CHAPTER 5

PHYSICAL DEVELOPMENT AND HEALTH,

WHAT'S TO COME

When William was born, he was 19½ inches long and weighed 7½ pounds. He slept in short bursts most of the day and night and cried when he needed to be fed, changed, or soothed. Over the next 12 months, William grew nearly 10 inches and gained 20 pounds. Although he was not walking by himself when he turned 1, he could stand or cruise around the room while holding on to something or, when motivated, crawl with astonishing speed. Using gestures, such as outstretched arms when he wanted to be picked up, and a small vocabulary of one-word utterances, William could make his needs and desires clear. To his parents' relief he now slept through the night and took two short naps during the day. William was a typically developing infant, who at 12 months was on the verge of toddlerhood.

Infancy begins at birth and ends when a child begins walking and stringing words together—usually between 12 and 18 months. Toddlerhood lasts from about 18 to 36 months, a period when children become more verbal, independent, and able to move about. Although we focus on infants' and toddlers' physical development in this chapter, on their cognitive development in Chapter 6, and on their psychosocial development in Chapter 7, we will see many examples of how these aspects of development intertwine. All areas of development are interrelated, and development proceeds in a complex, reciprocal fashion.

In this chapter, we examine typical growth patterns of body and brain, and we see how a nourishing environment can stimulate both. We explore how sensory perception goes hand in hand with motor skills and shapes the astoundingly rapid development of the brain. And we discuss threats to infants' life and health, including abuse and neglect, and ways to prevent them.

0 TO 3

Early Growth and Physical Development

The first three years are a time of explosive growth and development. Never again will a person grow so quickly or change so rapidly. Despite its rapid growth, however, the developing body grows in an orderly and patterned way. And, for growth to be optimal, good nutrition and healthy eating habits are important. We discuss these processes in the following sections.

PRINCIPLES OF EARLY GROWTH AND PHYSICAL DEVELOPMENT

An infant's head is gigantic compared to the rest of its body. If you had the same body proportions as an infant, your head would approach the size of a watermelon. This highlights the cephalocaudal principle of early growth and physical development. According to the *cephalocaudal principle*, growth occurs from top down. Thus, a newborn baby's head is disproportionately large. At 1 year, the brain is 70 percent of its adult weight, but the rest of the body is only 10 to 20 percent of adult weight. The head becomes proportionately smaller as the child grows in height and the lower parts of the body develop (Figure 5.1). Sensory and motor development follow the same principle; infants see objects before they can control their torso, and they learn to use the upper parts of the body before the lower parts.

According to the *proximodistal principle*, growth and motor development proceed from the center of the body outward. For example, babies first develop the ability to use their upper arms and upper legs, then the forearms and forelegs, then hands and feet, and finally fingers and toes.

PHYSICAL GROWTH

Growth is faster in the first few months of life than it ever will be again. Babies continue to grow amazingly fast during the first 2 years, tapering off after the 3rd. Boys and girls show similar patterns of growth; however, boys are generally a bit heavier and taller than girls (McDowell, Fryar, Ogden, & Flegal, 2008). As a baby grows into a toddler, body shape and proportions change too; a 3-year-old typically is slender compared with a chubby, potbellied 1-year-old.

The genes an infant inherits strongly influence whether the child will be tall or short, thin or stocky, or somewhere in between. This genetic influence interacts with environmental influences, such as nutrition and living conditions, to determine characteristics. Today, children in many developed countries are growing taller and maturing at an earlier age than children did a century ago, probably because of better nutrition, improved sanitation and medical care, and decreases in child labor.

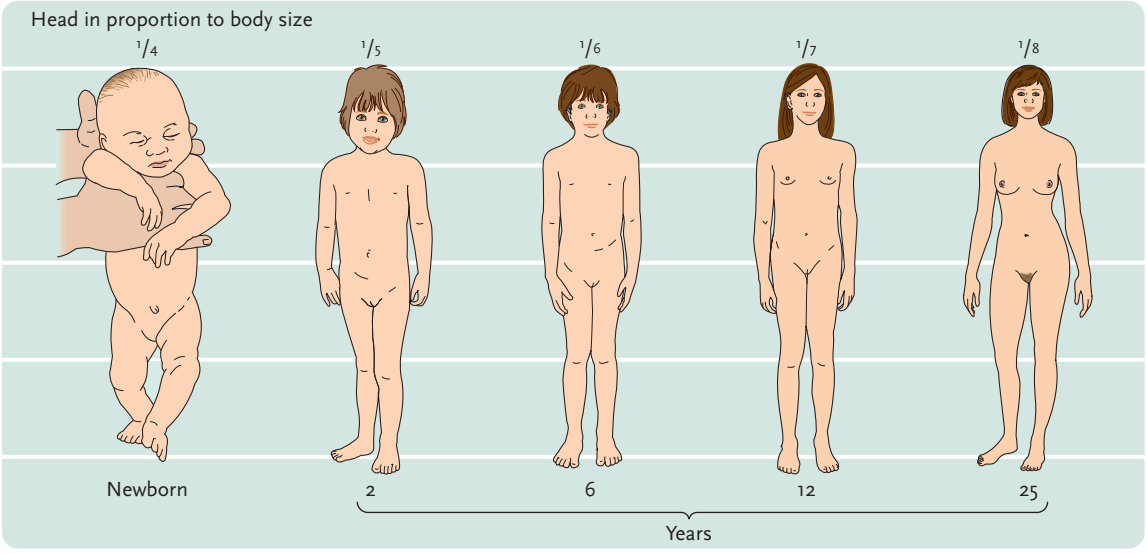
NUTRITION

Like most babies, William was an avid eater from birth. Whether breast-feeding or taking a bottle from his dad, he seemed happiest while eating. Cereals and other solid foods were gradually introduced before his first birthday, and William happily adjusted to this new experience. As he matured into toddlerhood, he became pickier—gobbling down his favorite foods with gusto and throwing others, such as broccoli and green peppers, onto the ground in disgust.

The importance of good nutrition for infants and toddlers is critical. Normal growth and brain development require the proper mix of vitamins, minerals, calories, and

FIGURE 5.1

Changes in Proportions of the Human Body



Actress Maggie Gyllenhaal breast feeds her daughter Ramona

high-quality protein sources. Failure to secure these essential substances can have effects lasting far past the early years in areas as diverse as cognitive development, physical health, work capacity, and earning power (Habicht & Martorell, 2010). Babies who eat well in the first year are smarter, stronger, healthier, and better suited to life's challenges. Given this, how and what should babies be fed?

Breast-feeding

Through most of human history, all babies were breast-fed. With the advent of dependable refrigeration, pasteurization, and sterilization in the first decade of the 20th century, manufacturers began to develop formulas to modify and enrich cow's milk for infant consumption. During the next half-century, formula feeding became the norm in the United States and some other industrialized countries. By 1971, only 25 percent of U.S. mothers even tried to nurse (Ryan, 1997).

With regard to nutrition, breast-feeding is almost always best for infants (Table 5.1). It should begin immediately after birth and continue for at least 1 year. The American Academy of Pediatrics [AAP] Section on Breast-feeding (2005) recommends that babies be exclusively breast-fed for 6 months. The rates of infants who were breast-fed increased to 77 percent in 2005–2006 from 60 percent in 1992–1993 (McDowell, Wang, & Kennedy-Stephenson, 2008). A recent study calculating the benefits of breast-feeding determined that if 90 percent of the U.S. mothers in the study complied with the AAP's recommendation to breast-feed for 6 months, potentially 911 infant deaths could be prevented and the United States could save $13 billion annually (Bartick & Reinhold, 2010).

Breast-feeding in U.S. hospitals and elsewhere greatly increased after a United Nations initiative encouraging institutional support of breast-feeding went into effect in 1991 (Merewood, Mehta, Chamberlain, Philipp, & Bauchner, 2005). However, a variety of social factors can make it difficult for women to follow this initiative. Such factors as a short or absent postpartum maternity leave, lack of flexible scheduling, an inability to take relatively frequent and extended breaks at work to pump milk, and a lack of privacy make it difficult to sustain breast-feeding (Guendelman et al., 2009).

TABLE 5.1 Benefits of Breast-feeding

Breast-fed babies . . .

- Are less likely to contract infectious illnesses such as diarrhea; respiratory infections; otitis media (an infection of the middle ear); and staphylococcal, bacterial, and urinary tract infections.
- Have a lower risk of SIDS and of postneonatal death.
- Have less risk of inflammatory bowel disease.
- Have better visual acuity, neurological development, and long-term cardiovascular health, including cholesterol levels.
- Are less likely to develop obesity, asthma, eczema, diabetes, lymphoma, childhood leukemia, and Hodgkin's disease.
- Are less likely to show language and motor delays.
- Score slightly higher on cognitive tests at school age and into young adulthood, but cognitive benefits have been questioned.
- Have fewer cavities and are less likely to need braces.

Breast-feeding mothers . . .

- Enjoy quicker recovery from childbirth with less risk of postpartum bleeding.
- Are more likely to return to their prepregnancy weight and less likely to develop long-term obesity.
- Have reduced risk of anemia and decreased risk of repeat pregnancy while breast-feeding.
- Report feeling more confident and less anxious.
- Are less likely to develop osteoporosis or ovarian and premenopausal breast cancer.

Sources: AAP Section on Breastfeeding. 2005; Black, Morris, & Bryce, 2003; Chen & Rogan, 2004; Dee, Li, Lee, & Grummer-Strawn, 2007; Kramer et al., 2008; Lanting, Fidler, Huisman, Touwen, & Boersma, 1994; Mortensen, Michaelson, Sanders, & Reinisch, 2002; Ogbuanu, Karmaus, Arshad, Kurukulaaratchy, & Ewart, 2009; Owen, Whincup, Odoki, Gilg, & Cook, 2002; Singhal, Cole, Fewtrell, & Lucas, 2004; Soliday, 2007; United States Breastfeeding Committee, 2002.

Did you know?

In 2010, Facebook came under fire for removing photos of breast-feeding mothers from their profiles. Facebook classified the photos as "indecent" and even deactivated the accounts of some repeat offenders. What do you think? Are such photos indecent?

Breast-feeding is inadvisable if a mother is infected with the acquired immune deficiency syndrome (AIDS) virus or any other infectious illness, if she has untreated active tuberculosis, if she has been exposed to radiation, or if she is taking any drug that would not be safe for the baby (AAP Section on Breastfeeding, 2005). The risk of transmitting human immunodeficiency virus (HIV) infection to an infant continues as long as an infected mother breastfeeds (Breastfeeding and HIV International Transmission Study Group, 2004), although this risk can be reduced via the use of zidovudine and/or nevirapine during the first 14 weeks of life (Kumwenda et al., 2008).

Overweight in Infancy

Obesity, defined as having a weight for height in the 95 percentile, has increased in infancy as it has in all age groups in the United States. In 2009, the prevalence of obesity in children birth to age 4 was 14.7 percent, with the highest rates found in American Indians or Alaska Natives (20.7 percent) and Latinos (17.9 percent) (Polhamus, Dalenius, Mackintosh, Smith, & Grummer-Strawn, 2011). Having an obese parent is highly predictive of future problems (AAP Committee on Nutrition, 2003). Thus, a young child who has an obese parent—or especially two obese parents—may be a candidate for preventive efforts.

How do babies become obese? Can they be overfed? Pediatric experts recommend that iron-enriched solid foods—usually beginning with cereal—should be introduced gradually between ages 6 and 12 months (AAP Section on Breastfeeding, 2005). Unfortunately, many parents do not follow these guidelines. According to random telephone interviews with parents and caregivers of more than 3,000 U.S. infants and toddlers, 29 percent of infants are given solid food before 4 months, 17 percent drink juice before 6 months, and 20 percent drink cow's milk before 12 months. By 7 to 24 months, the median food intake is 20 to 30 percent above normal daily requirements (Fox, Pac, Devaney, & Jankowski, 2004). Thirty percent of 19- to 24-month-old children eat no fruit, and French fries are the most commonly consumed vegetable in this age group. Sixty percent eat baked desserts, 20 percent candy, and 44 percent sweetened beverages on a daily basis (American Heart Association [AHA] et al., 2006).

While infants and toddlers in the United States may eat too much, in many low-income communities around the world, malnutrition in early life is widespread. Malnutrition, discussed in Chapter 8, is implicated in more than half of deaths of children globally, and many children are irreversibly damaged by age 2 from malnutrition (World Bank, 2006).

The Brain and Reflex Behavior

Holding a newborn has been compared to "holding a three-pound bag of corn" (Wingert & Underwood, 1997). But underneath the flailing limbs, fuzzy eyesight, and wailing cries of newborn infants, the brain is already starting to change and grow with amazing speed as it takes in environmental information and starts to make sense of the new world. How does this happen? How does a baby move from uncontrolled movements and reflexes to deliberate actions? Are these emerging skills reflected in the structure of the brain?

BUILDING THE BRAIN

The brain's growth occurs in fits and starts called brain growth spurts. Beginning about 3 weeks after conception, the brain gradually develops from a long hollow tube into a spherical mass of cells (Figure 5.2). By birth, the spinal cord and brain stem, the part of the brain responsible for

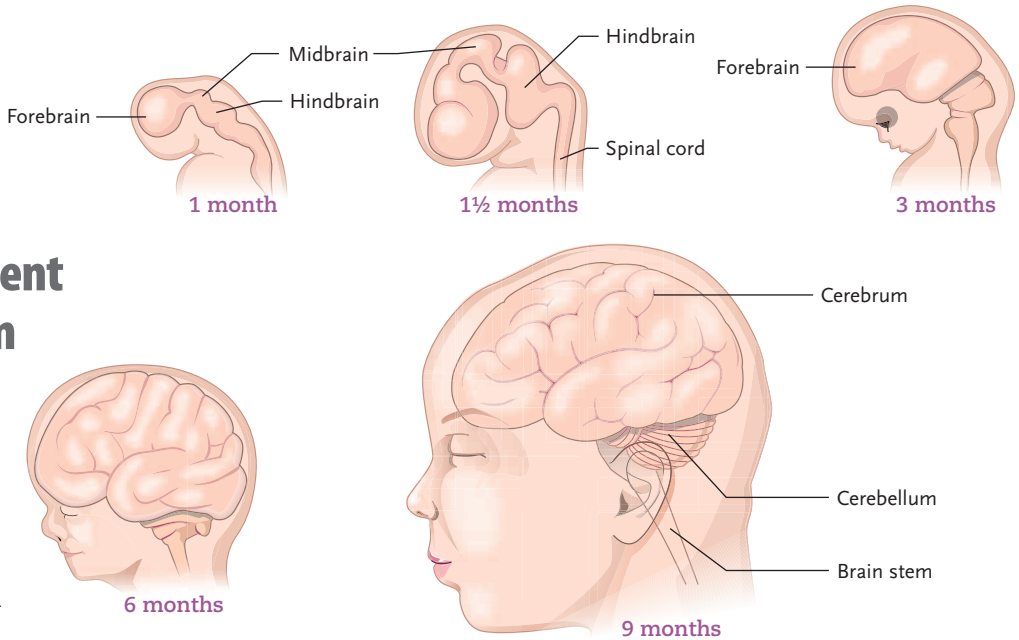


FIGURE 5.2 Fetal nervous system development begins at about 3 weeks. At 1 month, major regions of the brain appear: the forebrain, midbrain, and hindbrain. As the brain grows, the front part expands to form the cerebrum, the seat of conscious brain activity. The cerebellum grows most rapidly during the 1st year of life.

basic bodily functions such as breathing, heart rate, body temperature, and the sleep-wake cycle, are nearly complete. The brain at birth is only about one-fourth to one-third of its eventual adult volume (Toga, Thompson, & Sowell, 2006). The cerebellum, the part of the brain that maintains balance and motor coordination, grows fastest during the 1st year of life (Knickmeyer, et al., 2008). By age 3 the typical child's brain will weigh 3½ pounds, nearly 90 percent of its eventual adult weight (Gabbard, 1996).

The cerebrum, which resembles a giant wrinkled walnut, is the largest part of the brain; it is divided into right and left halves, or hemispheres, each with specialized functions. The left hemisphere is the center of language and logical thinking. The right hemisphere processes visual and spatial information, enabling us to read maps or draw. Joining the two hemispheres is a tough band of tissue called the corpus callosum. If you were looking at a side view of one-half of the human brain, the corpus callosum would resemble the cross-section of a mushroom cap. The corpus callosum is like a giant switchboard of fibers connecting the hemispheres and allowing them to share information and coordinate commands. It grows dramatically during childhood, reaching adult size by about age 10.

Each cerebral hemisphere has four lobes, or sections: the occipital, parietal, temporal, and frontal lobes, which control different functions (Figure 5.3) and develop at different rates. The regions of the cerebral cortex that govern vision, hearing, and other sensory information grow rapidly in the first few months after birth and are mature by 6 months, but the areas of the frontal cortex responsible for abstract thought, mental associations, remembering, and deliberate motor responses grow little during this period and remain immature through adolescence (Gilmore et al., 2007). The growth of the brain is a lifelong process fundamental to physical, cognitive, and emotional development.

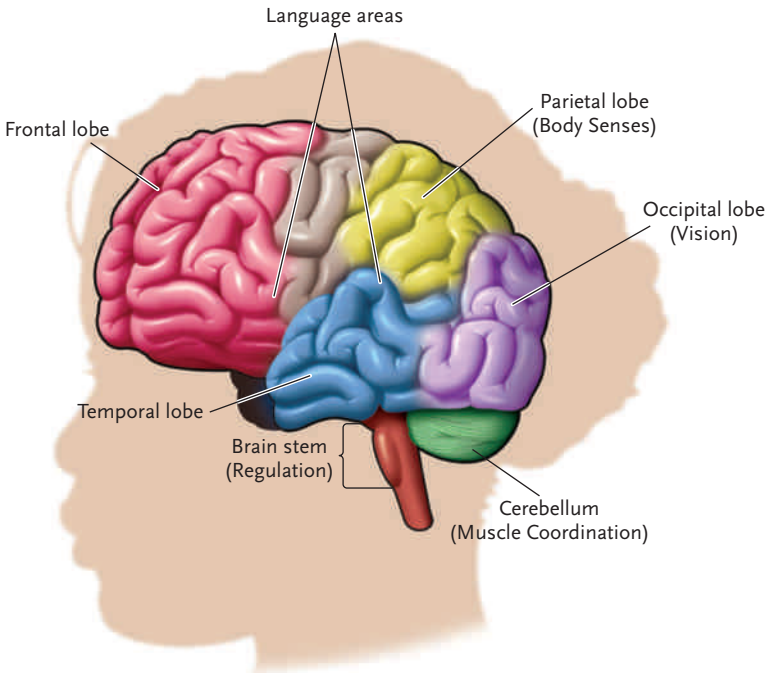


FIGURE 5.3
The Human Brain

EARLY REFLEXES

If you were to release an infant in a swimming pool, the baby will hold his or her breath, divert any ingested water into the stomach, and show movements of the arms and legs that are coordinated and strong enough for propulsion through a few feet through the water. This is known as the diving reflex; while it is one of the more puzzling behaviors babies come equipped with, it occurs in all neurologically normal babies.

reflex behaviors Automatic, involuntary, innate responses to stimulation.

plasticity Modifiability of the brain through experience.

Reflex behaviors are automatic, innate responses to stimulation. They are controlled by the lower brain centers that govern other involuntary processes, such as breathing and heart rate. Both the presence of reflexes and the disappearance of unneeded reflexes on schedule are signs of neurological development. Primitive reflexes, such as sucking, rooting for the nipple, and the Moro reflex (a response to being startled or beginning to fall), are related to instinctive needs for survival and protection. Some primitive reflexes may be part of humankind's evolutionary legacy. One example is the grasping reflex in which infants tightly grasp any object placed in their palm; presumably this is a holdover from our ancestral past when we held on to our primate mothers' fur as they scrambled among the trees.

As the higher brain centers become active during the first 2 to 4 months, babies begin to show postural reflexes—reactions to changes in position or balance. For example, infants who are tilted downward extend their arms in the parachute reflex, an instinctive attempt to break a fall. Locomotor reflexes, such as the walking reflex, resemble voluntary movements and may impede the development of voluntary movements unless they disappear.

Most of the early reflexes disappear during the first 6 months to 1 year. Reflexes that continue to serve protective functions, such as blinking, yawning, coughing, gagging, sneezing, and shivering remain.

BRAIN PLASTICITY

Although the brain's early development is in large part genetically directed, its structure is continually modified by environmental experiences; this modifiability is called **plasticity**. Because of plasticity, early experiences can have lasting effects on the capacity of the brain to learn and store information (Society for Neuroscience, 2008).

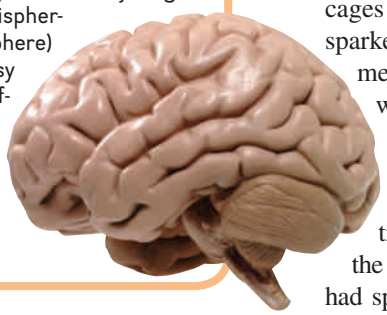
The brain is like a car—it needs gas, brake fuel, oil, coolant, and other substances to perform at peak efficiency. When a brain is malnourished, it cannot form new connections or add appropriate amounts of myelin to the axons of nerve cells because it lacks the required substances to do so. In addition, exposure to hazardous drugs, environmental toxins, or maternal stress can threaten the developing brain. For example, early abuse or sensory impoverishment can

TABLE 5.2 Early Human Reflexes

Reflex	Stimulation	Baby's Behavior	Typical Age of Appearance	Typical Age of Disappearance
Moro	Baby is dropped or hears loud noise.	Extends legs, arms, and fingers; arches back, draws back head.	7th month of gestation	3 months
Darwinian (grasping)	Palm of baby's hand is stroked.	Makes strong fist, can be raised to standing position if both fists are closed around a stick.	7th month of gestation	4 months
Tonic neck	Baby is laid down on back.	Turns head to one side, assumes "fencer" position, extends arms and legs on preferred side, flexes opposite limbs.	7th month of gestation	5 months
Babkin	Both of baby's palms are stroked at once.	Mouth opens, eyes close, neck flexes, head tilts forward.	Birth	3 months
Babinski	Sole of baby's foot is stroked.	Toes fan out, foot twists in.	Birth	4 months
Rooting	Baby's cheek or lower lip is stroked with finger or nipple.	Head turns, mouth opens, sucking movements begin.	Birth	9 months
Walking	Baby is held under arms, with bare feet touching flat surface.	Makes steplike motions that look like well-coordinated walking.	1 month	4 months
Swimming	Baby is put into water face down.	Makes well-coordinated swimming movements.	1 month	4 months

Did you know?

One striking example of plasticity is found in young children who have received hemispherectomies (removal of one hemisphere) as a treatment for severe epilepsy when medication has proved ineffective. Although such children *should* be totally paralyzed on the side opposite the hemisphere that was removed, after a few weeks, they may show only mild paralysis.



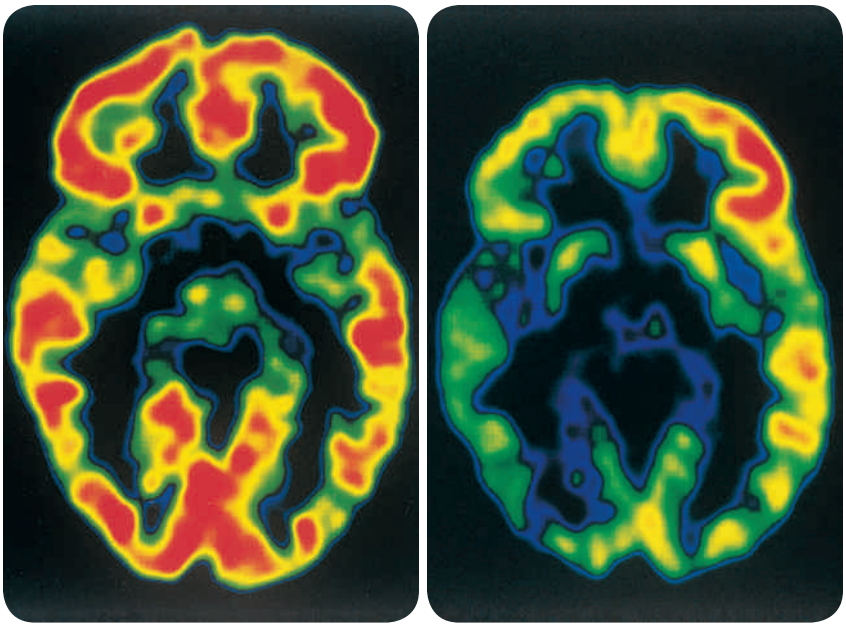
cell death In brain development, normal elimination of excess cells to achieve more efficient functioning.

delay neural development or negatively affect brain structure (Glaser, 2000). The lack of enriching experiences may inhibit the normal process of **cell death** and the streamlining of neural connections, resulting in smaller head size and reduced brain activity (C. A. Nelson, 2008).

If certain neural connections are not made early in life, these brain circuits may shut down forever (Society for Neuroscience, 2008). For example, children with a "lazy eye" who are not treated when young will forever lose the ability to process visual input through the affected eye, even if their muscle control is later corrected.

But just as negative experiences can affect the brain adversely, positive experiences or an enriched environment can spur brain development and even make up for past deprivation (Black, 1998; Society for Neuroscience, 2008). Animals raised in toy-filled cages sprout more axons, dendrites, and synapses than animals raised in bare cages (Society for Neuroscience, 2008). Such findings have sparked successful efforts to stimulate the brain development of premature infants (Als et al., 2004) and children with Down syndrome, and to help victims of brain damage recover function.

Ethical constraints prevent controlled experiments on the effects of profound environmental deprivation on human infants and young children. However, the thousands of orphaned or abandoned children who had spent virtually their entire lives in overcrowded Romanian orphanages offered a natural experiment (Beckett et al., 2006). The Bucharest Early Intervention Project (BEIP) has studied these children—one group abandoned at birth and placed in institutions; a second group abandoned at birth and placed in institutions but then randomly assigned to foster care; and a comparison group living with their biological parents. Findings so far suggest that long-term institutional care in severely deprived settings has a profound negative effect on many areas of development, including physical growth, cognitive development, and social-emotional functioning, but that foster care can help prevent problems in many of these areas. Age of adoption, length of previous institutionalization, and the specific features of the institutional experience were key factors in the children's prospects for improvement (C. A. Nelson, 2008). This suggests that high-quality foster care may moderate the adverse effects of early institutionalization (Moulson, Fox, Zeanah, & Nelson, 2009).



Extreme environmental deprivation in infancy can affect the structure of the brain, resulting in cognitive and emotional problems. A PET scan of a normal child's brain (*left*) shows regions of high (*red*) and low (*blue* and *black*) activity. A PET scan of the brain of a Romanian orphan institutionalized after birth (*right*) shows little activity.

Early Sensory Capacities

The regions of the developing brain that control sensory information grow rapidly during the first few months of life, enabling newborn infants to make fairly good sense of what they touch, see, smell, taste, and hear (Gilmore et al., 2007). It does not take long, for example, for newborns to recognize the smell of their mother's breast milk on a piece of cloth or to learn the sound of her voice.

TOUCH AND PAIN

Anytime you have comforted a crying baby by cuddling her or tickled a drowsy child to wake him up, you have made use of perhaps the most important sense in infancy: touch. Touch is the first sense to develop; for the first several months it is the most mature sensory system. By 32 weeks of gestation, all body parts are sensitive to touch, and this sensitivity increases during the first 5 days of life (Haith, 1986; Field, 2010). When a newborn's cheek is stroked near the mouth, the baby responds by trying to find a nipple, a reflex that is probably an evolved survival mechanism (Rakison, 2005).

In the past, physicians performing surgery on newborn babies, such as circumcision, often used no anesthesia in the mistaken belief that neonates could not feel pain, felt it only briefly, or did not have the memory capacity to remember and thus be affected by it. However, there is evidence that the capacity for pain perception may emerge by the third trimester of pregnancy (Lee et al., 2005). Newborns can and do feel pain, and they become more sensitive to it during their first few days. Anesthesia is dangerous for young infants, however, so alternative methods of pain management are used for minor procedures such as circumcision, when possible. Infants show a decreased pain response when they are held or cuddled and either breast-fed or given a sweet solution to suck on (Campbell-Yeo, Fernandes, & Johnston, 2011).

SMELL AND TASTE

The senses of smell and taste also begin to develop in the womb, and some taste preferences may be largely innate. Newborns prefer sweet tastes to sour, bitter, or salty ones (Haith, 1986). These are probably survival mechanisms—breast milk is very sweet (Ventura & Mennella, 2011) and poisons are often bitter (Beauchamp & Mennella, 2009).

Taste preferences developed in infancy may last into early childhood. In one study, 4- and 5-year-olds who, as infants, had been fed different types of formula had differing food preferences (Mennella & Beauchamp, 2002). Exposure to the flavors of healthy foods through breastfeeding may improve acceptance of healthy foods after weaning and later in life (AHA et al., 2006).

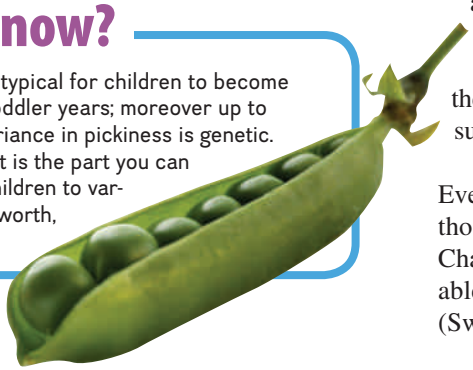
HEARING

Hearing, too, is functional before birth. It is likely that by the time a baby is born, she has been listening to her mother's muffled voice—and the rumbles in her stomach as she digests food—for months. From an evolutionary perspective, early recognition of voices and language heard in the womb may in part lay the foundation for the relationship with the mother, which is critical to early survival (Rakison, 2005).

Auditory discrimination develops rapidly after birth. Even 3-day-old infants can tell new speech sounds from those they have heard before (L. R. Brody, Zelazo, & Chaika, 1984), and infants as young as 2 days old were able to recognize a word they heard up to a day earlier (Swain, Zelazo, & Clifton, 1993). At 1 month, babies can

Did you know?

It is developmentally typical for children to become picky eaters in the toddler years; moreover up to 78 percent of the variance in pickiness is genetic. The other 22 percent is the part you can affect by exposing children to varied flavors (Cook, Haworth, & Wardle, 2007).



distinguish sounds as close as *ba* and *pa* (Eimas, Siqueland, Jusczyk, & Vigorito, 1971), even when they are pronounced by different people.

Because hearing is a key to language development and hearing impairments are the most common cause of speech delays, hearing impairments should be identified as early as possible. Hearing loss occurs in 1 to 3 of 1,000 infants (Gaffney, Gamble, Costa, Holstrum, & Boyle, 2003).

WHAT DO YOU DO?

Audiologist

Audiologists test hearing and diagnose hearing impairments. Audiologists work with individuals that may have hearing, balance, and other related ear problems. For example, an audiologist might help determine if the cause of a toddler's speech delay could be a hearing problem. All states require different licensures for audiologists, a master's degree is required, and a doctoral degree is becoming increasingly necessary. To learn more about becoming an audiologist, visit www.audiology.com and www.asha.org.

SIGHT

What does a baby see when in his or her parents' arms? Vision is the least developed sense at birth. From an evolutionary developmental perspective, the other senses are more directly related to a newborn's survival. Visual perception and the ability to use visual information—identifying caregivers, finding food, and avoiding dangers—become more important as infants become more alert and active (Rakison, 2005).

Denver Developmental Screening Test Screening test given to children age 1 month to 6 years to determine whether they are developing normally.

gross motor skills Physical skills that involve the large muscles.

fine motor skills Physical skills that involve the small muscles and eye-hand coordination.

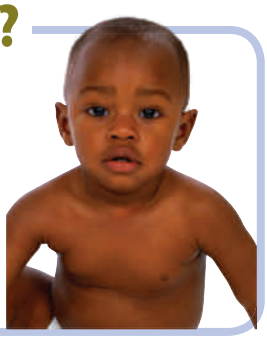
Newborns' eyes are smaller than adults' eyes, the retinal structures are incomplete, and the optic nerve is underdeveloped. A neonate's eyes focus best from about 1 foot away—just about the typical distance from the face of a person holding a newborn. This is probably not an accident; this focusing distance may have evolved to promote mother-infant bonding.

Newborns blink at bright lights. Their peripheral vision is very narrow; it more than doubles between 2 and 10 weeks of age (Tronick, 1972). The ability to follow a moving target also develops rapidly in the first months, as does color perception (Haith, 1986).

Visual acuity at birth is approximately 20/400 but improves rapidly, reaching the 20/20 level by about 8 months (Kellman & Arterberry, 1998). Binocular vision—the use of both eyes to focus, enabling depth and distance perception—usually does not develop until 4 or 5 months (Bushnell & Boudreau, 1993).

Did you know?

Infants also show an innate preference for faces, which is presumably also in the service of mother-infant bonding. Even before they understand what faces are, newborns will gaze at them for extended periods of time.



Early screening is essential to detect problems that interfere with vision. Infants should be examined by 6 months for visual fixation preference, ocular alignment, and signs of eye disease. Formal vision screening should begin by age 3 (AAP Committee on Practice and Ambulatory Medicine and Section on Ophthalmology, 2002). Doctors' offices have modified eye charts for toddlers specifically for this purpose; in place of letters are shapes easily recognized by most toddlers such as stars, hearts, and circles.

Motor Development

While William flailed and thrashed around in his crib when first born and was floppy and uncoordinated when held, his parents noticed a continual and rapid increase in his ability to control his body's movements. By about 4 months he was rolling over and could no longer be left unattended on his changing table without risking a fall. By 6 months he was sitting up by himself, although he had a tendency to topple over when reaching for a toy and needed help to reach a sitting position. And just after his 1st birthday, William took his first, halting, unaided steps. He was a typically developing baby, showing the same patterned timeline of development as humans worldwide.

MILESTONES

Motor development is marked by a series of milestones that develop systematically (Figure 5.4). Babies are driven to develop these skills and need nothing more than room to move and freedom to see what they can do.

The **Denver Developmental Screening Test** (Frankenburg, Dodds, Fandal, Kazuk, & Cohrs, 1975) charts normal progress between 1 month and 6 years. The test measures **gross motor skills** involving the use of large muscle groups, such as rolling over and catching a ball, and **fine motor skills** requiring precise coordination of small muscles, such as grasping a rattle and copying a circle. Generally, gross motor development occurs before fine motor development, and the Denver test provides a guideline of

WHAT DO YOU DO?

Occupational Therapist

Occupational therapists help individuals with mental, physical, or developmental disabilities improve their ability to perform everyday tasks at home and in working environments. Such activities may consist of computer usage, dressing, eating, or cooking. For example, an occupational therapist might help a toddler with a developmental disorder use utensils or manipulate toys. They work in a range of settings, including hospitals, rehabilitation clinics, private practices, schools, and mental health facilities. A master's degree or higher is required in most states. To learn more about becoming an occupational therapist, visit www.aota.org.

the approximate timeline different skills should come on board. It also assesses language development, personality, and social development. When we talk about what the "average" baby can do, we refer to the 50 percent Denver norms. However, it is important to remember that normality covers a wide range.

The pace of motor development responds to certain cultural factors. In Uganda, for example, babies generally walk at 10 months as compared with 12 months in the United States and 15 months in France (Gardiner & Kozmitzki, 2005). Asian babies tend to develop these skills more slowly. Such differences may be related in part to ethnic differences in temperament or may reflect a culture's child-rearing practices (Gardiner & Kozmitzki, 2005). Normal development need not follow the same timetable to reach the same destination, and there are many paths leading to proficiency in motor movements. Key milestones in the first three years of life relate to head control, hand control, and locomotion.

Head Control

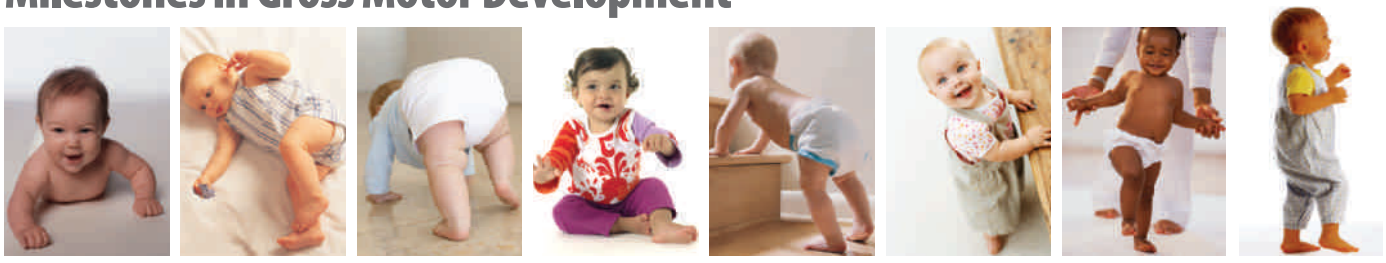
At birth, most infants can turn their heads from side to side while lying on their backs. While lying chest down, many can lift their heads enough to turn them. Within the first 2 to 3 months, they lift their heads higher and higher—sometimes to a point at which they lose their balance and roll over on their backs. By 4 months, almost all infants can keep their heads erect while being held or supported in a sitting position.

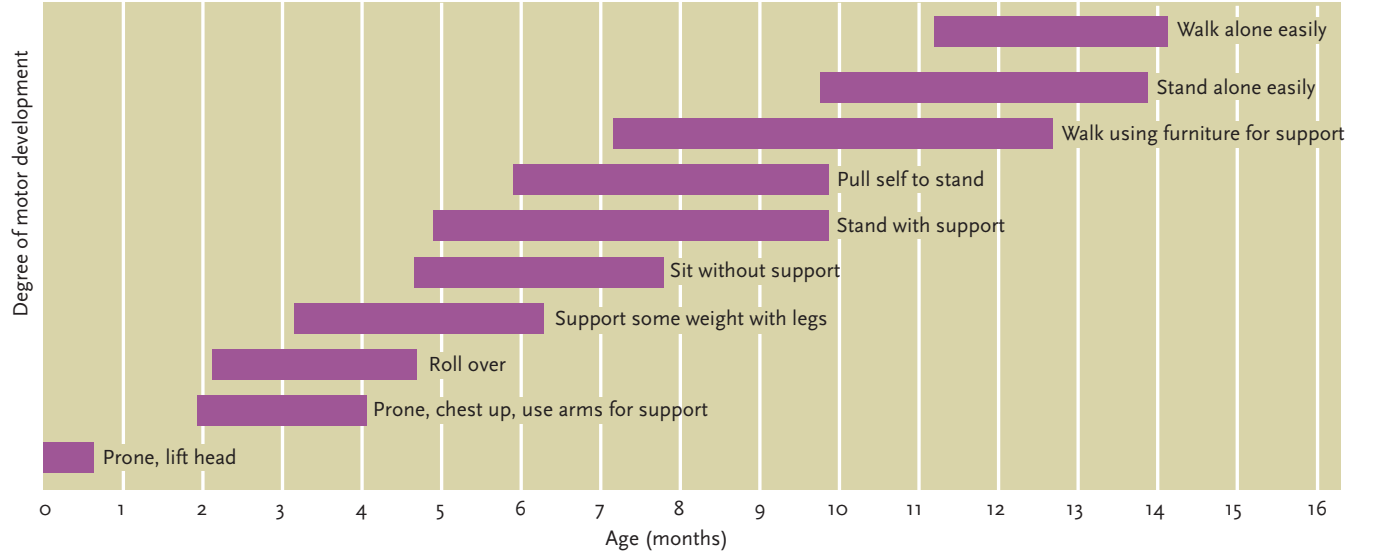
Hand Control

Babies are born with a grasping reflex. If the palm of an infant's hand is stroked, the hand closes tightly. At about 3 months, most infants can grasp an object of moderate size, such as a rattle, but have trouble holding a small object. Next, they begin to grasp objects with one hand and transfer them to the other, and then to hold, but not pick up, small objects. Between 7 and 11 months, their hands

FIGURE 5.4

Milestones in Gross Motor Development





depth perception Ability to perceive objects and surfaces in three dimensions.

become coordinated enough to pick up a tiny object, such as a pea, using the pincer grasp. By 15 months, the average baby can build a tower of two cubes. A few months after the third birthday, the average toddler can copy a circle fairly well.

Locomotion

After 3 months, the average baby begins to roll over deliberately—first from front to back and then from back to front. The average baby can sit without support by 6 months and can assume a sitting position without help by about 8 months.

Between 6 and 10 months, most babies begin to get around by creeping or crawling. This achievement of self-locomotion has striking cognitive and psychosocial benefits (Karasik, Tamis-LeMonda, & Adolph, 2011). Crawling infants become more sensitive to where objects are, how big they are, whether they can be moved, and how they look. Crawling helps babies learn to better judge distances and perceive depth. Crawling is not technically a motor milestone. Some babies move directly from sitting to walking, sometimes scooting on their bottoms in place of crawling.

By holding on to a helping hand or a piece of furniture, the average baby can stand at a little past 7 months. The average baby can let go and stand well alone at about 11 months. At this point, the baby is ready to learn how to walk. Babies often practice standing and walking more than 6 hours a day, on and off, and may take enough steps to cover the length of 29 football fields! Within a few weeks the baby is walking fairly well and thus achieves the status of toddler.

During the 2nd year, children begin to climb stairs one at a time, putting one foot after another on each step; later, they will alternate feet. Walking down stairs comes later. In their 2nd year, toddlers also begin to run and jump. By age 3, most children can balance briefly on one foot and begin to hop.

WHAT DO YOU DO?

Physical Therapist

Physical therapists work with individuals who have physical disabilities or limitations resulting from an injury or developmental delay. They diagnose and then create and implement treatment plans to improve patient movement and overall functionality. For example, a toddler who broke his leg might need physical therapy as part of the recovery process. Physical therapists need to have strong interpersonal skills due to the extensive interaction required with patients, family members, doctors, and other medical professionals. Physical therapists work in a variety of settings, including hospitals, clinics, private practices, and schools. A physical therapist needs a bachelor's or master's degree in physical therapy, and also needs to meet state-specific licensure requirements. To learn more about becoming a physical therapist, go to www. apta.org.

MOTOR DEVELOPMENT AND PERCEPTION

Motor experience sharpens and modifies infants' perceptual understanding of what is likely to happen if they move in a certain way. This two-way connection between perception and action, mediated by the developing brain, gives infants useful information about themselves and their world (Adolph & Eppler, 2002) and appears to be fairly well coordinated from birth (von Hofsten, 2004).

Infants begin reaching for objects at about 4 to 5 months; by 5 months, they can adapt their reach to moving or spinning objects (Wentworth, Benson, & Haith, 2000). While infants most frequently use vision to help them reach, those in this age group can also use other sensory cues to reach for an object. They can locate an unseen rattle by its sound, and they can reach for a glowing object in the dark, even though they cannot see their hands (McCall & Clifton, 1999). They even can reach for an object based only on their memory of its location (McCarty, Clifton, Ashmead, Lee, & Goubet, 2001). Slightly older infants, at 5 to 7 months, can grasp a moving, fluorescent object in the dark—a feat that requires awareness of the object's path and speed to anticipate the likely point of contact (Robin, Berthier, & Clifton, 1996).

Depth perception, the ability to perceive objects and surfaces in three dimensions, depends on cues that affect the image of an object on the retina of the eye where the sensory receptors cells are located. These cues involve both binocular coordination and motor control (Bushnell &

Boudreau, 1993). Kinetic cues are produced by movement of the object or the observer, or both. To find out whether an object is moving, a baby might hold his or her head still for a moment, an ability well established by about 3 months.

Between 5 and 7 months, babies respond to such cues as relative size and differences in texture and shading. These cues depend on **haptic perception**, the ability to acquire information by handling objects rather than just looking at them. Putting objects in the mouth—common in infants—is also a way to collect haptic information. The tongue's multiple receptors are capable of fine-grained discrimination and can provide a wealth of information. Haptic perception centered on the mouth occurs immediately after birth; however, haptic information that involves grasping objects comes only after babies develop enough eye-hand coordination to reach for objects and grasp them (Bushnell & Boudreau, 1993).

THEORIES OF MOTOR DEVELOPMENT

Developmental psychologists are interested not just in documenting the sequence and timing of events, but also in understanding the underlying processes. Given the complexity of motor development, it is not surprising that a variety of theoretical perspectives have been proposed as explanatory frameworks. Here, we focus on two of the most important approaches: the ecological theory of perception and the dynamic systems theory.

Ecological Theory of Perception

In a classic experiment by Richard Walk and Eleanor Gibson (1961), 6-month-old babies were placed on a clear acrylic tabletop laid over a checkerboard pattern that created the illusion of a vertical drop—a **visual cliff**—in the center of the table. Would the infants perceive this illusion of depth? The babies did see a difference between the "ledge" and the "drop." They crawled freely on the "ledge" but avoided the "drop," even when they saw their mothers beckoning from the far side of the table.

The visual cliff.

According to Eleanor Gibson's and James J. Gibson's **ecological theory of perception** (E. J. Gibson, 1969; J. J. Gibson, 1979; Gibson & Pick, 2000), babies continually gauge their abilities and their surroundings and adapt their movements accordingly, devising new strategies as needed. This process of "learning to learn" (Adolph, 2008, p. 214) involves visual and manual exploration, testing alternatives, and flexible problem solving. In visual cliff experiments, infants who have been crawling for some time are more likely than new crawlers to avoid the cliff. Likewise, when faced with a downward slope, infants who have just begun to crawl or walk seem unaware of the limits of their abilities and plunge recklessly down. In time, however, their judgment becomes more accurate and their explorations more discerning as they practice their new skills and learn from experience how far they can push their limits without losing their balance (Adolph, 2008).

haptic perception Ability to acquire information about properties of objects, such as size, weight, and texture, by handling them.

visual cliff Apparatus designed to give an illusion of depth and used to assess depth perception in infants.

ecological theory of perception Theory developed by Eleanor and James Gibson that describes developing motor and perceptual abilities as interdependent parts of a functional system that guides behavior in varying contexts.

According to Gibson's theory, locomotion does not develop in functionally related stages. Instead, "each problem space has its own . . . learning curve" (Adolph, 2008, p. 214). Babies who learn how far they can reach for a toy across a gap while in a sitting position must acquire this knowledge anew when they begin to crawl. Likewise, when crawling babies who have mastered slopes begin to walk, they have to learn to cope with slopes all over again (Adolph & Eppler, 2002).

Dynamic Systems Theory

The typical sequence of motor development was traditionally thought to be genetically programmed—a largely automatic, preordained series of steps directed by the maturing brain. Today, many developmental scientists consider this view too simple. Instead, according to Esther Thelen (1995; Smith & Thelen, 2003), motor development is a continuous process of interaction between baby and environment.

Thelen pointed to the walking reflex—stepping movements a neonate makes when held upright with the feet touching a surface. This behavior usually disappears by the 4th month. These movements do not appear again until late in the 1st year. The usual explanation for the reemerging movement is that the original reflex is replaced by a new—and deliberate—skill now controlled by the developing brain. But, as Thelen observed, a newborn's stepping involves the same movements the neonate makes while lying down and kicking. Why would stepping stop, whereas kicking continues? She proposed the answer might be that babies' legs become thicker and heavier during the early months, but the muscles are not yet strong enough to carry the increased weight (Thelen, 1995) and so walking

attempts disappear. In fact, when infants who had stopped stepping were held in warm water, which helps support their legs, stepping reappeared.

Thelen argued there is no single, simple cause—such as maturation—that sufficiently explains motor development. Infant and environment form an interconnected, continually changing system, which includes such variables as the infant's motivation and muscular strength and the environmental affordances that are available. Environmental affordances are the qualities of the environment, or objects in it, that allow an individual to perform an action. For example, a safe environment affords exploration, and balls afford throwing. Ultimately, as babies act upon their environments, they try out various combinations of movements and select those that are most efficient. Their solutions must be flexible, or subject to modification in changing circumstances, because the environment and the baby's body are constantly changing. The maturing brain is only one part of it.

dynamic systems theory (DST) Thelen's theory that holds that motor development is a dynamic process of active coordination of multiple systems within the infant in relation to the environment.

infant mortality rate Proportion of babies born alive who die within the 1st year.

According to Thelen's **dynamic systems theory (DST)**, typical babies develop the same skills in the same order because they are built approximately the same way and have similar physical challenges and needs. Thus they eventually discover that walking is more efficient than crawling in most situations. However, this discovery arises from each particular baby's physical characteristics and experience in a particular context, which explains why some babies learn to walk earlier than others.

Health

William was born to parents with the resources to provide him with good nutrition, enriching experiences, and quality health care. Perhaps most important, his parents were also loving, kind, and able to help him establish trust in others and confidence in his own fledgling abilities. William lived in a sunny world filled with toys and affection. He was lucky—many babies do not grow up in these circumstances, and they face numerous physical and emotional risks in early childhood. What are the risks such children face?

INFANT MORTALITY

Great strides have been made in protecting new babies' lives, but these advances are not evenly distributed. Worldwide, 47 infants die during their first year for every 1,000 live births—about 6 million infant deaths. Nearly 60 percent of these deaths occur during the first month, one-half of them in the first 24 hours. The vast majority of these early deaths are in developing countries, especially in South Asia and West and Central Africa (United Nations Children's Fund [UNICEF], 2008b; Table 5.3).

Eighty-six percent of all neonatal deaths are the result of severe infections, including sepsis or pneumonia, tetanus, and diarrhea (36 percent); preterm delivery (27 percent); and asphyxia (difficulty breathing) at birth (23 percent) (UNICEF, 2008b). Many of these deaths are preventable, resulting from a combination of poverty, poor maternal health and nutrition, infection, and inadequate medical care (Lawn, Cousens, & Zupan, 2005; UNICEF, 2008b). Community-based postnatal care for mothers and babies in the first few days after birth might save many of these lives.

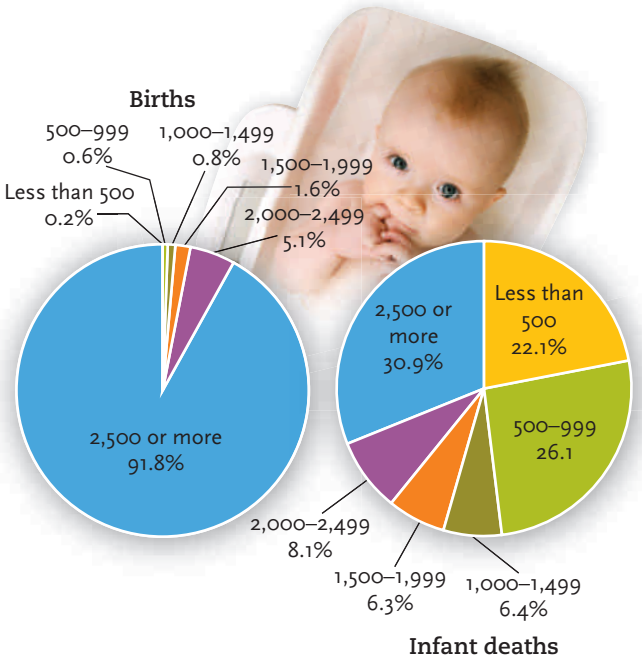
TABLE 5.3 Neonatal Mortality Rate

Regions	Neonatal mortality rate (deaths per 1,000 live births) 1990	2010	Decline (percent) 1990–2010	Number of neonatal deaths (thousands) 1990	2010
Developed regions	7	4	43	106	53
Developing regions	36	25	31	4,319	3,019
Nothern Africa	29	13	55	107	46
Sub-Saharan Africa	43	35	19	969	1,123
Latin America and the Caribbean	23	11	52	265	117
Caucasus and Central Asia	30	21	30	58	34
Eastern Asia	23	11	52	589	189
Excluding China	12	9	25	14	8
Southern Asia	48	32	33	1,875	1,256
Excluding India	48	33	31	576	381
Southeast Asia	28	15	46	335	169
Western Asia	28	16	43	116	79
Oceania	26	21	19	5	5
World	**32**	**23**	**28**	**4,425**	**3,072**

Source: "Regional rates of neonatal mortality," from UNICEF, *State of the World's Children*, 2009, Figure 1-4. Reprinted with permission from UNICEF.

In the United States, the **infant mortality rate**—the proportion of babies who die within the first year—has fallen almost continuously since the beginning of the 20th century, when 100 infants died for every 1,000 born alive. However, the rate plateaued from 2000 to 2006, when 6.69 infants died for every 1,000 live births, largely due to a 9 percent increase in preterm births during that 5-year period. More than half of U.S. infant deaths take place in the first week of life, and about two-thirds occur during the neonatal period (Heron et al., 2009).

Birth defects are the leading cause of infant deaths in the United States, followed by disorders related to prematurity or low birth



Infant Birth and Mortality Statistics by Weight

FIGURE 5.5 Percentage of live births and infant deaths by birth weight in grams: United States, 2005. Low-birth-weight babies constitute l ess than 10 percent of live births but nearly 70 percent of infant deaths. Source: Mathews & MacDorman, 2008.

weight; sudden infant death syndrome (SIDS); maternal complications of pregnancy; and complications of the placenta, umbilical cord, and membranes (Heron et al., 2009). The proportion of preterm and low-birth-weight births has increased steadily since the mid-1980s. In 2005, more than two-thirds of all deaths in infancy were of preterm babies, and more than half were of very preterm infants. In that same year, only 0.8 percent of U.S. infants were born weighing less than 1,000 grams (about 2 pounds), but they represented nearly half (48.2 percent) of all infant deaths (Mathews & MacDorman, 2008; Figure 5.5).

The overall improvement in U.S. infant mortality rates since 1990, even at a time when more babies are born dangerously small, is attributable largely to prevention of SIDS (discussed in the next section) and to effective treatment for respiratory distress and medical advances in keeping

WHERE DO YOU STAND?

Medicine has gotten better at keeping very small preterm babies alive. However, these infants often suffer from developmental consequences such as mental retardation or cerebral palsy. Is it always best to try and help a baby survive, no matter how small the child?

very small babies alive (Arias et al., 2003). Still, the U.S. infant mortality rate in 2008 was higher than in 44 countries worldwide (U.S. Census Bureau, 2009a). In the following sections we address the racial and ethnic disparities in mortality rates as the leading causes of postneonatal death—SIDS and the occurrence of accidental injuries.

sudden infant death syndrome (SIDS) Sudden and unexplained death of an apparently healthy infant.

Racial/Ethnic Disparities in Infant Mortality

Although infant mortality has declined for all races and ethnic groups in the United States, large disparities remain. Black babies are nearly 2 times as likely to die in their 1st year as white and Hispanic babies, largely because of the greater prevalence of low birth weight and SIDS among African Americans. Infant mortality among Native Americans and Alaska Natives is about 1 times that among white babies, in this case due to SIDS and fetal alcohol syndrome (American Public Health Association, 2004; Mathews & MacDorman, 2008).

Racial or ethnic disparities in access to and quality of health care for minority children (Federal Interagency Forum on Child and Family Statistics, 2005) clearly help account for differences in mortality, but behavioral factors also may play a part. Obesity, smoking, and alcohol consumption contribute to poor outcomes of pregnancy. African Americans have the highest obesity rates, and Native Americans and Alaska Natives tend to be heavy smokers and drinkers. Rates of prenatal care vary from about 89 percent of non-Hispanic white expectant mothers down to about 76 percent of Native Americans and Alaska Natives (National Center for Health Statistics [NCHS], 2006). Because risk factors for infant mortality vary among ethnic groups, efforts to further reduce infant deaths need to focus on factors specific to each group (Hesso & Fuentes, 2005).

Sudden Infant Death Syndrome

Sudden infant death syndrome (SIDS), sometimes called crib death, is the sudden and unexplained death of an infant under 1 year. SIDS is the leading cause of postneonatal infant death in the United States (Anderson & Smith, 2005). It peaks between 2 and 3 months and is most common among African American and Native American/Alaska Native babies, boy babies, preterm babies, and those whose mothers are young and received late or no prenatal care (AAP Task Force on Sudden Infant Death Syndrome, 2005).

SIDS most likely results from a combination of factors. An underlying biological defect may make some infants vulnerable during a critical period to certain contributing or triggering experiences, such as prenatal exposure to smoke—an identified risk factor (AAP Task Force on Sudden Infant Death Syndrome, 2005). The underlying defect may be a delay in maturation of the neural network responsible for arousal from sleep in the presence of life-threatening conditions (AAP Task Force on Sudden Infant

Perspectives on Diversity

SLEEP CUSTOMS

In many cultures, co-sleeping with young infants is expected. For example, Gusii infants in Kenya fall asleep in someone's arms or on a caregiver's back. In many societies, infants sleep in the same room with their mothers for the first few years of life and frequently in the same bed, making it easier to nurse at night (Broude, 1995). Mayan mothers sleep with children until the birth of a new baby, and even express shock at the idea that anyone would let a baby sleep in a room all alone (Morelli, Rogoff, Oppenheim, & Goldsmith, 1992).

Although parents in the United States are likely to have their child sleep in the same room but not in the same bed, co-sleeping has become more popular in recent years. The percentage of babies in the United States that sleep with their parents has more than doubled between 1993 and 2000 (Brenner et al., 2003); at 2 weeks of age, approximately 42 percent of American infants sleep with a parent (Hauck, Signore, Fein, & Raju, 2008).

Some researchers have argued that co-sleeping is a safe and desirable choice (Goldberg & Keller, 2007). The physical closeness of mother and baby facilitates breast-feeding, touching, and maternal responsiveness (Ball, 2009).

However, under certain conditions, bed sharing can increase the risk of sudden infant death syndrome or suffocation. The risk seems to be particularly high when the infant is under 11 weeks, when more than one person co-sleeps with the baby, or when a bed sharer has been smoking, drinking alcohol, or is overtired (AAP Task Force on Sudden Infant Death Syndrome, 2005).

Sources: Ball, 2009; Goldberg & Keller, 2007; Hauck, Signore, Fein, & Raju, 2008.

Death Syndrome, 2005), a disturbance in the brain mechanism that regulates breathing (Tryba, Peña, & Ramirez, 2006), or a genetic factor (Opdal & Rognum, 2004). Such factors may prevent some babies from waking or turning their heads when they breathe stale air containing carbon dioxide trapped under their blankets (AAP Task Force on Infant Sleep Position, 2000). Thus, sleeping with a fan, which circulates the air, has been associated with a 72 percent reduction in SIDS risk (Coleman-Phox, Odouli, & Li, 2008).

Doctors recommend that infants not sleep on soft surfaces, such as pillows or quilts, or under loose covers that may increase the risk of overheating or breathing exhaled waste products (AAP Task Force on Sudden Infant Death Syndrome, 2005). The risk of SIDS is increased 20-fold when infants sleep in adult beds, sofas, or chairs, or on other surfaces not designed for infants (Scheers, Rutherford, & Kemp, 2003). Studies associate use of pacifiers with lower risk of SIDS (Mitchell, Blair, & L'Hoir, 2006). Research strongly supports a relationship between SIDS and sleeping on the stomach. Following recommendations that healthy babies be laid on their backs to sleep, SIDS rates in the United States declined by 53 percent between 1992 and 2001 (AAP Task Force on Sudden Infant Death Syndrome, 2005).

Injuries

Unintentional injuries are the fifth leading cause of death in infancy in the United States (Heron et al., 2009). Suffocation accounts for about two-thirds of injury deaths in the 1st year of life. Among children ages 1 to 4, traffic accidents are the leading cause of unintentional injury deaths, followed by drowning and burns. Falls are by far the major cause of nonfatal injuries in both infancy (52 percent) and toddlerhood (43 percent), followed by ingesting harmful substances and burns (Pickett, Streight, Simpson, & Brison, 2003). Boys of all ages are more likely to be injured and to die from their injuries than girls (Borse et al., 2008). These statistics speak to the importance of baby-proofing the home environment, since many accidents are avoidable.

IMMUNIZATIONS

Such once-familiar and sometimes fatal childhood illnesses as measles, pertussis (whooping cough), and polio are now largely preventable, thanks to the development of vaccines. Unfortunately, many children still are not adequately protected.

Worldwide, more than 78 percent of children now receive routine vaccinations during their 1st year (UNICEF,

WHERE DO YOU STAND?

Vaccines only work if a high enough proportion of the population is inoculated. Parents who opt not to vaccinate their children are thus relying on herd immunity—on the fact that others *are* vaccinating. Is this ethical?

2007). Still, during 2002, 2.5 million vaccine-preventable deaths occurred among children under 5 years, nearly 2 million of them in Africa and Southeast Asia.

In the United States, thanks to a nationwide immunization initiative, 77.4 percent of 19- to 35-month-olds in all racial/ethnic groups had completed a recommended series of childhood vaccinations in 2007, a record high, and at least 90 percent had received most of the recommended vaccines (Darling, Kolasa, & Wooten, 2008). Still, many children, especially poor children, lack one or more of the required shots, and there are regional differences in coverage (Darling et al., 2008).

Some parents hesitate to immunize their children because they think vaccines may cause autism, but the preponderance of evidence suggests no reason for this concern (Hornig et al., 2008), and the scientific community has widely discredited the original research on the relationship between vaccines and autism. However, many parents continue to worry about vaccines and do not immunize their children. With nearly 8 percent of children who are eligible for vaccination left unprotected against measles, recent outbreaks of the disease have occurred in certain communities (Darling et al., 2008). This puts pregnant women and young infants in danger of contracting the diseases.

Did you know?

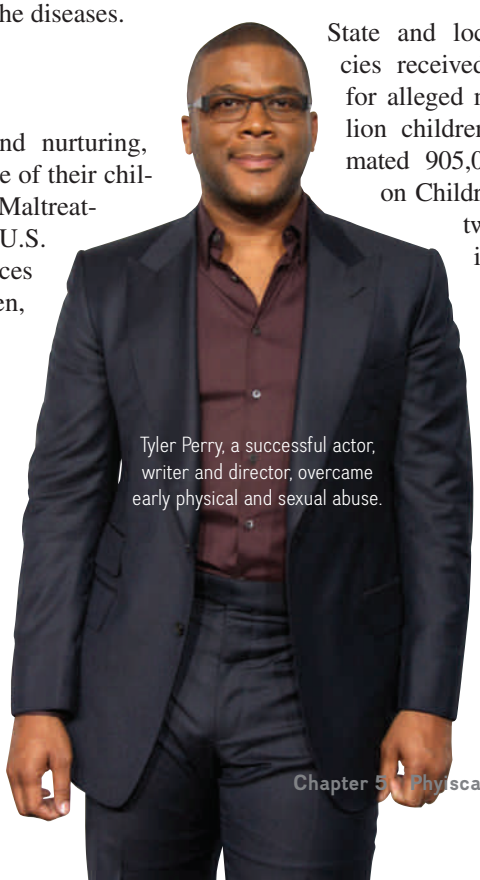
The original paper linking autism and vaccines was formally retracted by the *Lancet* in February of 2010 amid allegations that the primary researcher, Andrew Wakefield, had committed deliberate scientific fraud and had financial conflicts of interest that colored his findings.

Another parental worry is that infants receive too many vaccines for their immune system to handle safely. Actually, the opposite is true. Multiple vaccines fortify the immune system against a variety of bacteria and viruses and reduce related infections (Offit et al., 2002). One day at a typical children's museum exposes children to a far greater immune system load than a regular course of vaccines.

CHILD MALTREATMENT

Although most parents are loving and nurturing, some cannot or will not take proper care of their children and some deliberately harm them. Maltreatment can take several specific forms (U.S. Department of Health and Human Services [USDHHS], Administration on Children, Youth and Families, 2008):

- Physical abuse: injury to the body through punching, beating, kicking, or burning
- Neglect: failure to meet a child's basic needs, such as food, clothing, medical care, protection, and supervision
- Sexual abuse: any sexual activity involving a child and an older person
- Emotional maltreatment: includes rejection; terrorization; isolation; exploitation; degradation; ridicule; or failure to provide emotional support, love, and affection



Tyler Perry, a successful actor, writer and director, overcame early physical and sexual abuse.

State and local Child Protective Services agencies received an estimated 3.3 million referrals for alleged maltreatment of approximately 6 million children in 2006 and substantiated an estimated 905,000 cases (USDHHS, Administration on Children, Youth and Families, 2008). Nearly two-thirds (64.1 percent) of the children identified as maltreated were neglected, 16 percent were physically abused, 8.8 percent were sexually abused, and 6.6 percent were emotionally abused. An estimated 1,530 children died of maltreatment, and the actual number may well have been considerably higher. Forty-one percent of these fatalities were attributed to neglect, 22.4 percent to physical abuse, and 31.4 percent to more than one type of maltreatment (Child Welfare Information Gateway, 2008a; USDHHS, Administration on Children, Youth and Families, 2008).

Maltreatment in Infancy and Toddlerhood

Children are abused and neglected at all ages, but the highest rates of victimization and death from maltreatment are for age 3 and younger (Child Welfare Information Gateway, 2008a; USDHHS, Administration on Children, Youth and Families, 2008). In 2006 about 19 percent of children who died of maltreatment were infants. Nearly one-third (32.7 percent) were in their first week of life, and more than two-thirds (68.5 percent) of those newborns were victims of neglect (Brodowski et al., 2008).

Some infants die of **nonorganic failure to thrive**, which is slowed or arrested physical growth with no known medical cause accompanied by poor developmental and emotional functioning. Symptoms may include lack of appropriate weight gain, irritability, excessive sleepiness and fatigue, avoidance of eye contact, lack of smiling or vocalizing, and delayed motor development. Failure to thrive can result from a combination of inadequate nutrition, difficulties in breast-feeding, improper formula preparation or feeding techniques, and disturbed interactions with parents. Poverty is the greatest single risk factor for failure to thrive worldwide. Infants whose mother or primary caregiver is depressed, abuses alcohol or other substances, is under severe stress, or does not show warmth or affection toward the baby also are at heightened risk (Block, Krebs, the Committee on Child Abuse and Neglect, & the Committee on Nutrition, 2005; Lucile Packard Children's Hospital at Stanford, 2009).

nonorganic failure to thrive In infancy, lack of appropriate growth for no known medical cause, accompanied by poor developmental and emotional functioning.

shaken baby syndrome Form of maltreatment in which shaking an infant or toddler can cause brain damage, paralysis, or death.

Head trauma is the leading cause of death in child abuse cases in the United States (Dowshen, Crowley, & Palusci, 2004) and can result from a baby being shaken, dropped, or thrown. **Shaken baby syndrome** is found mainly in children under 2, most often in infants. The baby's weak neck muscles and heavy head result in the brain bouncing back and forth inside the skull during a shaking episode, with damage even more likely if the baby is thrown into bed or against a wall. This can cause bruising, bleeding, and swelling, and can lead to permanent and severe brain damage, paralysis, and even death (AAP, 2000; National Institute of Neurological Disorders and Stroke [NINDS], 2006).

Contributing Factors

In nearly 80 percent of cases of maltreatment, the perpetrator is the child's parent, usually the mother (USDHHS, Administration on Children, Youth and Families, 2008). Maltreatment by parents is a symptom of extreme disturbance in child rearing, usually aggravated by other family problems, such as poverty, lack of education, alcoholism, depression, or antisocial behavior. Substance abuse is a factor in as many as one-third to two-thirds of cases of abuse and neglect (USDHHS, Office on Child Abuse and Neglect, 2009).

Characteristics of the household environment are related to the likelihood a child will be physically abused (Jaffee et al., 2004). Abuse may begin when a parent who is already anxious, depressed, or hostile tries to control a child physically but loses self-control and ends up shaking or beating the child. Parents who abuse children tend to have marital problems and fight physically. Their households are often disorganized, and they experience more stressful events than other families.

Abuse and neglect reflect the interplay of multiple layers of contributing factors; in addition to family characteristics there are cultural factors that increase the likelihood of maltreatment. Two cultural factors associated with child abuse are societal violence and physical punishment of children. For example, more frequent use of corporal punishment is related to higher rates of violence in societies (Lansford & Dodge, 2008). In the United States, homicide, domestic violence, and rape are common, and many states still permit corporal punishment in schools. According to one study, more than 90 percent of parents of 3- and 4-year-olds and about 50 percent of parents of 12-year-olds report using physical punishment at home (Straus, 2010).

Helping Families in Trouble

Preventing maltreatment before it occurs is an effective, fiscally sound policy. Some prevention activities, such as public service announcements, aim to raise awareness among the general population. Others, such as parenting classes for single teen mothers, are targeted to high-risk families or to families where abuse or neglect has already occurred (Child Welfare Information Gateway, 2008b).

If maltreatment is suspected, Child Protective Services agencies investigate claims and determine what steps, if any, need to be taken. Agency staff may try to help the family resolve their problems or arrange for alternative care for children who cannot safely remain at home. Services for abused children and their parents include shelters, education in parenting skills, and therapy. Parents Anonymous and other organizations offer free, confidential support groups. However, availability of these services is often limited (Burns et al., 2004).

When authorities remove children from their homes, the usual alternative is to put the children in foster care. Foster care removes a child from immediate danger, but it is often unstable, further alienates the child from the family, and may turn out to be another abusive situation. Often a child's basic health and educational needs are not met in foster care (David and Lucile Packard Foundation, 2004; National Research Council [NRC], 1993b).

WHERE DO YOU STAND?

One of the assumptions Child Protective Services holds is that it is best to keep children with their parents when their safety can be assured. Do you agree with this policy?

Did you know?

Prison inmates, both male and female, are more likely to have been abused as children than nonincarcerated adults (Carlson & Shafer, 2010).

Long-Term Effects of Maltreatment

Without help, maltreated children often grow up with serious problems and may continue the cycle of maltreatment when they have children of their own. An estimated one-third of adults who were abused and neglected in childhood victimize their own children (National Clearinghouse on Child Abuse and Neglect Information [NCCANI], 2004).

Childhood abuse or neglect can delay or alter brain development and undermine emotion regulation. Long-term effects of maltreatment include poor physical, mental, and emotional health; impaired brain development; cognitive, language, and academic difficulties; memory problems; emotional instability; problems in attachment and social relationships; and attentional and behavioral problems (Twardosz, 2010). As adolescents, children who have been abused or neglected are at heightened risk of poor academic achievement, delinquency, pregnancy, alcohol and drug use, and suicide (NCCANI, 2004). As adults, they tend to be in poor health and to develop fatal illnesses, such as stroke, cancer, and heart disease (Leeb, Lewis, & Zolotar, 2011). Adults who were maltreated early in life tend to be anxious or depressed; those who were older when maltreated are more likely to show aggression and to engage in substance abuse (Kaplow & Widom, 2007).

Sexually abused children tend to show disturbed behavior; to have low self-esteem; and to be depressed, anxious, or unhappy (Swanston, Tebbutt, O'Toole, & Oates, 1997; Putnam, 2002), or develop certain eating disorders (Smolak & Murnen, 2002), and they may become sexually active at an early age (Noll, Trickett, & Putnam, 2003). Adults who were sexually abused as children tend to be anxious, depressed, angry, or hostile; to mistrust people; to feel isolated and stigmatized; to be sexually maladjusted; and to abuse alcohol or drugs (USDHHS, 1999a; Dube et al., 2005; Fergusson, Boden, & Horwood, 2008). One study found that adults who were victims of severe childhood sexual abuse were more likely to engage in violence in their relationships (Friesen et al., 2009).

Many maltreated children show remarkable resilience. Optimism, self-esteem, intelligence, creativity, humor, and independence are protective factors, as is the social support of a caring adult (NCCANI, 2004). In Chapter 14 we further discuss factors that affect resilience.

Fortunately, most babies survive and grow up healthy and well cared for. Their physical development forms the underpinning for cognitive and psychosocial developments that enable infants and toddlers to become more at home in their world, as we will see in Chapters 7 and 8.

TEST PREP

CHAPTER 5 PHYSICAL DEVELOPMENT AND HEALTH, 0 TO 3

What you need to know:

Check what you know:

- ☐ LearnSmart
- ☐ connect Chapter 5 Quizzes

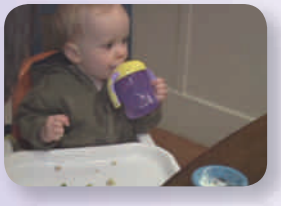
Where to go to learn what you need to know:

Learning Objective 5.1

Describe early patterns of growth and appropriate nutrition for young children.

1. The reason babies learn how to use their arms before using their legs has to do with the _____, while the reason babies learn how to use their arms before grasping objects has to do with the _____.
2. What are the recommended foods for babies according to the ages listed below?
   a. 6 months of age and younger_____
   b. 6–12 months of age _____

Eating Habits, Atlas



Early Growth and Physical Development

pp. 86–88

connect

MILESTONES

Growth Pattern, Amalia and Krista

Learning Objective 5.2

Outline brain development in infants and explain the importance of reflexes and early experiences.

3. In general, the areas of the brain responsible for sensation and perception _____, while areas of the brain specialized for higher cognitive functions _____.
   a. develop slowly over a number of years; are absent at birth
   b. develop rapidly in the first few months after birth; remain immature through adolescence
   c. develop prenatally; develop rapidly in the first few months after birth
   d. develop slowly over a number of years; develop prenatally
4. Neurological health can be gauged by:
   a. the presence of reflexes when they are supposed to be there
   b. the absence of reflexes by the age of 6 months
   c. the disappearance of reflexes on schedule
   d. a and c
5. Rooting is an example of a _____ reflex and the walking reflex is an example of a _____ reflex.
6. What kind of environmental experiences are likely to have a negative effect on early brain development?

_____

_____

The Brain and Reflex Behavior

pp. 88–90

connect

MILESTONES

Brain Development, Colin

Infant Reflexes, Amalia

TESTPREP

Learning Objective 5.3
Summarize the early sensory capacities of young infants

7. At birth, the most mature sensory system is _____.

8. Babies whose mothers consume garlic while pregnant seem to like the smell of garlic more than those babies whose mothers did not consume garlic while pregnant. This suggests that:
   a. liking garlic is an innate preference
   b. babies learn to like certain flavors or smells prenatally
   c. babies learn to like certain flavors or smells postnatally
   d. babies must be taught to like garlic

9. It is important to identify hearing impairments early in life because:
   a. if they are not identified by six months of age the neural pathways for auditory information will disappear
   b. being able to respond to parents is heavily dependent upon hearing
   c. hearing is key to language development
   d. hearing impairments can lead to failure to thrive

10. What are three differences between an infant's and an adult's eyes?

_____
_____
_____

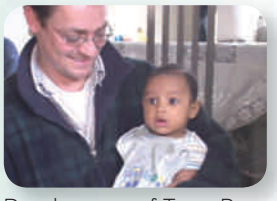
Ecological View of Perception, Kestrel

Early Sensory Capacities
pp. 91–92

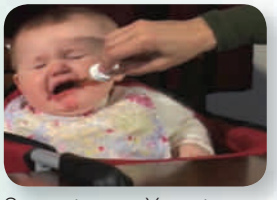
connect

MILESTONES

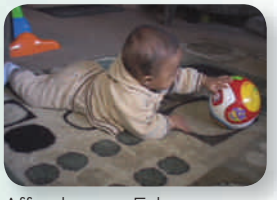
Sound Sensitivity, Yovani



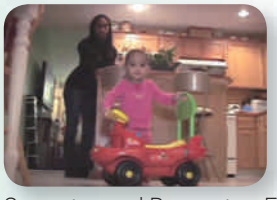
Development of Taste Perception, Amalia



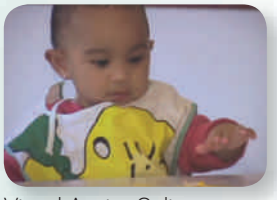
Sensorimotor, Yovani



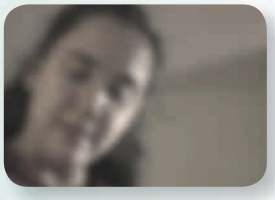
Affordances, Felana



Sensation and Perception, Felana



Visual Acuity, Colin



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TESTPREP —*Continued*

Learning Objective 5.4

List the major motor milestones and summarize the major theories of motor development and the impact of culture.

11. What motor skills are developing at the following ages:
    0–3 months _____
    _____
    3–6 months _____
    _____
    6–12 months _____
    _____
    12–24 months _____
    _____
    24–36 months _____
    _____

12. The best way to describe the way perception and motor development are related to each other is:
    a. perception leads to advances in motor development
    b. motor development leads to changes in perceptual abilities
    c. perception and motor development do not influence each other
    d. perception and motor development mutually influence each other

13. Which would be the best analogy of a developing child's development according to the ecological theory of perception?
    a. a person carefully following instructions in a manual
    b. a magician waving a wand to cast a spell
    c. a scientist exploring the world
    d. a gambler rolling dice multiple times

Motor Development

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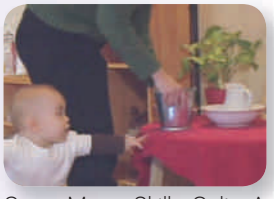
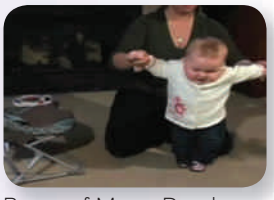
connect

MILESTONES

Bi-Pedal Posture and Dynamic Systems Theory, Colin

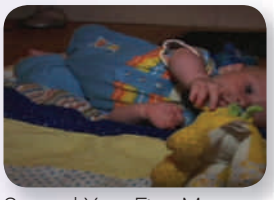


Gross Motor Skills, Colin, Amalia, Kestrel, Del and Atlas

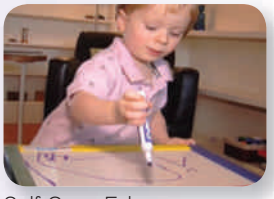


Range of Motor Development, Yovani

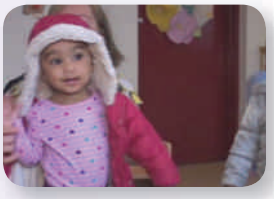
Fine Motor Skills, Atlas



Second Year Fine Motor Development, Atlas



Self Care, Felana



TEST**PREP**

Learning Objective 5.5

Review major mortality risks in young infants and discuss the role of immunizations in health.

14. What are two reasons infant mortality rates in African American babies might be higher than those for white babies?

_____

_____

_____

15. Evidence suggests the link between autism and vaccines:

    a. does not exist
    b. is very strong
    c. exists, but only for the measles vaccine
    d. exists, but only for boys

16. Name three contributing factors to child maltreatment.

_____

_____

_____

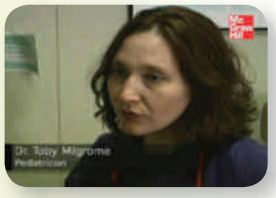
Health

pp. 96–101

connect

Video Clip

SIDS: Expert Interview



Answers: 1–cephalocaudal; proximodistal; 2–(a) Breast milk; (b) iron-enriched solid foods; 3–b; 4–d; 5–primitive; locomotor; 6–exposure to hazardous drugs, environmental toxins, maternal stress, malnutrition, early abuse, and sensory impoverishment; 7–touch; 8–b; 9–c; 10–Newborn eyes are smaller than adults', their retinal structure is incomplete, and the optic nerve is underdeveloped; 11–See Table 5.3; 12–d; 13–c; 14–The prevalence of low birth weight and SIDS is higher in African American populations; 15–a; 16–Contributing factors to maltreatment include family variables (large, poor, single-parent, high stress, disorganized, critical, uncommunicative), community characteristics (rampant crime, lack of community services and facilities, lack of social support networks, weak political leadership), and cultural values (high levels of societal violence, physical punishment of children seen as appropriate).