

CHAPTER 3 PRENATAL DEVELOPMENT

CHAPTER-AT-A-GLANCE

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Prenatal Development pp. 95–101 Conception • Germinal Period • Period of the Embryo • Period of the Fetus	Learning Objective 3.2 Learning Activities 3.1, 3.4 Ask Yourself p. 101	Test Bank Items 14–50, 102
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Preparing for Parenthood pp. 118–120 The Baby Becomes a Reality • Models of Effective Parenthood • The Parental Relationship	Learning Objective 3.7 Learning Activity 3.4 Ask Yourself p. 120	Test Bank Items 98–100

BRIEF CHAPTER SUMMARY

Today, in Western industrialized nations, the question of whether to have children is a matter of individual choice. Nevertheless, most U.S. adults of childbearing age either have children or plan to have them. The American family has declined in size over time, and first births to women in their thirties have increased. Although reproductive capacity declines with age, adults who delay childbearing until their education is complete, their careers are established, and they are emotionally more mature may be better able to invest in parenting.

Prenatal development begins with conception and unfolds in three phases: (1) the germinal period, during which the newly formed zygote travels down and out of the fallopian tube and attaches itself to the uterine wall; (2) the period of the embryo, during which the groundwork is laid for all body structures and internal organs; and (3) the period of the fetus, the “growth and finishing” phase.

During the prenatal period, the developing organism can be endangered by teratogens, including drugs, tobacco, alcohol, radiation, and environmental pollution, as well as by infectious disease, inadequate exercise, poor nutrition, emotional stress, Rh factor incompatibility, and maternal age. Prenatal health care is vitally important to ensure the health of mother and baby.

For expectant parents with positive, stable relationships, the prenatal period is an exciting period of major life change during which individuals construct a parental identity and take practical steps to prepare for parenthood.

LEARNING OBJECTIVES

After reading this chapter, you should be able to answer the following:

- 3.1 How has decision making about childbearing changed over the past half century, and what are the consequences for child rearing and child development? (pp. 91–94)
- 3.2 List the three phases of prenatal development, and describe the major milestones of each. (pp. 96–101)
- 3.3 What are teratogens, and what factors influence their impact? (pp. 101–104)

- 3.4 List agents known to be or suspected of being teratogens, and discuss evidence supporting their harmful impact. (pp. 104–111)
- 3.5 Describe the impact of other maternal factors on prenatal development. (pp. 111–115)
- 3.6 Why is early and regular health care vital during the prenatal period? (pp. 115–118)
- 3.7 What factors contribute to preparation for parenthood during the prenatal period? (pp. 118–120)

LECTURE OUTLINE

I. MOTIVATIONS FOR PARENTHOOD (pp. 91–94)

- A. Why Have Children? (pp. 91–93)
 1. In the past, many adults had children because it was biologically or socially expected.
 2. Today, in Western industrialized nations, childbearing decisions are a matter of personal choice because of effective birth control techniques and changes in cultural values.
 3. Contemporary American and European adults of childbearing age mention childbearing motivations, such as giving and receiving warmth and affection and personal fulfillment.
 4. They also cite disadvantages of having children—for example, role overload and risk of bringing up children in a troubled world.
- B. How Large a Family? (pp. 93–94)
 1. Since 1960, the average number of children per American woman of childbearing age has dropped from 3.1 to 2.1.
 2. Smaller family size is more compatible with women working. Marital instability also plays a role.
 3. Research shows that large families do not make less intelligent children. Parents reallocate their energies as new children are born, but parenting quality does not decline.
 4. Research also shows that only children are as well-adjusted as children with siblings.
- C. Is There a Best Time During Adulthood to Have a Child? (p. 94)
 1. First births to women in their thirties have increased greatly over the past several decades.
 2. Older parents are financially better off and emotionally more mature than younger parents. However, fertility problems and other risks increase with age.

II. PRENATAL DEVELOPMENT (pp. 95–101)

- A. Conception (pp. 95–96)
 1. About once every 28 days, an ovum bursts from one of a woman's ovaries and is drawn into one of two *fallopian tubes*. The *corpus luteum* then secretes hormones that prepare the lining of the uterus to receive a fertilized ovum.
 2. Following intercourse, sperm, which are produced in a male's *testes*, travel through the *cervix* and into the fallopian tube, where fertilization usually occurs.
 3. Sperm can live for up to six days, but most conceptions result from intercourse during the three-day period before and during ovulation.
- B. Germinal Period (pp. 97–98)
 1. The germinal period lasts about two weeks, from fertilization until the cell mass drifts out of the fallopian tube and attaches itself to the uterine wall.
 2. By the fourth day, 60 to 70 cells exist, forming a hollow, fluid-filled ball called a **blastocyst**.
 3. The **embryonic disk** (the cells on the inside of the blastocyst) will become the new organism; the thin outer ring of cells, the **trophoblast**, will become the structures that provide protective covering and nourishment.
 4. Implantation
 - a. **Implantation** occurs between the seventh and ninth days, when the blastocyst burrows into the uterine lining.
 - b. The trophoblast forms a membrane, the **amnion**, that encloses the developing organism in **amniotic fluid**, which provides a cushion against jolts and regulates the temperature of the prenatal world.
 5. The Placenta and Umbilical Cord
 - a. By the end of the second week, the **chorion**, a protective membrane surrounding the amnion, forms, and tiny blood vessels emerge and burrow into the uterine wall.
 - b. The **placenta** develops and permits food and oxygen to reach the developing organism and waste products to be carried away.
 - c. The placenta is connected to the developing organism by the **umbilical cord**.

- C. Period of the Embryo (p. 98)
1. During the period of the **embryo**, from implantation through the eighth week of pregnancy, the groundwork is laid for all body structures and internal organs.
 2. Last Half of the First Month
 - a. In the third week of pregnancy, the embryonic disk forms three layers of cells—the *ectoderm*, the *mesoderm*, and the *endoderm*—which give rise to all parts of the body.
 - b. At first, the nervous system develops fastest. The ectoderm folds over, forming the **neural tube**, or spinal cord.
 3. The Second Month
 - a. Growth continues rapidly, as the eyes, ears, nose, jaw, and neck form and tiny buds become arms, legs, fingers, and toes.
 - b. At 7 weeks, rapid production of neurons begins.
 - c. At the end of this period, the embryo can move and responds to touch.
- D. Period of the Fetus (pp. 99–101)
1. The period of the **fetus** lasts from the ninth week to the end of pregnancy.
 2. The Third Month
 - a. The organs, muscles, and nervous system start to become organized and connected.
 - b. By the twelfth week, the external genitals are well-formed.
 - c. The end of the third month marks the completion of the first of three **trimesters**.
 3. The Second Trimester
 - a. By the middle of the second trimester, the mother can feel the movements of the fetus.
 - b. A cheeselike substance called **vernix** protects the skin of the fetus from chapping.
 - c. Downy hair called **lanugo** also covers the body, helping the vernix stick to the skin.
 - d. At the end of the second trimester, many organs are well-developed, and most of the brain's neurons are in place.
 - e. The fetus can now be both stimulated and irritated by sounds and light.
 4. The Third Trimester
 - a. The **age of viability**, between 22 and 26 weeks, is the point at which the baby can first survive if born early.
 - b. The *cerebral cortex* enlarges, and the fetus spends more time awake.
 - c. Between 30 and 34 weeks, fetuses show rhythmic alternations between sleep and wakefulness.
 - d. Between 23 and 30 weeks, connections form between the cerebral cortex and brain regions involved in pain sensitivity, so that the fetus can feel pain.
 - e. Around 28 weeks, fetuses blink their eyes in reaction to nearby sounds; within the next 6 weeks, they can distinguish different voices and sounds by tone and rhythm.
 - f. In the eighth month, the fetus receives antibodies from the mother's blood to protect against illnesses.
 - g. In the last weeks, most fetuses assume an upside-down position, and growth slows.

III. PRENATAL ENVIRONMENTAL INFLUENCES (pp. 101–118)

- A. Teratogens (pp. 101–111)
1. A **teratogen** is any environmental agent that causes damage during the prenatal period.
 - a. Larger doses of teratogens over longer time periods usually have more negative effects.
 - b. The genetic makeup of the mother and the developing organism affect the individual's ability to withstand harmful environments.
 - c. The presence of several negative factors at once can worsen the impact of a harmful agent.
 - d. The effects of teratogens vary with the age of the organism at the time of exposure.
 - e. Beyond immediate physical damage, effects may be subtle and delayed and may include indirect psychological consequences.
 2. Prescription and Nonprescription Drugs
 - a. In the past, drugs such as *thalidomide* (a sedative) and *diethylstilbestrol (DES)* (prescribed to prevent miscarriage) led to deformities in the offspring, impairments to intelligence, cancer, and infertility.
 - b. Currently, *isotretinoin* is the most widely used potent teratogen. It is prescribed to treat severe acne and causes abnormalities of the eye, ear, skull, brain, heart, and immune system when taken during pregnancy.
 - c. Several studies have linked regular aspirin use to problems such as low birth weight and poorer motor development, but other research fails to confirm these findings.

- d. High doses of caffeine increase the risk of low birth weight.
 - e. Persistent intake of antidepressants is linked to a higher incidence of premature delivery and birth complications.
3. Illegal Drugs
- a. Nearly 6 percent of U.S. pregnant women use addictive mood-altering drugs, such as cocaine or heroin.
 - b. Babies born to users of cocaine, heroin, or methadone are at risk for prematurity, low birth weight, and physical defects, and they are born drug-addicted.
 - c. Throughout the first year, heroin- and methadone-exposed infants are less attentive to the environment than nonexposed babies, and their motor development is slow. In some children, problems persist.
 - d. Evidence on cocaine suggests that prenatal exposure causes lasting difficulties in some babies, but other investigations reveal no major negative effects.
 - e. Several researchers have linked prenatal marijuana exposure to attention, memory, and academic achievement difficulties and to other problems, but lasting consequences are not well-established.
4. Tobacco
- a. About 11 percent of U.S. women smoke during their pregnancies.
 - b. Effects of smoking during pregnancy include low birth weight and increased risk of miscarriage, prematurity, cleft lip and palate, blood vessel abnormalities, infant death, and asthma and cancer later in childhood.
 - c. The more cigarettes a mother smokes, the greater the chances that her baby will be affected.
 - d. Newborns of smoking mothers are less attentive to sounds and more often have colic.
 - e. Prenatally exposed children and adolescents tend to have shorter attention spans, poorer memories, lower intelligence test scores, and higher levels of disruptive, aggressive behavior.
 - f. Passive smoking is related to low birth weight, infant death, childhood respiratory illnesses, and possible long-term attention, learning, and behavior problems.
5. Alcohol
- a. **Fetal alcohol spectrum disorder (FASD)** encompasses a range of physical, mental, and behavioral outcomes caused by prenatal alcohol exposure.
 - (1) **Fetal alcohol syndrome (FAS)**, the most severe diagnosis, is distinguished by slow physical growth, facial abnormalities, and brain injury causing impairment in at least three areas of functioning.
 - (2) **Partial fetal alcohol syndrome (p-FAS)** is characterized by two of the three facial abnormalities seen in FAS, as well as brain injury evident in at least three areas of functioning.
 - (3) **Alcohol-related neurodevelopmental disorder (ARND)** is characterized by impairment in at least three areas of mental functioning, despite typical physical growth and absence of facial abnormalities.
 - b. The more alcohol a woman consumes during pregnancy, the poorer the child's motor coordination, speed of information processing, reasoning, and intelligence and achievement test scores.
 - c. In adolescence and early adulthood, FASD is associated with poor school performance, trouble with the law, and lasting mental health problems.
 - d. Alcohol interferes with production and migration of neurons in the primitive neural tube, and it requires large quantities of oxygen to metabolize, which draws away oxygen that the developing organism needs.
 - e. About 25 percent of U.S. mothers report drinking some alcohol during their pregnancies.
 - f. Even mild drinking is associated with reduced head size, slow body growth, and behavior problems.
6. Radiation
- a. Exposure to radiation during pregnancy leads to a higher incidence of miscarriage and babies born with brain damage, physical deformities, and slow physical growth.
 - b. Even when a radiation-exposed baby appears normal, problems may appear later.
 - c. Women should avoid medical X-rays as much as possible during pregnancy.
7. Environmental Pollution
- a. In industrialized nations, many potentially dangerous chemicals are released into the environment.
 - b. Established teratogens include *mercury*, *polychlorinated biphenyls (PCBs)*, *lead*, and *dioxins*.
8. Infectious Disease
- a. Certain diseases, when contracted by the expectant mother during pregnancy, are major causes of miscarriage and birth defects.
 - b. Viruses
 - (1) *Rubella* can cause a wide variety of abnormalities.
 - (2) The *human immunodeficiency virus (HIV)*, which can lead to *acquired immune deficiency syndrome (AIDS)*, is passed from the expectant mother to the fetus 10 to 20 percent of the time.

- (3) The developing organism is especially sensitive to the family of herpes viruses.
 - c. Bacterial and Parasitic Diseases: *Toxoplasmosis*, a parasitic disease caused by eating undercooked or raw meat or from contact with the feces of infected cats, can lead to eye and brain damage.
- B. Other Maternal Factors (pp. 111–115)
1. Exercise
 - a. Regular moderate exercise is related to improved fetal cardiovascular functioning, higher birth weight, and a reduction in risk for certain complications of pregnancy.
 - b. Expectant mothers who remain fit experience fewer physical discomforts late in pregnancy.
 2. Nutrition
 - a. A healthy prenatal diet helps ensure the health of mother and baby.
 - b. Consequences of Prenatal Malnutrition
 - (1) Studies show a sensitive period for nutrition in the first trimester, when maternal malnutrition is more likely to result in miscarriage or physical defects.
 - (2) Prenatal malnutrition can damage the central nervous system and the structure of other organs, and can suppress development of the immune system.
 - (3) Prenatally malnourished babies are often irritable and, with age, may develop serious learning problems.
 - c. Prevention and Treatment
 - (1) Many studies show that providing pregnant women with adequate food has a substantial impact on the health of their newborn babies.
 - (2) Vitamin–mineral enrichment is also crucial. For example, folic acid supplementation reduces abnormalities of the neural tube, such as *anencephaly* and *spina bifida*.
 - (3) When poor nutrition continues throughout pregnancy, successful intervention after birth must not only provide nutrients but also break the cycle of apathetic caregiver–infant interaction.
 3. Emotional Stress
 - a. Severe emotional stress during pregnancy is associated with higher rates of miscarriage, prematurity, low birth weight, colic, sleep disturbances, and irritability during the child’s first three years.
 - b. When an expectant mother experiences fear and anxiety, stimulant hormones cause increases in blood flow to parts of the body involved in the defensive response. Blood flow to other organs, including the uterus, is reduced, depriving the fetus of a full supply of oxygen and nutrients.
 - c. Stress hormones cross the placenta, leading to a dramatic rise in fetal heart rate, blood pressure, blood glucose, and activity level.
 - d. Maternal emotional stress during pregnancy also predicts weakened immune system functioning and increased susceptibility to infectious disease in childhood, as well as negative behavioral outcomes.
 - e. Stress-related prenatal complications are greatly reduced when mothers receive social support. For example, the Nurse–Family Partnership provides home visits to first-time, low-income expectant mothers.
 4. Rh Factor Incompatibility
 - a. **Rh factor incompatibility** occurs when the Rh protein is present in the blood of the fetus but not in the mother’s blood. The mother forms antibodies to the foreign Rh protein, which can enter the fetus’s system and destroy red blood cells.
 - b. In most cases, Rh incompatibility can be prevented with a vaccine to prevent the buildup of antibodies.
 5. Maternal Age and Previous Births
 - a. Women who delay childbearing until their thirties or forties face increased risk of infertility, miscarriage, and babies with chromosomal defects.
 - b. Healthy women in their thirties have about the same rates of other pregnancy complications as women in their twenties. Thereafter, complication rates increase.
 - c. Once a girl can conceive, her body is physically ready to carry and give birth to a baby.
- C. The Importance of Prenatal Health Care (pp. 115–118)
1. Regular prenatal checkups help ensure the health of the mother and fetus by monitoring the mother’s health and the growth of the fetus.
 2. Pregnant women with diabetes need careful monitoring, as do women who experience *preeclampsia*, a sharp increase in blood pressure that can cause convulsions in the mother and fetal death.
 3. In nations with universally available affordable medical care, maternal and infant health problems are greatly reduced.

4. Inadequate prenatal care may result from financial hardship, *situational barriers* (difficulty finding a doctor, lack of transportation), and *personal barriers* (psychological stress, ambivalence about the pregnancy).
5. Culturally sensitive prenatal care, including *group prenatal care*, can be especially beneficial for low-SES minority women.

IV. PREPARING FOR PARENTHOOD (pp. 118–120)

- A. During the prenatal period, expectant parents have time to develop a new sense of themselves as mothers and fathers.
- B. The Baby Becomes a Reality (pp. 118–119)
 1. As the woman's abdomen enlarges, the baby starts to become a reality.
 2. As parents get to know the fetus as an individual—often through seeing an ultrasound image or sensing fetal movements—they are likely to form an emotional attachment to the new being.
- C. Models of Effective Parenthood (p. 119)
 1. Expectant parents who have had good relationships with their own parents are more likely to develop positive images of parenthood.
 2. Expectant mothers and fathers who had mixed or negative parental relationships may seek other examples of effective parenthood.
- D. The Parental Relationship (pp. 119–120)
 1. In a distressed marriage, pregnancy adds to family conflict.
 2. In a marriage based on love and respect, parents are well-equipped for the challenges of pregnancy and those that will occur after the baby is born.

LECTURE ENHANCEMENTS

LECTURE ENHANCEMENT 3.1

Pollution and Infant Health: Research Findings and Policy Implications (pp. 108–109)

Time: 20–30 minutes

Objective: To consider research findings on the health effects of prenatal exposure to low levels of pollution and the implications of these findings for public policy.

Currie's (2013) review of recent research on the impact of low levels of pollution is a useful supplement to the text discussion of prenatal exposure to environmental pollution (pp. 108–109).

As described in the text, even low levels of maternal exposure to pollutants during pregnancy may pose serious risks. For example, steady, low-level prenatal exposure to polychlorinated biphenyls (PCBs) is associated with lower birth weights, smaller heads, persisting attention and memory difficulties, and lower intelligence test scores in childhood. Similarly, low levels of prenatal lead exposure are related to prematurity, low birth weight, brain damage, and physical defects.

Currie focuses on studies that were specifically designed to investigate the health effects of the relatively low ambient levels of pollution that are typically found in wealthy countries today, as compared with the much higher levels of the past. For example, she notes that high levels of carbon monoxide (CO), which meet the Environmental Protection Agency's criteria for "hazardous," rarely occur in the developed world today. "Moderate" levels, however, are far more common, and urbanization means that more people than in the past are subjected to these lower levels of pollution. On the other hand, plant closings due to economic downturns reduce pollution in the immediate vicinity, and some studies have identified an associated decline in infant mortality in these areas.

As Currie observes, some researchers argue that pervasive low-level exposure to environmental pollution may help to account for rising rates of asthma, autism, and attention-deficit hyperactivity disorder (ADHD) in many rich countries. Currie is especially interested in the policy implications of research findings; she emphasizes the importance for public policy of determining whether, for example, the cause of a negative outcome is pollution per se or the impact of poverty in general, which is associated with poor outcomes for children.

Currie's attention to studies that try to identify causal effects of pollution, rather than simply documenting correlations, makes her work a valuable addition to class discussion of the effects of prenatal environmental pollution and of the policy implications of research findings.

Currie, J. (2013). Pollution and infant health. *Child Development Perspectives*, 7, 237–242. doi: 10.1111/cdep.12047

LECTURE ENHANCEMENT 3.2**Investigating the Effects of Prenatal Anxiety and Stress on Infant Illness (p. 113)****Time:** 20–30 minutes**Objective:** To examine recent research findings on the association between prenatal emotional stress and infant illnesses.

In this study, Beijers et al. (2010) set out “to examine whether maternal prenatal anxiety and stress, measured both by self-report and by cortisol physiology, are related to more infant illnesses and antibiotic use during the first year of life.” Their findings can be used in connection with class discussion of the effects of maternal prenatal stress (p. 113).

As described in the text, when women experience severe emotional stress during pregnancy, their babies are at risk for a wide variety of difficulties, including prematurity, low birth weight, infant respiratory and digestive illnesses, colic, sleep disturbances, and irritability during the first three years. The text considers how maternal stress might affect the developing organism through the release of epinephrine and cortisol into the mother’s bloodstream, stimulating blood flow to parts of the body involved in the defensive response while simultaneously reducing blood flow to other organs, including the uterus.

Beijers et al. note that their study is one of the first to find an association between maternal prenatal stress, as measured by self-report and neurobiological measures, and infant illness and antibiotic use early in life. Their findings expand on animal studies demonstrating a negative impact of maternal prenatal stress on the offspring’s immune system.

Beijers et al. used a combination of psychological self-report measures (third-trimester questionnaires on anxiety and stress, followed by monthly interviews with the mothers during the baby’s first year of life) and neurobiological measures—specifically, cortisol samples taken at 37 weeks of pregnancy. They speculate that the increase in infant illnesses may be related to increased cortisol in the fetus, which may program the fetus’s immune function, making the young infant more susceptible to illness.

This study provides a good starting point for follow-up research to determine the extent of the effects of prenatal anxiety and stress on infant susceptibility to illnesses early in life.

Beijers, R., Jansen, J., Riksen-Walraven, M., & de Weerth, C. (2010). Maternal prenatal anxiety and stress predict infant illness and health complaints. *Pediatrics*, *126*, 401–409. doi: 10.1542/peds.2009-3226

LEARNING ACTIVITIES**LEARNING ACTIVITY 3.1****True or False: Prenatal Development (pp. 95–101)**

Present the following exercise as an in-class activity or quiz.

Directions: Read each of the following statements and determine whether it is *True* (T) or *False* (F).

- _____ 1. Fertilization usually takes place in the fallopian tube.
- _____ 2. As many as 50 percent of zygotes do not survive the first two weeks.
- _____ 3. During the period of the fetus, the most rapid prenatal changes take place.
- _____ 4. During the period of the embryo, the nervous system develops fastest.
- _____ 5. In the second month of pregnancy, the eyes, ears, nose, jaw, and neck form.
- _____ 6. The period of the fetus is the longest prenatal period.
- _____ 7. Brain weight doubles from the twentieth week until birth.
- _____ 8. The age of viability occurs sometime between 22 and 26 weeks.
- _____ 9. By 28 weeks, fetuses are awake about 30 percent of the time.
- _____ 10. Research indicates that fetal activity toward the end of pregnancy is linked to infant temperament.

Answers:

- | | |
|------|-------|
| 1. T | 6. T |
| 2. F | 7. F |
| 3. F | 8. T |
| 4. T | 9. F |
| 5. T | 10. T |

LEARNING ACTIVITY 3.2

Examining Genetic and Environmental Vulnerability to Teratogens (pp. 101–111)

The term teratogen refers to any environmental agent that causes damage during the prenatal period. However, genes influence the extent to which the developing organism is affected by teratogens. In small groups, have students generate a list of genetic and environmental factors that might contribute to the developing organism's susceptibility to the effects of teratogens. Once students have completed the activity, ask them to share some examples with the class.

LEARNING ACTIVITY 3.3

Speaking to Pregnant Women About Prenatal Environmental Influences (pp. 101–118)

Present the following scenario to students:

You have been asked by a local health department to speak to a group of newly pregnant women about prenatal environmental influences. What information would you include in your discussion? For example, what should the women know about teratogens? How about maternal disease, exercise, nutrition, and emotional stress? What recommendations would you give to promote a healthy pregnancy? Use research cited in the text to support your answers.

LEARNING ACTIVITY 3.4

Creating a PowerPoint Presentation for Expectant Partners

Using research discussed throughout the chapter, ask students to create a PowerPoint presentation for expectant partners on what to anticipate during pregnancy and childbirth. For example, what changes can be expected in the mother? What changes does the baby undergo during each trimester? Why are health and nutrition so important during pregnancy? How can the partner best support the mother during pregnancy and childbirth?

ASK YOURSELF . . .

REVIEW: Explain why the common assumption that larger families reduce child-rearing quality, resulting in less intelligent children, is mistaken. (pp. 93–94)

For years, researchers thought that earlier birth order and wider spacing might grant children more parental attention and stimulation and, therefore, result in more favorable cognitive development. But recent evidence indicates that birth order and spacing are unrelated to children's intelligence. Parents' differential treatment of siblings is far more responsive to children's personalities, interests, and behaviors than to these aspects of family structure. Other evidence confirms that rather than parenting quality declining as new children are born, parents reallocate their energies. After the birth of a new baby, mothers seem to reorganize their parenting practices to best meet all their children's needs.

Furthermore, the well-documented association between large family size and lower intelligence test scores of all siblings can be entirely explained by a strong trend for low-SES mothers to give birth to more children. Among children of well-educated, economically advantaged mothers, the family size–intelligence relationship disappears. Although many good reasons exist for limiting family size, the concern that additional births will reduce parenting quality and, thus, impair children's skills and life chances is not warranted.

CONNECT: Why is it incorrect for couples who postpone childbearing until age 35 or later to conclude that medical advances can overcome fertility problems? (See Chapter 2, page 62.) (p. 94)

Just as fertility declines with age, so does the effectiveness of reproductive technologies. For example, in vitro fertilization has a 55 percent success rate in women age 31 to 35, but the rate drops to 8 percent in women age 43.

Age also affects male reproductive capacity: Compared to a 25-year-old man, a 40-year-old is 12 times as likely to take more than two years to achieve a conception. As a result, men hoping to become fathers in their forties may be more likely than younger men to use reproductive technologies such as in vitro fertilization. This method increases the chance of multiple births, posing greater risks to infant survival and health than natural conception. Therefore, individuals who postpone childbirth until their late thirties or early forties risk having fewer children than they desire or none at all.

APPLY: Rhonda and Mark, a career-oriented couple in their early thirties, are thinking about having a baby. What factors should they keep in mind as they decide whether to add to their family at this time in their lives? (p. 94)

Older parents may be somewhat less energetic than they once were, but they are financially better off and emotionally more mature. For these reasons, they may be better able to invest in parenting. Nevertheless, reproductive capacity does decline with age. Fertility problems among women increase from age 15 to 50, with a sharp rise in the mid-thirties. About 39 percent of 35- to 39-year-olds and 47 percent of 40- to 44-year-olds are affected. Age also affects male reproductive capacity. Amount of semen, concentration of sperm in each ejaculation, and quality of sperm gradually decline after age 35. Another factor to consider is the risk of having a baby with a chromosomal disorder, which increases with maternal age. Likewise, advanced paternal age is associated with elevated risk of certain genetically influenced disorders, including autism and schizophrenia.

REFLECT: Ask one of your parents or grandparents to list his or her childbearing motivations. How do those motivations compare with your own? What factors—for example, education or cultural changes—might account for any differences? (pp. 91–93)

This is an open-ended question with no right or wrong answer.

REVIEW: Why is the period of the embryo regarded as the most dramatic prenatal period? Why is the period of the fetus called the “growth and finishing” phase? (pp. 98, 99)

The period of the embryo lasts from implantation through the eighth week of pregnancy. During these brief six weeks, the most rapid prenatal changes take place as the groundwork is laid for all body structures and internal organs.

The period of the fetus is the longest prenatal period, extending from the ninth week to the end of pregnancy. During this period, the developing organism increases rapidly in size, and the brain and other body organs become well-developed.

CONNECT: How is brain development related to fetal capacities and behavior? What implications do individual differences in fetal behavior have for infant temperament after birth? (pp. 99–100)

Brain growth means new sensory and behavioral capacities. The 20-week-old fetus, for example, can be stimulated as well as irritated by sounds. Slow eye movements appear, with rapid eye movements following at 22 weeks. If a doctor looks inside the uterus using fetoscopy, fetuses try to shield their eyes from the light with their hands, indicating the sense of sight has begun to emerge.

The brain continues to make great strides during the third trimester. The *cerebral cortex*, the seat of human intelligence, enlarges. As rapid gains in neural connectivity and organization continue, the fetus spends more time awake. At 20 weeks, the fetal heart rate reveals no periods of alertness; by 28 weeks, fetuses are awake about 11 percent of the time, a figure that rises to 16 percent just before birth. Between 30 and 34 weeks, fetuses show rhythmic alternations between sleep and wakefulness that gradually increase in organization.

By the end of pregnancy, the fetus takes on the beginnings of a personality. Higher fetal activity in the last weeks of pregnancy predicts a more active infant in the first month of life. Fetal activity is linked in other ways to infant temperament. In one study, more active fetuses during the third trimester became 1-year-olds who could better handle frustration and 2-year-olds who were less fearful. Fetal activity level may be an indicator of healthy neurological development, which fosters adaptability in childhood.

APPLY: Amy, two months pregnant, wonders how the embryo is being fed and what parts of the body have formed. “I don’t look pregnant yet, so does that mean not much development has taken place?” she asks. How would you respond to Amy? (pp. 97–98)

The first trimester is the time of the most rapid prenatal changes. By the end of the second week, tiny blood vessels called *villi* emerge from a protective membrane called the chorion. As these villi burrow into the uterine wall, the placenta starts to develop. By bringing the mother’s and the embryo’s blood close together, the placenta permits food and oxygen to reach the developing organism and waste products to be carried away. The placenta is connected to the developing organism by the umbilical cord. During these first two weeks—often, before the mother even knows that she is pregnant—the developing organism has become a complex being.

During the period of the embryo, from the end of the second week through the eighth week of pregnancy, the groundwork is laid for all body structures and internal organs. During the last half of the first month, the embryonic disk forms three layers of cells, which will give rise to all parts of the body. In the second month, the eyes, ears, nose, jaw, neck, arms, legs, fingers, and toes form. Internal organs become more distinct; for example, the heart develops separate chambers. Also, the embryo responds to touch and it can move. Because all parts of the body are forming during this period, the embryo is especially vulnerable to interference with healthy development.

REVIEW: Why is it difficult to determine the prenatal effects of many environmental agents, such as drugs and pollution? (pp. 101–102)

It is difficult to determine the effects of many environmental agents on the developing organism because the harm done by teratogens is not always simple and straightforward. Rather, it depends on several factors, including dose, heredity, other negative influences, and age. For example, larger doses over longer time periods usually have more negative effects. The genetic makeup of the mother and the developing organism plays a vital role, as some individuals are better able than others to withstand harmful environments. The presence of several negative factors at once, such as additional teratogens, poor nutrition, and lack of medical care, can worsen the impact of a harmful agent. Moreover, the effects of teratogens vary with the age of the organism at time of exposure. Finally, the effects of teratogens go beyond immediate physical damage. Some health effects are subtle and may not show up for decades, and psychological consequences may occur indirectly as a result of physical damage.

CONNECT: How do teratogens illustrate the notion of epigenesis, presented in Chapter 2, that environments can affect gene expression? (See page 86 to review.) (p. 107)

Epigenesis refers to development resulting from ongoing, bidirectional exchanges between heredity and all levels of the environment. When positive, these exchanges alter gene expression in ways that enhance development. In contrast, harmful environments, such as prenatal exposure to teratogens, can cause modifications to gene expression, sometimes so profoundly that later experiences can do little to modify the affected characteristics. As an example, a child born with fetal alcohol syndrome (FAS) will not catch up in physical size during infancy or childhood, even when provided with an enriched diet, because the harmful environment created by prenatal alcohol exposure has affected the individual's gene expression. Similarly, intellectual disability associated with fetal alcohol spectrum disorder (FASD) is permanent.

APPLY: Nora, pregnant for the first time, believes that a few cigarettes and a glass of wine a day won't be harmful. Provide Nora with research-based reasons for not smoking or drinking. (pp. 105–108)

Nora should be told that both smoking and drinking alcohol can be harmful to the developing baby. Smoking harms the fetus in several ways. Nicotine, the addictive substance in tobacco, constricts blood vessels, lessens blood flow to the uterus, and causes the placenta to grow abnormally. This reduces the transfer of nutrients, so the fetus gains weight poorly. Nicotine also raises the concentration of carbon monoxide in the bloodstreams of both mother and fetus, damaging the central nervous system and slowing body growth in the fetuses of laboratory animals. Similar effects may occur in humans.

The best-known effect of smoking during pregnancy is low birth weight. Prenatal smoking also increases the risk of other serious consequences, including miscarriage, prematurity, cleft lip and palate, blood vessel abnormalities, impaired heart rate and breathing during sleep, infant death, and asthma and cancer later in childhood. Newborns of smoking mothers are less attentive to sounds, display more muscle tension, are more excitable when touched and visually stimulated, and more often have colic—findings that suggest subtle negative effects on brain development. Prenatally exposed children and adolescents tend to have shorter attention spans, difficulties with impulsivity and overactivity, poorer memories, lower intelligence test scores, and higher levels of disruptive, aggressive behavior. “Passive smoking,” too, is related to low birth weight, infant death, childhood respiratory illnesses, and possible long-term attention, learning, and behavior problems.

Prenatal maternal drinking is linked to fetal alcohol spectrum disorder (FASD), which encompasses a range of physical, mental, and behavioral outcomes, including fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (p-FAS), and a less severe form, alcohol-related neurodevelopmental disorder (ARND). While varying in severity, all forms of FASD involve some physical, mental, and behavioral impairment. Because even mild drinking—less than one drink per day—is associated with reduced head size, slow body growth, and behavior problems, Nora should avoid alcohol, as well as tobacco, altogether.

REFLECT: If you had to choose five environmental influences to publicize in a campaign aimed at promoting healthy prenatal development, which ones would you choose, and why? (pp. 104–117)

This is an open-ended question with no right or wrong answer.

REVIEW: List psychological factors during pregnancy that predict parenting effectiveness after childbirth. (pp. 118–119)

The nine months of pregnancy give expectant mothers and fathers time to develop a new sense of themselves as parents. This period of psychological preparation for parenthood is vital. How effectively individuals construct a parental identity during pregnancy has important consequences for the parent–child relationship. Many factors contribute to the personal adjustments that take place. One major turning point occurs when expectant parents have concrete proof that a fetus is actually developing inside the uterus—for example, when they first see an ultrasound image of the fetus. Similarly, sensing the fetus’s movements gives parents a sense of getting to know their baby as an individual and allows them to form an emotional attachment to the new being. In a Swedish study, the stronger mothers’ and fathers’ attachment to their fetus, the more positively they related to each other and to their baby after birth, and the more upbeat the baby’s mood at age 8 months.

When men and women have had good relationships with their own parents, they are more likely to develop positive images of themselves as parents during pregnancy. But if their own parental relationships are mixed or negative, expectant mothers and fathers may have trouble building a healthy picture of themselves as parents. Some adults handle this challenge by seeking other examples of effective parenthood. Many people come to terms with negative experiences in their own childhoods, recognize that other options are available to them, and build healthier and happier relationships with their children.

APPLY: Megan, who is expecting her first child, recalls her own mother as cold and distant. Suggest steps she can take to form a confident, positive picture of herself as a new parent. (p. 119)

Megan’s recollection of her mother as cold and distant may interfere with her efforts to build a healthy image of herself as a parent. One way she can overcome this challenge is to come to terms with negative experiences in her own childhood and recognize that other options are available to her. To do this, she might meet with a counselor to talk about her concerns. For some couples, a special intervention program aimed at expectant parents can be effective in helping them to feel better about themselves and their relationships, communicate more effectively, feel more competent as parents after the baby arrives, and adapt more easily when family problems arise.

REFLECT: Ask your parents and/or your grandparents to describe attitudes and experiences that fostered or interfered with their capacity to build a positive parental identity when they were expecting their first child. Do you think building a healthy picture of oneself as a parent is more challenging today than it was in your parents’ or grandparents’ generation? (pp. 118–119)

This is an open-ended question with no right or wrong answer.

MEDIA MATERIALS

For details on individual video segments that accompany the DVDs for *Infants, Children, and Adolescents*, Eighth Edition, please see the DVD Guide for *Explorations in Child Development*. The DVD and DVD Guide are available through your Pearson sales representative.

Additional DVDs and streaming videos that may be useful in your class are listed below. They are not available through your Pearson sales representative, but you can order them directly from the distributor. (See contact information at the end of this manual.)

Beginnings of Life: From Conception to Baby (2011, Learning Seed, 30 min.). This program covers fertilization, how chromosomes determine a baby’s gender and physical attributes, and how a single cell develops into an embryo. It follows the stages of fetal development and examines the importance of prenatal care, good nutrition, and a healthy prenatal environment.

Fetal Alcohol Exposure: Changing the Future (2006, Films Media Group, 31 min.). This program investigates the prenatal effects of maternal drinking and the primary and secondary disabilities—including neurological, cognitive, and behavioral characteristics—associated with fetal alcohol spectrum disorder (FASD). It draws on the firsthand experiences of several experts, including Ann Streissguth, former director of the University of Washington’s Fetal Alcohol and Drug Unit; Kathy Mitchell, vice president of the National Organization on Fetal Alcohol Syndrome (NOFAS); Erica Lara, who works at a residential drug and alcohol treatment facility for women with young children; and Erica Gitis-Miles, a then-college student with FASD.

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From Conception to Birth (2005, Films Media Group, 52 min.). This program, part of the series *The Human Body*, uses in utero photography, along with microscopy and computer graphics, to follow the development of a human being from conception to birth. The program illustrates how organs and body systems develop until, in the seventh month, the lungs are able to function alone.

Human Reproduction and Childbirth (2009, Human Relations Media, 21 min.). This program illustrates the biological functions of the male and female reproductive systems. It describes menstruation, details the process of fertilization, and traces the stages of embryonic and fetal development. The program follows a young woman's pregnancy; explains the importance of good maternal nutrition, sleep, low stress, and avoidance of alcohol and drugs; and describes the birth process.

The Nine Months That Made You: Pregnancy and Human Development (2011, Films Media Group/BBC Science, 50 min.). This program follows research exploring the role of gestational factors in children's disease risks, behavioral traits, and other characteristics. Specific topics include hormonal factors, early brain development, maternal diet during pregnancy, and the placenta.

Understanding Fetal Alcohol Syndrome (2009, Human Relations Media, 13 min.). This program emphasizes the dangers of consuming alcohol during pregnancy. Featuring clear graphics, it shows how the developing fetus is damaged by alcohol and describes the signs and symptoms of fetal alcohol syndrome (FAS). It also profiles a teenager with FAS.