Module 2.1

Physical Development in Infancy

Learning Objectives

After reading Module 2.1, students will know

- how the human body and nervous system develop.
- how the environment affects the pattern of development.
- what developmental tasks infants must accomplish in this period.
- what the role of nutrition is in physical development.
- what sensory capabilities infants possess.

Key Terms and Concepts

Affordances
Brazelton Neonatal Behavioral Assessment Scale (NBAS)
Cephalocaudal principle
Cerebral cortex
Multimodal approach to perception
Myelin
Neuron
Nonorganic failure to thrive
Norms
Perception
Plasticity
Principle of hierarchical integration
Principle of the independence of systems
Proximodistal principle
Rapid eye movement (REM) sleep
Reflexes
Rhythms
Sensation
Sensitive period
State
Sudden infant death syndrome (SIDS)
Synapse
Synaptic pruning

Module Outline

I. Growth and Stability
   A. Physical Growth: The Rapid Advances of Infancy
      1. By age 5 months, the average infant's birthweight has doubled to about 15 pounds.
      2. By age 1, the infant's birthweight has tripled to approximately 22 pounds.

3. By the end of its second year, the average child weighs four times its birthweight.
4. By age 1, the average baby stands 30 inches tall.
5. By the end of the second year, the average child is 3 feet tall.
6. Not all parts of the body grow at the same rate.
7. The **CEPHALOCAUDAL PRINCIPLE** *states that growth follows a pattern that begins with the head and upper body parts and then proceeds to the rest of the body.*
8. The **PROXIMODISTAL PRINCIPLE** *states that development proceeds from the center of the body outward.*
9. The **PRINCIPLE OF HIERARCHICAL INTEGRATION** *states that simple skills typically develop separately and independently but are later integrated into more complex skills.*
10. The **PRINCIPLE OF INDEPENDENCE OF SYSTEMS** *suggests that different body systems grow at different rates.*

B. The Nervous System and Brain: The Foundations of Development
1. The *nervous system* comprises the brain and the nerves that extend throughout the body.
2. Infants are born with between 100 and 200 billion **NEURONS**, *the nerve cells of the nervous system.*
    a) Neurons communicate with other neurons by means of chemical transmitters that travel across the small gaps between neurons, known as *synapses*.
3. As the infant's experience in the world increases, neurons that do not become interconnected become *unnecessary and die off* – a process called **SYNAPTIC PRUNING.**
4. Neurons increase in size.
    a) Neurons become coated with **MYELIN**, *a fatty substance that helps insulate neurons and speeds transmission of nerve impulses.*
    b) The brain triples its weight in the first 2 years of life.
    c) The infant's brain is 3/4 its adult size by age 2.
5. As they grow, neurons become arranged by function.
    a) Some move into the **CEREBRAL CORTEX**, *the upper layer of the brain*.
    b) Others move to *subcortical levels*, which regulate fundamental activites such as breathing and heart rate and are below the cerebral cortex.
6. **PLASTICITY** *is the degree to which a developing structure (e.g., the brain) or behavior is susceptible to experience and is relatively great for the brain.*
    a) Infants who grow up in severely restricted environments are likely to show differences in brain structure and weight.
    b) Research with nonhumans reveals that a **SENSITIVE PERIOD** exists, *which is a specific but limited time span, usually early in an organism's life, during which the organism is particularly susceptible to environmental influences relating to some particular facet of development*.

C. Integrating the Bodily Systems: The Life Cycles of Infancy
1. Behavior becomes integrated through the development of various body **RHYTHMS**, *which are repetitive, cyclical patterns of behavior.*
2. An infant's **STATE** *is the degree of awareness it displays to both internal and external stimulation*
    a) Although irregular in infant brain waves become regular by age 3.
3. Changes are reflected in *brain waves* measured by a device called an *EEG, or electroencephalogram*.
4. The major state occupying the infant is sleep.

a) On average, newborns sleep 16-17 hours daily, ranging from 10 to 20 hours a day.
b) Sleep stages are fitful and "out of sync" during early infancy.
c) By the end of the first year most infants are sleeping through the night for a total of about 15 hours.
d) Infants have a cycle of sleep similar to but different than **REM — RAPID EYE MOVEMENT**, *the period of sleep found in adults and children and associated with dreaming.*
   (1) Brain waves are different than the dreaming sleep of adults.
   (2) This active REM-like sleep takes up half an infant's sleep at first.
   (3) Researchers think the function of REM sleep in infants is to provide a means for the brain to stimulate itself – a process called *autostimulation*.
   (4) Cultural practices affect the sleep patterns of infants.
e) **SUDDEN INFANT DEATH SYNDROME (SIDS)** *is a disorder in which seemingly healthy infants die in their sleep.*
   (1) It affects 1 in 1,000 infants in the U.S. annually.
   (2) No cause has been found.
   (3) It is the leading cause of death in children under 1 year old.
   (4) Since "back-to-sleep" was recommended by the American Academy of Pediatrics there has been a significant decrease in the number of SIDS deaths.

II. Motor Development
   A. Reflexes: Our Inborn Physical Skills
      1. Basic **REFLEXES**, *unlearned, organized, involuntary responses that occur automatically in the presence of certain stimuli, represent behavior that has survival value for the infant.*
         a) Swimming reflex
         b) Eye blink reflex
         c) Some reflexes stay throughout life; others disappear over time.
         d) Some researchers believe reflexes stimulate the brain toward development.
         e) Reflexes can serve as helpful diagnostic tools for pediatricians because they appear and disappear on a regular timetable.
         f) Reflexes are genetically determined and universal and may be remnants from the past.
         g) Reflexes evolved because they had, at one point in humankind's history, survival value.
         h) There appears to be cultural variations in the way reflexes are displayed.
   B. Motor Development in Infancy: Landmarks of Physical Achievement
      1. Gross Motor Skills
         a) By 6 months infants can move by themselves.
         b) Crawling appears between 8 and 10 months.
         c) Infants can walk holding on to furniture by 9 months and most can walk alone by 1 year.
         d) Most can sit unsupported by 6 months.
      2. Fine Motor Skills
         a) By 3 months infants can coordinate movements of limbs.
         b) Infants can grasp an object by 11 months.
         c) By age 2, infants can drink from a cup without spilling.
         d) Motor skill development follows a sequential pattern in

which simple skills are combined with more sophisticated ones.

3. It is important to keep in mind that developmental **NORMS** *are the average performance of a large sample of individuals of a certain age and mask substantial individual differences.*
    a) **BRAZELTON NEONATAL BEHAVIORAL ASSESSMENT SCALE (NBAS)** *is a measure used to determine infants' neurological and behavioral responses to their environment*.
        (1) Supplements the Apgar
        (2) It includes 27 categories of responses
            (a) Interactions with others
            (b) Motor behavior
            (c) Physiological control
            (d) Response to stress
    b) Norms should be based on large, heterogeneous samples.
    c) The time at which specific motor skills appear is in part determined by cultural factors.
    d) There are certain genetic constraints on how early a skill can emerge.

C. **Cultural Dimensions:** The Cultural Dimensions of Motor Development
    1. The time at which specific motor skills appear is in part determined by cultural factors.
    2. Activities that are intrinsic to a culture are more apt to be purposely taught to infants in that culture, leading to their earlier emergence.
    3. However, there are certain genetically determined constraints on how early a skill can emerge.

D. Nutrition in Infancy: Fueling Motor Development
    1. Without proper nutrition, infants cannot reach their physical potential and also may suffer cognitive and social consequences.
    2. *Malnutrition*, the condition of having an improper amount and balance of nutrients, produces several results.
        a) Slower growth
        b) Susceptibility to disease
        c) Lower IQ scores
    3. Risks are greater in underdeveloped countries and in areas with high poverty rates.
    4. Malnutrition can cause **MARASMUS**, *a disease characterized by the cessation of growth in infants.*
    5. Older children are susceptible to **KWASHIORKOR**, *a disease in which a child's stomach, limbs, and face swell with water.*
    6. In some cases, **NONORGANIC FAILURE TO THRIVE** *is a disorder in which infants stop growing due to a lack of stimulation and attention as the result of inadequate parenting.*
    7. Infant **OBESITY**
        a) defined as weight greater than 20 % above the average for a given height
        b) Research, although inconclusive, suggests an excess of fat cells (which remain in the body throughout life) early on may predispose an individual to be overweight as an adult.
    8. There appears to be no correlation between *obesity,* defined as weight greater than 20 % above the average for a given height, and later weight at age 16.

E. Breast or Bottle?
    1. For the first 12 months of life there is no better food for an infant than breast milk.

a) All essential nutrients
b) Natural immunity to childhood diseases
c) More easily digested
d) It is sterile, warm, and convenient for mother to dispense.
e) Some evidence it may enhance cognitive growth

F. Introducing Solid Foods: When and What?
1. Most babies can begin to eat solid foods at about 4 to 6 months.
a) Foods are introduced gradually.
b) *Weaning*, the cessation of breastfeeding, occurs on average in the U.S. at 3 to 4 months.
c) Experts recommend infants be breastfed for the first 12 months of life.

III. Development of the Senses
A. **SENSATION** *is the stimulation of the sense organs*.
B. **PERCEPTION** *is the sorting out, interpretation, analysis, and integration of stimuli involving the sense organs and brain.*
C. Visual Perception: Seeing the World
1. Newborn infants cannot see beyond 20 feet.
2. By 6 months, the average infant's vision is 20/20.
a) Gibson and Walk's "visual cliff" experiments showed that most infants between 6 and 14 months would not crawl over the apparent cliff.
b) This depth perception develops by 6 months of age.
3. Infants prefer to look at patterns and complex stimuli.
4. Infants prefer to look at faces.
D. Auditory Perception: The World of Sound
1. The ability to hear begins prenatally.
2. Infants are more sensitive than adults to high and low frequencies but not to the middle ranges.
3. *Sound localization* permits infants to discern direction from which a sound is emanating.
a) This skill is poorer in infants than adults because of infants' smaller heads.
b) It reaches adult level at 1 year.
E. Smell and Taste
1. Infants react to unpleasant tastes and smells from birth.
2. Newborns can detect their mother's smell, but only when breastfed.
3. Infants have an innate sweet tooth.
F. Sensitivity to Pain and Touch
1. Infants are born with the capacity to feel pain.
a) There seems to be a developmental progression in reactions to pain.
b) Research with rats suggests that exposure to pain in infancy may lead to permanent rewiring of the nervous system that results in greater sensitivity to pain during adulthood.
2. Touch is one of the most highly developed sensory systems in a newborn.
a) The rooting reflex is strong.
b) Infants gain information about the world through touch.
G. Multimodal Perception: Combining Individual Sensory Inputs
1. Eventually infants use the **MULTIMODAL APPROACH TO PERCEPTION** *in which information collected by various individual sensory systems is integrated and coordinated.*
2. Infant's perceptual growth is aided by **AFFORDANCES**, *the action possibilities that a given situation provides.*