Learning Goal 10** Evaluate the Links Between Culture and Prenatal Care



The Course of Prenatal Development

Imagine how you came to be. Out of thousands of eggs and millions of sperm, one egg and one sperm united to produce you. Had the union of sperm and egg come a day or even an hour earlier or later, you might have been very different—maybe even of the opposite sex. Remember from chapter 3 that conception occurs when a single sperm cell from the male unites with an ovum (egg) in the female's fallopian tube in a process called fertilization. Remember also that the fertilized egg is called a zygote. By the time the zygote ends its three- to four-day journey through the fallopian tube and reaches the uterus, it has divided into approximately 12 to 16 cells.

germinal period

The period of prenatal development that takes place in the first two weeks after conception. It includes the creation of the zygote, continued cell division, and the attachment of the zygote to the uterine wall.

blastocyst

The inner layer of cells that develops during the germinal period. These cells later develop into the embryo.

trophoblast

The outer layer of cells that develops in the germinal period. These cells provide nutrition and support for the embryo.

The Germinal Period

The **germinal period** is the period of prenatal development that takes place in the first two weeks after conception. It includes the creation of the zygote, continued cell division, and the attachment of the zygote to the uterine wall. By approximately one week after conception, the zygote is composed of 100 to 150 cells. The differentiation of cells has already commenced, as inner and outer layers of the organism are formed. The **blastocyst** is the inner layer of cells that develops during the germinal period. These cells later develop into the embryo. The **trophoblast** is the outer layer of cells that develops during the germinal period. It later provides nutrition and support for the embryo. Implantation, the attachment of the zygote to the uterine wall, takes place about 10 days after conception. Figure 4.1 illustrates some of the most significant developments during the germinal period.

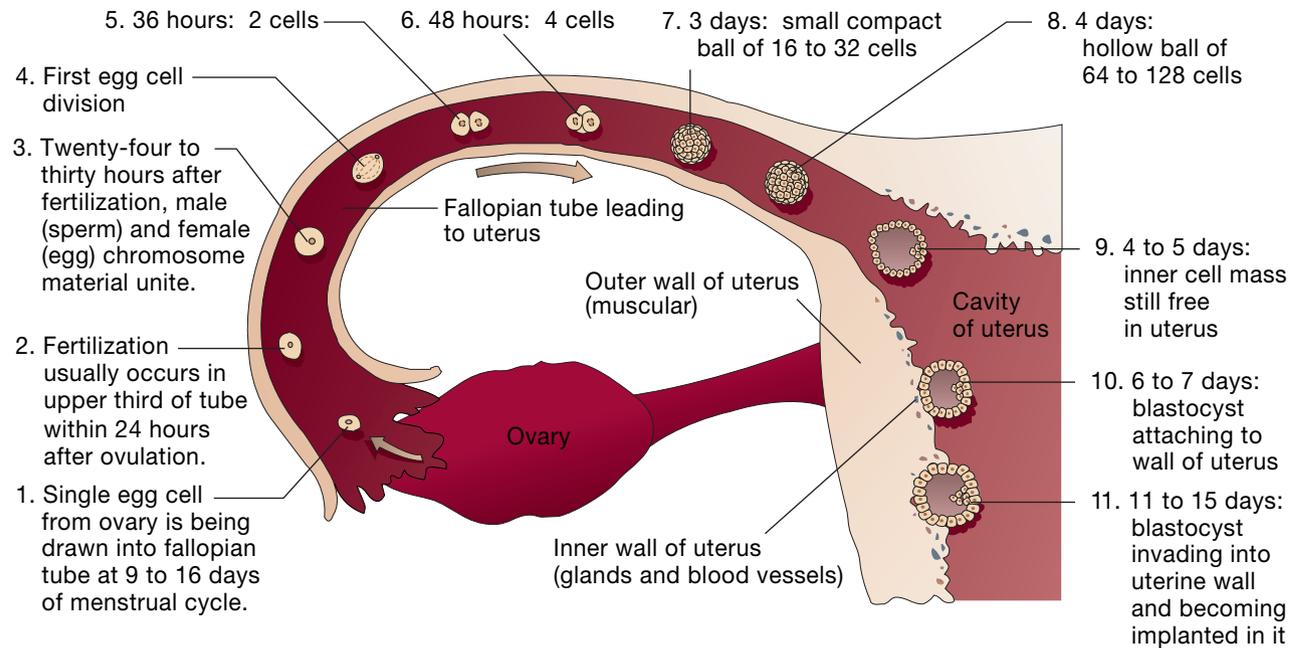


Figure 4.1
Significant Developments in the Germinal Period

The Embryonic Period

The **embryonic period** is the period of prenatal development that occurs from two to eight weeks after conception. During the embryonic period, the rate of cell differentiation intensifies, support systems for the cells form, and organs appear. Once the zygote attaches to the uterine wall, the label for the mass of cells changes from zygote to embryo. The embryo's **endoderm** is the inner layer of cells, which will develop into the digestive and respiratory systems. The outer layer of cells is divided into two parts. The **ectoderm** is the outermost layer, which will become the nervous system, sensory receptors (ears, nose, and eyes, for example), and skin parts (hair and nails, for example). The **mesoderm** is the middle layer, which will become the circulatory system, bones, muscles, excretory system, and reproductive system. Every body part eventually develops from these three layers. The endoderm primarily produces internal body parts, the mesoderm primarily produces parts that surround the internal areas, and the ectoderm primarily produces surface parts.

As the embryo's three layers form, life-support systems for the embryo mature and develop rapidly. These life-support systems include the placenta, the umbilical cord, and the amnion. The **placenta** is a life-support system that consists of a disk-shaped group of tissues in which small blood vessels from the mother and the offspring intertwine but do not join. The **umbilical cord** is a life-support system, containing two arteries and one vein, that connects the baby to the placenta. Very small molecules—oxygen, water, salt, food from the mother's blood, as well as carbon dioxide and digestive wastes from the embryo's blood—pass back and forth between the mother and embryo (Bush & others, 2000). Large molecules cannot pass through the placental wall; these include red blood cells and harmful substances, such as most bacteria, maternal wastes, and hormones. The mechanisms that govern the transfer of substances across the placental barrier are complex and are still not entirely understood (Mostyn & others, 2001; Rosenblith, 1992). Figure 4.2 on page 102 provides an illustration of the placenta, the umbilical cord, and the nature of blood flow in the expectant mother and developing child in the uterus. The **amnion**, a bag or an envelope that contains a clear fluid in which

embryonic period

The period of prenatal development that occurs two to eight weeks after conception. During the embryonic period, the rate of cell differentiation intensifies, support systems for the cells form, and organs appear.

endoderm

The inner layer of cells, which develops into digestive and respiratory systems.

ectoderm

The outermost layer of cells, which becomes the nervous system, sensory receptors (ears, nose, and eyes, for example), and skin parts (hair and nails, for example).

mesoderm

The middle layer of cells, which becomes the circulatory system, bones, muscles, excretory system, and reproductive system.

amnion

The life-support system that is a bag or envelope that contains a clear fluid in which the developing embryo floats.

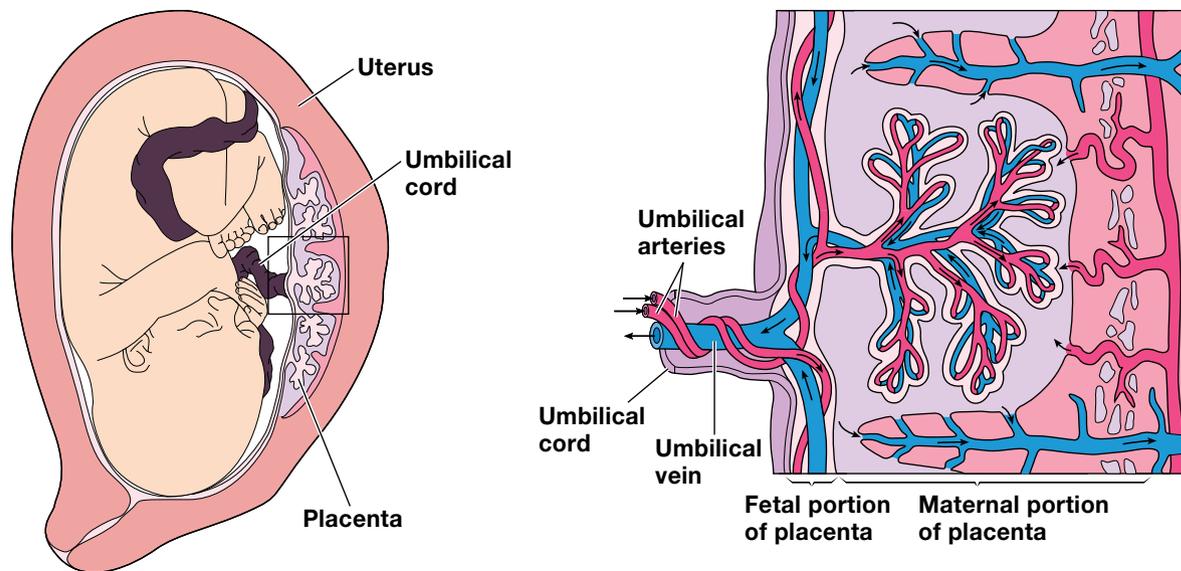


Figure 4.2

The Placenta and the Umbilical Cord

Maternal blood flows through the uterine arteries to the spaces housing the placenta, and it returns through the uterine veins to maternal circulation. Fetal blood flows through the umbilical arteries into the capillaries of the placenta and returns through the umbilical veins to the fetal circulation. The exchange of materials takes place across the layer separating the maternal and fetal blood supplies, so the bloods never come into contact. *Note:* The area bound by the square is enlarged in the right half of the illustration. Arrows indicate the direction of blood flow.

the developing embryo floats, is another important life-support system. Like the placenta and umbilical cord, the amnion develops from the fertilized egg, not from the mother's own body. At approximately 16 weeks, the kidneys of the fetus begin to produce urine. This fetal urine remains the main source of the amniotic fluid until the third trimester, when some of the fluid is excreted from the lungs of the growing fetus. Although the amniotic fluid increases in volume tenfold from the 12th to the 40th week of pregnancy, it is also removed in various ways (Challis & others, 2001). Some is swallowed by the fetus, and some is absorbed through the umbilical cord and the membranes covering the placenta. The amniotic fluid provides an environment that is temperature and humidity controlled, as well as shockproof.

Before most women even know they are pregnant, some important embryonic developments take place. In the third week, the neural tube that eventually becomes the spinal cord forms. At about 21 days, eyes begin to appear, and at 24 days the cells for the heart begin to differentiate. During the fourth week, the first appearance of the urogenital system is apparent, and arm and leg buds emerge. Four chambers of the heart take shape, and blood vessels surface. From the fifth to the eighth week, arms and legs differentiate further; at this time, the face starts to form but still is not very recognizable. The intestinal tract develops and the facial structures fuse. At eight weeks, the developing organism weighs about $\frac{1}{30}$ ounce and is just over 1 inch long. **Organogenesis** is the process of organ formation that takes place during the first two months of prenatal development. When organs are being formed, they are especially vulnerable to environmental changes. Later in the chapter, we will describe the environmental hazards that are harmful during organogenesis.

organogenesis

Organ formation that takes place during the first two months of prenatal development.

fetal period

The prenatal period of development that begins two months after conception and lasts for seven months, on the average.

The Fetal Period

The **fetal period** is the prenatal period of development that begins two months after conception and lasts for seven months, on the average. Growth and development continue their dramatic course during this time. Three months after conception, the fetus is



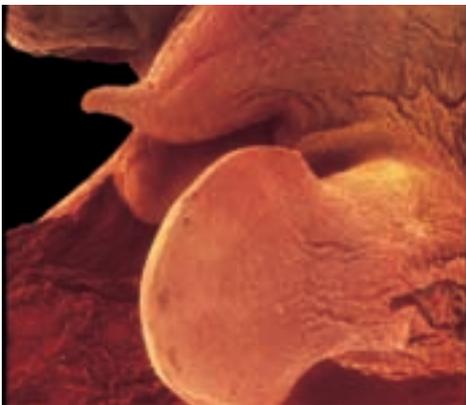
The hand of an embryo at 6 weeks



Fingers and thumb with pads seen at 8 weeks



The finger pads have regressed by 13 weeks



Toe ridges emerge after 7 weeks



Toe pads and the emerging heel are visible by 9 weeks



The toe pads have regressed by 13 weeks

The fingers and toes form rapidly during the first trimester. After 13 weeks of pregnancy, the hands and feet already look remarkably similar to those of a mature human, although they are still smaller than an adult's fingernail.

about 3 inches long and weighs about 1 ounce. It has become active, moving its arms and legs, opening and closing its mouth, and moving its head. The face, forehead, eyelids, nose, and chin are distinguishable, as are the upper arms, lower arms, hands, and lower limbs. The genitals can be identified as male or female. By the end of the fourth month, the fetus has grown to 6 inches in length and weighs 4 to 7 ounces. At this time, a growth spurt occurs in the body's lower parts. Prenatal reflexes are stronger; arm and leg movements can be felt for the first time by the mother.

By the end of the fifth month, the fetus is about 12 inches long and weighs close to a pound. Structures of the skin have formed—toenails and fingernails, for example. The fetus is more active, showing a preference for a particular position in the womb. By the end of the sixth month, the fetus is about 14 inches long and already has gained another half pound to a pound. The eyes and eyelids are completely formed, and a fine layer of hair covers the head. A grasping reflex is present and irregular breathing movements occur. By the end of the seventh month, the fetus is about 16 inches long and has gained another pound, now weighing about 3 pounds. During the eighth and ninth months, the fetus grows longer and gains substantial weight—about another 4 pounds. At birth, the average American baby weighs 7 pounds and is about 20 inches long. In these last two months, fatty tissues develop, and the functioning of various organ systems—heart and kidneys, for example—steps up.

We have described a number of developments in the germinal, embryonic, and fetal periods. An overview of some of the main developments we have discussed and some more specific changes in prenatal development are presented in figure 4.3 on page 104.

The history of man for nine months preceding his birth would, probably, be far more interesting, and contain events of greater moment than all three score and ten years that follow it.

—Samuel Taylor Coleridge
English Poet, Essayist, 19th Century

		First trimester (first 3 months)				
		Conception to 4 weeks	8 weeks	12 weeks		
Prenatal growth		<ul style="list-style-type: none"> • Is less than 1/10 inch long • Beginning development of spinal cord, nervous system, gastrointestinal system, heart, and lungs • Amniotic sac envelops the preliminary tissues of entire body • Is called an “ovum” 	<ul style="list-style-type: none"> • Is less than 1 inch long • Face is forming with rudimentary eyes, ears, mouth, and tooth buds • Arms and legs are moving • Brain is forming • Fetal heartbeat is detectable with ultrasound • Is called an “embryo” 	<ul style="list-style-type: none"> • Is about 3 inches long and weighs about 1 ounce • Can move arms, legs, fingers, and toes • Fingerprints are present • Can smile, frown, suck, and swallow • Sex is distinguishable • Can urinate • Is called a “fetus” 		
			Second trimester (middle 3 months)			
			16 weeks	20 weeks	24 weeks	
Prenatal growth		<ul style="list-style-type: none"> • Is about 5 1/2 inches long and weighs about 4 ounces • Heartbeat is strong • Skin is thin, transparent • Downy hair (lanugo) covers body • Fingernails and toenails are forming • Has coordinated movements; is able to roll over in amniotic fluid 	<ul style="list-style-type: none"> • Is 10 to 12 inches long and weighs 1/2 to 1 pound • Heartbeat is audible with ordinary stethoscope • Sucks thumb • Hiccups • Hair, eyelashes, eyebrows are present 	<ul style="list-style-type: none"> • Is 11 to 14 inches long and weighs 1 to 1 1/2 pounds • Skin is wrinkled and covered with protective coating (vernix caseosa) • Eyes are open • Meconium is collecting in bowel • Has strong grip 		
			Third trimester (last 3 months)			
			28 weeks	32 weeks	36 to 38 weeks	
Prenatal growth		<ul style="list-style-type: none"> • Is 14 to 17 inches long and weighs 2 1/2 to 3 pounds • Is adding body fat • Is very active • Rudimentary breathing movements are present 	<ul style="list-style-type: none"> • Is 16 1/2 to 18 inches long and weighs 4 to 5 pounds • Has periods of sleep and wakefulness • Responds to sounds • May assume birth position • Bones of head are soft and flexible • Iron is being stored in liver 	<ul style="list-style-type: none"> • Is 19 inches long and weighs 6 pounds • Skin is less wrinkled • Vernix caseosa is thick • Lanugo is mostly gone • Is less active • Is gaining immunities from mother 		

Figure 4.3

The Three Trimesters of Prenatal Development

Notice in figure 4.3 that we have divided these changes into trimesters, or three equal time periods. The three trimesters are not the same as the three prenatal periods we have discussed—germinal, embryonic, and fetal. An important point that needs to be made is that the first time a fetus has a chance of surviving outside of the womb is the beginning of the third trimester (at about seven months). An infant born in the seventh month usually needs assistance in breathing.

At this point we have discussed many aspects of the course of prenatal development. This review should help you reach your learning goal related to this topic.

FOR YOUR REVIEW

Learning Goal 1 Name and Describe the Three Prenatal Periods

- The **germinal period** is from conception until about 10 to 14 days later. A fertilized egg is called a zygote. The period ends when the zygote attaches to the uterine wall.
- The **embryonic period** lasts from about two to eight weeks after conception. The embryo differentiates into three layers, life-support systems develop, and organ systems form (**organogenesis**).
- The **fetal period** lasts from about two months until nine months, or when the infant is born. Growth and development continue their dramatic course, and organ systems mature to the point at which life can be sustained outside the womb.

Now that we have studied the normal course of the three prenatal periods, let's explore some things that can possibly go wrong in prenatal development.

Teratology and Hazards to Prenatal Development

Some expectant mothers carefully tiptoe about, in the belief that everything they do and feel has a direct effect on their unborn child. Others behave casually, assuming that their experiences will have little effect. The truth lies somewhere between these two extremes. Although living in a protected, comfortable environment, the fetus is not totally immune to the larger world surrounding the mother (Fifer & Grose-Fifer, 2001; McFarlane, Parker, & Soeken, 1996). The environment can affect the child in many well-documented ways. Thousands of babies are born deformed or mentally retarded every year as the result of events that occurred in the mother's life, as early as one or two months before conception.

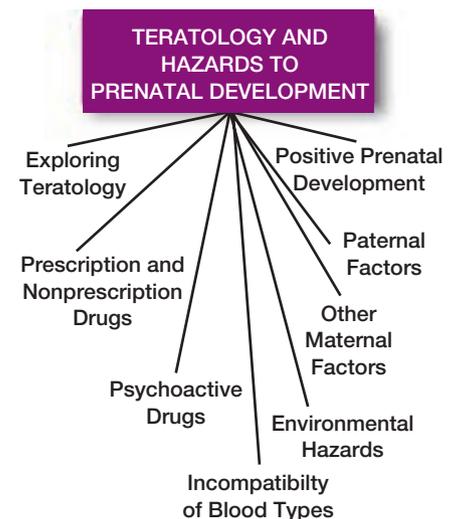
Exploring Teratology

A **teratogen** (*the word comes from the Greek word *tera* meaning "monster"*) is any agent that causes a birth defect. The field of study that investigates the causes of birth defects is called *teratology*. A specific teratogen (such as a drug) usually does not cause a specific birth defect (such as malformation of the legs). So many teratogens exist that practically every fetus is exposed to at least some teratogens. For this reason, it is difficult to determine which teratogen causes which birth defect. In addition, it may take a long time for the effects of a teratogen to show up. Only about half of all potential effects appear at birth.

The dose, the time of exposure to a particular agent, and genetic susceptibility influence the severity of the damage and the type of defect that occurs.

Dose The dose effect is rather obvious—the greater the dose of an agent, such as a drug, the greater the effect.

Time of Exposure Teratogens do more damage when they occur at some points of development than others (Brent & Fawcett, 2000). In general, the embryonic period (first trimester) is a more vulnerable time than the fetal period (second and third trimesters). As figure 4.4 on page 106 shows, sensitivity to teratogens begins at about three weeks after conception. The probability of a structural defect is greatest early in the embryonic period because this is when organs are being formed. After organogenesis is complete, teratogens are less likely to cause anatomical defects. Exposure later, during the fetal period, is more likely to stunt growth or to create problems in the way organs function.

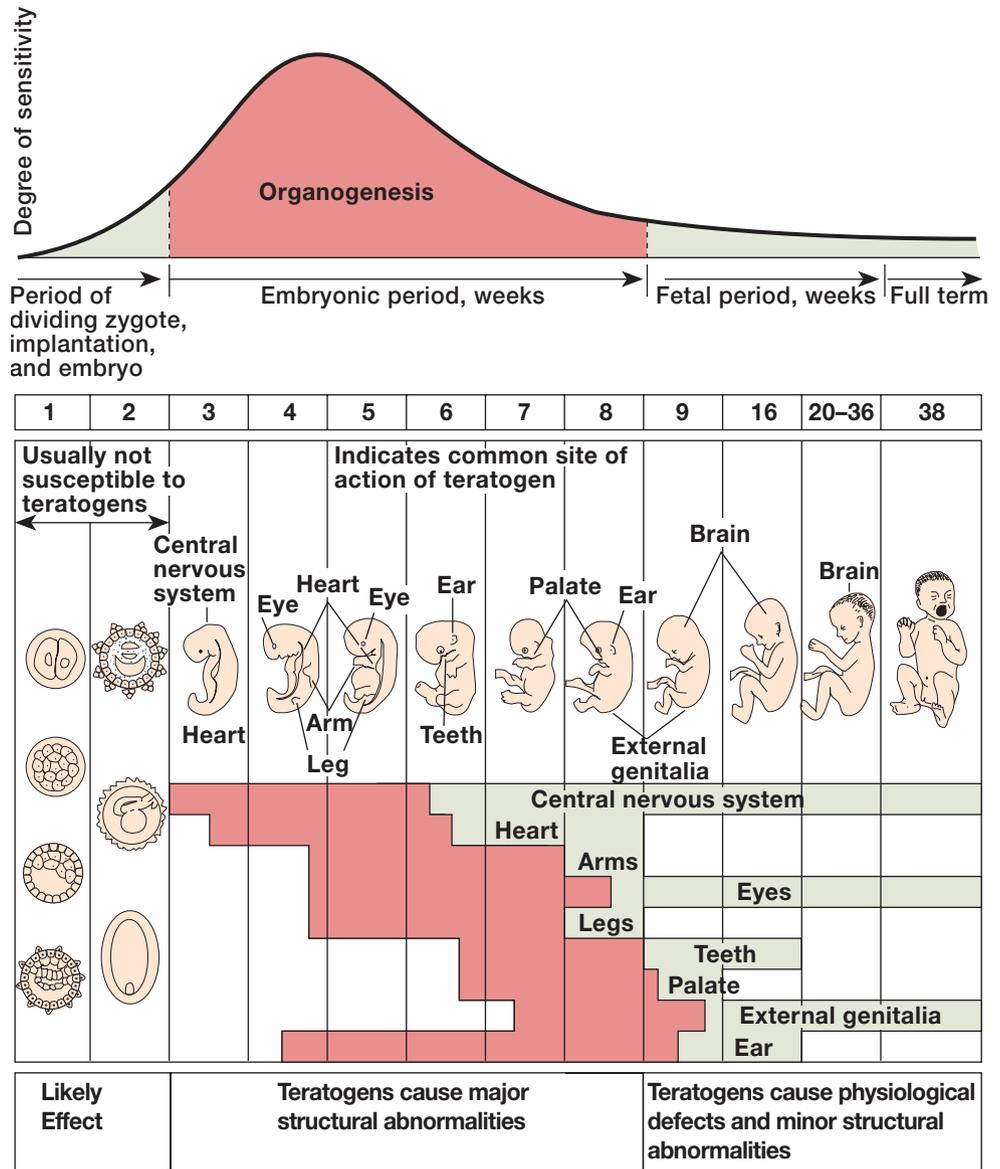


teratogen

From the Greek word *tera*, meaning "monster," any agent that causes a birth defect. The field of study that investigates the causes of birth defects is called *teratology*.

Figure 4.4 Teratogens and the Timing of Their Effects on Prenatal Development

The danger of structural defects caused by teratogens is greatest early in embryonic development. This is the period of organogenesis, and it lasts for about six weeks. Damage caused by teratogens during this period is represented by the red area. Later assaults by teratogens typically occur during the fetal period and, instead of structural damage, are more likely to stunt growth or cause problems of organ function.



The precision of organogenesis is evident. Teratologists point out that the vulnerability of the brain is greatest at 15 to 25 days after conception, the eyes at 24 to 40 days, the heart at 20 to 40 days, and the legs at 24 to 36 days.

In chapter 2, we introduced the concept of *critical period* in our discussion of Lorenz' ethological theory (P. 49). Recall that a critical period is a fixed time period very early in development during which certain experiences or events can have a long-lasting effect on development. As shown in figure 4.4, each body structure has its own critical period of formation. Thus, the critical period for major structural abnormalities in the brain is earlier than for the arms and legs.

Genetic Susceptibility The type or severity of abnormalities caused by a teratogen is linked to the genotype of the pregnant woman and the genotype of the fetus (Thursz, 2001). For example, variation in maternal metabolism of a particular drug can influence the degree to which the drug effects are transferred to the fetus. Differences in placental membranes and placental transport also affect fetal exposure. The genetic susceptibility of the fetus to a particular teratogen also can affect the extent to which the fetus is vulnerable.



Prescription and Nonprescription Drugs

Some pregnant women take prescription and nonprescription drugs without thinking about the possible effects on the fetus. Occasionally, a rash of deformed babies is born, bringing to light the damage drugs can have on a developing fetus. This happened in 1961, when many pregnant women took a popular tranquilizer, thalidomide, to alleviate their morning sickness. In adults, the effects of thalidomide are mild; in embryos, however, they are devastating. Not all infants were affected in the same way. If the mother took thalidomide on day 26 (probably before she knew she was pregnant), an arm might not grow. If she took the drug two days later, the arm might not grow past the elbow. The thalidomide tragedy shocked the medical community and parents into the stark realization that the mother does not have to be a chronic drug user for the fetus to be harmed. Taking the wrong drug at the wrong time is enough to physically handicap the offspring for life.

Among the prescription drugs that can function as teratogens are antibiotics, such as streptomycin and tetracycline; some depressants; certain hormones, such as progesterin and synthetic estrogen; and Accutane (which often is prescribed for acne).

Among the nonprescription drugs that may be harmful are diet pills, aspirin, and caffeine (Gilbert-Barnes, 2000). Let's explore the research on caffeine. In a review of studies focused on caffeine consumption during pregnancy, it was concluded that a small increase in the risks for spontaneous abortion and low birth weight occurs for pregnant women consuming more than 150 milligrams of caffeine (about 2 cups of coffee or 3 colas) per day (Fernandez & others, 1998). For example, in one recent study, pregnant women who drank caffeinated coffee were more likely to have preterm deliveries and newborns with a lower birth weight compared to their counterparts who did not drink caffeinated coffee (Eskenazi & others, 1999). In this study, no effects were found for pregnant women who drank decaffeinated coffee. Taking into account such results, the Food and Drug Administration recommends that pregnant women either not consume caffeine or consume it sparingly.

Psychoactive Drugs

Psychoactive drugs are drugs that act on the nervous system to alter states of consciousness, modify perceptions, and change moods. A number of psychoactive drugs, including alcohol and nicotine, as well as illegal drugs such as cocaine, marijuana, and heroin have been studied to determine their links to prenatal and child development.

Alcohol Heavy drinking by pregnant women can be devastating to offspring (Olson, 2000; Sood & others, 2001). **Fetal alcohol syndrome (FAS)** is a cluster of abnormalities that appears in the offspring of mothers who drink alcohol heavily during pregnancy. The abnormalities include facial deformities and defective limbs, face, and heart (Hard & others, 2001). Most of these children are below average in intelligence, and some are mentally retarded (Olson & Burgess, 1996; Thackray & Tiffet, 2001). Recent studies using brain scans reveal the children with FAS are characterized by microencephaly (a smaller than average head circumference) and reduced volume in several brain areas (Archibald & others, 2001). Although many mothers of FAS infants are heavy drinkers, many mothers who are heavy drinkers do not have children with FAS or have one child with FAS and other children who do not have it. Figure 4.5 shows a child with fetal alcohol syndrome. Although no serious malformations such as those produced by FAS are found in infants born to mothers who are moderate drinkers, in one study conducted by Ann Streissguth and her colleagues (1984), the infants whose mothers drank moderately (one to two drinks a day) during pregnancy were less attentive and alert, with the effects still present at 4 years of age. In one study, prenatal alcohol exposure was a better predictor of adolescent alcohol use and its negative consequences than was family history of alcohol problems (Baer & others, 1998). And in another study, adults with fetal alcohol syndrome had a high incidence of mental disorders, such as depression or anxiety (Famy, Streissguth, & Unis, 1998).

fetal alcohol syndrome (FAS)

A cluster of abnormalities that appears in the offspring of mothers who drink alcohol heavily during pregnancy.



Figure 4.5
Fetal Alcohol Syndrome

Notice the wide-set eyes, flat bones, and thin upper lip.

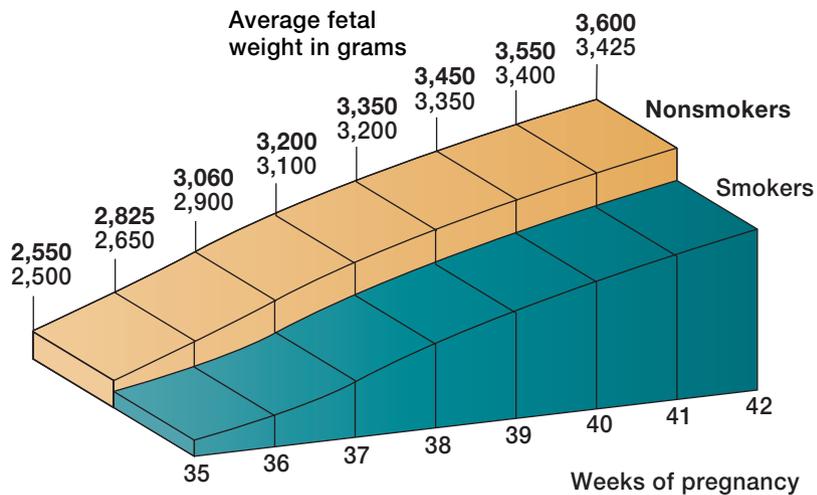
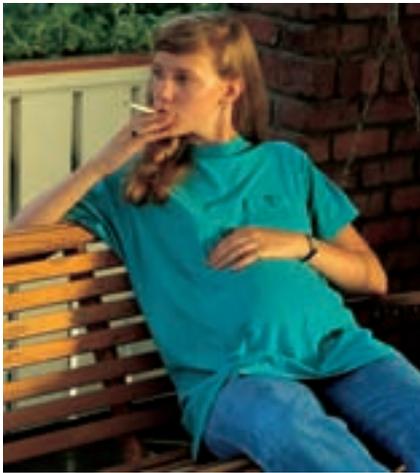


Figure 4.6

The Effects of Smoking by Expectant Mothers on Fetal Weight

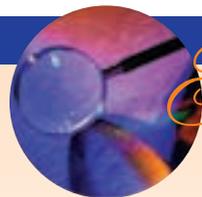
Throughout prenatal development, the fetuses of expectant mothers who smoke weigh less than the fetuses of expectant mothers who do not smoke.



Fetal Alcohol Syndrome Smoking and Pregnancy

What are some guidelines for alcohol use during pregnancy? To be absolutely sure that there will be no negative effects on the fetus, it is a good idea not to drink alcohol during pregnancy. When the pregnant woman has three or more drinks a day on a regular basis or binge drinks (five or more drinks on any one occasion) early in pregnancy, the risk of fetal alcohol syndrome goes up considerably (Barr & Streissguth, 2001). Moderate drinking of one or two servings of beer or wine or one serving of hard liquor a few days a week may or may not have a negative effect on the fetus, although it is generally agreed that this level of alcohol use will not cause fetal alcohol syndrome. As we saw in one study discussed earlier, even one or two servings of alcohol per day was linked with less effective attention in the infant and young child. The U.S. Surgeon General recommends that *no* alcohol be consumed during pregnancy.

Nicotine Cigarette smoking by pregnant women can also adversely influence prenatal development, birth, and postnatal development (Hellstrom-Lindhahl & others, 2001). Fetal and neonatal deaths are higher among smoking mothers. There also are higher incidences of preterm births and lower birth weights (Wang & others, 2000) (see figure 4.6). In one study, urine samples from 22 of 31 newborns of smoking mothers had substantial amounts of one of the strongest carcinogens (NNK) in tobacco smoke; the urine samples of the newborns whose mothers did not smoke did not contain the carcinogen (Lackmann & others, 1999). In another study, prenatal exposure to cigarette smoking was related to poorer language and cognitive skills at 4 years of age (Fried & Watkinson, 1990). Respiratory problems and sudden infant death syndrome (also known as crib death) are more common among the offspring of mothers who smoked during pregnancy (Schoendorf & Kiely, 1992). Intervention programs designed to get pregnant women to stop smoking can reduce some of smoking's negative behaviors, especially by raising birth weights (Klesges & others, 2001; Lightwood, Phibbs, & Glantz, 1999). To further consider such intervention programs, see the Thinking Critically insert.



THINKING CRITICALLY

Intervention to Stop Pregnant Women from Smoking

SCIENTISTS HAVE KNOWN about the negative consequences of smoking for more than three decades, but they have made little progress in developing effective interventions to help pregnant women quit smoking or to keep young women from becoming addicted to smoking. What needs to be done to get pregnant women to not smoke? Consider the role of health-care providers and their training, the role of insurance companies, and specific programs targeted at pregnant women.

Illegal Drugs Among the illegal drugs that have been studied to determine their effects on prenatal and child development are cocaine, marijuana, and heroin.

Cocaine With the increased use of cocaine in the United States, there is growing concern about its effects on the embryos, fetuses, and infants of pregnant cocaine users (Hurt & others, 1999; Smith & others, 2001). Cocaine use during pregnancy has recently attracted considerable attention because of possible harm to the developing embryo and fetus (Zeskind & others, 1999). The most consistent finding is that cocaine exposure during prenatal development is associated with reduced birth weight, length, and head circumference (Chiriboga & others, 1999). Also, in one recent study, prenatal cocaine exposure was associated with impaired motor development at 2 years of age (Arendt & others, 1999).

Researchers increasingly are finding that fetal cocaine exposure is linked with impaired information processing (Singer & others, 1999). In one study, prenatal cocaine exposure was moderately related to poor attentional skills through 5 years of age (Bandstra & others, 2000). In another study, prenatal cocaine exposure was related to impaired processing of auditory information after birth (Potter & others, 2000).

Although researchers are finding such deficits in children who are prenatally exposed to cocaine, caution in interpreting these findings is in order (Potter and others, 2000). Why? Because other factors (such as poverty, malnutrition, and other substance abuse) in the lives of pregnant women who use cocaine often cannot be ruled out as possible contributors to the negative effects on children (Addis & others, 2001; Bergin & others, 2001; Delaney-Black & others, 2001). For example, cocaine users are more likely than nonusers to smoke cigarettes, use marijuana, drink alcohol, and take amphetamines. Teasing apart these potential influences from the effects of cocaine itself has not yet been adequately accomplished. Obtaining valid information about the frequency and type of drug use by mothers is complicated since many mothers fear prosecution and loss of child custody because of their drug use.

Indeed, there is still controversy about the effects on the offspring of cocaine use by women during pregnancy. In one recent review, it was concluded that it has not been demonstrated that prenatal exposure to cocaine by itself has negative effects on the offspring (Frank & others, 2001).

Marijuana In spite of marijuana being used by a number of women of reproductive age, there has not been extensive research investigation of its effects on the offspring. In a recent review of the research that has been done, it was concluded that marijuana use during pregnancy is not linked to the offspring's general intelligence but that the child's attention may be impaired (Fried & Smith, 2001). Also, the National Institute of Drug Abuse's (2001) review of marijuana effects concludes that babies born to mothers who used marijuana during pregnancy are smaller than babies born to mothers who did not use the drug. Nonetheless, because of the small numbers of studies, it is difficult to reach conclusions about the effects of marijuana use by mothers during pregnancy on the child's development.

Heroin It is well documented that infants whose mothers are addicted to heroin show several behavioral difficulties (Hans, 1989; Kelly, Davis, & Henschke, 2000). The young infants of these mothers are addicted and show withdrawal symptoms characteristic of opiate abstinence, such as tremors, irritability, abnormal crying, disturbed sleep, and impaired motor control. Behavioral problems are still often present at the first birthday, and attention deficits may appear later in the child's development. The most common treatment for heroin addicts, methadone, is associated with very severe withdrawal symptoms in newborns (Weinstein, 2000).



This baby was born addicted to cocaine because its mother was a cocaine addict. *What do we know about the effects of cocaine on children's development?*

The effects of various drugs—the main ones we have discussed as well as others—on the offspring and some guidelines for safe use of these drugs is presented in figure 4.7 on page 111.

Since our last review we have discussed the concept of teratology and how different types of drugs affect development. This review should help you to reach your learning goals related to these topics.

FOR YOUR REVIEW

Learning Goal 2 Define the Concept of Teratology

- Teratology is the field that investigates the causes of congenital (birth) defects. A **teratogen** is any agent that causes birth defects. The effects of a teratogen vary by the amount of the dose, time of exposure (greater in the **embryonic period**), and genetic susceptibility.

Learning Goal 3 Describe How Different Types of Drugs Affect Prenatal Development

- Prescription and nonprescription drugs can affect prenatal development. In the 1960s, the thalidomide tragedy alerted the medical community about the potential risks of some prescription drugs. Among the prescription drugs that can be harmful are antibiotics.
- Among the nonprescription drugs that are potentially harmful are diet pills, aspirin, and caffeine.
- In terms of psychoactive drugs, alcohol, nicotine, and illegal drugs can influence prenatal development. **Fetal alcohol syndrome (FAS)** is a cluster of abnormalities that appear in offspring of mothers who drink too much during pregnancy. Even one to two drinks a day by a pregnant woman may have adverse effects on her offspring. Cigarette smoking by pregnant women has serious adverse effects on prenatal and child development (such as low birth weight). Among the illegal drugs that are potentially harmful to prenatal development are marijuana, cocaine, and heroin.

Now that we have learned what teratology involves and some effects of prescription and nonprescription drugs, let's turn our attention to some other potential problems in prenatal development.

Incompatibility of Blood Types

In addition to the blood group (A, B, O, AB), the *Rh factor* in blood is either positive or negative. Most people are Rh positive.

A woman is at risk during pregnancy when she has a negative Rh factor and her partner has a positive Rh factor (Weiss, 2001). This combination can produce a fetus whose blood has a positive Rh factor. When the fetus' blood is Rh positive and the mother's is Rh negative, antibodies in the mother may attack the fetus. This can result in any number of problems, including miscarriage or stillbirth, anemia, jaundice, heart defects, brain damage, or death soon after birth (Narang & Jain, 2001).

In most instances, the first Rh-positive baby of an Rh-negative mother is not affected but with each pregnancy the risk becomes greater. A vaccine (RhoGAM) may be given to the mother within three days after the child's birth which will prevent her body from making antibodies that will attack future Rh-positive fetuses. Also, babies already affected by Rh incompatibility can be given blood transfusions, in some cases even before birth (Mannessier & others, 2000).

Environmental Hazards

Radiation, chemicals, and other hazards in our modern industrial world can endanger the fetus (Ostrea, Whitehall, & Laken, 2000). For instance, radiation can cause a gene mutation (an abrupt, permanent change in genetic material). Chromosome abnormalities are higher among the offspring of fathers exposed to high levels of radiation in

Drug	Effects on fetus and offspring	Safe use of the drug
Alcohol	Three or more drinks a day on a regular basis or binge drinking early in pregnancy can cause fetal alcohol syndrome. Moderate drinking (1 or 2 servings of beer or wine or 1 serving of hard liquor a few days a week) may or may not have negative effects on the fetus, but this level of alcohol exposure does not cause fetal alcohol syndrome.	Avoid use.
Nicotine	Heavy smoking is associated with low birth weight babies, which means the babies may have more health problems than other infants. Smoking may be especially harmful in the second half of pregnancy.	Avoid use.
Tranquilizers	Taken during the first three months of pregnancy, they may cause cleft palate or other congenital malformations.	Avoid use if you might become pregnant and during early pregnancy. Use only under a doctor's supervision.
Barbiturates	Mothers who take large doses may have babies who are addicted. Babies may have tremors, restlessness, and irritability.	Use only under a doctor's supervision.
Amphetamines	They may cause birth defects.	Use only under a doctor's supervision.
Cocaine	Cocaine may cause drug dependency and withdrawal symptoms at birth, as well as physical and mental problems, especially if the mother uses cocaine in the first three months of pregnancy. There is a higher risk of hypertension, heart problems, developmental retardation, and learning difficulties. Cocaine's independent effects are still controversial.	Avoid use.
Marijuana	It may be linked with babies being smaller and impaired attention.	Avoid use.

Figure 4.7

Drug Use During Pregnancy

their occupations (Schrag & Dixon, 1985). Radiation from X-rays also can affect the developing embryo and fetus, with the most dangerous time being the first several weeks after conception, when women do not yet know they are pregnant. It is important for women and their physicians to weigh the risk of an X-ray when an actual or potential pregnancy is involved (Barnett & Maulik, 2001). Multiple X-ray exams and high doses of radiation can be risk factors (Timins, 2001).

Environmental pollutants and toxic wastes are also sources of danger to unborn children. Researchers have found that various hazardous wastes and pesticides cause defects in animals exposed to high doses. Among the dangerous pollutants and wastes are carbon monoxide, mercury, and lead (Gardella & Hill, 2000). Some children are exposed to lead because they live in houses in which lead-based paint flakes off the walls or near busy highways, where there are heavy automobile emissions from leaded gasoline (Bearer, 2000). Researchers believe that early exposure to lead affects children's mental development. For example, in one study, 2-year-olds who prenatally had high levels of lead in their umbilical-cord blood performed poorly on a test of mental development (Bellinger & others, 1987).

Researchers also have found that manufacturing chemicals known as PCBs are harmful to prenatal development. In one study, the extent to which pregnant women



An explosion at the Chernobyl nuclear power plant in the Ukraine produced radioactive contamination that spread to surrounding areas. Thousands of infants were born with health problems and deformities as a result of the nuclear contamination, including this boy whose arm did not form. *Other than radioactive contamination, what are some other types of environmental hazards to prenatal development?*

ate PCB-polluted fish from Lake Michigan was examined, and subsequently their newborns were observed (Jacobson & others, 1984). The women who had eaten more PCB-polluted fish were more likely to have smaller, preterm infants who were more likely to react slowly to stimuli. And, in another study, prenatal exposure to PCBs was associated with problems in visual discrimination and short-term memory in 4-year-old children (Jacobson & others, 1992).

A current environmental concern involves women who spend long hours in front of computer monitors. The fear is that low-level electromagnetic radiation from the monitors might adversely affect their offspring, should these women become pregnant. Researchers have not found exposure to computer monitors to be related to miscarriage (Schnorr & others, 1991; Shaw, 2001).

Yet another recent environmental concern for expectant mothers is prolonged exposure to heat in saunas or hot tubs that raises the mother's body temperature, creating a fever that endangers the fetus. The high temperature of a fever may interfere with cell division and may cause birth defects or even fetal death if the fever occurs repeatedly for prolonged periods of time. If the expectant mother wants to take a sauna or bathe in a hot tub, prenatal experts recommend that she take her oral temperature while she is exposed to the heat. When the expectant mother's body temperature rises a degree or more, she should get out and cool down. Ten minutes is a reasonable length of time for expectant mothers to spend in a sauna or hot tub, since the body temperature does not usually rise in this length of time. If the expectant mother feels uncomfortably hot in a sauna or hot tub, she should get out, even if she has been there only for a short time.

Other Maternal Factors

So far we have discussed a number of drugs that when taken by pregnant women may have harmful effects on prenatal and child development. We also have examined some environmental hazards that pregnant women may encounter that can be harmful. Here we will explore these other maternal factors that can affect prenatal and child development: infectious diseases, nutrition, emotional states and stress, and age.

Infectious Diseases Maternal diseases and infections can produce defects by crossing the placental barrier, or they can cause damage during the birth process itself.

Rubella Rubella (German measles) is a maternal disease that can cause prenatal defects. A rubella outbreak in 1964–1965 resulted in 30,000 prenatal and neonatal (newborn) deaths, and more than 20,000 affected infants were born with malformations, including mental retardation, blindness, deafness, and heart problems. The greatest damage occurs when mothers contract rubella in the third and fourth weeks of pregnancy, although infection during the second month is also damaging. Elaborate preventive efforts ensure that rubella will never again have the disastrous effects it had in the mid-1960s. A vaccine that prevents German measles is now routinely administered to children, and women who plan to have children should have a blood test before they become pregnant to determine if they are immune to the disease (Signore, 2001; Ward, Lambert, & Lester, 2001).

Syphilis Syphilis (a sexually transmitted disease) is more damaging later in prenatal development—four months or more after conception (Hollier & others, 2001). Rather than affecting organogenesis, as rubella does, syphilis damages organs after they have formed. Damage includes eye lesions, which can cause blindness, and skin lesions. When syphilis is present at birth, other problems, involving the central nervous system and gastrointestinal tract, can develop. Most states require that pregnant women be given a blood test to detect the presence of syphilis (Baldwin, 2001).

Genital Herpes Another infection that has received widespread attention recently is genital herpes (Qutub & others, 2001). Newborns contract this virus when they are delivered through the birth canal of a mother with genital herpes. About one-third of babies delivered through an infected birth canal die; another one-fourth become brain damaged. If an active case of genital herpes is detected in a pregnant woman close to her delivery date, a cesarean section can be performed (in which the infant is delivered through an incision in the mother's abdomen) to keep the virus from infecting the newborn. In one recent study, the drug acyclovir was successful in reducing subsequent outbreaks of genital herpes in late pregnancy (Braig & others, 2001).

AIDS *AIDS* is a sexually transmitted disease that is caused by the human immunodeficiency virus (HIV), which destroys the body's immune system. In the early 1990s, before preventive treatments were available, 1,000 to 2,000 infants were born with HIV infection each year in the United States. Today, dramatic reductions in the transmission of AIDS from mothers to the fetus/newborn have occurred. Only about one-third as many cases of newborns with AIDS appear today as in the early 1990s. This decline is due to the increase in counseling and voluntary testing of pregnant women for HIV and the use of zidovudine (AZT) by infected women during pregnancy and delivery, and for the infant after birth (Centers for Disease Control and Prevention, 2000; Rovira & others, 2001).

A mother can infect her offspring in three ways: (1) during gestation across the placenta; (2) during delivery through contact with maternal blood or fluids; and (3) postpartum (after birth) through breast-feeding. The transmission of AIDS through breast-feeding is especially a problem in many developing countries (Hankins, 2000).

Babies born to HIV-infected mothers can be (1) infected and symptomatic (show AIDS symptoms), (2) infected but asymptomatic (not show AIDS symptoms), or (3) not infected at all. An infant who is infected and asymptomatic may still develop HIV symptoms up until 15 months of age.

Toxoplasmosis Another disease that can be lethal for the fetus is **toxoplasmosis**, which is caused by a parasite with which humans can become infected by eating raw meat or by not washing their hands after touching cats' feces or yard dirt. Toxoplasmosis causes only a mild infection in adults, who get coldlike symptoms or none at all. However, toxoplasmosis can be transmitted from the mother to the fetus, causing possible eye defects, brain damage, or premature birth (Gagne, 2001; Pinon & others, 2001). To avoid getting toxoplasmosis, expectant mothers need to wash their hands after handling cats, litter boxes, and raw meat. In addition, pregnant women should make sure that all meats are thoroughly cooked before eating them and use gloves when working in the garden.

Nutrition A developing fetus depends completely on its mother for nutrition, which comes from the mother's blood. Nutritional status is not determined by any specific aspect of diet. Among the important factors are the total number of calories and appropriate levels of protein, vitamins, and minerals. The mother's nutrition even influences her ability to reproduce. In extreme instances of malnutrition, women stop menstruating, thus precluding conception. Children born to malnourished mothers are more likely to be malformed (Vdipi, Ghugre, & Anthony, 2000).

Researchers also have found that being overweight before pregnancy and during pregnancy can be risk factors for the fetus and child. In two recent studies, obese women had a significant risk of late fetal death although the risk of preterm delivery was decreased in these women (Cnatinguis & others, 1998; Kumari, 2001).

One aspect of maternal nutrition that has emerged as important is folic acid (Caldender, Rickard, & Rinsky-Eng, 2001). The U.S. Public Health Service now recommends that pregnant women consume a minimum of 400 micrograms of folic acid per day



Pregnancy and HIV

toxoplasmosis

A disease caused by a parasite with which humans can become infected by eating raw meat or by not washing their hands after touching cats' feces or yard dirt. It can be transmitted to the fetus and can cause eye defects, brain damage, or premature birth. A mild infection that causes coldlike symptoms in adults but can be a teratogen for the unborn baby.



Nutrition and Pregnancy



Because the fetus depends entirely on its mother for nutrition, it is important for the pregnant woman to have good nutritional habits. In Kenya, this government clinic provides pregnant women with information about how their diet can influence the health of their fetus and offspring. *What might the information about diet be like?*



Later Life Pregnancy



What are some of the risks for infants born to adolescent mothers?

(that is about twice the amount the average woman gets in one day). What is important about folic acid? A lack of folic acid is linked with neural-tube defects in offspring, such as spina bifida (Honein & others, 2001). Orange juice and spinach are examples of folic-acid-rich foods (Werler & others, 1996).

Emotional States and Stress Tales abound about how a pregnant woman's emotional state affects the fetus. For centuries it was thought that frightening experiences—such as a severe thunderstorm or a family member's death—leave birthmarks on the child or affect the child in more serious ways. Today we believe that the mother's stress can be transmitted to the fetus, but we have a better grasp of how this takes place (Monk & others, 2000). We now know that when a pregnant woman experiences intense fears, anxieties, and other emotions, physiological changes occur—among them, changes in respiration and glandular secretions. For example, producing adrenaline in response to fear restricts blood flow to the uterine area and may deprive the fetus of adequate oxygen (Relier, 2001).

The mother's emotional state during pregnancy can influence the birth process too. An emotionally distraught mother might have irregular contractions and a more difficult labor, which can cause irregularities in the baby's oxygen supply or can produce irregularities after birth. Babies born after extended labor also may adjust more slowly to their world and be more irritable.

Maternal anxiety during pregnancy is related to less than optimal outcomes. Circumstances that are linked with maternal anxiety during pregnancy include marital discord, death of a husband, and unwanted pregnancy (Field, 1990).

In other research on stress, prenatal development, and birth, Christine Dunkel-Schetter and her colleagues (1998; Dunkel-Schetter & others, 2001) have found that women under stress are about four times as likely to deliver their babies prematurely than their low-stress counterparts. In another study, maternal stress increased corticotrophin-releasing hormone (CRH) early in pregnancy (Hobel & others, 1999). This hormone is linked with stress. There also is a connection between stress and unhealthy behaviors, such as smoking, drug use, and poor prenatal care (Dunkel-Schetter, 1999). Further, researchers have found that pregnant women who are optimistic thinkers have less adverse birth outcomes than pregnant women who are pessimistic thinkers. Optimists believe that they have more control over the outcome of their pregnancy.

Maternal Age When the mother's age is considered in terms of possible harmful effects on the fetus and infant, two maternal ages are of special interest: adolescence and the thirties and beyond (James & others, 1999). Approximately one of every five births is to an adolescent; in some urban areas, the figure reaches as high as one in every two births. Infants born to adolescents are often premature (Ekwo & Moawad, 2001). The mortality rate of infants born to adolescent mothers is double that of infants born to mothers in their twenties. Such figures probably reflect poor nutrition, lack of prenatal care, and low socioeconomic status (Lenders, McElrath, & Scholl, 2000). Prenatal care decreases the probability that a child born to an adolescent girl will have physical problems. However, adolescents are the least likely of women in all age groups to obtain prenatal assistance from clinics, pediatricians, and health services.

Increasingly, women seek to establish their careers before beginning a family, delaying childbearing until their thirties. Down syndrome, a form of mental retardation,

is related to the mother's age. By age 40, the probability is slightly over 1 in 100, and, by age 50, it is almost 1 in 10. The risk also is higher before age 18.

Women also have more difficulty becoming pregnant after the age of 30. One study in a French fertility clinic focused on women whose husbands were sterile (Schwartz & Mayaux, 1982). To make it possible for the women to have a child, they were artificially inseminated once a month for 1 year. Each woman had 12 chances to become pregnant. Seventy-five percent of the women in their twenties became pregnant, 62 percent of the women 31 to 35 years old became pregnant, and only 54 percent of the women over 35 years old became pregnant.

We still have much to learn about the role of the mother's age in pregnancy and childbirth. As women remain active, exercise regularly, and are careful about their nutrition, their reproductive systems may remain healthier at older ages than was thought possible in the past.

Paternal Factors

So far, we have been considering maternal factors during pregnancy that can influence prenatal development and the development of the child. Might there also be some paternal factors that can have this influence? Men's exposure to lead, radiation, certain pesticides, and petrochemicals may cause abnormalities in sperm that lead to miscarriage or diseases, such as childhood cancer (Lindbohm, 1991; Trasler & Doerksen, 2000). Also, in one recent study, a father's exposure to pesticides at work was related to a child's preterm delivery (Hourani & Hilton, 2000). When fathers have a diet low in vitamin C, their offspring have a higher risk of birth defects and cancer (Fraga & others, 1991). Also, it has been speculated that, when fathers take cocaine, it may attach itself to sperm and cause birth defects, but the evidence for this is not yet strongly established. In some studies, chronic marijuana use has been shown to reduce testosterone levels and sperm counts, although the results have been inconsistent (Fields, 1998; Nahas, 1984).

The father's smoking during the mother's pregnancy also can cause problems for the offspring. In one investigation, the newborns of fathers who smoked during their wives' pregnancy were 4 ounces lighter at birth for each pack of cigarettes smoked per day than were the newborns whose fathers did not smoke during their wives' pregnancy (Rubin & others, 1986). In another study, in China, the longer the fathers smoked, the stronger the risk was for their children to develop cancer (Ji & others, 1997). In such studies, it is very difficult to tease apart prenatal and postnatal effects.

As is the case with older mothers, older fathers also may place their offspring at risk for certain birth defects. These include Down syndrome (about 5 percent of these children have older fathers), dwarfism, and Marfan syndrome, which involves head and limb deformities.

Positive Prenatal Development

In the previous sections, we mainly examined what can go wrong with prenatal development. It is important to keep in mind that for most pregnancies, prenatal development does not go awry and development occurs along the positive path that we described at the beginning of the chapter (Lester, 2000). That said, it is still important for prospective mothers and those who are pregnant to avoid the vulnerabilities to fetal development that we have described.



Reproductive Health Links

Since our last review, we have studied some potential environmental hazards to prenatal development, how some other maternal and paternal factors might affect prenatal development, and underscored the importance of not taking a perspective that is too negative. This review should help you reach your learning goals related to these topics.

FOR YOUR REVIEW

Learning Goal 4 Explain Incompatibility of Blood Types and Environmental Hazards to Prenatal Development

- Incompatibility of blood types occurs when the fetus is Rh positive and the mother is Rh negative. This can produce a number of problems in the fetus.
- Potential environmental hazards include radiation in job sites and X-rays, environmental pollutants, toxic wastes, and prolonged exposure to heat in saunas and hot tubs.

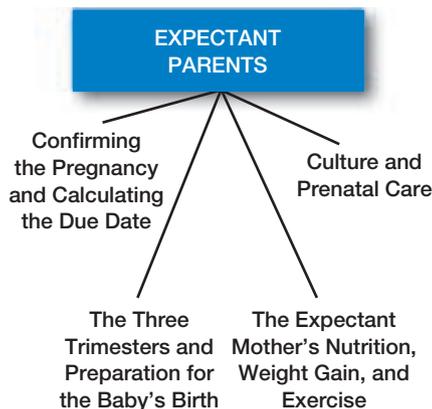
Learning Goal 5 Discuss How Other Maternal Factors and Paternal Factors Influence Prenatal Development

- Infectious diseases that can harm the fetus are rubella (German measles), syphilis, genital herpes, AIDS, and toxoplasmosis.
- A developing fetus depends entirely on its mother for nutrition. Malnutrition, obesity, and folic acid deficits in the mother are risk factors for the fetus.
- High anxiety and stress on the part of the mother are linked with less than optimal prenatal and birth outcomes.
- Two age periods may lead to problems for the offspring's development: adolescent mothers and mothers of age 30 or older.
- Among the paternal factors that may influence prenatal development are exposure to lead, radiation, certain pesticides, and petrochemicals.

Learning Goal 6 Provide a Balanced Discussion of the Positive and Negative Aspects of Prenatal Development

- It is important not to read too much doom and gloom into pregnancy and prenatal development. Most pregnancies and prenatal development go well, although it is important to avoid the vulnerabilities that **teratogens** produce.

At this point we have studied a number of ideas about teratology and hazards to prenatal development. Next, we will explore some issues that expectant parents face.



Exploring Pregnancy

Expectant Parents

For many people, becoming parents is one of the greatest life changes they will experience. Parenthood is permanent, and the physical and emotional nurturing of a child is both a time-intensive responsibility and a wonderful opportunity. So far, most of our discussion has focused on the embryo and the fetus, but it is also important to examine the effects of pregnancy on the expectant parents. An important first consideration is to confirm the pregnancy and then to calculate the due date. Then, as the pregnancy proceeds, a number of family issues emerge in the first, second, and third trimesters of pregnancy.

Confirming the Pregnancy and Calculating the Due Date

Although pregnancy can be detected soon after conception, a woman might not suspect she is pregnant until she has missed a menstrual period. A pregnancy test checks the woman's urine or blood for human chorionic gonadotropin (HCG), a hormone produced during pregnancy. If a woman thinks she is pregnant, she should have her pregnancy confirmed early, so she can obtain prenatal care, avoid environmental hazards, and give special attention to nutritional needs. Figure 4.8 describes the early signs and symptoms of pregnancy.

Fetal life begins with the fertilization of the ovum, which occurs about 2 weeks after the woman's last menstrual period. However, the length of the pregnancy is

calculated from the first day of the woman's last menstrual period and lasts an average of 280 days, or 40 weeks. When a doctor or midwife says that a woman is 8 weeks pregnant, it means that the fetus is 6 weeks old. The method of dating confuses many parents, who are certain they know just when conception occurred. When they are informed that the expectant mother is 8 weeks pregnant, they might know that the pregnancy is only just 6 weeks along, and they are correct. Birth is likely to occur anytime between 2 weeks before and after the so-called due date. Approximately two-thirds of all babies are born within 10 days of their due dates.

The Three Trimesters and Preparation for the Baby's Birth

A common way of thinking about issues that arise during pregnancy is in terms of pregnancy's trimesters.

The First Trimester Earlier in this chapter, we learned that the first three calendar months of pregnancy (the first trimester) is a time when prenatal organ systems are being formed and begin to function. For the pregnant woman, the first trimester is a time of physical and emotional adjustment to her pregnant state.

The expectant mother may feel extraordinarily tired and require more sleep because of the new demands on her energy and because of the subsequent shift in her metabolic rate, especially in the second and third months of pregnancy. She also may experience nausea and vomiting during the early months of pregnancy. Although this is usually referred to as "morning sickness," it can occur at any time of day and is believed to be caused by human chorionic gonadotropin, produced by the developing placenta.

Although the female's breasts develop in puberty, the glandular tissue that produces milk does not completely develop until the woman becomes pregnant. As the levels of estrogen and other hormones change during pregnancy, the expectant mother's breasts change. They enlarge, veins are often more prominent, and a tingling sensation is often felt in the nipples. The expectant mother may also need to urinate more frequently as the enlarging uterus puts increased pressure on the bladder. In addition, her vagina and cervix become bluish in color, the cervix becomes softer, and vaginal secretions increase.

Emotional changes accompany physical changes in the early months of pregnancy. It is not unusual for the expectant mother to experience emotional ups and downs. The thought of motherhood may at times be pleasing and, at others, disturbing. She may cry easily. Such mood swings may be difficult to understand, for both the expectant mother and her partner.

Finding out that she is pregnant may not only bring about a mixture of emotions in the expectant mother but also in her partner: pride in the ability to produce a child; fear of losing independence; apprehension about changes in the marital relationship; doubts about one's ability to parent; and happiness about becoming parents. Sharing thoughts and feelings with each other can help expectant couples develop a closer relationship during the transition to parenthood.

A couple's sexual relationship may change during the first trimester. The expectant mother may experience an increased interest in spontaneous sexual activity because she no longer has to worry about trying to become pregnant or about avoiding pregnancy, or an expectant mother's sexual interest may decrease because of fatigue, nausea, breast changes, or fear of miscarriage. In a normal pregnancy, the expectant couple should discuss their feelings about sexual intercourse and do what is mutually desired.

Might expectant parents benefit from a parent education class on pregnancy and prenatal development in the first trimester of pregnancy? It is important for expectant parents to become knowledgeable about the nature of pregnancy and prenatal development (Haertsch, Campbell, & Sanson-Fisher, 1999). In the Caring for Children box, we further discuss prenatal care and the nature of prenatal classes for expectant parents.

- **Missed menstrual period**
- **Breast changes—a heavy and full feeling, tenderness, tingling in the nipple area, and a darkened areola**
- **Fullness or aching in the lower abdomen**
- **Fatigue and drowsiness, faintness**
- **Nausea, vomiting, or both**
- **Frequent urination**
- **Increased vaginal secretions**
- **Positive pregnancy test**

Figure 4.8
Early Signs and Symptoms of Pregnancy



Interactive Pregnancy Calendar
Childbirth Classes
Becoming a Childbirth Educator

CARING FOR CHILDREN

Prenatal Care and Classes

PRENATAL CARE VARIES ENORMOUSLY but usually involves a package of medical care services in a defined schedule of visits. In addition to medical care, prenatal care programs often include comprehensive educational, social, and nutritional services (Shiono & Behrman, 1995).

Prenatal care usually includes screening that can reveal manageable conditions and/or treatable diseases that could affect both the baby's life and the pregnant woman's. The education the mother receives about pregnancy, labor and delivery, and caring for the newborn can be extremely valuable, especially for first-time mothers. Prenatal care is also very important for women in poverty because it links them with other social services. The legacy of prenatal care continues after the birth because women who experience this type of care are more likely to get preventive care for their infants (Bates & others, 1994).

Women sometimes receive inadequate prenatal care for reasons related to the health-care system, provider practices, and their own individual and social characteristics. In one national study, 71 percent of the low-income women experienced a problem in getting prenatal care (U.S. General Accounting Office, 1987). They cited finances, transportation, and child care as barriers. Motivating positive attitudes toward pregnancy is also important. Women who do not want to be pregnant, who have negative attitudes about being pregnant, or who unintentionally become pregnant are more likely to delay prenatal care or to miss appointments (Joseph, 1989).

Early prenatal classes may include couples in both early pregnancy and prepregnancy (Olds, London, & Ladewig, 1988). The classes often focus on topics such as these:

- Changes in the development of the embryo and the fetus

- Self-care during pregnancy
- Fetal development concerns and environmental dangers for the fetus
- Sexuality during pregnancy
- Birth setting and types of care providers
- Nutrition, rest, and exercise
- Common discomforts of pregnancy and relief measures
- Psychological changes in both the expectant mother and her partner
- Information needed to get the pregnancy off to a good start

Early classes also may include information about factors that place the expectant mother at risk for preterm labor and recognition of the possible signs and symptoms of preterm labor. Prenatal education classes also may include information on the advantages and disadvantages of breast- and bottle-feeding. Most expectant mothers (50 to 80 percent) make this infant feeding decision prior to the sixth month of pregnancy. Therefore, information about the issues involved in breast-versus-bottle-feeding in an early prenatal education class is helpful.

So far, the prenatal education classes we have described focus on expectant couples in the first trimester of pregnancy. The later classes—those when the expectant mother is in the second or third trimester of pregnancy—focus on preparation for the birth, infant care and feeding, postpartum self-care, and birth choices. Much more about these topics appears in chapter 5.



How do early and later prenatal classes differ?

The Second Trimester During the middle months of pregnancy, the expectant mother will probably feel better than she did earlier or than she will later. Nausea and fatigue usually lessen or disappear. As the baby's growth continues, the expectant mother's uterus expands into the abdominal cavity. By the end of the fifth month of pregnancy, the top of the uterus (called the fundus) reaches the navel. During monthly visits, the physician or caregiver measures the height of the fundus to ensure that the fetus is growing adequately and to estimate the length of the pregnancy. The expectant mother's breasts do not increase much in size during the second trimester, but colostrum (a yellowish fluid produced before breast milk) is usually present in the milk glands by the middle of pregnancy. This is the time for expectant mothers to begin preparing their breasts for breast-feeding if they have decided to breast-feed the baby.

Accompanying physical changes in the second trimester are psychological changes in response to advancing pregnancy and a changing body. Some expectant mothers enjoy how they look; others consider themselves unattractive, inconvenienced, and restricted. If the expectant mother has not yet read books about child care in the first few years of life, this is a good time to purchase one or more of them. Later in this book, we will recommend some of the books as we discuss infants' physical, cognitive, and social development. This also is a good time to begin preparing the nursery for the baby's arrival.

During the second trimester, pregnancy becomes more of a reality for the expectant mother's partner. He can feel the baby move when he puts his hand on her abdomen or when she is in close contact with him. This contact with the baby increases his feelings of closeness and his interest in the pregnancy and the baby. He may or may not like the changing appearance of the expectant mother. In a normal pregnancy, the expectant couple can continue to have sexual intercourse without harming the fetus, which is believed to be adequately protected from penetrations and the strong contractions that sometimes accompany orgasm.

The Third Trimester During the third trimester, the expectant mother's uterus expands to a level just below her breastbone (figure 4.9 shows the space taken up by the developing fetus in the first, second, and third trimesters of pregnancy). Crowding by the uterus, in addition to high levels of progesterone, may give the expectant mother heartburn and indigestion. She may also experience shortness of breath as her uterus presses upward on her diaphragm and ribs. Varicose veins in the legs, hemorrhoids, and swollen ankles sometimes appear because of the increased pressure within the abdomen, the decreased blood return from the lower limbs, and the effect of progesterone, which relaxes the walls of the blood vessels.

By the ninth month, the expectant mother often looks forward to the end of the pregnancy, relief from physical restrictions, and the long-awaited joy of having the baby. She may become more introspective and, at times, worry about labor, birth, and the baby. Through childbirth classes, the expectant couple can learn more about labor, birth, and how to cope with the stress of the latter part of pregnancy. In chapter 5, we will discuss different types of childbirth and childbirth classes.

In the third trimester of pregnancy, the expectant couple may feel protective of the developing baby. Adjustments in sexual activity continue as the expectant mother's abdomen enlarges. Lines of communication should be open between the expectant mother and her partner about their needs, feelings, and desires.

Preparation for the Baby's Birth About two weeks before the baby's birth, the expectant mother's profile may change as the fetus descends into the pelvic cavity. The expectant mother may now feel less pressure on her diaphragm and thus find it easier to breathe and eat. However,

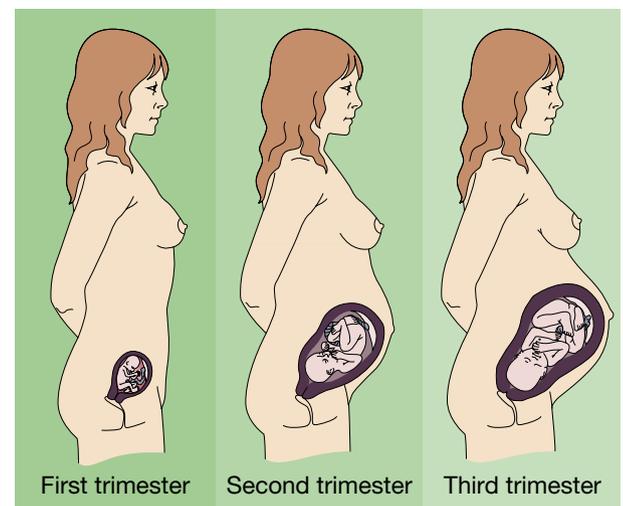


Figure 4.9

The Changing Shape and Size of the Expectant Mother and the Fetus During the First, Second, and Third Trimesters of Pregnancy



In the third trimester of pregnancy, the expectant couple may feel protective of the developing baby. *What are some good communication strategies between the expectant mother and her partner about their needs?*

because the head of the fetus can press on the expectant mother's bladder, she may need to urinate more frequently.

Toward the end of the pregnancy, noticeable contractions of the uterus (called Braxton Hicks contractions) increase in frequency. These contractions, which have occurred intermittently throughout pregnancy and which may or may not be felt by the expectant mother, help increase the efficiency of uterine circulation. Though usually not directly associated with labor, these contractions prepare the uterine muscles for labor. As the pregnancy comes to an end and the baby's head presses against the expectant mother's pelvis, her cervix becomes softer and thinner. This thinning is a sign of readiness for labor and birth.

Awkwardness and fatigue may add to the expectant mother's motivation for the pregnancy to end. She may feel as if she has been and will be pregnant forever. At the same time, the expectant mother may feel a "nesting urge" in the form of a spurt of energy that often results in preparations for the arrival of the new baby. She now visits her physician or midwife more often as these physical changes signal that her body is preparing for labor and birth.

The Expectant Mother's Nutrition, Weight Gain, and Exercise

Earlier we indicated that the mother's nutrition can have a strong influence on the development of the fetus. Here we will further discuss the mother's nutritional needs and optimal nutrition during pregnancy, as well as the role of exercise in the expectant mother's health.

Nutrition and Weight Gain The best assurance of an adequate caloric intake during pregnancy is a satisfactory weight gain over time. The optimal weight gain depends on the expectant mother's height, bone structure, and prepregnant nutritional state. However, maternal weight gains that average from 25 to 35 pounds are associated with the best reproductive outcomes. Approximately one-third of pregnant women gain more than this recommended amount (Cogswell & others, 2001). The pattern of weight gain is also important. The ideal pattern of weight gain during pregnancy is 2 to 4.4 pounds during the first trimester, followed by an average gain of 1 pound per week during the last two trimesters. In the second trimester, most of the weight gain is due to increased blood volume; the enlargement of breasts, uterus, and associated tissue and fluid; and the deposit of maternal fat. In the third trimester, weight gain mainly involves the fetus, placenta, and amniotic fluid. A 25-pound weight gain during pregnancy is generally distributed in the following way:

- 11 lb Fetus, placenta, and amniotic fluid
- 5 lb Maternal stores
- 4 lb Increased blood volume
- 3 lb Tissue fluid
- 2 lb Uterus and breasts

During the second and third trimesters, inadequate gains of less than 2.2 pounds per month or excessive gains of more than 6.6 pounds per month should be evaluated and the need for nutritional counseling considered. Inadequate weight gain has been associated with low birth weight infants. Sudden sharp increases in weight of 3 to 5 pounds in a week may result from fluid retention and may require evaluation.

The recommended daily allowance (RDA) for all nutrients increases during pregnancy. The expectant mother should eat three meals a day, with nutritious snacks of fruits, cheese, milk, or other foods between meals if desired. More frequent, smaller meals also are recommended. Four to six glasses (8 ounces) of water and a total of 8 to 10 cups (8 ounces) of total fluid should be consumed daily. Water is an essential nutrient. The amount of the increase in nutrients depends on the nutrient. The need for protein, iron, vitamin D, calcium, phosphorus, and magnesium increases by

50 percent or more. Recommended increases for other nutrients range from 15 to 50 percent (see figure 4.10).

Exercise How much and what type of exercise is best during pregnancy depend to some degree on the course of the pregnancy, the expectant mother's fitness, and her customary activity level. Normal participation in exercise can continue throughout an uncomplicated pregnancy. In general, the skilled sportswoman is no longer discouraged from participating in sports she participated in prior to her pregnancy. However, pregnancy is not the appropriate time to begin strenuous activity.

Because of the increased emphasis on physical fitness in our society, more women routinely jog as part of a physical fitness program prior to pregnancy. There are few concerns about continuing to jog during the early part of pregnancy, but in the latter part of pregnancy there is some concern about the jarring effect of jogging on breasts and abdomen. As pregnancy progresses, low-impact activities, such as swimming and bicycling, are safer and provide fitness as well as greater comfort, eliminating the bouncing associated with jogging.

The following guidelines for exercise are recommended for expectant mothers (Olds, London, & Ladewig, 1988):

- Exercise for shorter time intervals. Exercising for 10 to 15 minutes, resting for a few minutes, and then exercising for another 10 to 15 minutes decreases potential problems associated with the shunting of blood to the musculoskeletal system and away from organs, such as the uterus.
- As pregnancy proceeds, expectant mothers should decrease the intensity of the exercise. The decreased intensity helps compensate for the expectant mother's decreased cardiac reserve, increased respiratory effort, and increased weight gain.
- Avoid prolonged overheating. Strenuous exercise, especially in a humid environment, can raise the body temperature and increase the risk of fetal problems. Remember also our earlier discussion about avoiding overheating in saunas and hot tubs.

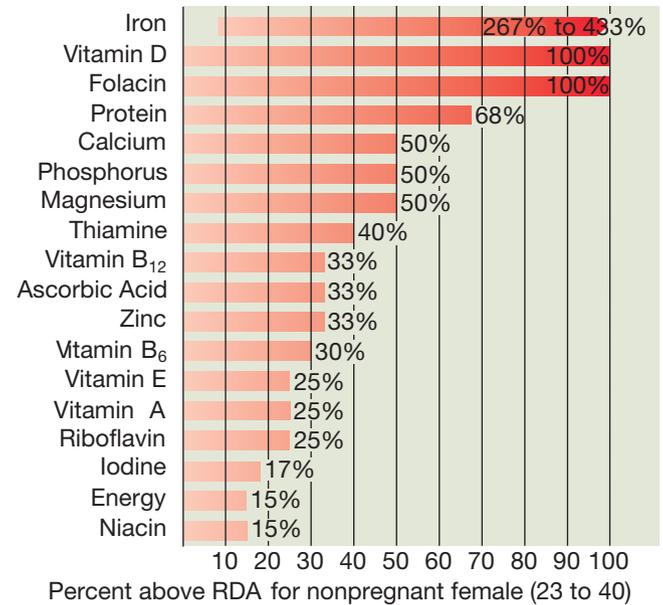


Figure 4.10
Recommended Nutrient Increases for Expectant Mothers



Nutrition and Pregnancy
Exercise in Pregnancy



What are some exercise guidelines for expectant mothers?

CAREERS IN CHILD DEVELOPMENT

Elizabeth Noble, *Physical Therapist and Childbirth Educator*

ELIZABETH NOBLE grew up in Australia where she obtained undergraduate degrees in physiotherapy, philosophy, and anthropology. She moved to the United States in the 1970s and founded the Women's Health section of the American Physical Therapy Association.

Elizabeth has authored numerous books such as *Essential Exercises for the Childbearing Years*. She also is a consultant, lecturer, and workshop leader. More than 2,000 instructors in prenatal and postpartum exercise have been trained by Elizabeth. Currently, she is the director of Women's Health Resources in Harwich, Massachusetts.



Elizabeth Noble, demonstrating an effective postpartum exercise.

- As pregnancy increases, the expectant mother should avoid high-risk activities, such as skydiving, mountain climbing, racquetball, and surfing. An expectant mother's changed center of gravity and softened joints may decrease her coordination and increase the risk of falls and injuries in such sports.
- Warm up and stretch to help prepare the joints for activity, and cool down with a period of mild activity to help restore circulation.
- After exercising, lie on the left side for 10 minutes to rest. This improves circulation from the extremities and promotes placental function.
- Wear supportive shoes and a supportive bra.
- Stop exercising and contact the physician or caregiver if dizziness, shortness of breath, tingling, numbness, vaginal bleeding, or abdominal pain occur.
- Reduce exercise in the last four weeks of pregnancy because there is some evidence that strenuous exercise near term increases the risk of low birth weight, stillbirth, and infant death.

Exercise during pregnancy helps prevent constipation, conditions the body, and is associated with a more positive mental state (Ezmerli, 2000). However, it is important to remember to not overdo it. Pregnant women should always consult their physician before starting any exercise program.

Might the mother's exercise during pregnancy be related to the development of the fetus and the birth of the child? Few studies have been conducted on this topic, but recently several studies indicated that moderate exercise three to four times a week was linked to healthy weight gain in the fetus and a normal birth weight, whereas the risk of low birth weight increased for women who exercised intensely most days of the week and for women who exercised less than twice a week or not at all (Campbell & Mottola, 2001; Clapp & others, 2000).

At this point, we have discussed numerous ideas about prenatal development. An important agenda is to provide such information to expectant parents so that they can maximize positive prenatal outcomes.



Prenatal Care Health-Care Providers

Culture and Prenatal Care

What is prenatal care in the United States like compared with that of other countries? What are some cultural beliefs about pregnancy?

Prenatal Care in the United States and Around the World

As advanced a nation as the United States has become economically and technologically, it still has more low birth weight infants than a number of other countries (Grant, 1996). Only 4 percent of the infants born in Sweden, Finland, the Netherlands, and Norway are low birth weight, and only 5 percent of those born in New Zealand, Australia, France, and Japan are low birth weight. In the United States, 7 percent of all infants are low birth weight. In some developing countries, such as Bangladesh, where



In India, a midwife checks on the size, position, and heartbeat of a fetus. Midwives deliver babies in many cultures around the world. *What are some cultural variations in prenatal care?*

poverty is rampant and the health and nutrition of mothers are poor, the percentage of low birth weight infants reaches as high as 50 percent of all infants.

In the United States, discrepancies occur between the prenatal development and birth of African American infants and White infants (Dubay & others, 2001). African American infants are twice as likely to be born prematurely, have low birth weight, and have mothers who received late or no prenatal care. They are three times as likely to have their mothers die in childbirth. And they are five times as likely to be born to unmarried teenage mothers (Edelman, 1995).

In many of the countries with a lower percentage of low birth weight infants than the United States, either free or very-low-cost prenatal and postnatal care is available to mothers. This care includes paid maternity leave from work that ranges from 9 to 40 weeks. In Norway and the Netherlands, prenatal care is coordinated with a general practitioner, an obstetrician, and a midwife.

Pregnant women in the United States do not receive the uniform prenatal care that women in many Scandinavian and Western European countries receive (McCormick, 2001). The United States does not have a national policy of health care that assures high-quality assistance for pregnant women. The cost of giving birth is approximately \$4,000 in the United States (more than \$5,000 for a cesarean birth). More than 25 percent of all American women of prime childbearing age do not have insurance that will pay for hospital costs. More than one-fifth of all White mothers and one-third of all African American mothers do not receive prenatal care in the first trimester of their pregnancy. Five percent of White mothers and 10 percent of African American mothers receive no prenatal care at all (Wegman, 1986). Many infant-development researchers

believe that the United States needs more comprehensive medical and educational services to improve the quality of prenatal care and to reduce the percentage of low birth weight infants (Cosey & Bechtel, 2001; Howell, 2001).

Cultural Beliefs About Pregnancy and Development Specific actions in pregnancy are often determined by cultural beliefs. Certain behaviors are expected if a culture views pregnancy as a medical condition, whereas other behaviors are expected if pregnancy is viewed as a natural occurrence. Prenatal care may not be a priority for expectant mothers who view pregnancy as a natural occurrence. It is important for health-care providers to become aware of the health practices of various cultural groups, including health beliefs about pregnancy and prenatal development. Cultural assessment is an important dimension of providing adequate health care for expectant mothers from various cultural groups. Cultural assessment includes identifying the main beliefs, values, and behaviors related to pregnancy and childbearing. Among the important cultural dimensions are ethnic background, degree of affiliation with the ethnic group, patterns of decision making, religious preference, language, communication style, and common etiquette practices.

Health-care practices during pregnancy are influenced by numerous factors, including the prevalence of traditional home care remedies and folk beliefs, the importance of indigenous healers, and the influence of professional health-care workers. Many Mexican American mothers are strongly influenced by their mothers and older women in their culture, often seeking and following their advice during pregnancy. In Mexican American culture, the indigenous healer is called a *curandero*. In some Native American tribes, the medicine woman or man fulfills the healing role. Herbalists are often found in Asian cultures, and faith healers, root doctors, and spiritualists are sometimes found in African American culture. When health-care providers come into contact with expectant mothers, they need to assess whether such cultural practices pose a threat to the expectant mother and the fetus. If they pose no threat, there is no reason to try to change them. On the other hand, if certain cultural practices do pose a threat to the health of the expectant mother or the fetus, the health-care provider should consider a culturally sensitive way to handle the problem. For example, some Philipinos will not take any medication during pregnancy.

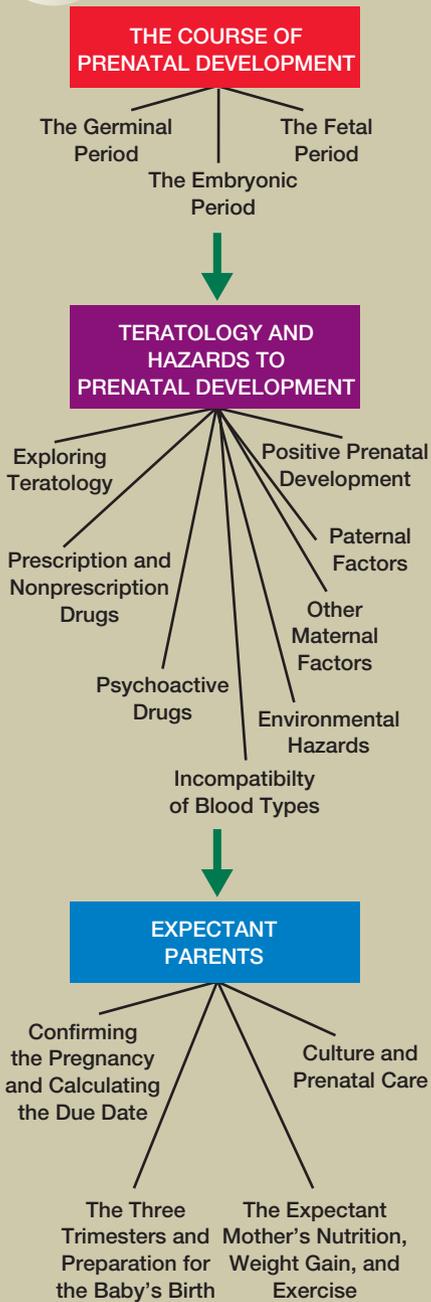
At this point, we have discussed a number of ideas about expectant parents. This review should help you reach your learning goals related to this topic.

*F*OR YOUR REVIEW

- Learning Goal 7** **Describe How Pregnancy Is Confirmed and How to Calculate the Due Date**
- A pregnancy test checks the woman's urine or blood for human chorionic gonadotropin (HCG).
 - The length of pregnancy is computed from the first day of the woman's last menstrual period and lasts an average of 280 days or 40 weeks.
- Learning Goal 8** **Discuss Changes in the Expectant Mother in the Three Trimesters of Pregnancy and Preparation for the Baby's Birth**
- The expectant mother may especially feel tired and require more sleep in the second and third months of pregnancy. She also may experience nausea and vomiting. Many expectant mothers experience emotional mood swings.
 - During the middle months of pregnancy, the expectant mother often feels better than she did earlier or will feel later. Her uterus expands. If she plans to breast-feed, when colostrum begins to appear in the milk glands she should begin preparing her breasts for breast-feeding.
 - In the third trimester, her uterus expands to a level just below her breastbone. At this time, she may experience indigestion and heartburn. She also may experience shortness of breath.
 - Two weeks prior to the baby's birth, the expectant mother's profile may change as the fetus descends into the pelvic cavity. She often has to urinate more because of bladder pressure from the fetus' head. Toward the end of pregnancy, uterine contractions increase. Her cervix becomes softer and thinner.
- Learning Goal 9** **Know About the Expectant Mother's Nutrition, Weight Gain, and Exercise**
- The best assurance of adequate caloric intake during pregnancy is a satisfactory weight gain over time. Maternal weight gain that averages 25 to 35 pounds is often linked with the best reproductive outcomes.
 - How much and what type of exercise depends to some extent on the course of pregnancy, the expectant mother's fitness, and her customary activity level.
- Learning Goal 10** **Evaluate the Links Between Culture and Prenatal Care**
- Many countries, especially in Scandinavia, have a lower percentage of low birth weight infants than in the United States. As many as one-third of African American mothers do not receive prenatal care in the first trimester of pregnancy.
 - Specific actions in pregnancy are influenced by cultural beliefs. Certain behaviors are expected depending on whether the culture views pregnancy as a medical or a natural condition.

In this chapter we have examined many aspects of prenatal development. In chapter 5, we will explore the birth process itself.

Chapter Map



Reach Your Learning Goals

At the beginning of this chapter, we stated ten learning goals and encouraged you to review material related to the learning goals at four points in the chapter. This is a good time to return to those reviews and use them to organize your study of this chapter and guide you in reaching your learning goals.

Page 105

Learning Goal 1 Name and Describe the Three Prenatal Periods

Page 110

Learning Goal 2 Define the Concept of Teratology

Learning Goal 3 Describe How Different Types of Drugs Affect Prenatal Development

Page 116

Learning Goal 4 Explain Incompatibility of Blood Types and Environmental Hazards to Prenatal Development

Learning Goal 5 Discuss How Other Maternal Factors and Paternal Factors Influence Prenatal Development

Learning Goal 6 Provide a Balanced Discussion of the Positive and Negative Aspects of Prenatal Development

Page 125

Learning Goal 7 Describe How Pregnancy Is Confirmed and How to Calculate the Due Date

Learning Goal 8 Discuss Changes in the Expectant Mother in the Three Trimesters of Pregnancy and Preparation for the Baby's Birth

Learning Goal 9 Know About the Expectant Mother's Nutrition, Weight Gain, and Exercise

Learning Goal 10 Evaluate the Links Between Culture and Prenatal Care

Key Terms

germinal period 100
 blastocyst 100
 trophoblast 100
 embryonic period 101
 endoderm 101
 ectoderm 101
 mesoderm 101

amnion 101
 organogenesis 102
 fetal period 102
 teratogen 105
 fetal alcohol syndrome (FAS) 107
 toxoplasmosis 113

Key People

Ann Streissguth 107
 Christine Dunkel-Schetter 114

Making a Difference

Maximizing Positive Prenatal Outcomes

What are some good strategies during pregnancy that are likely to maximize positive outcomes for prenatal development?

- *Eat nutritiously and monitor weight gain.* The recommended daily allowances for all nutrients increase during pregnancy. The pregnant woman should eat three balanced meals a day and nutritious snacks between meals if desired. Weight gains that average 25 to 35 pounds are associated with the best reproductive outcomes.
- *Engage in safe exercise.* How much and what type of exercise is best during pregnancy depends to some degree on the course of the pregnancy, the expectant mother's fitness, and her customary activity level. Normal participation in exercise can continue throughout an uncomplicated pregnancy. It is important to remember not to overdo exercise. Exercising for shorter intervals and decreasing the intensity of exercise as pregnancy proceeds are good strategies. Pregnant women should always consult a physician before starting an exercise program.
- *Don't drink alcohol or take other potentially harmful drugs.* An important strategy for pregnancy is to totally abstain from alcohol and other drugs, such as nicotine and cocaine. In this chapter, we described the harmful effects that these drugs can have on the

developing fetus. Fathers also need to be aware of potentially harmful effects they can have on prenatal development.

- *Have a support system of family and friends.* The pregnant woman benefits from a support system of family members and friends. A positive relationship with a spouse helps keep stress levels down, as does a close relationship with one or more friends.
- *Reduce stress and stay calm.* Try to maintain an even, calm emotional state during pregnancy. High stress levels can harm the fetus. Pregnant women who are feeling a lot of anxiety can reduce their anxiety through a relaxation or stress management program.
- *Stay away from environmental hazards.* We saw in this chapter that some environmental hazards, such as pollutants and toxic wastes, can harm prenatal development. Be aware of these hazards and stay away from them.
- *Get excellent prenatal care.* The quality of prenatal care varies extensively. The education the mother receives about pregnancy, labor and delivery, and care of the newborn can be valuable, especially for first-time mothers.
- *Read a good book for expectant mothers.* An excellent one is *What to Expect When You Are Expecting*.



Children Resources

National Center for Education in Maternal and Child Health

38th and R Streets, NW
Washington, DC 20057
202-625-8400

This center answers questions about pregnancy and childbirth, high-risk infants, and maternal and child health programs. It also publishes a free guide, *Maternal and Child Health Publications*.

Prenatal Care Tips

Pregnant women can call this federal government toll-free number for prenatal care advice and referral to local health-care providers
800-311-2229.



Taking It to the Net

1. Jacqueline is a marathon runner who has recently become pregnant. Although she has postponed her marathon training, she still plans to run at least four times a week. *Do you think this is a wise decision? What forms of exercise would be safe for Jacqueline? What could potentially be harmful?*
2. A significant portion of prenatal development occurs within the first eight weeks after conception. *How does development progress from a single cell to a human body? What are the major milestones in brain development? What occurs to ensure that each fertilized egg is unique?*

<http://www.mhhe.com/santrockc7>

3. Both Maria and her husband, Frank, drink coffee throughout the day. They are planning to have a child, and although Maria is toying with the idea of giving up caffeine during her pregnancy, she has had a difficult time quitting in the past. *Based on the research, how important would it be for Maria and/or Frank to eliminate consumption of caffeine?*

Connect to <http://www.mhhe.com/santrockc7> to research the answers and complete the exercises.