CHAPTER 4
PHYSICAL DEVELOPMENT IN INFANCY
Physical Growth

• General principles
  ◦ Directionality: development that refers to how body proportions change
  ◦ Cephalocaudal: development advance “head to tail”
  ◦ Proximodistal: physical development from the center of the body outwards

• Norms and Individual Differences
  ◦ Represent average outcomes
  ◦ Wide variation in individual differences occur within normal range
  ◦ Growth affected by larger genetic and cultural factors
Figure 4.2: Changes in Body Proportions from Prenatal Development Through Adulthood
Figure 4.3: Differential Growth Rates in the Human Body
Development of the CNS

- Division of the nervous system that consists of brain and spinal cord
- Processes information and directs behavior
- Develops at many levels at the same time
- Reciprocal interplay between biology and context affects brain development
The Brain and Nervous System

• Develops rapidly during the first 2 years
The Brain

- Brain development
  - Subcortical structures
  - Limbic system
  - Cortex and association areas
Brain Cells

- Neurons
  - Cell body
  - Dendrites
  - Axon
Figure 4.4: Areas of the Brain
**Figure 4.5: The Neuron and Synapse**

- **Dendrites:** processes extending from the cell body that pick up signals from other cells.
- **Cell body:** contains the cell nucleus.
- **Action potential:** electrical charge that travels along the axon.
- **Myelin sheath:** fatty tissue that insulates a cell and speeds cell nerve conduction.
- **Axon:** the part of the cell that carries signals to other cells.
- **Neurotransmitter:** electrochemicals that cross the synapse between cells.
- **Axon terminal:**
- **Synapse:** the space between the axon terminal of one cell and the dendrite of another cell.
Synaptic Development

• Synaptogenesis
  ◦ The creation of synapses—connections between neurons
  ◦ Occurs rapidly during first years after birth
  ◦ Happens in spurts
  ◦ Brain weight quadruples by age 4

• Pruning
  ◦ Eliminating unused neural pathways and connections
Plasticity
- The brain’s ability to change in response to experience

Use it or Lose it
- Intellectually challenging environment creates a more complex network of synapses.
- So stimulate your baby!!!
Brain Plasticity

- **Experience-expectant processes**
  - Prewired processes in the brain

- **Experience-dependent processes**
  - Involve the active formation of new synaptic connections in response to experience

- **Types of plasticity**
  - **Modifiability:**
    - Development that asserts that, although cells are predestined for specific functions, their function can be changed
  - **Compensation:**
    - Cells substitute for others, permitting recovery of function after loss or damage
The Autonomic Nervous System

- Regulates many body activities without voluntary control
  - Many systems cycle in identifiable and predictable rhythms.
  - States of arousal
  - Regulation of sleep-wake cycle
Reflexes and Development

- Reflexes are simple, involuntary responses to certain stimuli
  - Approach reflexes
  - Avoidance reflexes
  - Other reflexes

- Most develop before birth and are normally present for four to eight months after birth
Reflexes and Behavioral States
Adaptive reflexes

- **Help survival**
  - Sucking
  - Withdrawal from pain
  - Opening and closing of pupil

- **Weak or absent reflexes warn of possible neuronal development problems**
Reflexes and Behavioral States

Primitive Reflexes

- Controlled by less sophisticated parts of the brain
  - Moro (or “startle”) Reflex
  - Babinski Reflex: Only babies do.
  - Stroke down the little-toe side of baby’s foot with your finger. Instead of curling or flexing his little toes downward, he will lift them up in extension and splay them out.

- These reflexes should disappear by six to eight months

- Persistence may indicate neurological problems
Patterns of sleep and wakefulness stabilize with age

- Neonates sleep 80% of the time
- By 8 weeks, babies begin to sleep through the night
- By 6 months, babies average 14 hours sleep per day
- Clear nighttime patterns and daytime naps are established
Reflexes and Behavioral States

- **Cries**
  - **Basic cry signals hunger** – rhythmic pattern
  - Anger cry – louder and more intense
  - Pain cry – very abrupt onset

- Cross-cultural studies suggest crying increases until 6 weeks then tapers off

- Prompt attention to crying in the first three months leads to less crying later
Video: The Newborn: Reflex Development
Physical Changes
Growth

• **By Age One**
  ◦ 10 – 12 inches of growth
  ◦ Infants triple their body weight

• **Around Age Two**
  ◦ Toddlers reach half their adult heights.
  ◦ Proportionately much larger heads
Motor Development

- Predictable sequence of developmental milestones
- Motor development influenced by parental expectations and childrearing practices.
- Milestones also affect parent-infant interaction.
- Dynamic systems theory
  - A theory that asserts that change in one area of development impacts others
Developing Body Systems and Motor Skills

- Motor skills interact with other aspects of physical development (Thelen)
- Muscles, bones, weight—all work together
- Opportunities to practice motor skills are important
Developing Body Systems and Motor Skills: BONES

- Changes in number and density of bones responsible for improved coordination

- **Ossification**
  - The process of hardening of the bones
  - Begins during prenatal development
  - Continues through puberty
  - Motor development depends on ossification
Developing Body Systems and Motor Skills

- **Muscles**
  - All are present at birth
  - Decline in muscle tissue to fat ratio occurs by age one

- **Lungs and Heart**
  - Rapid growth during first 2 years leads to *stamina*
Video: Infancy: Gross Motor
Video: Infancy: Fine Motor

PLAY
Sudden Infant Death Syndrome (SIDS)

- Leading cause of death in U.S. infants 1-12 months
- More common in babies with apnea (brief cessations in breathing)
- More frequent in babies who sleep on their stomachs
- Higher risk if mother smokes during pregnancy or smoking in the home after birth
Sensing and Perceiving

- Five senses
  - Seeing
    - Pattern, shape, and form
    - Depth
    - Movement
    - Color
  - Hearing
  - Touching
  - Tasting
  - Smelling
Sensory Skills
Vision

- **Rapid development of visual acuity**
  - Approximately 20-20 by about age 2

- **Color Vision**
  - Red, green and blue present by 1 month
  - Infant’s ability to sense color almost identical to an adult’s

- **Tracking**
  - The process of following a moving object
  - Initially inefficient but improves rapidly
Sensory Skills

- **Hearing**
  - Newborns hear adult voices well
  - High-pitched noises must be loud to be heard
  - Infants can locate direction of some sounds at birth

- **Smelling and Tasting**
  - Newborns react differently to each basic taste as early as birth

- **Touch and Motion**
  - Best developed of all senses
Perceptual Skills
Studying Perceptual Development

- **Preference Technique**
  - How long baby attends to a particular stimulus

- **Habituation/Dishabituation**
  - Loss of interest in a particular stimulus after repeated exposures

- **Operant Conditioning**
  - Vary the stimulus and study the learned responses
Looking Skills

Depth Perception

- **Binocular cues**
  - Involve both eyes
  - The closer an object, the more the view from the two eyes differs
  - Information from eye muscles tells about distance

- **Monocular cues**
  - Input from one eye
    - *Interposition*
    - *Linear perspective*

- **Kinetic cues**
  - Motion from objects or the eyes
Depth Perception

- **Visual Cliff click** – Gibson and Walk (1960)
  - Initially showed that 6-month old babies would not cross the visual cliff
  - **Recent Research**
    - Babies use kinetic information as early as 3 months
    - Binocular cues are used at 4 months
    - Linear perspective cues are used last, at 5 – 7 months
  - 3 month olds have some depth perception
What Babies Look At

- Babies initially scan for light/dark contrast.

- At 2 months, babies scan entire objects and scan for patterns.

- Caron and Caron (1981) suggest that by 3 – 4 months babies can find and pay attention to patterns.
What Babies Look At

Faces

- NOT uniquely interesting to infants
- Clearly prefer attractive faces
- Prefer mother’s face from the earliest hours of life
- Focus on internal features of the face at about age 2-3 months
Video: Newborns and Infants: Sensation and Perception
Figure 4.7: What the Infant Sees
Figure 4.8: The Visual Cliff
Video: Vision
Figure 4.9: Infant Perception of Motion and Object Continuity

Habituation display
Video: Smell
Video: Taste
Listening
Discriminating Speech Sounds

- At 1 month, can discriminate between *pa* and *ba*
- At 6 months, can discriminate between two-syllable words
- By 3 months, respond to male, female, and children’s voices similarly
- At 6 months, distinguish sound contrasts in any language; by 1 year old, this ability fades
- Prefer the mother’s voice above all others
Perceptual Systems

- **Intermodal perception**
  - Learn in one sense modality, transfer information to another modality

- **Nativists**
  - Believe most perceptual abilities inborn
  - Indeed many of these abilities are present at birth

- **Empiricists**
  - Claim most perceptual abilities are learned
  - Experience is needed to develop perceptual systems
Multimodal and Cross-Modal Perception

- Our senses interact with another and fuse perceptions into wholes.
- Information obtained by sight, sound, and touch are coordinated very early in life.
- Self-knowledge might be based on the coordination of information.
Experience and Early Perceptual Development

- Perceptual experience is critical for normal psychological growth and development.

- Perceptual development provides examples of the interplay between biology and experience.