PART III

Infancy

By simultaneously considering brain and psychological development we can shed light on the interaction between genes and the environment.

Mark Johnson

CHAPTER 5

Physical and Cognitive Development in Infancy

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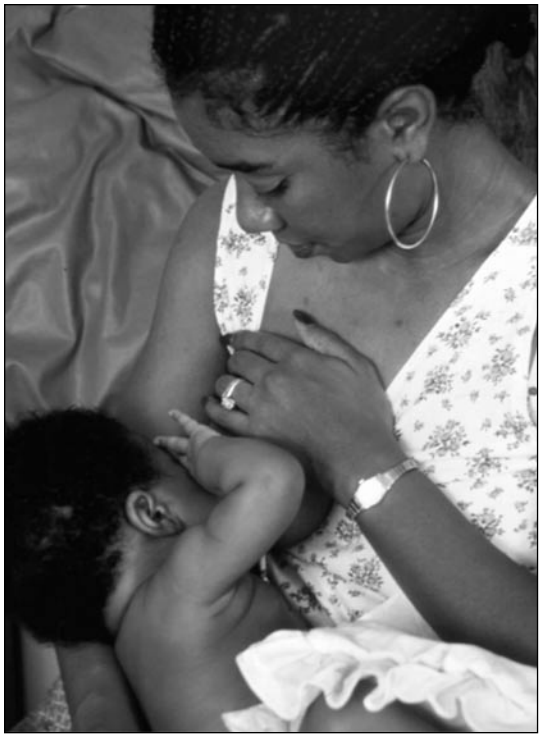
Liz gazed at the infant girl in her arms. Although she had carried this tiny creature within her for nine months, it was still a stranger. Would it be easy to take care of? Who would she really look like? Would she do well in school? Of course she would be smart!

As these thoughts flashed through her mind, she remembered a course in child psychology she had taken and the theorists she had studied. What was it that Freud had said? Oh, Yes: "From the very first children have a copious sexual life." Liz smiled. That must have been a popular idea in Victorian days.

Or the behaviorist, John Watson, who believed that infants are a source of potential stimulus-response connections. He believed that if you turn your attention to an infant early enough, you can make that infant into anything you want—it's all a matter of conditioning!

As she struggled to recall what these theorists said about infancy, Piaget's name flashed across her memory. Rather than seeing children as small sponges waiting for something to be poured into them, Piaget believed that children actively construct their own views of the world during these early years. One of the first psychologists to question the apparently passive state of infants, he argued that infants are much more competent than originally thought and during infancy they build the cognitive structures that are the foundation of their intelligence.

How had the instructor referred to a newborn? Neonate; yes, that was it. She had read the books on infancy, especially those by T. Berry Brazelton and knew what to expect: feedings, sleep patterns, possible illnesses. But what really was a neonate? What was an infant? Maybe I should check Brazelton's work again; he's speaking at the university tomorrow night. Catching herself in these musings, she began to laugh.



The tall, athletic-looking man walked quickly across the stage and put his notes on the podium. He then looked up and smiled at the crowd filling the university theatre. They had come to hear T. Berry Brazelton, professor of pediatrics at Harvard Medical School, founder of the Child Development Unit at Boston's Childrens Hospital and probably America's most popular pediatrician, talk about the importance of the infancy years.

With his belief that infants are both competent and complex, Brazelton, in his own practice, his writings, and in television appearances, has been one of the leaders in changing our views of infancy. Thanks to his work and that of his colleagues (see Brazelton & Nugent, 1995), we now recognize how much infants contribute to their own development in these early years.

To help you understand an infant's world, in this chapter you'll first trace the infant's physical development and then examine the methods used to assess the well-being of infants following birth. Next you'll follow various paths of infant development: motor, perceptual, cognitive, and language. You'll also begin to discern the issues and themes discussed in chapter 1. For example, stability is particularly important in any discussion of infancy. That is, do the events that occur in infancy leave an indelible mark that lasts a lifetime?

Chapter Objectives

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

- **What are the major physical accomplishments of the infancy period?**
- **How do infants acquire information about their world?**
- **What are the differences between Piaget's view of cognitive development in infancy and that of information processing?**
- **How do infants acquire their language?**

Physical Development in Infancy

Infancy is a time of rapid physical and nervous system development, accomplishments that ensure an infant's survival and ability to cope with its world. The typical newborn weighs about 7½ pounds and is about 20 inches in length. In one year after its birth, an infant's length increases by one-half and its weight almost triples. Infancy sees exciting changes in psychomotor development.

Developmental Milestones of Infancy

In his careful analysis of physical growth and development, Tanner (1990) described growth as like the weaving of a cloth whose design never repeats itself. The underlying threads, each coming from the reel at its own rhythm, interact with one another continuously, in a manner always highly regulated and controlled.

To help you visualize the rapid growth that occurs during infancy, consider table 5.1.

As their baby's growing physical competence becomes observable, parents begin to treat their child differently, recognizing greater individuality and maturity. Different parenting practices now spring into action and these varied practices reflect the culture into which a child is born. The manner in which Balinese mothers carry their children affects children's motor development; infants in Ghana show superior motor abilities due to their considerable physical freedom; the expectations of Jamaican mothers help their infants to sit and walk relatively early (Bornstein, 1995). In other words, different families in different cultures go about parenting in different ways.

TABLE 5.1 DEVELOPMENTAL MILESTONES OF INFANCY

Age (mos.)	Height (in.)	Weight (lbs.)
3	24	13–14
6	26	17–18
9	28	20–22
12	30	22–24
18	32	25–26
24	34	27–29

Growing children experience changes in shape and body composition, in the distribution of tissues, and in their developing motor skills, and these changes then influence cognitive, psychosocial, and emotional development. For example, the infant's head at birth is about a quarter of the body's total length, but in the adult it is about one-seventh of body length. Different tissues (muscles, nerves) also grow at different rates, and total growth represents a complex series of changes. Underlying this rapidly unfolding and complex process is, of course, proper nutrition.

Nutrition

Developed countries have nearly eliminated malnutrition, although the familiar suspects of poverty, illness, and neglect can still cause considerable nutritional damage. In developed countries, the issue focuses on concerns about the relative benefits of breast versus formula feeding.

Although breast versus formula has almost always caused controversy, it's interesting to note that breast-feeding in the United States declined noticeably from 1984 to 1989 (Lutz & Przytulski, 1997). Given the recent attention to the benefits of breast-feeding and the national goal of having 75 percent of mothers breast-feed, the trend has been reversed.

The composition of breast milk varies during the first weeks following birth. For the first 3 or 4 days, it's known as *colostrum,* a thin, yellowish fluid that is high in proteins. *Transitional milk* then appears until about the end of the second week. Finally, *mature milk* is available (Moore, 1997).

Breast-feeding leads to two advantages that can't be duplicated by formula feeding. First is the protection against disease offered by a mother's milk. Breast-fed babies seem to have a lesser degree of illness than formula-fed babies, an important consideration in developing countries. Second, breast-fed babies are less at risk for allergic reactions than are formula-fed babies.

On the other hand, one of the advantages of formula feeding is that others, including the father, can feed the baby. Commercial formulas are good, containing more proteins than breast milk. Assuming that the formula is appropriate, nutritional problems should not arise. In the United States, infants are usually well-nourished either through breast or formula feeding. Other considerations, such as returning to work, may influence a woman's decision to either breast or formula feed (Lutz & Przytulski, 1997).

Newborn infants have a special need for protein, given the rapid tissue building occurring during these days. Their high metabolic rates also consume large amounts of their energy, thus they require substantial amounts of proteins, fats, carbohydrates, minerals and vitamins—especially iron, zinc, and calcium (Moore, 1997). Infants are usually ready for solid food at about 4 to 5 months. Table 5.2 presents a recommended schedule for the introduction of solid food (Tamborlane, 1997).

TABLE 5.2 INTRODUCING SOLID FOODS

Age	Foods
0–4 months	Breast milk or formula
4–6 months	Iron fortified cereals made with rice or barley
6–7 months	Strained fruits and vegetables
	Fruit juices, teething foods
8–9 months	Pureed meats, potatoes, rice, or pasta
10–12 months	Finger foods, toast strips, yogurt, and an increased variety of foods

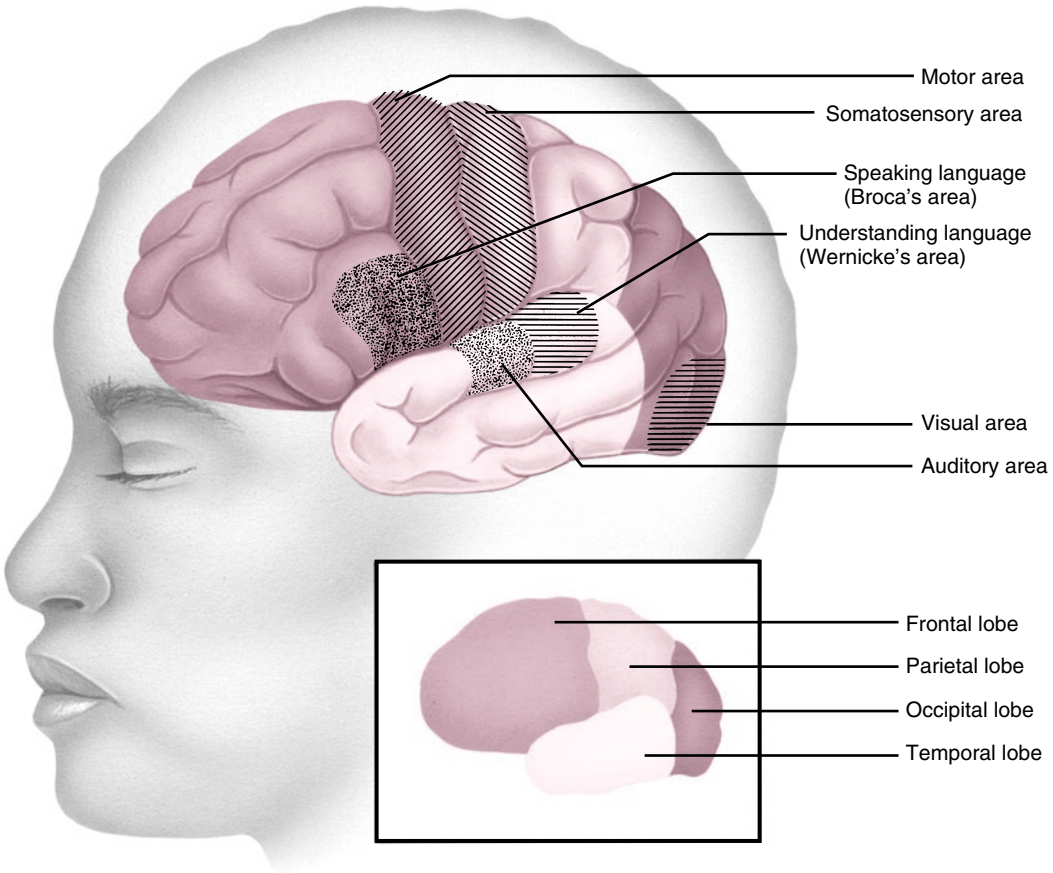
In the course of one year, then, infants progress from either breast- or bottle-feeding to a variety of table foods.

Let's turn now to the remarkable role of the brain in development.

Brain Development

The adult human brain weighs about 3 to 4 pounds and contains about 100–200 billion neurons (Gopnik, Meltzoff, & Kuhl, 2000). As we have seen, nervous system development begins during the embryonic period when neurons reproduce at the rate of about 250,000 per minute. During infancy, connections among the neurons begin to increase notably (as much as 100 to 1,000 connections for each of the billions of neurons). This amazing complexity provides the biological basis for cognitive development (Fischbach, 1992). Estimates are that the baby's brain at birth is

Shown here are the brain's lobes and functional areas.



about a quarter of its adult size. At 6 months it's about 50 percent of its adult weight, 60 percent at 1 year, 75 percent at 2½ years, 90 percent at 6 years, and 95 percent at 10 years. The developmental pattern is seen in figure 5.1.

The human brain (unlike that of other primates) continues to grow rapidly after birth, especially during the first two years (Howard, 2000). The myelin sheath, which helps the passage of nerve impulses, isn't complete until about 6 years of age, and the brain isn't considered to be physically mature until puberty. Thus about 75 percent of the human brain develops outside of the womb in direct relationship with its environment (Shore, 1996).

Our knowledge of the brain has increased dramatically with new discoveries in the neurosciences. Thanks to technological advances such as the *MRI* (Magnetic Resonance Imaging) and the *PET* scan (Positive Emission Tomography), brain researchers now have a much more detailed view of the brain and its activity levels. As new data emerge, new speculations about the relationship of brain to behavior inevitably arise.

Another example of startling new breakthroughs in brain research is the ability to grow new brain cells to replace damaged brain cells (in mice). It was long thought that brain cells, once damaged, could never be replaced. However, recent research (Saltus, 2000) has discovered that neural brain cells migrate through the brain, attach to damaged nerves, and transform themselves into the appropriate nerves cells. As a result, the future looks brighter for sufferers of such diseases as Parkinson's and Lou Gehrig's disease.

Current thinking concerning brain behavior interactions (referred to as *probabilistic epigenesis*) reflects the system analysis of development discussed in chapter 2.

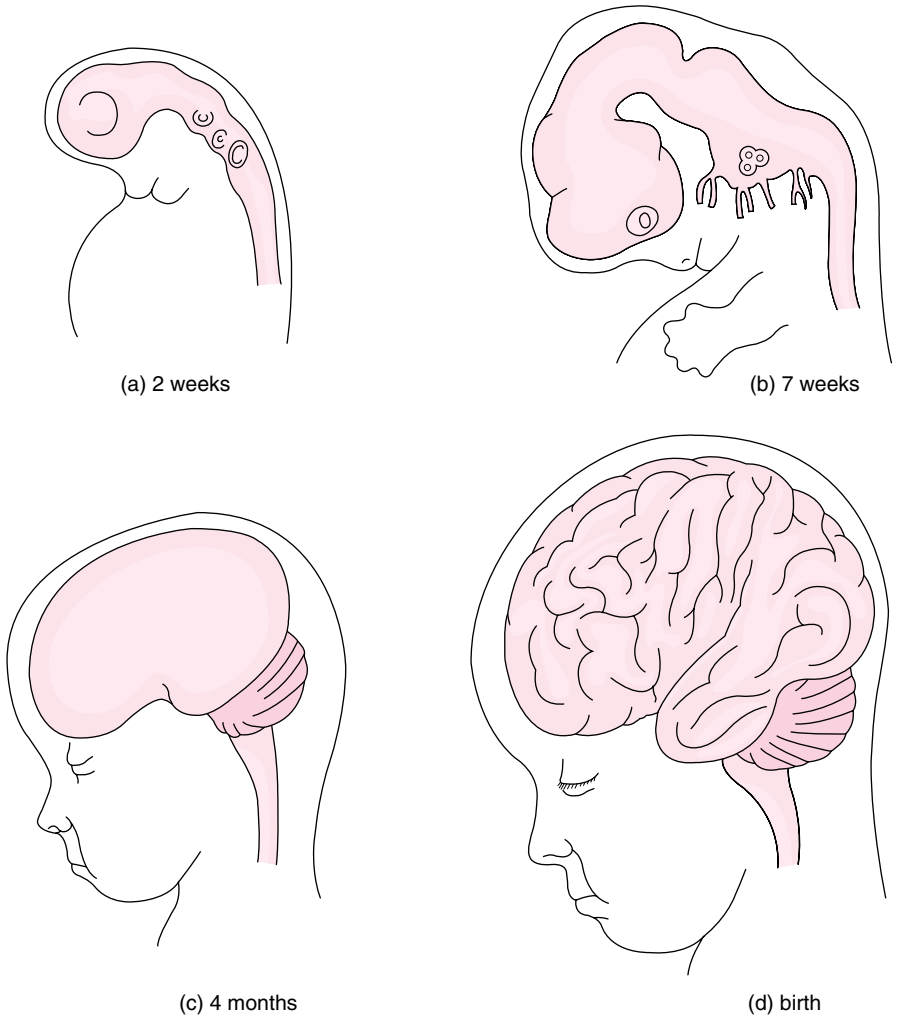


Figure 5.1
Brain development.

(For an excellent discussion of this topic see Johnson, 2000.) Consequently, these new findings have forced us to change our thinking about the brain and its functions, as seen in table 5.3.

For example, at birth, the baby's experiences add a new dimension to the brain's wiring process. The range of a baby's pleasant and unpleasant experiences begin to shape an infant's emotional life; the degree to which parents talk to their babies the more complex will be their wiring for language; when babies have the opportunity to interact with appropriate toys and objects, the more refined their circuitry for motor control becomes. In other words, the brain keeps rewiring itself even after it's turned on (Gopnik, Meltzoff, & Kuhl, 2000).

Each of the brain's four lobes (frontal, parietal, temporal, and occipital) exercises specialized functions. For example, the frontal lobe contains the motor area for control of all the skeletal muscles (which shows rapid growth for survival purposes); the parietal lobe seems to be the controlling center for the body's sense areas; the temporal lobe manages auditory functions; the occipital lobe analyzes visual information. Brain structures for thinking are diffused throughout the cortical area, which makes considerable sense when you think (!!!) about answering a question. You listen to the question (auditory area); you respond by speaking (motor area); you search your memory.

At birth, of course, the infant must assume those life-sustaining functions that the mother provided for nine months, which leads us to an analysis of the important role that native reflexes play.

Neonatal Reflexes

Reflex When a stimulus repeatedly elicits the same response.

Think of a **reflex** as an automatic response to certain stimuli. Popular examples include the eye blink and the knee jerk. All of the activities needed to sustain life's functions are present at birth (breathing, sucking, swallowing, elimination). These reflexes serve a definite purpose: The gag reflex enables infants to spit up mucus; the eye blink protects the eyes from excessive light; an antismothering reflex facilitates breathing.

In an attempt to rank an infant's reflexes in order of importance, Harris and Liebert (1992) note that the most crucial reflexes are those associated with breathing. Breathing patterns are not fully established at birth, and sometimes infants briefly stop breathing. These periods are called **apnea,** and although there is some concern that apnea may be associated with sudden infant death, these periods are quite common in all infants. Usually they last for about 2 to 5 seconds; episodes

Apnea Brief periods when breathing is suspended.

TABLE 5.3 RETHINKING THE BRAIN

Old Thinking	New Thinking
A brain's development depends solely on genes.	Brain development depends on the interactions between genes and experience.
Experiences before three years are relatively insignificant.	Experiences during infancy are critical for the structure of the brain and its future potential.
A good relationship between a child and parents facilitates development and learning.	A secure relationship not only aids development, it also affects the way the brain is wired.
Brain development proceeds steadily, that is, in a linear fashion.	Brain development is essentially non-linear, that is, there are ideal times for different kinds of experiences.
The brain is less active during the early years.	During these years, an infant's brain may be twice as active as an adolescent's or adult's.

Adapted from R. Shore. (1997). *Rethinking the brain: New insights into early development*. New York: Families and Work Institute.

that extend from about 10 to 20 seconds may suggest the possibility of a problem. Sneezing and coughing are both reflexes that help to clear air passages.

Next in importance are those reflexes associated with feeding. Infants suck and swallow during the prenatal period and continue at birth. They also demonstrate the rooting reflex, in which they'll turn toward a nipple or a finger placed on the cheek and attempt to get it into the mouth. Table 5.4 describes some of the more important neonatal reflexes.

Newborn Abilities

Neonate Term for an infant in the first days and weeks after birth.

In the days immediately following birth until about two weeks to one month, the infant is called a **neonate.** During this period, babies immediately begin to use their abilities to adapt to their environment. Among the most significant of these are the following:

- *Infants display clear signs of imitative behavior at 7 to 10 days.* (Try this: Stick out your tongue at a baby who is about 10 days old. What happens? The baby will stick its tongue out at you!) Here neonates are telling us that they have the ability to imitate almost immediately after birth, an ability that should alert parents to immediately demonstrate desirable behavior for their children to learn and imitate. Infants' imitation of such tongue movements as just described is well-established in babies as young as a few hours to more than six weeks of age (Jones, 1996).
- *Infants can see at birth* and, if you capture their attention with an appropriate object (such as a small, red rubber ball held at about 10 inches from the face), they will track it as you move the ball from side to side. Infants react to color at between 2 and 4 months; depth perception appears at about 4 to 5 months (Brazelton & Nugent, 1995).
- *Infants not only can hear at birth (and prenatally),* but they also can perceive the direction of the sound. In a famous yet simple experiment, Michael Wertheimer (1962) sounded a clicker (similar to those children play with) from different sides of a delivery room only 10 minutes after an infant's birth. The infant not only reacted to the noise, but attempted to turn in the direction of the sound, indicating that children immediately tune into their environment (Olds, London, & Ladewig, 1996).

TABLE 5.4 NEONATAL REFLEXES

Name of Reflex	How Elicited	Description of Response
Plantar grasp	Press thumbs against the balls of the infant's foot	Toes tend to curl
Babinski	Gently stroke lateral side of sole of foot	Toes spread in an outward and upward manner
Babkin	Press palm of hand while infant lies on back	Mouth opens; eyes close
Rooting	Gently touch cheek of infant with light finger pressure	Head turns toward finger in effort to suck
Sucking	Mouth contacts nipple of breast or bottle	Mouth and tongue used to manipulate (suck) nipple
Moro	Loud noise or sudden dropping of infant	Stretches arms and legs and then hugs self; cries
Grasping	Object or finger is placed in infant's palm	Fingers curl around object
Tonic neck reflex	Place infant flat on back	Infant assumes fencer position: turns head and extends arm and leg in same direction as head
Stepping	Support infant in upright position; soles of feet brush surface	Infant attempts regular progression of steps

From John F. Travers, *The Growing Child,* Scott, Foresman and Company, Glenview, IL, 1982. Reprinted by permission of the author.

Sample photographs of a model's happy, surprised, and sad expressions, and an infant's corresponding expressions

Courtesy of Dr. Tiffany Field and *Science.* From Field, et al., Model and Infant Expressions from "Discrimination and Imitation of Facial Express by Neonates" in *Science,* fig. 2, Vol. 218, pp. 179–181, October 8, 1982. Reprinted by permission of the American Association for the Advancement of Science.

- *Infants are active seekers of stimulation.* Infants want—actually need—people, sounds, and physical contact to stimulate their cognitive development and to give them a feeling of security in their world. Remember that infants are engaged in a subtle, though powerful battle to establish control over their bodies. For example, they are struggling to regulate their bodily functions such as eating, breathing, and heart rate. But for brief moments, perhaps for only 15 or 20 seconds, they stop these efforts and pay close attention to the environment in a search for stimulation. This happens even when they are hungry.

  One of the authors takes students to Boston's Children Hospital for observation visits, and attempts to find a nurse bottle-feeding an infant. Watching what happens when someone moves into the baby's field of vision, they are surprised at the baby's reaction. *The baby stops sucking and stares intently at that person's face!* Not for long, but long enough to interrupt feeding. Now you may not be too impressed with this but think about it. An infant's hunger drive is extremely powerful, yet, momentarily, the need for stimulation is even stronger indicating that infants show a willingness, even a need, to interact with other human beings.

- *Infants, using these abilities, begin their efforts to master the developmental tasks of the first two years:* learning to take solid foods, learning to talk, learning to walk.

Neonatal Assessment Techniques

Although all infants are born with these reflexes and abilities, not all possess them to the same degree. For example, some neonates demonstrate much weaker reflex action than others, a condition that affects their chances of surviving. Consequently, efforts to develop reliable measures of early behavior, called *neonatal assessment,* have increased sharply.

An Informed View

Neonates: Competent or Helpless?

Before continuing your reading, try to decide how competent you think a newborn baby is. In one view, infants are empty, unresponsive beings merely waiting for things to be done to and for them. They become active, healthy babies only because of maturation and the actions of those around them.

In another view, newborns are seen as amazingly competent and capable of much more than is now expected of them. Adherents of this belief view infants as "Super Babies," capable of prodigious accomplishments from birth, if not before. Consequently, from the first months of an infant's life, infants need some form of education.

In a third view, infants are seen as neither passive objects nor as superbabies, designed for instant greatness. Newborn babies are seen as bringing abilities with them into the world, a cluster of competencies that enables them to survive but also permits them to engage in a wider range of activities than was previously suspected (Brazelton & Nugent, 1995).

The expectations that parents have for their babies determine how they treat them and these expectations have important physical, cognitive, and psychosocial consequences. Babies "tune into" their environments—they react to the tone of an adult's voice, they sense how they're being handled (gently or roughly)—and are quite skillful in detecting the moods of those around them.

Ask your parents to think back on their childbearing days and try to recall how competent they thought babies were. Ask them if it made any difference in how they treated you. If you have brothers or sisters or friends with children, ask them what they expected a new-born baby would be like? Combining their practical outlook on infancy with what you have read, decide which of the above three views of infancy you think is most realistic. Which will most help infants to fulfill their potential?

If you would like to have a more informed view on this issue, you may want to read one or more of the references in this chapter, such as Brazelton & Nugent's account of newborn behavior.

You may also wish to learn more about it by going to our web site at http:/www.mhhe.com/dacey5.

Three basic classifications of neonatal tests are used to assess infant reflexes and behavior: the *Apgar scale, neurological assessment,* and *behavioral assessment*.

Apgar A scale to evaluate a newborn's basic life signs.

1. *The Apgar.* In 1953 Virginia Apgar proposed a scale to evaluate a newborn's basic life signs. The **Apgar** is administered one minute after birth, and repeated at three-, five-, and ten-minute intervals. Using five life signs—heart rate, respiratory effort, muscle tone, reflex irritability, and skin color—an observer evaluates the infant by a three-point scale. Each of the five dimensions receives a score of 0, 1, or 2. (0 indicates severe problems, whereas 2 suggests an absence of major difficulties.)

Neurological assessment Identifies any neurological problem, suggests means of monitoring the problem, and offers a prognosis about the problem.

2. *Neurological Assessment.* The **neurological assessment** is used for three purposes:

   - Identification of any neurological problem
   - Constant monitoring of a neurological problem
   - Prognosis about some neurological problem

   Each of these purposes requires testing the infant's reflexes, which is critical for neurological evaluation and basic for all infant tests.

Brazelton Neonatal Behavioral Assessment Scale A neonatal assessment technique that includes a baby's state of consciousness.

3. *Behavioral Assessment.* The **Brazelton Neonatal Behavioral Assessment Scale** (named after T. Berry Brazelton) has become a significant worldwide tool for infant assessment. Brazelton and Nugent (1995) believe that the baby's state of consciousness (sleepy, drowsy, alert, fussy) is the single most important element in the examination. The Brazelton test also permits us to examine the infant's behavior, which, as we have mentioned, is sensitive to cultural differences.

For example, during the administration of the Brazelton, one of the tests involves gently placing a piece of cheese cloth over the eyes and nose of the baby. This is intended to measure the baby's defensive reactions, so important for survival. Most African- and Anglo-American babies quickly turned their heads away or tried to push the cloth away. Chinese American babies, however, remained still and breathed through their mouths (Brazelton & Nugent, 1995; Kagan, 1994). (For an excellent discussion of the role of culture in the origins of individual differences in neonatal behavior, see Nugent & others, 1995.)

All three of these assessment techniques provide clues about the infant's ability to function on its own and have proved to be invaluable tools in diagnosing problems in the early days of infancy. Tests such as these, plus careful observation, have given us much greater insight into infant development. These tests have also helped us to realize that infants are much more competent than we previously suspected.

Given the rapid development of the brain and the survival value of the reflexes, we should expect motor development to proceed rapidly, which is just what happens.

Motor Development

Note the steady development of body control in this picture, especially the head and upper body. Control of the lower body and legs follows by several months.

Parents are fascinated by their child's motor development: Is she sitting up on time? Shouldn't she be crawling by now? I wonder if she'll ever walk. Why can't she hold her head steady? Motor development occurs in both head-to-feet direction (called *cephalocaudal*), as well as a *proximodistal* direction (from the center of the body to the extremities).

For many years, research into infant locomotion has been at a standstill mainly because of the belief that neuromuscular maturation was the primary agent of motor development. Recently, however, modern investigators using high-speed film, computerized video recordings, and infrared emitting diodes, have provided new insights into changes in coordination, balance, and strength in infants' locomotion.

Studies have shown that continuity of walking movements in the first year may be masked by underlying changes in the infant's muscle distribution, body fat, and the differential effect of gravity. For example, newborns with chubby legs stepped less than slender-legged infants. But when the slender-legged infants were weighted with an amount usually gained over the first months of life, they stopped stepping (Adolph, 1997).

Here are several important characteristics of motor control.

Head Control

The most obvious initial head movements are from side to side, although the 1-month-old infant occasionally lifts its head when in a prone position. Four-month-old infants can hold their heads steady while sitting and will lift their head and shoulders to a 90 degree angle when on their abdomens. By the age of 6 months, most youngsters can balance their heads quite well.

Locomotion: Crawling and Creeping

Crawling Locomotion in which the infant's abdomen touches the floor and the weight of the head and shoulders rests on the elbows.

Creeping Movement is on hands and knees and the trunk does not touch the ground; creeping appears from nine months in most youngsters.

Crawling and creeping are two distinct developmental phases. In **crawling,** the infant's abdomen touches the floor and the weight of the head and shoulders rests on the elbows. Locomotion is mainly by arm action. The legs usually drag, although some youngsters push with their legs. Most youngsters can crawl after age 7 months.

Creeping is more advanced than crawling, since movement is on hands and knees and the trunk does not touch the ground. After age 9 months, most youngsters can creep.

Most descriptions of crawling and creeping are quite uniform. The progression is from propulsion on the abdomen to quick, accurate movements on hands and knees, but the sequence is endlessly varied. Youngsters adopt a bewildering diversity of positions and movements that can only loosely be grouped together.

Most youngsters somewhere in the 7 to 9 month period begin to pull themselves up to a standing position. Their legs are now strong enough to support them while standing.

Locomotion: Standing and Walking

After about age 7 months, infants when held will support most of their weight on their legs. Coordination of arm and leg movements enables babies to pull themselves up and grope toward control of leg movements. The first steps are a propulsive, lunging forward. Gradually a smooth, speedy, and versatile gait emerges. The world now belongs to the infant.

Once babies begin to walk, their attention darts from one thing to another, thus quickening their perceptual development (our next topic). Tremendous energy and mobility, coupled with a growing curiosity, push infants to search for the boundaries of their world. It is an exciting time for youngsters but a watchful time for parents, since they must draw the line between encouraging curiosity and initiative and protecting the child from personal injury. The task is not easy. It is, however, a problem for all aspects of development: What separates unreasonable restraint from reasonable freedom?

Finally, we want to call your attention to changes in theorizing about and research into motor development. Reflecting current thinking about development (see chapters 1 and 2), recent studies have incorporated a multicausal explanation of motor development (Lockman & Thelen, 1993; Thelen, 1995). For example, in analyzing the stepping reflex previously discussed (see p. 110), Thelen (1995) commented on the disappearance of this behavior by two or three months. Yet kicking, which has the same movement pattern as stepping, is *not* lost. How can these differences be explained? Thelen (1995) pointed to a change of posture, plus weight gain (the legs get heavier) plus the pull of gravity as the multicausal answer.

Table 5.5 summarizes milestones in motor development.

Neonatal Problems

Not all infants enter the world unscathed. Occasionally the developmental sequence that we have just discussed does not run smoothly. Among the most prominent of possible problems are the following.

TABLE 5.5 MILESTONES IN MOTOR DEVELOPMENT

Age	Head Control	Grasping	Sitting	Creeping, Crawling	Standing, Walking
1–3 months	Can lift head and chest while prone	Grasps objects, briefly holds objects, carries objects to mouth	Sits awkwardly with support		
4–8 months	Holds head steady while sitting, balances head	Develops skillful use of thumb	Transition from sitting with slight support to brief periods without support	Crawling movements appear at about 7 months (trunk touches floor)	
8–12 months	Has established head control	Coordinates hand activities, handedness begins to appear	Good trunk control, sits alone steadily	Creeping (trunk raised from floor) begins at 9–10 months and continues until steady walking	Can stand and take steps holding on to something; by 12 months will pull self up
12–14 months		Handedness pronounced, holds crayon, marks lines	Can sit from standing position		Stands alone; begins to walk alone
18 months					Begins to run

From John F. Travers, *The Growing Child,* Scott, Foresman and Company, Glenview, IL, 1982. Reprinted by permission of the author.

An Applied View

Toilet Training—Easy or Difficult?

By the end of their child's infancy period, most parents begin to think about toilet training. One important fact to remember is that voluntary control of the sphincter muscles, which are the muscles that control elimination, does not occur until about the 18th month. For some children, however, control is not possible until about 30 months.

Evidence suggests that children are ready to participate in toilet training at about 18 months of age and may be completely trained between 2 and 3 years of age. Attempting to train children before they are ready can only cause anxiety and stress for the child and frustration for the parents (Brazelton & others, 1999).

Toilet training should commence when bladder control and rectal muscles are sufficiently mature.

Children really can't be trained; they learn when to use the toilet. Certain signs of readiness can alert parents when they can initiate the process. For example, necessary muscle control does not occur until well into the second year and a child must be able to communicate, either by words or gesture, the need to use the bathroom.

At about 2 years, almost all children want to use the toilet, to become more "grown-up," and to rid themselves of the discomfort of wet or soiled diapers. Parents should try to obtain equipment that the child feels most comfortable with—either a chair that sits on the floor or one that fits over the toilet seat.

Most parents expect their children to be toilet trained by the end of infancy, usually sometime between 2 and 3 years of age. Physiologically, most children are ready to learn control; socially it is desirable; psychologically it may be traumatic unless parents are careful. Here are several suggestions that can help parents (Gorski, 1999).

- Recognize the time of day and children's moods when they are most approachable.
- Work with children's attention span; plan distractions that will keep them comfortable on a potty chair.
- Accept a child's frustration level and work within those limits.
- Provide as much support and encouragement as a particular child needs.

Failure to Thrive

Failure-to-thrive (FTT) A condition in which the weight and height of infants consistently remain far below normal (the bottom 3% of height and weight measures).

The weight and height of **failure-to-thrive (FTT)** infants consistently remain far below normal. They are estimated to be in the bottom 3 percent of height and weight measures. They account for about 3 percent of pediatric hospital admissions.

There are two types of FTT, organic and nonorganic. *Organic FTT* accounts for 30 percent of FTT cases, and the problem is usually some gastrointestinal disease, occasionally a problem with the nervous system. *Nonorganic FTT,* much more difficult to diagnose and treat, lacks a physical cause. Consequently, researchers have looked to the environment and identified problems such as poverty, neglect, and often ignorance of good parenting practices. The seriousness of this problem is evident from the outlook for FTT infants: Almost 50 percent of them will continue to experience physical, cognitive, and behavioral problems (Blackman, 1997).

Sudden Infant Death Syndrome

Sudden infant death syndrome (SIDS) Death of an apparently healthy infant, usually between 2 and 4 months of age; thought to be a brain-related respiratory problem.

Discussion of the survival value of reflexes introduces one of the most perplexing problems facing both parents and researchers, **sudden infant death syndrome (SIDS).** An estimated 4,000 infants 2 to 4 months old die each year from SIDS. There is little warning, although almost all cases are preceded by mild cold symptoms and usually occur in late winter or early spring (American Academy of Pediatrics, 2000).

SIDS rarely occurs before age 1 month or after age 1 year; most victims are between 2 and 4 months old. Deaths peak between November and March. Boys are more vulnerable than girls, in this case by a 3 to 2 margin (Donner, 1997).

SIDS is particularly devastating for parents because of the lack of warning. These infants are apparently normal. Parents put them in a crib for a nap or for the night and return later to find them dead (hence the common name, "crib death"). You can imagine the effect this has on parents, particularly the feelings of guilt: What did I do wrong? Why didn't I look in earlier? Why didn't I see that something was wrong? Today, special centers have been established to counsel grieving parents. (One disturbing recent statistic has raised concern: There is a larger proprtion of SIDS deaths in day-care centers than in parent care. For an analysis of this research, see Moon & colleagues, 2000.)

Although no definite answers to the SIDS dilemma have yet been found, current research points to a respiratory problem. Control of breathing resides in the brain stem, and autopsies have indicated that the SIDS infant may not have received sufficient oxygen while in the womb, a condition known as *fetal hypoxia*. Consequently, parents are being urged to be extremely cautious when their babies are sleeping: Keep them on their back as much as possible, be alert to overheating, and avoid soft, loose bedding (American Academy of Pediatrics, 2000; Klonof-Cohen, 1997). These cautionary practices have resulted in a decrease in post-neonatal SIDS mortality (Malloy & Freeman, 2000).

A startling twist in the analysis of SIDS deaths has recently led researchers to attribute *some* of these deaths to child abuse. One possible cause is called *Munchausen by proxy,* in which a parent deliberately injures or kills a child to attract attention. Munchausen by proxy is a variant of adult Munchausen in which victims inflict harm on themselves, again to seek attention and sympathy.

In a bizarre episode, researchers, baffled by unexplained illnesses in children who were being treated at an Atlanta hospital, hid video cameras in 41 rooms. In more than *half* the cases mothers were inflicting injury on the child. One mother injected her child with her own urine; another gagged herself to vomit and then said the vomit was the child's; another injected chemicals into her child's feeding tube causing chronic fatigue (Hall & others, 2000). Remember, however, in the vast majority of SIDS cases (estimates range from 95–98 percent), the parents are blameless. This bizarre finding will undoubtedly lead to more detailed studies.

Sleeping Disorders

Most sleeping disorders are less serious than FTT or SIDS. Nevertheless, infant sleeping problems negatively affect growth and trouble parents. As Ferber (1985, p. 15) stated:

> **The most frequent calls I receive at the Center for Pediatric Sleep Disorders at Children's Hospital in Boston are from a parent or parents whose children are sleeping poorly. When the parent on the phone begins by telling me "I am at the end of my rope" or "We are at our wits' end" I can almost predict what will be said next.**

Ferber went on to explain that typically the parent has a child between the ages of 5 months and 4 years who does not sleep readily at night and wakes repeatedly. Parents become tired, frustrated, and often angry. Frequently the relationship between the parents becomes tense.

Usually a sleeping disorder has nothing to do with parenting. Also, usually nothing is wrong with the child, either physically or mentally. Occasionally problems do exist; for example, a bladder infection or, with an older child, emotional factors causing night terrors. A sleep problem is not normal and should not be waited out.

Neonates sleep more than they do anything else (usually from 14 to 15 hours per day) and have three sleep patterns: light or restless, periodic, and deep. Little if any activity occurs during deep sleep (about 25 percent of sleep). Neonates are mostly light sleepers and have the brain wave patterns associated with dreaming (although infants probably do not dream).

Some internal clock seems to regulate sleep patterns, with most deep sleep spells lasting approximately 20 minutes. At the end of the second week, a consistent and predictable pattern emerges. Neonates sleep in short stretches, about seven or eight hours. The pattern soon reverses itself, and infants assume an adult's sleep schedule. Sleep patterns in infants range from about 16 to 17 hours in the first week to 13 hours at age 2.

Adults also need to exercise caution when they take children into their own beds. From January 1990 to December 1997, 515 children under 2 died while sleeping with adults (Wright, 1999); 394 of these resulted from the baby becoming wedged between the mattress and the wall or headboard. The remaining 121 deaths occurred when an adult rolled over and smothered the child. The *American Academy of Pediatrics* recommends the following procedures.

- Place infants on their backs on a firm mattress that meets current safety standards.
- Remove all pillows, quilts, and comforters, and any soft toys from the crib.
- If using a blanket, tuck it around the mattress and be sure it reaches only to the baby's chest (Wright, 1999).

Respiratory Distress Syndrome

Respiratory distress syndrome (RDS) A problem common with premature babies that is caused by the lack of a substance called surfactant, which keeps the air sacs in the lungs open.

The last of the disorders to be discussed is **respiratory distress syndrome (RDS)** (also called hyaline membrane disease). Although this problem is most common with prematures, it may strike full-term infants whose lungs are particularly immature.

RDS is caused by the lack of a substance called *surfactant,* which keeps open the air sacs in the lungs. When surfactant is inadequate, the lung can collapse. Since most babies do not produce sufficient surfactant until the 35th prenatal week, you can see why it is a serious problem for premature infants. (Only 10 percent of a baby's lung tissue is developed at full-term birth.)

Full-term newborns whose mothers are diabetic seem especially vulnerable to RDS. Babies whose delivery has been particularly difficult also are more susceptible. The good news is that today 90 percent of these youngsters will survive and, given early detection and treatment, the outlook for them is excellent.

Field, T. (1990). *Infancy.* Cambridge, MA: Harvard University Press. A clear, simple, and carefully written account of infancy by a well-known commentator on these years.

Guided Review

1. About _____% of the brain develops outside of the womb.
2. A _____ is a behavior in which a repeated stimulus elicits the same response.
3. The _____ is a neonatal assessment technique that measures how an infant interacts with the environment.
4. Motor development occurs in a _____ and _____ direction.
5. The weight and height of _____ infants consistently remain below normal.

Perceptual Development

From what we've said so far, the current picture of an infant is that of an active, vibrant individual vigorously searching for stimuli. How do infants process these stimuli? Answering this question moves us into the perceptual world. We know now that babies not only receive stimuli, they interpret them. Perception begins our experience and interpretation of the world. It is also our basis for the growth of thought, the regulation of emotions, interactions in social relationships, and for

Answers

1. 75 2. reflex 3. Brazelton 4. cephalocaudal, proximodistal 5. FTT

progress in almost all aspects of development (Bornstein & Arterberry, 1999). Before attempting to chart perceptual development, let's explore the meaning of perception in more detail.

The Meaning of Perception

Infants acquire information about the world and constantly check the validity of that information. This process defines *perception:* getting and interpreting information from stimuli. Infants are particularly ingenious at obtaining information from the stimuli around them. They attend to objects according to the perceptual information the objects contain. As Bornstein (1995) noted, during infancy the capacity to take in information through the major sensory channels, to make sense of the environment, and to attribute meaning to information improves dramatically.

Seeking information leads to meaning. Objects roll, bounce, or squeak—in this way infants learn what objects are and what they do. In the first year of life, infants discern patterns, depth, orientation, location, movement, and color (Bornstein & Arterberry, 1999). During infancy, babies also discover what they can do with objects, which furthers their perceptual development. For example, Lewkowicz (1996) reported that when an investigator used both her voice and face as stimuli, 4-, 6-, and 8-month-old infants responded better to the combination of stimuli than to face or voice alone.

Habituation A process in which stimuli that are presented frequently cause a decrease in an infant's attention.

Remember: Infants are born ready to attend to changes in physical stimulation. Stimuli presented frequently cause a decrease in an infant's attention **(habituation).** If the stimuli are altered, the infant again attends, indicating awareness of the difference. For example, if you show an infant a picture (flower, birds, anything attractive), the child is first fascinated, then becomes bored; the child has habituated. If you now change the picture, you again capture the child's attention.

Infants, however, encounter a wide variety of objects, people, and events, all of which differ in many dimensions: color, size, shape. They must learn how to react to each, and how they react depends on many factors. For example, Clifton, Perris, and Bullinger (1991) found that when 6- and 7-month-old infants were in a dark setting and were presented with objects that made a sound, they reached accurately for the objects as long as they were within their reach. When the objects were out of reach, the infants were far less accurate. They thus perceive distance and direction and seem able to define their auditory space as long as an object is within reach of the body.

In a classic study, Brooks and Lewis (1976) studied how infants responded to four different types of strangers, a male and female child, a female adult, and a female midget. In this way, facial configurations and height were varied. The infants reacted to the children by continuous looking and some smiling. They reacted to the midget with considerable puzzlement but no positive response such as smiling or movement toward her. They reacted to the adult by sporadic looking, averting their eyes, frowning, and even crying. Thus the infants used size and facial configuration cues.

Infants quickly begin to attend to the objects in their environments, thus constructing their views about how the world "works."

We may conclude, then, that perception depends on both learning and maturation. An infant's perceptual system undergoes considerable development following birth, resulting from greater familiarity with objects and events in the world as well as from growth.

Visual Perception

Infants are born able to see and quickly exhibit a preference for patterns. Do infants prefer looking at some objects more than others? In a pioneering series of experiments, Robert Fantz provided dramatic documentation of an infant's perceptual ability. Fantz (1961) stated that the best indicator of an infant's visual ability is eye activity. Infants who consistently gaze at some forms more than others show perceptual discrimination; that is, something in one form holds their attention.

Using a "looking chamber" in which an infant lies in a crib at the bottom of the chamber and looks at objects placed on the ceiling, Fantz could determine the amount of time that infants fixated on different objects. In one of his experiments, Fantz tested pattern perception by using six objects, all flat discs 6 inches in diameter: face, bull's-eye, newsprint, red disc, yellow disc, and white disc. The face attracted the greatest attention (human faces are remarkably complex), followed by the newsprint, the bull's-eye, and then the three plain-colored discs (none of which received much attention). Infants, then, show definite preferences based on as much complexity as they can handle (Lewkowicz, 1996).

Visual Adaptation

Studying visual development spurs speculation about how growing visual skill helps infants to adjust to their environment. Gibson and Walk (1960), in their famous *visual cliff* experiment, reasoned that infants would use visual stimuli to discriminate both depth and distance.

The visual cliff is a board dividing a large sheet of heavy glass. A checkerboard pattern is attached flush to one half of the bottom of the glass, giving the impression of solidity. The investigators then placed a similar sheet on the floor under the other half, creating a sense of depth—the visual cliff.

Thirty-six infants from ages 6 to 14 months were tested. After the infant was placed on the center board, the mother called the child from the shallow side and then the cliff side. Twenty-seven of the youngsters moved onto the shallow side toward the mother. When called from the cliff side, only three infants ventured over the depth. The experiment suggests that infants discriminate depth when they begin crawling.

To conclude, we can state that by 2 to 4 months of age, infant perception is fairly sophisticated. Infants perceive figures as organized wholes; they react to the relationship among elements rather than single elements; they perceive color; and complex rather than simple patterns fascinate them. They scan the environment, pick up information, encode and process information. Why? Because they are well-equipped to hear, to orient to, to perceive, and to distinguish sounds (Bornstein & Arterberry, 1999).

A child's depth perception is tested on the visual cliff. The apparatus consists of a board laid across a sheet of heavy glass, with a patterned material directly beneath the glass on one side and several feet below it on the other.

Auditory Perception

In chapter 4, we described how Anthony DeCasper's experiment illustrated how both a fetus and infant will recognize its mother's voice. Hearing and auditory discrimination is well-developed at birth since sounds are carried to the fetus through the amniotic fluid as a series of vibrations. Infants display a remarkable sensitivity to differences in the quality of sounds. For example, some babies may prefer music to other sounds and one type of music to another; they can discriminate their mothers' voices from those of other women. They also can locate where a sound comes from, and newborns will even turn their heads to the sound of a rattle or bell (Hetherington & Parke, 1999).

Although important in itself, this perceptual sensitivity underscores the importance of auditory perception in language development. For example, infants begin to differentiate the sounds of their language and tune into the speech they hear around them. By four months of age, infants can detect the match between heard and seen vowels, looking preferentially at a "talking head" producing the sounds (Werker & Tees, 1999). It's as if nature has determined that infants must immediately attend efficiently to the important information in the speech surrounding them.

Guided Review

6. The decrease in an infant's attention to stimuli presented frequently is called _____.
7. Newborn infants show a preference for _____.
8. A child's depth perception is tested on an apparatus called a _____.
9. Neonates require about _____ hours of sleep per day.
10. Perception depends on _____ and _____.

Cognitive Development

How do infants develop an understanding of the world around them? Can infants really think? If they can, what is their thinking like? How do we explain the cognitive changes in the first two years of life? As you read this section, keep in mind the possible relationship between physical growth (especially the brain) and cognitive development. (For a further discussion of this topic, see Diamond, 2000.)

In their first year of life, infants seem to proceed through several stages. In the first month, they have no idea that objects are permanent—out of sight, out of mind. From 1 to 4 months, infants will continue to stare at the spot where an object disappeared and then turn their attention to something else. From 4 to 8 months, infants begin to show signs that an object still exists even if they can't see it; they'll look for a toy after they drop it; they love playing peek-a-boo. From 8 to 12 months, infants develop the notion of **object permanence** and will continue to hunt for a hidden object.

Object permanence Refers to children gradually realizing that there are permanent objects around them, even when these objects are out of sight.

Recent studies indicate that object permanence is related to later cognitive development suggesting that roots of cognition lie in infancy. For example, Rose and his associates (1991) compared object permanence (among other cognitive indicators) in premature infants at 1 year with IQ measures at 5 years. They found a significant relationship between the two, suggesting developmental continuities in cognition.

Answers

6. habituation 7. patterns 8. visual cliff 9. 14 10. learning and maturation

To discover how infants develop such concepts as object permanence, we now turn to the work of the great Swiss scholar, Jean Piaget. You previously read about several of his important ideas in chapter 2; here we'll examine his interpretation of infancy in some detail.

Piaget's Sensorimotor Period

Egocentrism Child focuses on self in early phases of cognitive development; term associated with Piaget.

Piaget (1967) states that the period from birth to language acquisition is marked by extraordinary mental growth and influences the entire course of development. **Egocentrism** describes the initial world of children. Everything centers on them; they see the world only from their point of view. Very young children lack social orientation. They speak at and not to each other, and two children in conversation may be discussing utterly unrelated topics. (Likewise, egocentric adults know that other viewpoints exist, but they disregard them.) The egocentric child simply is unaware of any other viewpoint.

Sensorimotor period Piaget's term for the first of his cognitive stages of development (0 to 2 years).

The remarkable changes of the **sensorimotor period** (about the first two years of life) occur within a sequence of six stages. Most of Piaget's conclusions about these stages were derived from observation of his own three children. (Jacqueline, Lucianne, and Laurent have become as famous in psychological literature as some of Freud's cases or John Watson's Albert.)

Stage 1 During the first stage, children do little more than exercise the reflexes with which they were born. For example, Piaget (1952) stated that the sucking reflex is hereditary and functions from birth. At first infants suck anything that touches their lips; they suck when nothing touches their lips; then they actively search for the nipple. What we see here is the steady development of the coordination of arm, eye, hand, and mouth. Through these activities, the baby is building a foundation for forming cognitive structures. (For a more extended discussion of the antecedents of these behaviors, see Smotherman & Robinson, 1996.)

Primary circular reactions Infants repeat some act involving their bodies; term associated with Piaget's theory.

Stage 2 Piaget referred to stage 2 (from about 1 to 4 months) as the stage of first habits. During stage 2, **primary circular reactions** appear, in which infants repeat some act involving their bodies. For example, they continue to suck when nothing is present. They continue to open and close their hands. Infants seem to have no external goal, no intent in these actions other than the pleasure of self-exploration. But they are learning something about that primary object in their world: their own bodies.

Secondary circular reactions Infants direct their activities toward objects and events outside themselves.

Stage 3 **Secondary circular reactions** emerge during the third stage, which extends from about 4 to 8 months. During this stage, infants direct their activities toward objects and events outside themselves. Secondary circular reactions thus produce results in the environment, and not, as with the primary circular reactions, on the child's own body.

For example, Piaget's son, Laurent, continued to shake and kick his crib to produce movement and sound. He also discovered that pulling a chain attached to some balls produced an interesting noise, and he kept doing it. In this way, babies learn about the world "out there," and feed this information into their developing cognitive structures.

Coordination of secondary schemes Infants combine secondary schemes to obtain a goal.

Stage 4 From about 8 to 12 months of age, infants **coordinate secondary schemes** to form new kinds of behavior. Now more complete acts of intelligence are evident (Piaget & Inhelder, 1969).

The baby first decides on a goal (finding an object that is hidden behind a cushion). The infant attempts to move objects to reach the goal. In stage 4, part of the goal object must be visible behind the obstacle. Here we see the first signs of intentional behavior.

Tertiary circular reaction
Repetition with variation; the infant is exploring the world's possibilities.

When infants begin to move things to get what they want, they are "coordinating secondary schemata." This is a clear signal of advancing cognitive development.

Stage 5 **Tertiary circular reactions** appear from 12 to 18 months of age. In the tertiary circular reaction, repetition occurs again, but it is repetition with variation. The infant is exploring the world's possibilities. Piaget thought that the infant deliberately attempts to provoke new results instead of merely reproducing activities. Tertiary circular reactions indicate an interest in novelty for its own sake.

How many times have you seen a baby standing in a crib and dropping everything on the floor? But listen to Piaget: Watch how the baby drops things, from different locations and different heights. Does it sound the same when it hits the floor as the rug? Is it as loud dropped from here or higher? Each repetition is actually a chance to learn. Thanks to Piaget, you will be a lot more patient when you see this behavior.

Stage 6 During stage 6, the sensorimotor period ends and children develop a basic kind of *internal representation*. A good example is the behavior of Piaget's daughter, Jacqueline. At age 20 months, she approached a door that she wished to close, but she was carrying some grass in each hand. She put down the grass by the threshold, preparing to close the door. But then she stopped and looked at the grass and the door, realizing that if she closed the door the grass would blow away. She then moved the grass away from the door's movement and then closed it. She had obviously planned and thought carefully about the event before acting. Table 5.6 summarizes the accomplishments of the sensorimotor period.

Progress through the sensorimotor period leads to four major accomplishments:

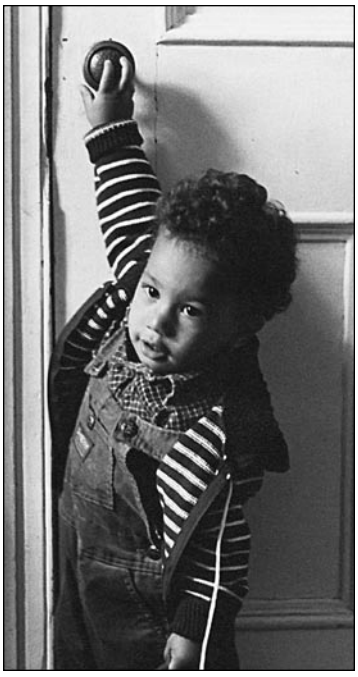
- *Object permanence:* Children realize that permanent objects exist around them; something out of sight is not gone forever.
- *A sense of space:* Children realize environmental objects have a spatial relationship.
- *Causality:* Children realize a relationship exists between actions and their consequences.
- *Time sequences:* Children realize that one thing comes after another.

By the end of the sensorimotor period, children move from purely sensory and motor functioning (hence the name sensorimotor) to a more symbolic kind of activity.

TABLE 5.6 OUTSTANDING CHARACTERISTICS OF THE SENSORIMOTOR PERIOD

The Six Subdivisions of This Period	
Stage 1:	During the first month the child exercises the native reflexes, for example, the sucking reflex. Here is the origin of mental development, for states of awareness accompany the reflex mechanisms.
Stage 2:	Piaget referred to stage 2 (from 1 to 4 months) as the stage of primary circular reactions. Infants repeat some act involving the body, for example, finger sucking. (Primary means first, circular reaction means repeating the act.)
Stage 3:	From 4 to 8 months, secondary circular reactions appear; that is, the children repeat acts involving objects outside themselves. For example, infants continue to shake or kick the crib.
Stage 4:	From 8 to 12 months, the child "coordinates secondary schemes." Recall the meaning of schema—behavior plus mental structure. During stage 4, infants combine several related schemata to achieve some objective. For example, they will remove an obstacle that blocks some desired object.
Stage 5:	From 12 to 18 months, tertiary circular reactions appear. Now children repeat acts, but not only for repetition's sake; now they search for novelty. For example, children of this age continually drop things. Piaget interpreted such behavior as expressing their uncertainty about what will happen to the object when they release it.
Stage 6:	At about 18 months or 2 years, a primitive type of representation appears. For example, one of Piaget's daughters wished to open a door but had grass in her hands. She put the grass on the floor and then moved it back from the door's movement so that it would not blow away.

From John F. Travers, *The Growing Child,* Scott, Foresman and Company, Glenview, IL, 1982. Reprinted by permission of the author.



As infants acquire the ability to form representations of objects, they begin to move through their environments more skillfully.

Criticisms of Piaget

Although Piaget has left a monumental legacy, his ideas have not been unchallenged. Piaget was a believer in the stage theory of development; that is, development is seen as a sequence of distinct stages, each of which entails important changes in the way a child thinks, feels, and behaves. However, the acquisition of cognitive structures may be gradual rather than abrupt and is not a matter of all or nothing; for example, a child is not completely in the sensorimotor or preoperational stage. A child's level of cognitive development seems to depend more on the nature of the task than on a rigid classification system.

In one of the first important challenges to Piaget, Gelman and Baillargeon (1983), changed the nature of the task as follows:

- by reducing the number of objects children must manipulate
- by allowing children to practice (e.g., teaching children conservation tasks)
- by using materials familiar to children

These researchers found that children can accomplish specific tasks at earlier ages than Piaget believed. Such criticisms have led to a more searching examination of the times during which children acquire certain cognitive abilities. For example, Piaget believed that infants will retrieve an object that is hidden from them in stage 4, from 8 to 12 months. Before this age, if a blanket is thrown over a toy that the infant is looking at, the child stops reaching for it as if it doesn't exist.

To trace the ages at which object permanence appears, Baillargeon (1987) devised an experiment in which infants between 3½ and 4½ months old were seated at a table where a cardboard screen could be moved back and forth, either forward (toward the baby) until it was flat on the table or backward (away from the baby) until the back of the cardboard touched the table.

Baillargeon then placed a painted wooden block behind the cardboard screen so that the infant could see the block when the screen was in a forward, flat position. But when the screen was moved backward, it came to rest on the block, removing it from the infant's sight. Occasionally Baillargeon secretly removed the block so that the screen continued backward until it rested flat on the table. The 4½-month-old infants looked surprised at the change (they looked at the screen longer); even some of the 3½-month-olds seemed to notice the "impossible" event. These findings suggest that infants may develop the object permanence concept earlier than Piaget originally thought.

Information Processing in Infancy

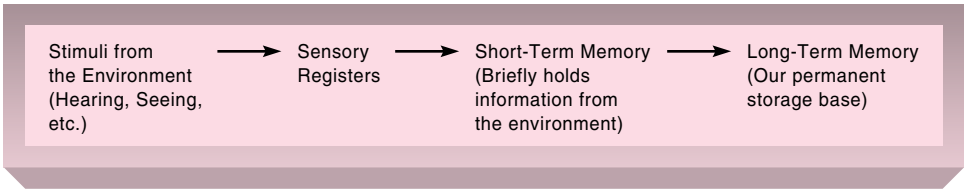
Piaget, as we have seen, argued forcefully that cognitive development proceeds by progression through discrete stages. Information processing theorists, however, argue just as strongly that cognitive development occurs by the gradual improvement of such cognitive processes as attention and memory.

An underlying assumption of information processing theory is that individuals are not passive recipients of stimuli. Rather, they are actively involved in their own development, which fits nicely with current interpretations of infancy. Consequently, any mental activity that involves noticing, taking in, mentally manipulating, storing, combining, retrieving, and acting on information describes information processing. Changes in these processes are the focus of developmental information processing theorists (Lutz & Sternberg, 1999).

To help you visualize how these processes work in information processing theory, consider Figure 5.2.

Now let's examine how infants "use" these processes.

Figure 5.2
An information processing model.



Infants and Attention

Infants attend to different stimuli for a variety of reasons: intensity, complexity of the stimuli, visual ability, and novelty. Consequently, they find human faces, voices, and movements particularly fascinating. Attending to and reacting to those around them occupies much of their time. They quickly become skilled at discriminating facial expressions and responding accordingly (Flavell, 1999). Yet we must introduce a note of caution here.

For example, how would you interpret this behavior? On a recent visit to a shopping mall with my wife, one of us (JFT) was sitting on a bench waiting for her to return. A young mother with three children—I would guess their ages to be about 8 years, 5 years, and 3 or 4 months—stopped at a nearby bench. The mother explained to the older children that she was going into the store for a few minutes to pick out a birthday card. She would be able to see them from the store and asked them to watch their baby sister whom they obviously loved.

When she left, the children began to do all sorts of things—smiling, patting, funny faces—to keep their sister's attention until finally the infant turned away for relief from such intense (for her) stimulation. Of course, this only spurred the boys to redouble their efforts and she then began to spit up. The baby simply could not handle the "stimulus overload."

What happened here? Think about what attention means for the developing infant.

- *Their attention becomes selective,* that is, people (especially infants) can't attend to everything.
- *Their attention involves cognitive processing,* that is, infants don't just passively accept stimuli—they actively process incoming information.
- *Their attention is limited,* that is, infants especially can attend only to a limited number of things at the same time (Flavell, 1999).

When we consider these limitations during the infancy years, we realize that babies simply lack the cognitive maturity—call it an adequate gate-keeping mechanism—that permits them to control all of the stimuli that assault them. A good rule of thumb to remember is that infants are drawn to stimuli of moderate intensity.

The adults around them must assume responsibility for monitoring the sights and sounds that their infants experience to shield them from too intense stimulation. Most mothers intuitively read their babies' signals and react appropriately, which reflects sensitive responsiveness to a child's needs. (See Brazelton & Nugent, 1995, for an analysis of an infant's ability to attend to and control stimuli.)

Infants and Memory

As infants progress through these first two years, behavior appears that can only be attributed to memory. (For an excellent discussion of current research into memory, see Kuhn, 2000; Samuelson & Smith, 2000.) The last half of the first year appears to be a time of rapid growth in memory ability (Schacter, 1996). To explain what's occurring, Siegler (1998) identified four sources of memory development.

- *Basic capacities* are present and functioning, such as association and recognition.

- *Strategies,* such as following with eyes, pointing, naming, and selective attention begin to emerge (Herbert & Hayne, 2000).
- *Content knowledge* grows steadily and aids memory.

Although infants have limited cognitive skills, they use these basic processes to form immediate memories.

Testing infant memory is difficult because infants can't tell us whether or what they remembered. Consequently, investigators have relied on experiments that measure the time that infants look at familiar and novel objects, which is referred to as *habituation/dishabituation procedures*. For example, Kail (1990) presented two groups of infants with a bull's-eye pattern and a set of stripes. One group saw the bull's-eye first and then the stripes; the other group had the procedure reversed: first the stripes and then the bull's-eye.

If both groups looked longer at the second presentation (the stripes for the first group and the bull's-eye for the second), it shows that they preferred the novel stimuli, thus giving evidence of infant memory. That is, they remembered the first and habituated and were then more interested in the novel stimulus. Research has shown that infants' rates of habituation and preferences for novelty are related to later measures of childhood IQ (Schneider & Bjorklund, 1998).

Siegler, R. (1998). *Children's thinking.* (3d ed.). Upper Saddle River: Prentice Hall. An exellent, well-documented account of how children develop their thinking skills during infancy.

Newborns seem to recognize events they have heard or seen before (recall DeCasper's work that we mentioned in chapter 4). By 2 to 3 months, infants will remember an event for several days, perhaps as long as a week. Memory continues to improve as infants "economize," that is, rather than remembering specific events, they begin to integrate their experiences (Shields & Rovee-Collier, 1992). This helps to explain how they find hidden objects (such as in the object permanence experiments); they can now recall things and events (Kail, 1990). We may conclude that memory during infancy is highly specific to the conditions surrounding the original encoding and that the last items forgotten are the first to be retrieved (Hayne & Rovee-Collier, 1995).

Infantile Amnesia

If memory seems to develop early in our lives, why do we have difficulty in remembering most of our experiences in infancy? You undoubtedly look with considerable skepticism at those individuals who claim to remember events from the first days of their lives. More common is a phenomenon called infantile amnesia, which refers to an inability to recall events from early in life. Infantile amnesia refers to our inability to remember much before the age of four. Memories much before the age of of six or seven years are rare (Schneider & Bjorklund, 1998; Schneider & Pressley, 1997).

How do we explain this phenomenon? The passage of time is an inadequate explanation, as is a psychoanalytic interpretation that we tend to repress infant sexual experiences. Recent explanations point to the gradual maturation of the brain's frontal lobes, which seems to be involved in memory. A second explanation relates to language development. For example, you and I try to remember the names of people and events, but infants do not encode such information verbally. As infants listen to and begin to comprehend the stories they hear around them, they impose a logical construction upon them that they tend to remember.

Finally, there may be crucial differences in the way that infants encode information compared to older children and adults. That is, do infants encode information in a way that they can later retrieve? As Siegler (1998) notes, the world looks quite different from the perspective of a 12-month-old infant and a 19-year-old adult. The general knowledge we acquire as we mature helps us to encode information more precisely and clearly, thus making retrieval that much easier.

You can see that these three recent explanations are not mutually exclusive, but may interact with each other as our memory sharpens with time. For example, brain maturation is a must for healthy cognitive development; hearing others explain what's happening around them helps infants to encode information more meaningfully; improved encoding helps children to retrieve information more rapidly and accurately.

Guided Review

11. Piaget's first stage of cognitive development is known as the _____ period.

12. _____ describes a phase of child development in which children perceive the world only from their point of view.

13. _____ _____ is when a child realizes that an object out of sight is not gone forever.

14. A major assumption of information-processing theory is that children are not _____ recipients of stimuli.

15. Two important information processes of infancy are _____ and _____.

Language Development

A friend of one of us recently expressed amazement at the way his grandson was talking. "You know," he said, "it seems like only the other day that he was just making noises. But when I asked him today if we were still pals, he said, 'No, we're firefighters.' And he's not quite two." Here we see an excellent example of the tremendous growth of language during infancy.

The forerunners of language appear immediately after birth in infant gazes and vocal exchanges with those around them. With no formal learning and often exposed to dramatically faulty language models, children learn words, meanings, and how to combine them in a purposeful manner. To guide you through the complexity of language development, here are several transitions that help to explain children's amazing accomplishments (Bloom, 1998).

- The first transition occurs at the end of the first year and continues in the second year with the appearance of words and the acquisition of a basic vocabulary (McLaughlin, 1998).
- The second transition occurs when children change from saying only one word at a time to combining words into phrases and simple sentences about the end of the second year.
- The final transition occurs when children move beyond using simple sentences to express one idea to complex sentences expressing multiple ideas and the relations between them.

Acquiring Their Language

How does this uniquely human achievement occur? Students of language, attempting to explain the richness and complexity of children's language, are convinced that this feat is possible because of two accomplishments. First, *children learn the rules of their language,* which they then apply in a wide variety of situations. Second, by the end of the second year, *children begin to fast map;* that is, they learn to apply a label to an object without anyone telling them. Even when children don't understand a word, they acquire information about it from the surrounding context (Hulit & Howard, 1997).

The process of acquiring language goes on at a furious pace until, at about the age of 5 for most children, they have acquired the fundamentals of their language. By the time children enter elementary school, they are sophisticated language users. After that, it's a matter of expanding and refining language skills, a task that often defines success or failure. The speed of acquisition and the fact that it generally

Answers

11. sensorimotor 12. Egocentrism 13. Object permanence 14. passive 15. attention, memory

occurs, without overt instruction, for all children, regardless of great differences in a range of social and cultural factors, have led to the belief that there is some "innate" predisposition in the human infant to acquire language (Yule, 1996).

As an example of the world into which language development takes children, consider some of the intricacies of the English language that we, as adults, understand completely. Do you realize that you drive on a parkway and park on a driveway? Do you realize that you eat *ghoti* quite frequently? (*gh* as in tough, *o* as in women, *ti* as in nation—put them all together and you're eating fish.)

Since understanding how children acquire their language is a difficult task, we have decided to use the five stages of Roger Brown's seminal work (1973), coupled with recent research on grammar, meaning, and usage as a means of providing you with a usable framework for tracing language development usage (Bloom, 1998; Hulit & Howard, 1997; Tager-Flusberg, 1997). Brown was particularly interested in the development of grammar, which he measured by a technique called the *mean length of utterance (MLU)*. This simply refers to counting the morphemes (meaningful units of language) in each utterance and dividing by the number of utterances. A child who uses 215 morphemes in 100 utterances has a MLU of 2.15.

In Brown's Stage One (12 to 26 months, MLU of 1.0 to 2.0), children develop first words, begin to combine them, and use them as a form of conversation. Stage One opens when children produce thir first meaningful words and closes when they start to put words together. During the infancy years children progress from one word at the beginning of the stage to 200–300 words at the end of the stage, ask questions, use negatives, make demands, and use language to get things done (Hulit & Howard, 1997).

Context and Language

The Russian psychologist, Lev Vygotsky, whose ideas we discussed in chapter 2, proposed a contextual view of language development that attracted considerable attention. Vygotsky (1978) believed that *speech* is one of the most powerful tools humans use to progress developmentally. Speech, especially *inner speech,* plays a critical role in Vygotsky's interpretation of cognitive development. In *Thought and Language* (1962), he clearly presented his views about the four stages of language development.

1. The first stage, which he called *preintellectual speech,* refers to such elementary processes as crying, cooing, babbling, and bodily movements that gradually develop into more sophisticated forms of speech and behavior. Although human beings have an inborn ability to develop language, we must then interact with the environment if language development is to fulfill its potential. Michael Cole (1996) employs a garden metaphor to help explain these issues: Think of a seed planted in damp earth in a jar and then placed in a shed for two weeks. The seed sprouts, a stem emerges, and then leaves appear. But for further development the plant must now interact with sunlight.
2. Vygotsky referred to the second stage of language development as "naive psychology," in which children explore the concrete objects in their world. At this stage, children begin to label the objects around them and acquire the grammar of their speech.
3. At about 3 years of age *egocentric speech* emerges, that form of speech in which children carry on lively conversations, whether anyone is present or listening to them.
4. Finally, speech turns inward (inner speech) and serves an important function in guiding and planning behavior.

For example, think of a 5-year-old girl asked to get a book from a library shelf. The book is just out of her reach, and as she tries to reach it, she mutters to herself, "Need a chair." After dragging a chair over, she climbs up and reaches for the book. "Is that the one?" "Just a little more." "OK." Note how speech accompanies her physical movements, guiding her behavior. In two or three years, the same girl, asked to do the same thing, will probably act the same way, with one major exception: she won't be talking aloud. Vygotsky believed she would be talking to herself, using inner speech to guide her behavior, and for difficult tasks she undoubtedly would use inner speech *to plan her behavior.*

In many cases, children who aren't permitted these vocalizations *can't accomplish the task!* In fact, the more complex the task, the greater the need for egocentric speech. Note how Vygotsky and Piaget disagreed about the function of egocentric speech: Piaget believed it simply vanishes; Vygosky believed it's an important transitional stage in the formation of inner speech.

With this brief background, let's turn our attention to what we know about language development. All children learn their native language at about the same time and in a similar manner. During the infancy period, children at about 3 months use sounds in a similar manner to adults and at about 1 year they begin to use recognizable words. The specific sequence of language development during infancy appears in table 5.7.

Key Signs of Language Development

In the first year, babies continue to learn the sounds of their language (Sansavini, Bertoncini, & Giovanelli, 1997). Here's a question for you to think about: Since the fetus responds to sound (as we've seen), do you think it's possible that language acquisition begins *before* birth?

Let us help you out here. Remember: When a newborn baby is presented with something new, its heart rate slows. Researchers asked several pregnant women to repeat the sentences *Hello, baby. How are you today?* while they rested. Each time the mother asked the question, the fetal heart rate slowed (Golinkoff & Hirsh-Pasek, 2000). It seems indeed that fetuses listen to their mothers' voices.

Cooing Early language sounds that resemble vowels.

Babbling Infant produces sounds approximating speech between 5 and 6 months.

During the first two months, babies seem to develop sounds that are associated with breathing, feeding, and crying. **Cooing** (sounds like vowels) appears during the second month (McLaughlin, 1998). Between five and seven months, babies play with the sounds they can make, and this output begins to take on the sounds of consonants and syllables, the beginning of **babbling.** Babbling probably appears initially because of biological maturation. At seven and eight months, sounds like syllables appear—da-da-da, ba-ba-ba (a phenomenon occurring in all languages), a pattern that continues for the remainder of the first year (Pinker, 1994).

Babbling, producing vowel and consonant sounds, encourages parents to interact verbally with their children.

TABLE 5.7 LANGUAGE DEVELOPMENT DURING INFANCY

Language	Age
Crying	From birth
Cooing	2–5 months
Babbling	5–7 months
Single words	12 months
Two words	18 months
Phrases	2 years

Vocables Consistent sound patterns to refer to objects and events.

Late in the babbling period, children use consistent sound patterns to refer to objects and events. These are called **vocables** and suggest children's discovery that meaning is associated with sound. For example, a lingering "L" sound may mean that someone is at the door. The use of vocables is a possible link between babbling and the first intelligible words.

First Words

Phonology The sounds of a language.

Semantics The meaning of words.

Syntax Rules for constructing sentences.

Pragmatics Rules for taking part in a conversation.

Around their first birthday, babies produce single words, about half of which are for objects (food, clothing, toys). Throughout the world children's first words express similar menings. These words refer to people, animals, toys, vehicles, and other objects that fascinate children (Siegler, 1998). Children quickly learn the sounds of their language **(phonology),** the meanings of words **(semantics),** how to construct sentences **(syntax),** and how to communicate **(pragmatics)** (Gleason, 1997).

At eighteen months, children acquire words at the rate of 40 new words per week (Woodward & Markman, 1998). This rapid increase in vocabulary lasts until about 3 years of age and is frequently referred to as the **language explosion.** Vocabulary constantly expands, but estimating the extent of a child's vocabulary is difficult because youngsters know more words than they articulate.

Language explosion Rapid acquisition of words beginning at 18 months.

Estimates are that a 1-year-old child may use from two to six words, and a 2-year-old has a vocabulary ranging from 50 to 250 words. Children at this stage also begin to combine two words (Pinker, 1994). By first grade, children may understand 10,000 words, and by fifth grade they understand about 40,000 words (Woodward & Markman, 1998).

Holophrases If you have the opportunity, listen to a child's speech when single words begin to appear. You will notice a subtle change before the two-word stage. *Children begin to use one word to convey multiple meanings.* For example, youngsters say "ball" meaning "give me the ball," "throw the ball," or "watch the ball roll." They have now gone far beyond merely labeling this round object as a ball. Often called **holophrastic speech** (one word to communicate many meanings and ideas), it is difficult to analyze. These first words, or **holophrases,** are usually nouns, adjectives, or self-inventive words and often contain multiple meanings. As mentioned previously, "ball" may mean not only the ball itself but "throw the ball to me."

Holophrastic speech The use of one word to communicate many meanings and ideas.

Holophrase Children's first words that usually carry multiple meanings.

When the two-word stage appears (anytime from 18 to 24 months), children initially struggle to convey tense (past and present) and number (singular and plural). They also experience difficulty with grammatical correctness. Children usually employ word order ("me go") for meaning, only gradually mastering inflections (plurals, tenses, possessives) as they begin to form three-word sentences. They use nouns and verbs initially and their sentences demonstrate grammatical structure. (Although the nouns, verbs, and adjectives of children's sentences differ from those of adults, the same organizational principles are present.)

Children begin to use multiple words to refer to the things that they previously named with single words. Rather than learning rules of word combination to express new ideas, children learn to use new word forms. Later, combining words in phrases and sentences suggests that children are learning the structure of their language.

Telegraphic Speech At about 18 to 24 months of age children's vocabularies begin to expand rapidly, and simple two-word sentences appear. Children primarily use nouns and verbs (not adverbs, conjunctions, or prepositions), and their sentences demonstrate grammatical structure. These initial multiple-word utterances (usually two or three words: "mommy milk"—give me the milk) are called **telegraphic speech.** Telegraphic speech contains considerably more meaning than superficially appears in the two or three words.

Telegraphic speech Initial multiple-word utterances, usually two or three words.

Word order and inflection (changing word form: e.g., "word"/"words") now become increasingly important. During the first stages of language acquisition, word order is paramount. At first, children combine words without concern for inflections, and it is word order that provides clues as to their level of syntactic (grammatical) development. Once two-word sentences are used, inflection soon appears, usually with three-word sentences. The appearance of inflections seems to follow a pattern: first the plural of nouns, then tense and person of verbs, and then possessives.

A youngster's effort to inject grammatical order into language is a good sign of normal language development. Several things, however, signal delay or difficulty in language acquisition. When children begin to babble beyond one year, problems may be present. For example, deaf children continue to babble past the age when other children begin to use words (Cole & Cole, 1996).

As we complete this initial phase of examining infant development, remember that all phases of development come together in an integrated manner. Motor development is involved when a child moves excitedly toward its mother on her return. Language development is involved when infants intensify their relationships with their mothers by words that are now directed toward her. Cognitive development is probably less obvious but just as significant: Children are excited by their mothers' return because they remember their mothers. Consequently, a sound principle of development remains—all development is integrated. Table 5.8 summarizes several of the developmental highlights we have discussed in this chapter.

Pinker, S. (1994). *The language instinct.* New York: Morrow. You would enjoy this fascinating, well-written account of the nature of language and how humans acquire their language.

Guided Review

16. _____ is sounds that approximate speech.
17. One word used to communicate many meanings is called _____ speech.
18. Vygotsky's work reflects a _____ view of language development.
19. A good sign of normal language development is a child's attempt to build _____ order into language.
20. For Vygotsky, _____ _____ plays a key role in cognitive development.

TABLE 5.8 DEVELOPMENTAL CHARACTERISTICS OF INFANCY

Age (Months)	Height (in.)	Weight (lbs.)	Language Development	Motor Development	Cognitive (Piaget)
3	24	13–14	Cooing	Supports head in prone position	Primary circular reactions
6	26	17–18	Babbling—single syllable sounds	Sits erect when supported	Secondary circular reactions
9	26	20–22	Repetition of sounds signals emotions	Stands with support	Coordinates secondary schemata
12	29.5	22–24	Single words—mama, dada	Walks when held by hand	Same
18	32	25–26	3–50 words	Grasps objects accurately, walks steadily	Tertiary circular reaction
24	34	27–29	50–250 words, 2–3 word sentences	Walks and runs up and down stairs	Representation

Answers

16. Babbling 17. holophrastic 18. cultural 19. grammatical 20. inner speech

CONCLUSION & SUMMARY

Our view of an infant today is of an individual of enormous potential, one whose activity and competence are much greater than originally suspected. It is as if a newborn enters the world with all its systems ready to function and eager for growth. What happens during these first two years has important implications for future development. Setbacks—both physical and psychological—will occur, but they need not cause permanent damage. From your reading in chapter 1, you realize that human infants show remarkable resiliency.

What are the major physical accomplishments of the infancy period?

- Newborns display clear signs of their competence: movement, seeing, hearing, interacting.
- Infants' physical and motor abilities influence all aspects of development.
- Techniques to assess infant competence and well-being are widely used today.
- Motor development follows a well-documented schedule.
- Infants can develop problems such as SIDS and FTT for a variety of reasons.

How do infants acquire information about their world?

- Infants are born with the ability to detect changes in their environment.
- Infants are capable of acquiring and interpreting information from their immediate surroundings.
- Infants from birth show preferences for certain types of stimuli.

What are the differences between Piaget's view of cognitive development in infancy and that of information processing?

- Infants, even at this early age, are attempting to answer questions about their world, questions that will continue to occupy them in more complex and sophisticated forms throughout their lives.
- One of the first tasks that infants must master is an understanding of the objects around them.
- Piaget's theory of cognitive development has shed considerable light on the ways that children grow mentally.
- A key element in understanding an infant's cognitive development is the role of memory.

How do infants acquire their language?

- Infants show rapid growth in their language development.
- Language acquisition follows a definite sequence.
- Language behaviors in infancy range from crying to the use of words and phrases.

KEY TERMS

Apgar
Apnea
Babbling
Brazelton Neonatal Behavioral Assessment Scale
Cooing
Coordination of secondary schemes
Crawling
Creeping
Egocentrism
Failure to thrive (FTT)
Habituation
Holophrases
Holophrastic speech
Language explosion
Neonate
Neurological assessment
Object permanence
Phonology
Pragmatics
Primary circular reactions
Reflex
Respiratory distress syndrome (RDS)
Secondary circular reactions
Semantics
Sensorimotor period
Sudden infant death syndrome (SIDS)
Syntax
Telegraphic speech
Tertiary circular reactions
Variable accommodation
Vocables

WHAT DO YOU THINK?

1. The shift from considering an infant as nothing more than a passive sponge to seeing infants as amazingly competent carries with it certain responsibilities. We can't be overly optimistic about a baby's abilities. Why? What are some of the more common dangers of this viewpoint?
2. Testing infants has grown in popularity these past years. You should consider some cautions, however. Remembering what you have read about infants in this chapter, mention several facts you would be careful about.
3. You have been asked to babysit your sister's 14-month-old baby. When you arrive, the mother is upset because she has been repeatedly picking up things that the baby has thrown out of the crib. With your new knowledge, you calm her down by explaining the baby's behavior. What do you tell her?
4. After reviewing the infancy work, what do you think about this period as "preparation for the future"? Select one phase of development (e.g., cognitive development) and show how a stimulating environment can help to lay the foundation for future cognitive growth.

CHAPTER REVIEW TEST

1. Which of the following is not a reflex?
   a. Breathing
   b. Sucking
   c. Swallowing
   d. Laughing

2. A _____ reflex is elicited by gently touching the infant's cheek.
   a. Moro
   b. rooting
   c. Babkin
   d. Babinski

3. _____ are brief periods when an infant stops breathing.
   a. Apnea
   b. Rooting
   c. Babbling
   d. Primary circular reactions

4. Depth perception in infants appears at
   a. birth.
   b. 7 to 10 days.
   c. 2 to 4 months.
   d. 4 to 5 months.

5. The Brazelton test assesses an infant's
   a. interaction with the environment.
   b. respiratory effort.
   c. reflex irritability.
   d. hearing.

6. Neurological assessment is not used for which of the following purposes?
   a. Identification of a neurological problem
   b. Treatment of a neurological problem
   c. Monitoring a neurological problem
   d. Prognosis about a neurological problem

7. The final area of the brain to develop is the
   a. sensory region.
   b. motor area.
   c. visual area.
   d. auditory area.

8. _____ is a disorder caused by the lack of a substance called surfactant.
   a. SIDS
   b. RDS
   c. AIDS
   d. FTT

9. When infants demonstrate a decrease in attention, this is called
   a. repression.
   b. habituation.
   c. egocentrism.
   d. permanence.

10. The Brazelton test is a type of
    a. survival assessment.
    b. motor assessment.
    c. play assessment.
    d. behavioral assessment.

11. Infants from _____ show preferences for certain types of stimuli.
    a. birth
    b. 10 days
    c. two months
    d. six months

12. An infant's search for novelty during the sensorimotor period is seen in
    a. object permanence.
    b. secondary circular reactions.
    c. coordination of secondary schemes.
    d. tertiary circular reactions.

13. Infants initially show memory ability during
    a. the first and second weeks.
    b. the first three months.
    c. third to sixth month.
    d. sixth to 12th month.

14. In the development of language, children about 1 year of age begin to use recognizable
    a. vocables.
    b. holophrases.
    c. phrases.
    d. sentences.

15. According to Piaget, the acquisition of language in children depends on
    a. cognitive structures.
    b. biology.
    c. reinforcement.
    d. language acquisition devices.

16. By _____ months a child begins to run.
    a. 9
    b 12
    c. 24
    d. 18

17. Which of the following is not a major accomplishment of the sensorimotor period?
    a. Reversibility
    b. Sense of space
    c. Causality
    d. Time sequence

18. _____ argue that cognitive development occurs by the gradual improvement of such cognitive processes as attention and memory.
    a. Psychoanalysts
    b. Behaviorists
    c. Humanists
    d. Information processing theorists

19. A 2-year-old child may have a vocabulary of as many as _____ words.
    a. 250
    b. 500
    c. 1,000
    d. 2,000

20. _____ believed the roots of language and thought were separate and only become linked through development.
    a. Chomsky
    b. Lenneberg
    c. Vygotsky
    d. Piaget

Answers

1. d 2. b 3. a 4. d 5. a 6. b 7. c 8. b 9. b 10. d 11. a 12. d 13. d 14. c 15. a 16. d 17. a 18. d 19. a 20. c