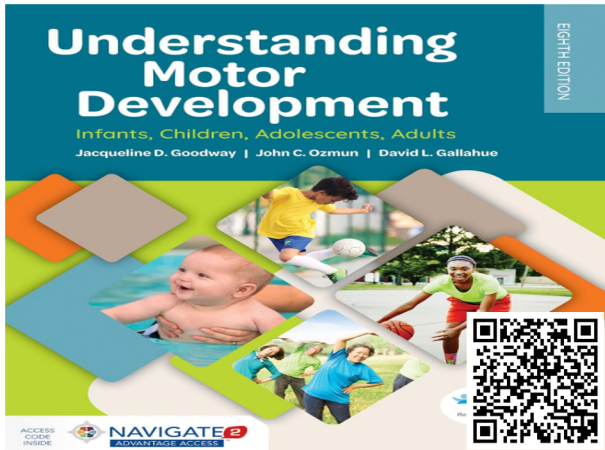


# Understanding Motor Development 8th Edition PDF

Visit the link below to download the full version of the ebook

## [DOWNLOAD NOW](#)



# Understanding Motor Development

Infants, Children, Adolescents, Adults

EIGHTH EDITION



Jacqueline D. Goodway  
John C. Ozmun  
David L. Gallahue

# Understanding Motor Development

Infants, Children, Adolescents, Adults

EIGHTH EDITION



Jacqueline D. Goodway  
John C. Ozmun  
David L. Gallahue

# **Understanding Motor Development**

**Infants, Children, Adolescents, Adults**



**Jacqueline D. Goodway, PhD**

Professor, Department of Human Sciences  
College of Education and Human Ecology  
and

Director, SKIP Early Childhood Development Lab  
The Ohio State University  
Columbus, Ohio

**John C. Ozmun, PED**

Professor  
Division of Health and Human Performance  
Indiana Wesleyan University  
Marion, Indiana

**David L. Gallahue, PhD**

Professor and Dean Emeritus  
School of Public Health  
Indiana University  
Bloomington, Indiana



JONES & BARTLETT  
LEARNING



*World Headquarters*

Jones & Bartlett Learning

5 Wall Street

Burlington, MA 01803

978-443-5000

[info@jblearning.com](mailto:info@jblearning.com)

[www.jblearning.com](http://www.jblearning.com)

Jones & Bartlett Learning books and products are available through most bookstores and online booksellers. To contact Jones & Bartlett Learning directly, call 800-832-0034, fax 978-443-8000, or visit our website, [www.jblearning.com](http://www.jblearning.com).

Substantial discounts on bulk quantities of Jones & Bartlett Learning publications are available to corporations, professional associations, and other qualified organizations. For details and specific discount information, contact the special sales department at Jones & Bartlett Learning via the above contact information or send an email to [specialsales@jblearning.com](mailto:specialsales@jblearning.com).

Copyright © 2021 by Jones & Bartlett Learning, LLC, an Ascend Learning Company

All rights reserved. No part of the material protected by this copyright may be reproduced or utilized in any form, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from the copyright owner.

The content, statements, views, and opinions herein are the sole expression of the respective authors and not that of Jones & Bartlett Learning, LLC. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not constitute or imply its endorsement or recommendation by Jones & Bartlett Learning, LLC and such reference shall not be used for advertising or product endorsement purposes. All trademarks displayed are the trademarks of the parties noted herein.

*Understanding Motor Development: Infants, Children, Adolescents, Adults, Eighth Edition* is an independent publication and has not been authorized, sponsored, or otherwise approved by the owners of the trademarks or service marks referenced in this product.

There may be images in this book that feature models; these models do not necessarily endorse, represent, or participate in the activities represented in the images. Any screenshots in this product are for educational and instructive purposes only. Any individuals and scenarios featured in the case studies throughout this product may be real or fictitious, but are used for instructional purposes only.

The authors, editor, and publisher have made every effort to provide accurate information. However, they are not responsible for errors, omissions, or for any outcomes related to the use of the contents of this book and take no responsibility for the use of the products and procedures

described. Treatments and side effects described in this book may not be applicable to all people; likewise, some people may require a dose or experience a side effect that is not described herein. Drugs and medical devices are discussed that may have limited availability controlled by the Food and Drug Administration (FDA) for use only in a research study or clinical trial. Research, clinical practice, and government regulations often change the accepted standard in this field. When consideration is being given to use of any drug in the clinical setting, the health care provider or reader is responsible for determining FDA status of the drug, reading the package insert, and reviewing prescribing information for the most up-to-date recommendations on dose, precautions, and contraindications, and determining the appropriate usage for the product. This is especially important in the case of drugs that are new or seldom used.

19086-1

### **Production Credits**

VP, Product Management: Amanda Martin

Director of Product Management: Cathy L. Esperti

Product Manager: Sean Fabery

Product Assistant: Andrew LaBelle

Senior Project Specialist: Dan Stone

Director of Marketing: Andrea DeFronzo

VP, Manufacturing and Inventory Control: Therese  
Connell

Manufacturing and Inventory Control Supervisor: Amy  
Bacus

Product Fulfillment Manager: Wendy Kilborn

Composition: Exela Technologies

Project Management: Exela Technologies

Cover Design: Kristin E. Parker

Media Development Editor: Rebecca Damon

Rights & Media Specialist: John Rusk

Printing and Binding: CJK Group, Inc. (Michigan)

Cover Printing: CJK Group, Inc. (Michigan)

Cover Image (Title Page): Top: ©

MesquitaFMS/iStock/Getty Images; Left: © Rob

Hainer/Shutterstock; Right: © Thomas Barwick/Getty

Images; Bottom: © Tom Wang/Shutterstock

### **Library of Congress Cataloging-in-Publication Data**

Names: Gallahue, David L., author. | Goodway, Jackie, author. | Ozmun, John C., 1958- author.

Title: Understanding motor development : infants, children, adolescents, adults / Jacqueline D. Goodway, John C. Ozmun, David L. Gallahue.

Description: Eighth edition. | Burlington, MA : Jones & Bartlett Learning, [2020] | David L. Gallahue's name appears first in previous edition. | Includes bibliographical references and index.

Identifiers: LCCN 2019015983 | ISBN 9781284174946 (pbk. : alk. paper)

Subjects: | MESH: Motor Activity | Growth and Development | Motor Skills | Physical Education and Training | Physical Fitness

Classification: LCC RJ133 | NLM WE 103 | DDC 152.3—dc23

LC record available at <https://lcn.loc.gov/2019015983>

6048

Printed in the United States of America

23 22 21 20 19 10 9 8 7 6 5 4 3 2 1

*To my daughter Blaize, who keeps the  
inner child in me alive, and Scott and my  
parents, who gave me the wings to fly. And  
to my Mum, my angel in heaven.*

**—Jackie D. Goodway**

---

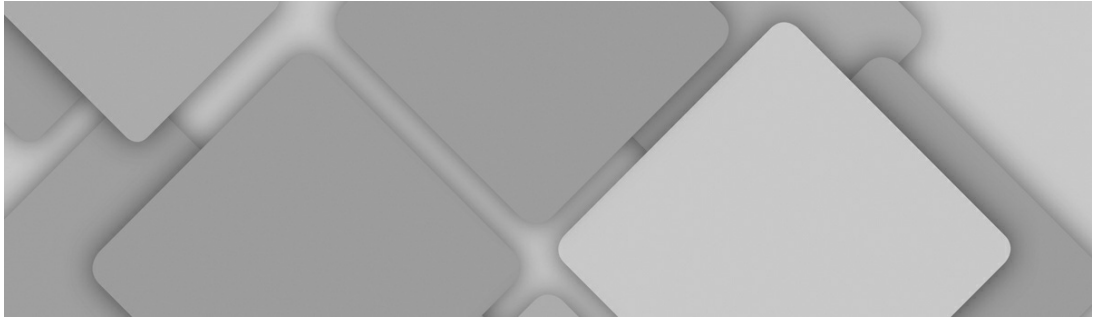
*To Ruth and my children, the treasures of  
my heart.*

**—John C. Ozmun**

---

*To Ellie, the sunshine of my life for 55  
years and counting.*

**—David L. Gallahue**



# Brief Contents

**Preface**

**Features of This Text**

**Acknowledgments**

**About the Authors**

**Reviewers**

## **UNIT I    Background**

---

**Chapter 1 Understanding Motor Development: An Overview**

**Chapter 2 Models of Human Development**

**Chapter 3 Motor Development: Theoretical Models**

**Chapter 4 Selected Factors Related to Motor Development**

## **UNIT II    Infancy**

---

**Chapter 5 Prenatal Factors Affecting Development**

**Chapter 6 Prenatal and Infant Growth**

**Chapter 7 Infant Reflexes and Rhythmical Stereotypies**

**Chapter 8 Rudimentary Movement Abilities**

**Chapter 9 Infant Perception**

## **UNIT III    Childhood**

---

**Chapter 10 Childhood Growth and Development**

**Chapter 11 Development of Fundamental Movement:  
Manipulation Skills**

**Chapter 12 Development of Fundamental Movement:  
Locomotor Skills**

**Chapter 13 Physical Development of Children**

**Chapter 14 Perceptual Motor Development and  
Motor Skill Interventions**

## **UNIT IV    Adolescence**

---

**Chapter 15 Adolescent Growth, Puberty, and  
Reproductive Maturity**

**Chapter 16 Specialized Movement Skills**

**Chapter 17 Fitness Changes During Adolescence**

## **UNIT V    Adulthood**

---

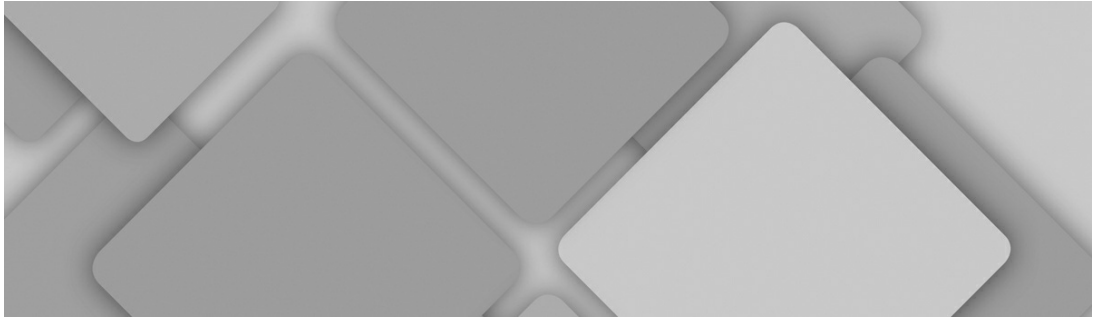
**Chapter 18 Physiological and Psychosocial  
Development in Adults**

**Chapter 19 Motor Performance in Adults**

**Appendix**

**Glossary**

**Index**



# Contents

**Preface**

**Features of This Text**

**Acknowledgments**

**About the Authors**

**Reviewers**

## **UNIT I    Background**

---

**Chapter 1 Understanding Motor Development: An Overview**

**Life Span Study of the Developmental Process**

**History of Motor Development**

**Methods of Studying Development**

**Age Classifications of Development**

**Terminology Used in Motor Development**

**Growth and Development**

**Domains of Behavior**

**The Psychomotor Domain**

**Movement Forms**

**Classifying Movement Skills**

**One-Dimensional Schemes**

## **Two-Dimensional Models**

### **Multidimensional Schemes**

#### **Summary**

#### **Questions for Reflection**

#### **Critical Readings**

#### **References**

## **Chapter 2 Models of Human Development**

### **Theoretical Models of Human Development**

#### **Conceptual Viewpoints of Development**

##### **Phase-Stage Theory**

##### **Developmental Task Theory**

##### **Developmental Milestone Theory**

##### **Ecological Theory**

##### **Behavior Setting Branch**

#### **Information Processing**

### **Two Leading Theories of Human Development**

#### **Erik Erikson**

#### **Jean Piaget**

#### **Summary**

#### **Questions for Reflection**

#### **Critical Readings**

#### **References**

## **Chapter 3 Motor Development: Theoretical Models**

## **Describing and Explaining Motor Development**

### **The Phases of Motor Development**

**Reflexive Movement Phase**

**Rudimentary Movement Phase**

**Fundamental Movement Phase**

**Specialized Movement Phase**

### **The Triangulated Hourglass: A Life Span Model**

### **The Mountain of Motor Development**

### **Summary**

### **Questions for Reflection**

### **Critical Readings**

### **References**

## **Chapter 4 Selected Factors Related to Motor Development**

### **Factors Within the Individual**

**Developmental Direction**

**Rate of Growth**

**Reciprocal Interweaving**

**Readiness**

**Critical and Sensitive Learning Periods**

**Individual Differences**

**Phylogeny and Ontogeny**

### **Factors in the Environment**

**Bonding**

## **Stimulation and Deprivation**

### **Physical Task Factors**

**Prematurity**

**Eating Disorders**

**Obesity and Overweight**

**Fitness Levels**

**Biomechanics**

### **Summary**

### **Questions for Reflection**

### **Critical Readings**

### **References**

## **UNIT II    Infancy**

---

### **Chapter 5 Prenatal Factors Affecting Development**

#### **Nutritional and Chemical Factors**

**Prenatal Malnutrition**

**Common Maternal Drugs**

**“Necessary” Maternal Drugs**

**Alcohol and Tobacco**

#### **Hereditary Factors**

**Chromosome-Based Disorders**

**Gene-Based Disorders**

#### **Environmental Factors**

**Radiation**

## **Chemical Pollutants**

### **Medical Problems**

**Sexually Transmitted Diseases/Infections**

**Maternal Infections**

**Rh Incompatibility**

**Teenage Pregnancy**

**Toxoplasmosis**

### **Prenatal Diagnosis and Treatment**

### **Vigorous Activity During Pregnancy**

### **Birth Process Factors**

**Birth Entry**

### **Summary**

### **Questions for Reflection**

### **Critical Readings**

### **References**

## **Chapter 6 Prenatal and Infant Growth**

### **Prenatal Growth**

**Zygotic Period (Conception–1st Week)**

**Embryonic Period (Second Week to Second Month)**

**Early Fetal Period (Third to Sixth Month)**

**Later Fetal Period (7th–9th Month)**

### **Infant Growth**

**Neonatal Period (Birth to 4 Weeks)**

**Early Infancy (4 Weeks–1 Year)**

**Later Infancy (1–2 Years)**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 7 Infant Reflexes and Rhythmical  
Stereotypies**

**Reflexive Behavior and Voluntary Movement**

**Diagnosing Central Nervous System Disorders**

**Primitive Reflexes**

**Moro and Startle Reflexes**

**Search and Sucking Reflexes**

**Hand-Mouth Reflexes**

**Palmar Grasping Reflex**

**Babinski and Plantar Grasping Reflexes**

**Asymmetrical and Symmetrical Tonic Neck  
Reflexes**

**Postural Reflexes**

**Labyrinthine and Optical Righting Reflexes**

**Pull-Up Reflex**

**Parachute and Propping Reflexes**

**Neck and Body Righting Reflexes**

**Crawling Reflex**

**Primary Stepping Reflex**

**Swimming Reflex**

**Rhythmical Stereotypies**

**Legs and Feet**

**Torso**

**Arms, Hands, and Fingers**

**Head and Face**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 8 Rudimentary Movement Abilities**

**Study of Infant Motor Development**

**Stability**

**Control of the Head and the Neck**

**Control of the Trunk**

**Sitting**

**Standing**

**Locomotion**

**Crawling**

**Creeping**

**Upright Gait**

**Manipulation**

**Reaching**

**Grasping**

**Releasing**

**Special Programs for Infants**

**Infant Aquatic Programs**

**Motor Assessment in Infancy**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 9 Infant Perception**

**Methods of Studying Infant Perception**

**Visual Perception**

**Contrast Sensitivity**

**Visual Acuity, Accommodation, and Peripheral Vision**

**Binocularity, Fixation, and Tracking**

**Depth Perception**

**Color Perception**

**Form Perception**

**Auditory, Olfactory, Gustatory, and Tactile Perception**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

## **UNIT III    Childhood**

---

### **Chapter 10 Childhood Growth and Development**

#### **Growth in Early Childhood**

#### **Development in Early Childhood**

**Physical and Motor Development Characteristics**

**Cognitive Development Characteristics**

**Affective Development Characteristics**

**Implications for the Developmental Movement  
Program**

#### **Growth in Later Childhood**

#### **Development in Later Childhood**

**Physical and Motor Development Characteristics**

**Cognitive Development Characteristics**

**Affective Development Characteristics**

**Implications for the Developmental Movement  
Program**

#### **Factors Affecting Child Growth and Development**

**Nutrition**

**Exercise and Injury**

**Illness and Climate**

**Secular Trends**

#### **Summary**

#### **Questions for Reflection**

#### **Critical Readings**

## **References**

### **Chapter 11 Development of Fundamental Movement: Manipulation Skills**

#### **Importance of Fundamental Motor Skills**

##### **Developmental Trajectory Model**

#### **Understanding the Development of FMS**

##### **Sequences of Fundamental Motor Skill Development**

##### **Dynamic Systems Theory and Stages of FMS**

#### **Manipulative Skills**

##### **Throwing**

##### **Catching**

##### **Kicking**

##### **Punting**

##### **Striking**

##### **Rolling**

#### **Summary**

#### **Questions for Reflection**

#### **Critical Readings**

## **References**

### **Chapter 12 Development of Fundamental Movement: Locomotor Skills**

#### **Development of Locomotor Skills**

#### **Running**

##### **Prerequisites to Running**

**Proficient Runners**  
**Development of Running**  
**Product Measures of Running**  
**Constraints in Running**

## **Galloping and Sliding**

**Prerequisites to Galloping & Sliding**  
**Proficient Gallopers**  
**Development of Galloping**

## **Skipping**

**Prerequisites to Skipping**  
**Proficient Skippers**  
**Development of Skipping**

## **Jumping**

**Prerequisites to Jumping**  
**Proficient Jumpers**  
**Development of Horizontal Jumping**

## **Hopping**

**Prerequisites to Hopping**  
**Proficient Hoppers**  
**Development of Hopping**

## **National Guidelines and Fundamental Motor Skills** **Standard 1**

### **Assessment of Fundamental Motor Skills**

**Test of Gross Motor Development (TGMD)**  
**Movement Assessment Battery for Children 2**

**Peabody Developmental Motor Scale–Second Edition (PDMS-2)**

**Bruininks-Oseretsky Test of Motor Proficiency (BOTMP, BOT-2)**

**Developmental Sequences**

**Which Assessment?**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 13 Physical Development of Children**

**Health-Related Fitness**

**Cardiovascular or Aerobic Endurance**

**Muscular Strength**

**Muscular Endurance**

**Joint Flexibility**

**Body Composition**

**Children’s Fitness Training**

**Aerobic Training**

**Strength Training**

**Flexibility Training**

**Health-Related Fitness and Movement Abilities**

**Performance-Related Fitness**

**Coordination**

**Balance**

**Speed**

**Agility**

**Power**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 14 Perceptual Motor Development and  
Motor Skill Interventions**

**Perceptual Development in Childhood**

**Visual Acuity**

**Figure-Ground Perception**

**Depth Perception**

**Visual-Motor Coordination**

**Perceptual Training**

**Perceptual-Motor Development in Children**

**What Is “Perceptual-Motor”?**

**The Perceptual-Motor Components**

**Body Awareness**

**Spatial Awareness**

**Directional Awareness**

**Temporal Awareness**

**Perceptual-Motor Activities**

**Intervening in the Motor Skills of Young Children**

**Developmental Delays and Gender Differences in  
Fundamental Motor Skills**

**Successful Kinesthetic Instruction for  
Preschoolers (SKIP)**

**SKIP Program Content**

**Motor Skill Intervention Research**

**Theoretical Framework of Motor Skill  
Interventions**

**Region/Country of Studies**

**Dose-Response: How Much Intervention Is  
Enough?**

**Pedagogical Approaches to Motor Skill  
Intervention – Child-Centered vs. Teacher-  
Centered**

**Different Types of Implementers of Motor Skill  
Instructions**

**Fidelity of Implementation**

**Providing Feedback to the Learner**

**Effect Sizes: Measuring the Effectiveness of the  
Intervention**

**Evidenced-based Principles for Motor Skill  
Interventions**

**Implications for Professional Practice**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

## **UNIT IV    Adolescence**

---

### **Chapter 15 Adolescent Growth, Puberty, and Reproductive Maturity**

#### **Adolescent Growth**

**Height**

**Weight**

**Heart and Lungs**

#### **Puberty**

**Sequence of Puberty**

**Hormonal Influences**

#### **Reproductive Maturity**

**Females**

**Males**

**Maturity Assessment**

#### **Summary**

#### **Questions for Reflection**

#### **Critical Readings**

#### **References**

### **Chapter 16 Specialized Movement Skills**

#### **Developmental Sequence of Specialized Movements**

**Transition Stage**

**Application Stage**

**Lifelong Utilization Stage**

#### **Youth Sports and Early Sport Specialization**

## **Fostering Improvement**

**Knowing the Learner**

**Cues to Teaching a New Movement Skill**

## **Levels and Stages of Movement Skill Learning**

**Fitts and Posner's Three Stages of Skill Learning**

**Gentile's Two Stages of Skill Learning**

**Combining Levels and Stages of Skill Learning**

**Open Motor Skills and Improving "Thinking Time"**

**Changing a Well-Learned Technique**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

## **Chapter 17 Fitness Changes During Adolescence**

### **Health-Related Fitness**

**Aerobic Endurance**

**Muscular Strength and Endurance**

**Flexibility**

**Body Composition**

### **Performance-Related Fitness**

**Running Speed**

**Jumping for Distance**

**Throwing for Distance**

**Balance**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

## **UNIT V    Adulthood**

---

### **Chapter 18 Physiological and Psychosocial Development in Adults**

**Why Do We Age?**

**Physiological Changes in the Adult Musculoskeletal  
System**

**Skeleton**

**Muscles and Joints**

**Central Nervous System**

**Circulatory and Respiratory Systems**

**Body Composition**

**Sensory Systems**

**Visual System**

**Auditory System**

**Proprioception**

**Psychosocial Development**

**Psychological Factors**

**Socialization Factors**

**Successful Aging**

**Summary**

**Questions for Reflection**

**Critical Readings**

**References**

**Chapter 19 Motor Performance in Adults**

**Reaction Time**

**Balance and Postural Control**

**Falls**

**Gait**

**Activities of Daily Living and Instrumental Activities  
of Daily Living**

**Automobile Driving**

**Elite Performance**

**Assessment**

**Summary**

**Questions for Reflection**

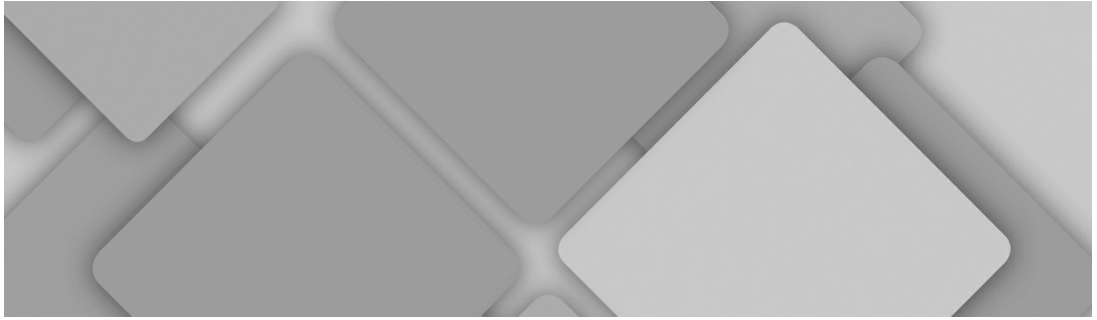
**Critical Readings**

**References**

**Appendix**

**Glossary**

**Index**



# Preface

## ► Audience

---

*Understanding Motor Development: Infants, Children, Adolescents, Adults, Eighth Edition*, is intended for students taking a first course in motor development. It is presented in an easy-to-understand and easy-to-use manner to be of significant value to educators from a variety of disciplines, including kinesiology, physical and occupational therapy, special education, physical education, early childhood education, and elementary and secondary education. This text provides both descriptive and explanatory profiles of the individual across the lifespan from conception through older adulthood.

## ► Approach

---

Development is a process that begins at conception and continues throughout life. This text discusses motor development from conception through older adulthood. By incorporating dynamic systems theory and phase stage theory, the Triangulated Hourglass Model provides the reader with a metaphor for conceptualizing both the explanatory and descriptive aspects of both the processes and products of motor development.

## ► Organization

---

**Unit I: Background** provides the reader with essential introductory information on the study of motor development. Chapter 1, “Understanding Motor Development: An Overview,” examines the history, methods of study, research problems, and terminology used in the study of motor development. Chapter 2, “Models of Human Development,” offers a discussion of developmental models of child development. Particular attention is given to dynamic systems theory as well as the works of Jean Piaget, Erik Erikson, and Robert Havighurst and the implications of each for motor development. In Chapter 3, “Motor Development: Theoretical Models,” theoretical frameworks for studying the process of motor development are presented. The Triangulated Hourglass metaphor, or heuristic device, is presented and serves as the organizational framework for the remainder of the text. The Mountain of Motor Development model is also presented and expanded upon. In Chapter 4, “Selected Factors Related to Motor Development,” there is an important discussion of the many critical factors within the Individual, Environment, and Movement tasks that influence the process of development throughout life.

**Unit II: Infancy** deals with a variety of important developmental topics of infancy. Chapter 5, “Prenatal Factors Affecting Development,” is devoted to discussion of those factors prior to birth that may affect later motor development. “Prenatal and Infant Growth” is the topic of Chapter 6. This chapter provides the reader with a descriptive profile of early growth processes. Chapter 7 examines “Infant Reflexes and Rhythmical Stereotypies” in the neonate and young infant. Particular attention is given to the integration of both into the expanding movement repertoire of the young child. Chapter 8, “Rudimentary Movement Abilities,” discusses the rapidly expanding movement repertoire of infants. The major

stability, locomotor, and manipulative tasks of this period are outlined and summarized. An extensive discussion of “Infant Perception” in Chapter 9 concludes the section on infancy. This chapter relates perceptual development to the motor behavior of infants.

**Unit III: Childhood** provides the reader with a wealth of important information about childhood motor development. Chapter 10, “Childhood Growth and Development,” offers a general overview of cognitive, affective, and motor characteristics during early and later childhood. This sets the stage for the three chapters that follow. Chapters 11 and 12, “Development of Fundamental Movement: Manipulative Skills” and “Development of Fundamental Movement: Locomotor Skills” explain how critical Fundamental Movement Skills emerge across childhood. These chapters provides a practical, easy-to-use, staging approach (i.e., initial stage, emerging stage, proficient stage, total body stages, and component stages) to observing and assessing the fundamental movement patterns of childhood. The following are provided for each Fundamental Movement Skill: a mechanically correct line drawing; descriptions of stages; a review of the Individual, Environmental, and Task constraints influencing each skill; and a summary of the research literature. “Physical Development of Children” is the topic of Chapter 13. A review of the latest information on children’s health-related fitness and performance-related fitness is presented along with information on fitness training for children. “Perceptual Motor Development and Motor Skill Interventions” is the topic of Chapter 14. Important information on a child’s developing perceptual abilities is provided. Then, the motor skill intervention literature is summarized including an in-depth understanding of one popular, evidenced-based intervention, the Successful Kinesthetic Instruction for Preschoolers (SKIP) program. Both of

these topics are synthesized with a view toward their complex interaction with the motor behavior of the individual.

**Unit IV: Adolescence** examines a number of important topics. Chapter 15, “Adolescent Growth, Puberty, and Reproductive Maturity,” opens this section with a wealth of essential and useful information about physical change during this critical developmental period. Chapter 16, “Specialized Movement Skills,” centers on the topics of specialized movement skill development, fostering improvement, and the developmental sequence of specialized movement skills. This is followed by a discussion of the “Fitness Changes During Adolescence” in Chapter 17 with a view toward the adolescent’s rapidly changing health-related and performance-related fitness.

**Unit V: Adulthood** provides the latest information available on the area of adult motor development from younger to older adults. Chapter 18, “Physiological and Psychosocial Development in Adults,” attempts to answer the question: Why do we age? A lively discussion is offered concerning changes in the adult musculoskeletal system, central nervous system, circulatory and respiratory systems, and sensory systems. Chapter 19, “Motor Performance in Adults,” examines reaction time, balance and postural control, falls, gait, activities of daily living, and the elite performer.

## ► **New to the *Eighth Edition***

---

The *Eighth Edition* has been significantly revised and updated to include the latest research, references, and suggested readings in the field. Tables and figures have also been updated throughout the text to reflect the latest research. Definitions and key terminology have been enhanced throughout for further clarity. Following is a

sampling of topics in each unit that are either new to this edition or greatly expanded upon since the previous edition:

## **Unit I: Background**

- Expanded explanations and discussions of leading theoretical perspectives on the processes and products of motor development across the lifespan
- Expanded discussion of historical perspectives
- Revised and clarified presentation of the Triangulated Hourglass Model of motor development and how it serves as a metaphor for conceptualizing the processes and products of motor development
- Enhanced description and discussion of the Mountain of Motor Development model
- Expanded explanation of dynamical systems theory and key constructs that are part of this theory, including Newell's constraints (i.e, Individual, Environmental, and Task)
- Explanation of stage theory, including the total body and component approaches to stage theory
- Addition of the Developmental Trajectory model of the relationship between motor development and physical activity mediated by perceived motor competence and physical fitness
- Summary of the literature of the relationship between motor development and physical activity
- Expanded discussion on risk factors affecting motor development including an updated overview of the relationship between obesity and motor development
- Updated International Perspectives on the processes and products of motor development
- Updated Developmental Dilemmas to stimulate critical thinking and discussion

- Additional imagery to bring enhanced meaning to the text

## **Unit II: Infancy**

- Updated data presented on vital statistics with infants
- Enhanced discussion of intervention strategies
- Updated International Perspectives on infancy
- Updated Developmental Dilemmas to stimulate critical thinking and discussion
- Inclusion of current information related to obesity in infancy
- Additional imagery to bring enhanced meaning to the text

## **Unit III: Childhood**

- Adjusted age ranges to reflect developmental rather than chronological timeframes
- Major expansion and new material for each of the locomotor and manipulative fundamental motor skills, incorporating:
  - Prerequisites necessary to perform the skill
  - Characteristics of a proficient performer of the skill (critical elements)
  - Summary of the Individual, Environmental and Task constraints that influence the skill and the implications to teaching this skill to children
  - Inclusion and explanation of the total body and component approaches to how each skill emerges
  - Updated and contemporary literature and its relevance to instructing children
  - Summary of the key findings from the literature with implications to working with children

- Enhanced discussion of gender-related differences with respect to fundamental motor skills
- Updated understanding of children's emerging perceptual motor skills
- Expansion of existing material and addition of new material relative to motor skill interventions, including:
  - Expanded discussion of developmental delays in motor skills and gender differences
  - New in-depth description of the Successful Kinesthetic Instruction for Preschoolers (SKIP) motor skill intervention program and relevance to teaching children
  - Using dynamical systems theory and Newell's constraints to design and implement developmentally appropriate instruction for children
  - Addition of a detailed breakdown of the motor skill intervention literature and implications for designing and delivering motor skill programs for children
  - Summary of the evidenced-based guidelines for teaching motor skills to children and professional practice
- Extensive updating of fitness-related materials to reflect current knowledge
- Increased focus on childhood obesity from the psychomotor and affective perspectives
- Updated International Perspectives on childhood motor development
- Updated Developmental Dilemmas to stimulate critical thinking and discussion
- Additional imagery to bring enhanced meaning to the text

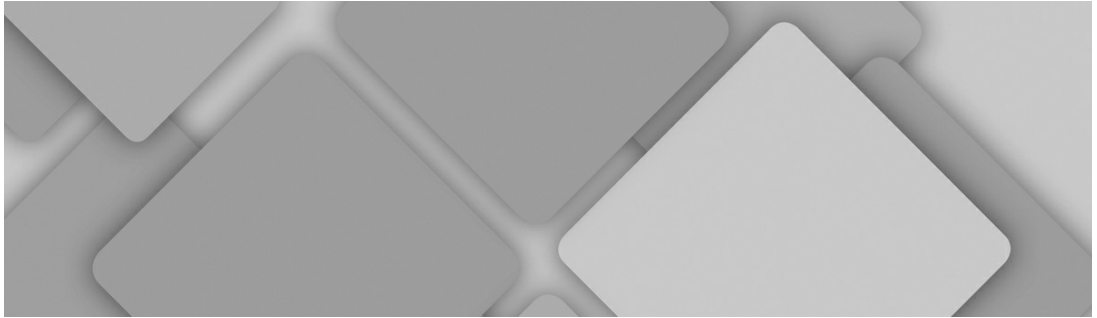
## **Unit IV: Adolescence**

- Adjusted age ranges to reflect developmental rather than chronological timeframes
- Extensive discussion of overweight and obesity issues during the pre-adolescent and adolescent periods
- Enhanced discussion related to the foundation of specialized movement skills
- Enhanced discussion related to the foundation of youth sport participation and early sport specialization
- Inclusion of discussion of Côté's Developmental Model of Sport Participation
- Extensive updating of fitness-related materials to reflect current knowledge
- Increased focus on childhood obesity from the psychomotor and affective perspectives
- Updated International Perspectives on motor development during adolescence
- Updated Developmental Dilemmas of adolescence to stimulate critical thinking and discussion
- Additional imagery to bring enhanced meaning to the text

## **Unit V: Adulthood**

- Expanded and updated information on aging and muscular strength characteristics
- Inclusion of discussion of Buettner's research on the Blue Zones as it relates to longevity
- Expanded discussion on the influence of physical activity and mental health
- Updated discussion on aging conditions
- Updated statistics on elite performance in older adults


- Updated International Perspectives on adult motor development
- Updated Developmental Dilemmas of adulthood to stimulate critical thinking and discussion
- Additional imagery to bring enhanced meaning to the text



# **Features of This Text**

## ► Key Terms and Chapter Competencies

Important terms that will be used and competencies that should be attained through careful and reflective reading are found at the beginning of each chapter. Take a few minutes to look these over in preparation for reading each of the chapters.



CHAPTER 1

# Understanding Motor Development: An Overview

---

**KEY TERMS**

Movement	Fundamental movement patterns	Motor skill
Motor control	Longitudinal method	Motor behavior
Motor development	Growth	Motor performance
Development	Cross-sectional method	Movement pattern
Motor learning	Mixed-longitudinal method	Sport skill
Movement skills	Biological age	Environmental context
Maturational	Motor	
Experience	Learning	

**CHAPTER COMPETENCIES**

Upon completion of this chapter, the reader will be able to:

- Be familiar with the research of several historical and contemporary scholars in motor development.
- Compare and contrast motor development with other studies in motor behavior (motor learning and motor control).
- Demonstrate knowledge of the various forms of analysis used in the study of motor development.
- Discuss advantages and shortcomings of the major methodologies associated with the study of change.
- Identify key methods of assessing biological maturity.
- List the chronological age classifications of human development across the life span.
- Define and apply terminology used in motor development.
- Discuss the advantages and shortcomings of various methods of classifying movement skills.

Describing and Explaining Motor Development 47

**KEY CONCEPT**

The processes and products of motor development across the lifespan may be conceptualized through use of an integrated ecological heuristic.

**CONCEPT 3.1**

Few comprehensive theoretical models of motor development exist, but there are commonalities in the models that do exist.

**CONCEPT 3.2**

Theoretical models attempt to describe and explain behaviors and may be inductive or deductive.

**CONCEPT 3.3**

A theory is a group of statements, concepts, or principles that integrate existing facts and lead to the generation of new facts. The **phases of motor development** presented in this chapter are not based

► **Describing and Explaining Motor Development**

Until the 1980s, interest in motor development had been concerned primarily with describing and cataloging data, with little interest in developmental models leading to theoretical explanations of behavior across the life span. This research was necessary and important to our knowledge base, but it did little to help us answer the critical questions of the underlying mechanisms that drive motor development and the factors that affect these processes. Only a limited number of comprehensive models of motor development exist, and there are still few comprehensive theories of motor development.

As motor development research has progressed, it has become much more theoretically grounded and contemporary work has strong theoretical foundations grounding the studies. The intent of this chapter is to present a comprehensive model of motor development, based on two specific theoretical viewpoints: **descriptive** phase-stage theory and **explanatory** dynamic systems theory. We will present this model in the form of an hourglass accompanied by an overlapping inverted triangle. Our intent here is to use this visual representation as a way to conceptualize both the descriptive products (hourglass) and explanatory processes (inverted triangle) of motor development as it typically unfolds across the life span. As with all

## ► Key Concepts and Chapter Concepts

At the beginning of each chapter, we provide a text box with a Key Concept. That concept is the overarching thought that we are attempting to convey in the chapter. Several more Concepts boxes throughout the chapter highlight particular topics of discussion. For us, understanding motor development is not a matter of memorizing isolated facts, but very much a matter of understanding important developmental concepts and being able to apply these concepts as a parent, teacher, coach, or therapist in real-life settings.

## ► Developmental Dilemmas

The study of human development is fascinating. It not only helps us better understand our own personal developmental journey and that of others, it also raises many interesting and perplexing questions. In the *Eighth Edition*, we explore different Developmental Dilemmas through boxes within each chapter.

Two Leading Theories of Human Development 37

### DEVELOPMENTAL DILEMMA

#### Al: A Story of Success

Several years ago, author David Colquhoun and his wife faced a very personal developmental dilemma. Our 17-year-old nephew, Alan, was in serious trouble with the law. Since the untimely death of his father when Alan was only 22 months of age, his life had gone steadily downhill. A grieving mother, an incompetent teacher, and unreliable father figures coupled with rejection, difficulty making friends, school failure, truancy, uncontrolled rage, and total disregard for authority finally culminated in several encounters with the police—the result being that the judge was prepared to send him to a prison for juveniles.

Upon learning of this, we hastily convened a family meeting and discussed the possibility of bringing Alan home from his home in the west out to Indiana to live with us. The court agreed to permit us to serve as his “parole officer” and, if he remained out of trouble for the next three years, his record as a juvenile would be expunged.

Thus began a three-year effort in tough love but with a definite frame of reference: Erik Erikson’s theory of psychosocial development. We focused on the first six stages in Erikson’s model, using them as the basis for structuring Alan’s life in the quest to help him become a responsible, law-abiding, contributing member of society.

Through a series of family-focused activities and living on a rural horse farm in southern Indiana, we were able to help Al (we never referred to him as Alan, but called him Al as a complete attempt for him to adopt a new identity). He learned to trust, he developed a sense of autonomy, initiative, industry, and personal identity. He even, for the first time, experienced what it was like to have a girlfriend and decent male friends who contributed to his emerging sense of intimacy.

Was it worth the time and effort? Absolutely. Al graduated from high school as the “Most Improved Student,” did a stint in the army, and now works as a graphic artist for a well-known company that advertises nationally.

With the help of Erik Erikson, we are able to tell the story of Al as a success story, rather than that of a life that went wrong from the very beginning and never recovered. Way to go, Al!

### INTERNATIONAL PERSPECTIVES

#### We Are Not Alone

Over the past 20 years, the United States has witnessed a secular trend (generational shift) in the percentage of Americans who are considered to be overweight or obese. Today, over two-thirds of all adults and one-third of all children are either overweight or obese. The statistics are startling because of the negative health consequences associated with obesity. But we are not alone. The obesity epidemic is now a worldwide phenomenon. Worldwide obesity has more than tripled since 1975, and in 2010 more than 1.9 billion adults were overweight (28% with 600 million being obese (34%)). Most of the world’s population lives in countries where overweight and obesity rates are higher than in the United States. Children across the world mirror adults, with 41 million children under the age of 15 and 146 million children and adolescents overweight or obese. Yes, the United States has the dubious honor of being number one in the percentage of overweight and obesity among its citizens, but our nearest followers, Mexico and New Zealand, are not far behind. Further, as Hungary, Austria, the United Kingdom, Canada, and Chile (CDC, 2017). Additionally, a large number of countries are reporting still relatively small, but nonetheless upward-trending, increases in their national obesity rates, including China and Indonesia—countries where much of their populations is shifting from rural areas to the cities (CDC, 2017; Statista, 2016).

It appears that a fundamental shift has occurred in the lifestyles of not only those living in North America, but in much of the rest of the world, also. Welcome to the global community. What should we do to address this issue?

## ► International Perspectives

Although human growth and development is a universal process, perspectives on various aspects of that process differ depending on cultural norms, ethnicity, socioeconomic conditions, and a host of other factors. In this edition, we bring some of these perspectives to light with a box in each chapter focusing on varying International Perspectives. These features should not only be interesting to read and consider, but should also generate thought-provoking discussion.

## ► Figures and Tables

Throughout the text, we have included a wide variety of figures and tables. They are intended to synthesize information and to provide a visual reference for better understanding motor development.

Locomotion 135

**FIGURE 8.2** Three stages in gaining a standing posture: (a) 6 months, (b) 10 months, and (c) 12 months.

Locomotor Task	Selected Abilities	Approximate Age of Onset
Horizontal movement	Creeping	8 months
	Crawling	9 months
	Walking on all fours	11 months
Upright gait	Walks with support	8 months
	Walks with hand holds	10 months
	Walks with lead	11 months
	Walks alone (hand held)	12 months
	Walks alone (hand held)	13 months

crawling. Crawling generally appears in the infant by 6 months but may appear as early as 4 months.

**Creeping**  
Creeping evolves from crawling and often develops into a highly efficient form of locomotion for the infant. Creeping differs from crawling in that the legs and arms are used in opposition to one another. The infant’s first attempts at creeping are characterized by deliberate movements of one limb at a time. As the infant’s proficiency increases, movements become asynchronous and more rapid. Most efficient creepers use a **contralateral pattern** (right arm and left leg). There is some evidence that suggests that infants who had skipped crawling and moved directly to creeping were less efficient in their creeping movements than those who experienced crawling initially (Adolph, Vereijken, & Denny, 1998). **FIGURE 8.4** shows a visual representation of contralateral creeping.

**FIGURE 8.3** Crawling

neck, and trunk. In a prone position and using a **homolateral pattern**, the infant may reach for an object in front of her, raising her head and chest off the floor. On coming back down, the outstretched arms pull her back toward the feet. The result of this combined effort is a slight sliding movement forward (**FIGURE 8.3**). The legs are usually not used in these early attempts at

### Questions for Reflection

1. The vast majority of pregnancies are uneventful and result in a healthy newborn. What could you and your partner do to help ensure a healthy pregnancy and positive outcome?
2. Alcohol and tobacco use during pregnancy can have severe negative effects on the unborn child. What are they, and why, in your view, do some expectant parents continue to smoke and/or drink during pregnancy?
3. What are primary contributors to any country's infant mortality rate and how might they be remedied?
4. Heredity plays an important role in both chromosomal and gene-based disorders. What familial factors need to be considered prior to becoming pregnant?
5. What about exercise during pregnancy? What activities are recommended and which ones should be avoided?

## Questions for Reflection

A list of questions to consider is also provided at the conclusion of each chapter. Take time to look these over and see how well you can answer them. They are intended to serve as a guide to better understanding motor development.

## Critical Readings

At the conclusion of each chapter, we provide a brief list of Critical Readings for those interested in learning more about the topics covered. We have selected these carefully with the intent of providing the reader with additional information from top authorities in their respective fields.

### Critical Readings

American College of Obstetricians and Gynecologists (ACOG). (2017). Prenatal alcohol exposure, pregnancy, FET, and prognosis. Retrieved from <https://www.acog.org/Patients/FAQs/Alcohol-and-Pregnancy>

American College of Obstetricians and Gynecologists (ACOG). (2017). Folate and pregnancy: learned from <https://www.acog.org/Patients/FAQs/Folate-During-Pregnancy>

Center for Disease Control and Prevention. (2015). Alcohol Use in Pregnancy. *Fetal Alcohol Spectrum Disorder Homepage*. Retrieved from <https://www.cdc.gov/ncbddd/fetalalcoholuse.html>

Center for Disease Control and Prevention. (2012). Folic acid and prevention of spina bifida and other neural tube defects 10 years after the U.S. Public Health Service recommendation. *Morbidity and Mortality Weekly Report*, 61, 1-3.

Center for Disease Control and Prevention. (2008). Update on neural prevalence of major birth defects—Atlanta, Georgia, 1979–2003. *Morbidity and Mortality Weekly Report*, 57(11), 1-5.

Gilbert-Ramirez, S. (2015). Neurogenic causes of malnutrition. *Annals of Clinical Laboratory Science*, 40, 99-114.

Harmon, E. W. (2010). *Children* (14th ed.) (Chapter 15). New York: McGraw-Hill.

Williams, J. E., Smith, V. C., & the AAFP Committee on Tobacco Use. (2015). Fetal alcohol spectrum disorder. *Pediatrics*, 136(1), 193-199. DOI: 10.1542/peds.2015-2113

Wing, C. H., & Samard, A. B. (2014). Pregnancy and exercise guidelines: 180 years makes a difference. *ACSM's Health & Fitness Journal*, 20, 8-9.

### References

Center for Disease Control and Prevention (CDC), National Center for Health Statistics. (2006). Growth charts for boys and girls aged 2 to 20 years. Retrieved April 21, 2019 from [https://www.cdc.gov/growthcharts/clinical\\_charts.htm](https://www.cdc.gov/growthcharts/clinical_charts.htm)

Balling, S. Y., Herman-Giddens, M. E., Lee, P. A., Seltman, S. G., Bull, A., Swanson, T. L., ... & Park, S. H. (2002). Examination of US puberty timing data from 1980 to 1994 for secular trends. *Paediatrics*, 110, 1072-1076.

Greer, F. R., Koepsell, N. B., & the American Academy of Pediatrics Committee on Nutrition. (2008). Optimizing bone health and calcium intakes of infants, children, and adolescents. *Pediatrics*, 121, 578-580.

Litaker, P. (2008). Nutrition and growth. *Journal of Clinical Research in Pediatric Endocrinology*, 1, 137-143.

Matta, R. M., Bouchard, C., & Bar-Or, O. (2000). Growth, maturation, and physical activity. *Unit and*. Champaign, IL: Human Kinetics.

Herman, V. B., Bouchard, C., Gellera, L. F., Franco, M., Martin, P. A., Gombosi, R., ... & Swain, A. L. (2011). Long lasting effects of malnutrition. *International Journal of Environmental Research and Public Health*, 8, 1817-1846.

Peterson, E. L. (1967). *Guide for Summating Children*. The Netherlands: Royal Vignette Ltd.

Shelton, N. H. (1994). *Atlas of Motor Skills for Summating the Adult Mind*. New York: Guilford Publishing Company.

Shelton, N. H., Stevens, S. L., & Tucker, W. B. (1980). *The Science of Human Posture*. New York: Harper.

## References

We provide a list of References at the end of each chapter. These references have been selected because of their timeliness and because they represent seminal works in the particular area of motor development being discussed.

## Glossary of Terms

Words have meaning, and it is important in the field of motor development, as with any other movement science, to be certain we are using terminology that conveys similar meaning. The end-of-text Glossary provides a brief definition of key terms highlighted throughout the text. This is done to ensure that we and our readers worldwide are "on the same page" when discussing a topic.

## Glossary

### A

**Abilities** One's present level of functioning in a particular movement skill. During infancy especially, movement abilities are a function of biological maturation; later, environmental influences impact one's abilities.

**Accelerometer** An electrochemical device worn by the subject that detects and records motion in a single plane or in multiple planes.

**Accommodation** Adaptation that the child must make to the environment when new and incongruent information is added to his or her repertoire of possible responses. A process that reaches outward toward reality and results in a visible change in behavior.

**Accommodation (visual)** The ability of the lens of each eye to vary its curvature to bring the retinal image into focus.

**Activity Concepts** Knowledge of where the body should move in terms of patterns, formations, risks, and strategies.

**Activity Theory** A theory of aging that states that as adults grow older they require interaction with other people and continual physical activity to be happy and satisfied.

**Activities of Daily Living** Movement-oriented tasks that individuals carry out throughout their lives that are required for basic everyday needs.

**Adaptation** The process of making adjustments to environmental conditions and internalizing these adjustments through the complementary processes of accommodation and assimilation.

**Adolescent Growth Spurt (Climacteric Period)** The adolescent growth spurt that lasts up to 4½ years.

**Advanced/Fine-Tuning Level** The third stage of learning a movement skill characterized by the performer gaining a complete understanding of the skill. At this level, the skill is performed smoothly, fluidly, and in a highly coordinated manner. The performer places emphasis on refining and fine-tuning the skill.

**Aerobic Endurance** The ability to perform numerous repetitions of a stressful activity requiring considerable use of the circulatory and respiratory systems.

**Affordances** Factors that tend to promote or encourage developmental change.

**Ageism** Stereotyping or discriminating against older adults on the basis of prejudice.

**Age Markers** Absence of maturation that appear in the older brain and increase in number as the brain continues to age.

**Agility** The ability to change direction of the entire body quickly and accurately while moving from one point to another.

**Air Displacement Plethysmography** A procedure for determining body composition that differs from hydrostatic weighing in that it incorporates air displacement to a chamber rather than water displacement in a tank.

**Algorithm** A procedure or set of rules to follow that will lead to the solution of a given problem. From a dynamic systems perspective of development, algorithms are used to predict and explain motor behavior.

**Amnorrhea** The temporary or permanent cessation of menstrual periods of an adolescent or adult female who previously experienced a regular cycle.

**Anabolic Hormones** Muscle-enhancing hormones such as human growth hormone and testosterone.

**Anorexia Nervosa** A severe emotional disorder typified by an aversion to food and an obsession with fitness that may result in death.

**Antioxidant** A substance that when ingested prevents or inhibits oxidation by binding with free radicals before they harm healthy body cells. Serves as a basis for a theory of aging-reversal intervention.

**Apoptosis** The process of programmed cell death.

**Application Stage** The stage within the specialized movement phase that represents a heightened awareness of personal physical assets and limitations and where more complex skills are refined and used in official sports and designated recreational activities for both leisure and competition.

**Arteriosclerosis** An age-related condition in which the arterial walls become less elastic.

**Assimilation** Interpretation of new information based on present interpretations by taking in information from the environment and incorporating it into one's existing cognitive structures.

**Assistive Stage** The movement skill learning stage at which the learner is able to make connections of environmental cues and associate them with the requirements of the movement task.

**Atherosclerosis** A cardiovascular disease represented by fatty deposits collecting within arteries.

**Atrophy** A decrease in the size of muscle fibers.

**Auditory Perception** The ability to receive and process information that is obtained by the sense of hearing.

## For the Instructor

Qualified instructors can also request access to a full suite of instructor resources, all of which have been revised to reflect the content of the *Eighth Edition*. These resources include the following:

- Test Bank
- Slides in PowerPoint format
- Instructor Manual

Additionally, lab activities and curated video content are available online for both students and instructors.

# Index

- preconceptual phase, [165](#)
- exercise and injury, [172–173](#)
- illness and climate, [173–174](#)
- later childhood
  - affective development characteristics, [170](#)
  - body mass index, [161](#), [163](#), [164](#)
  - cognitive development characteristics, [170](#)
  - developmental movement program, [170–171](#)
  - height (stature) and weight growth charts, [161](#), [162](#)
  - physical and motor development characteristics, [169–170](#)
  - striking, [169](#)
  - verge of growth spurts, [168](#)
- nutrition, [171–172](#)
- secular trends, [174](#)
- Children’s fitness training
  - aerobic training, [254–255](#)
  - flexibility training, [256–257](#)
  - strength training, [255–256](#)
- Chimeric antigen receptor (CAR), [100](#)
- Chlamydia, [97](#)
- Chorionic villus sampling (CVS), [100](#)
- Chromatic intensity, [152](#)
- Chromosome-based disorders, [93–94](#)
- Chronic malnutrition, [166–167](#), [172](#)
- Chronosystem, [32–33](#)
- Circulatory system, [370–371](#)
- Circumpubertal period, [302](#)
- Closed task, [16–17](#)
- Clustered, regularly interspaced short palindromic repeats (CRISPR), [100](#)
- Cognitive development characteristics
  - early childhood, [166–167](#)
  - later childhood, [170](#)
- Cognitive development theory, [25–26](#)
- Cognitive domain, [12](#)