

Nutrition

ACROSS LIFE STAGES

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5 Wall Street
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www.jblearning.com

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10223-9

Production Credits

VP, Executive Publisher: David D. Cella
Acquisitions Editor: Sean Fabery
Associate Editor: Taylor Maurice
Director of Production: Jenny L. Corriveau
Associate Production Editor: Alex Schab
Director of Marketing: Andrea DeFronzo
VP, Manufacturing and Inventory Control: Therese Connell

Composition: Integra Software Services Pvt. Ltd.
Cover Design: Theresa Manley
Rights & Media Specialist: Merideth Tumas
Media Development Editor: Shannon Sheehan
Cover Image and Title Page: © Monkey Business Images/Getty Images
Printing and Binding: LSC Communications
Cover Printing: LSC Communications

Library of Congress Cataloging-in-Publication Data

Names: Bernstein, Melissa, author. | McMahon, Kimberley, author.
Title: Nutrition across life stages / Melissa Bernstein and Kimberley McMahon.
Description: First edition. | Burlington, Massachusetts : Jones & Bartlett Learning, [2018] | Includes bibliographical references.
Identifiers: LCCN 2016054750 | ISBN 9781284102161
Subjects: | MESH: Nutritional Physiological Phenomena | Diet
Classification: LCC RA776.75 | NLM QU 145 | DDC 613.2--dc23
LC record available at <https://lccn.loc.gov/2016054750>

6048

Printed in the United States of America
21 20 19 18 17 10 9 8 7 6 5 4 3 2 1

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DEDICATION

Nutrition Across Life Stages is dedicated to my grandmother, Cherie Fine, who passed away at the age of 95 as we were nearing the completion of this edition. She had a special gift of connecting with people of all ages. Everyone who was fortunate to be a part of her life experienced her warmth, generosity, and wisdom. May her memory be a blessing.

—Melissa Bernstein

Nutrition Across Life Stages is dedicated to my three children. May they always see the value in making good choices for their health and well-being, and that they set good examples for others.

—Kimberley McMahon

FOREWORD

In *Nutrition Across Life Stages*, Melissa Bernstein and Kimberly McMahon take us across the life cycle with scientific clarity, covering the intersection between nutrition and health from preconception to adolescence to older adulthood. Over the course of this whirlwind trip, the authors raise insightful questions vital to the study of life cycle nutrition. What are the benefits and disadvantages of iron supplements? Can being underweight affect a pregnancy? Why is it important for a woman to take folic acid before she becomes pregnant? The authors discuss which substances found in the home or workplace can make it more difficult for a woman to become pregnant or to provide a healthy environment for her baby. Has she been exposed to toxic substances such as lead, mercury, pesticides, solvents, or radiation? These conditions are reviewed in detail.

Bernstein and McMahon are particularly good at citing the latest studies to show the consequences of dietary

decisions. Vitamin D deficiency, for example, is a major, unrecognized epidemic in adult women of childbearing age and can result in significant health problems in children born to these women. What about women who are strict vegetarians? Can they meet all their nutritional needs?

A very strong and compelling part of the book is the material related to the older adult and geriatric population. The authors expertly discuss the role of nutrition in the management of acute or chronic conditions specific to mature adults, such as drug–nutrient interactions, depression, anorexia of aging, arthritis, osteoporosis, overweight and obesity, and Alzheimer’s disease. Given the increased role registered dietitian nutritionists now play in health-care for older adults, the latter part of the book becomes a veritable page turner.

Paul Insel, PhD
Stanford University

PREFACE

Welcome to *Nutrition Across Life Stages*! This text covers topics applicable and relevant for entry-level Nutrition and Dietetics students who are focusing their study on nutritional requirements and challenges during each life stage. As such, *Nutrition Across Life Stages* includes chapters highlighting clinical-, health-, and disease-related topics specific to each age group that provide students with a knowledge and understanding of prevalent nutritional concerns from preconception to advanced age. Throughout, we as authors have strived to incorporate topics of special interest and to break down complex topics into key components to improve student understanding and build their practical knowledge base.

In writing this text, we kept in mind the needs of undergraduate students enrolled in an introductory life cycle nutrition course. As such, our aim has been to map to the way these courses are taught in a Nutrition and Dietetics program; however, we hope Nursing programs and programs that offer nutrition certification will also find this book a good fit.

The Goal of this Text

Good nutrition is a critical component at every stage of life, from preconception to end-of-life care. The maintenance of good health for all ages requires approaches that recognize multiple levels of influence on the individual and the impact of social, cultural, environmental, organizational, and medical factors. At any given age, there are significant challenges to healthy eating, especially for those affected by chronic conditions, physical limitations, and financial constraints; those who are racial and ethnic minorities; and those who reside in potentially challenging environments. More attention, resources, and nutrition expertise are needed to meet the food and nutrition requirements of vulnerable populations so that they can live healthfully with a good quality of life at every stage of life. Healthcare providers have opportunities to develop care plans that can help individuals of all ages promote personal well-being. Providing targeted and personalized nutrition guidance, services, and programs is vital to making a positive impact in the lives of all people.

As authors on two well-established introductory nutrition texts—*Nutrition* and *Discovering Nutrition*—we aim to keep our texts current and engaging for instructors and students alike. Having taught Life Cycle Nutrition ourselves, we saw a need for a fresh approach to

this material. Learning about the varying needs and challenges of different age groups begins with a solid foundation in nutrition basics, before then applying that knowledge to different ages, environments, challenges, and medical conditions. By using an approach that begins with normal nutrition and then considers alterations in nutritional needs and challenges resulting from common diseases and conditions that affect individuals at various ages, *Nutrition Across Life Stages* strives to keep students engaged and thinking critically in order to creatively apply their knowledge to problem-solving challenging real-life scenarios. Our aim is to make learning the material approachable, interesting, relevant, and fun without feeling overwhelming. We believe *Nutrition Across Life Stages* accomplishes this by presenting fresh pedagogy and engaging, student-centered learning activities that appeal to various learning styles.

Nutrition Across Life Stages facilitates active and participatory learning by providing many opportunities for classroom discussion and active engagement, presenting students with a multidimensional approach to the material. Discussion prompts and learning activities embedded throughout the text are designed to facilitate personalized teacher interaction with students. In lieu of rote lecturing, these endeavor to create a dynamic learning experience, whether they're used in a traditional classroom, as part of an online curriculum, or some hybrid of the two.

In crafting this text, we wanted to avoid categorizing older adults by chronological age. As a result, this is the first life cycle nutrition text to break out coverage of older adults across three unique chapters. Chapter 14, "Older Adult Nutrition," discusses normal nutrition for otherwise healthy older adults, while Chapter 15, "Geriatric Nutrition," highlights topics relevant to those who are frail, ill, and whose health is failing. Finally, Chapter 16, "Nutrition for Health and Disease in Older Adults and Geriatrics," addresses common health-related situations that require additional nutrition consideration.

Organization of the Text

We wrote *Nutrition Across Life Stages* with the typical Life Cycle Nutrition course in mind—that is, one focused on normal nutrition. *Nutrition Across Life Stages* begins in Chapter 1 with an overview of normal nutrition, national nutrition guidelines, and

recommendations. Subsequent chapters then follow a consistent pattern: first, normal nutritional needs at two to three life stages are presented, followed by a chapter discussing the nutritional implications of health and common conditions and diseases, their consequences, and treatment for those life stages. The text reviews the life cycle progressively by breaking it into the following stages:

- Preconception
- Pregnancy
- Lactation
- Infancy
- Early childhood
- Preadolescence
- Adolescence
- Adulthood
- Older adulthood
- Geriatrics

The last two categories aren't necessarily chronological but rather more categorically based on health status in old age, an organizing principle unique to this text.

Features and Benefits

Nutrition Across Life Stages incorporates a strong array of pedagogical features, including several that contain a strong visual component. These are deployed consistently across chapters, ensuring a uniform learning experience for the student.

Each chapter begins with a brief Chapter Outline, along with a series of Learning Objectives that establish what the chapter seeks to convey to the reader. Toward the beginning of each chapter, a Case Study is also introduced that is directly relevant to the content being discussed. These case studies are progressive and revisited throughout the chapter; questions tied to each Case Study have been included that can be used for self-study or as part of a classroom assignment. Additionally, each section within each chapter begins with a *Preview* statement and ends with a summarizing *Recap* that includes questions that allow the reader the opportunity to identify key concepts.

Within the chapters, several boxed features appear. These include the following:

- *The Big Picture* is an enhanced visual feature that incorporates key photos, diagrams, graphs, and illustrations to help visual learners by highlighting key concepts and breaking down tough concepts to their constituent components.
- *News You Can Use* presents topics of special interest to students, usually tied to current research in nutritional science.
- *Let's Discuss* provides topics that are meant to trigger engaging and insightful conversations in the classroom.

Each chapter concludes with a Learning Portfolio that contains the following:

- Visual Chapter Summary
- Key Terms
- Discussion Questions
- Activities
- Study Questions
- Weblinks

The Complete Learning Package

Nutrition Across the Life Stages provides instructors with a full suite of resources, including:

- Test Bank, containing more than 500 questions
- Slides in PowerPoint format, featuring more than 350 slides
- Image Bank, collecting photographs and illustrations that appear in the text
- Instructor's Manual, including an array of useful instructor tools:
 - Learning Objectives
 - Chapter Outlines
 - Answers to in-text Case Study questions
 - Answers to in-text Study Questions
 - Answers to in-text Discussion Questions
 - Nursing Notes, highlighting content especially relevant to Nursing students

Melissa Bernstein
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THE PEDAGOGY

Nutrition Across Life Stages incorporates an array of pedagogical features in order to facilitate active student engagement and class discussion.

The **Chapter Outline** at the beginning of each chapter gives students a preview of topics that will be covered.

Learning Objectives focus students on the key concepts of each chapter and the material they will learn.

A **Case Study** is introduced at the beginning of each chapter, illustrating how topics discussed in the text might appear in real-life. These case studies are revisited throughout the chapter, building in concert with the foundational material. As the case study progresses, questions are incorporated to encourage active student engagement with the scenarios.

Key Terms are in boldface type the first time they are mentioned, with definitions appearing in the end-of-chapter Learning Portfolio.

The screenshot shows the beginning of Chapter 10, 'Adolescent Nutrition'. At the top, there is a photograph of a group of diverse teenagers sitting on a lawn, eating and talking. Below the photo is the chapter title 'CHAPTER 10 Adolescent Nutrition' and the authors 'Katarina Berry, MS, RD, LDN, and Julie Cooper, MS, RD, LDN'. The page is divided into two main columns: 'Chapter Outline' and 'Learning Objectives'. The 'Chapter Outline' lists several sub-topics: Growth and Development During Adolescence, Factors Affecting Dietary Intake During Adolescence, Nutritional Recommendations and Requirements During Adolescence, Common Nutrition Considerations During Adolescence, and Promoting Healthy Lifestyles. The 'Learning Objectives' column contains five numbered points, starting with 'Describe normal physical and psychological growth and development during adolescence.' and ending with 'Use the theoretical model presented to create an effective intervention program that appeals to adolescents.'

The screenshot shows a 'Case Study' section. It features a small circular profile picture of a young girl. The text reads: 'Carla is a 14-year-old girl who lives with her mom and 17-year-old brother. She has had annual preventive health care from birth and has grown along average height and weight trends. Her medical history includes only seasonal allergies. Carla's parents divorced when she was very young, and she does not see her dad. Her mom has a full-time job and is comfortably able to provide food for the family. Carla is a strong student at her public middle school and has enjoyed participating in team sports for the past several years.'

Adolescence is a period of great physical, psychological, and emotional development that spans ages 10 to 19 years.¹ Perhaps the simplest way to define its endpoints is the entrance of a child and emergence of a young adult. Changes over this near decade of life are constant, with internal influences such as hormonal shifts and external factors such as family, school, media, and daily social interactions. Adequate nutrition is necessary for adolescents to achieve their growth potential, and with this period of development comes increased and unique nutrient needs. The American Academy of Pediatrics (AAP) recommends discussion of nutrition and physical activity with during annual preventive care appointments.² The role for registered dietitian nutritionists and other health-care providers in supporting healthy adolescent development is increasingly vital.

is a well-accepted method of evaluation in adolescent health care.^{4,5} A child with an SMR of stage 1 has no visual signs of change, which indicates prepuberty, whereas SMR stage 5 is reached once adult characteristics have developed. Secondary sexual characteristics at each stage are outlined in [TABLE 10.1](#).^{4,5}

Gonadarche is the first visual sign of puberty and heralds the child's transition from stage 1 to stage 2. Boys generally reach this milestone about 2 years behind girls. Gonadarche in girls is marked by breast budding, also called **thelarche**, and usually occurs between 9 and 13 years of age.⁶ In boys, gonadarche is marked by an increase in testicular size. On average for boys, this occurs at 11.5 to 12 years of age,⁷ with the vast majority of boys beginning pubertal genital development by age 13.³

During normal development of both boys and girls, changes associated with progression through SMR stages appear in a specific **sequence** and do not vary. This sequence is shown in [TABLE 10.2](#).⁸ The pace, or **tempo**, at which an adolescent moves through these stages is unique to each person. On average, it takes 4 years for a girl to progress from breast budding (SMR stage 2) to adult breast development (SMR stage 5). Boys, on average, take 3 years to move from SMR stage 2 to stage 5.⁶ Total time of puberty, however, can range from these averages and can take as little as 1.5 years to as long as 8 years in girls, and from 2 to 5 years in boys.⁹ Varied tempo of puberty is important to keep in mind because nutritional needs change during progression through SMR stages, and age itself is therefore not a good determinant of dietary requirements.⁶

Each section begins with a **Preview** statement, giving the reader a sense of what content to expect.

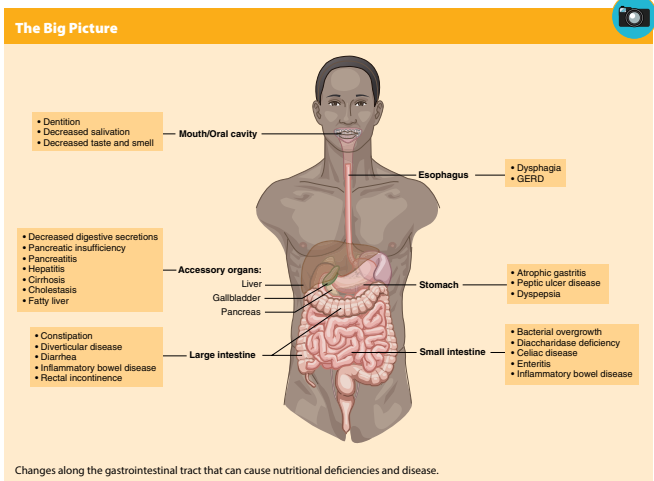
Preview Human milk is a unique, bioactive substance derived by the body to further the biological development of the human infant. Use of human milk enhances the immune, gastrointestinal, and metabolic health of infants.

Recap boxes summarize each section and provide open-ended questions, encouraging students to reflect on what they've just read.

Recap The structure of the breast allows for its function of providing nutrients to an infant. Hormones enhance development of the mammary gland and prepare the mammary system for milk production. For the initial stage of milk production, the mother's body produces colostrum, the first secretion from the mammary glands of the mother after giving birth. Colostrum is uniquely nutritive and significantly important, because this is the first feedings for an infant who has been well nourished by the maternal blood supply during pregnancy. The composition of breastmilk changes through the course of lactation, providing the vast majority of nutrients required for infant growth.

1. Explain how prolactin and oxytocin influence human milk production.

The Big Picture feature incorporates key photos, diagrams, and illustrations, highlighting key ideas and making difficult concepts easier to understand.



News You Can Use

Adults use complementary and alternative medicine, including taking dietary supplements, for a few main reasons, such as to prevent illness and for overall wellness, to reduce pain and treat painful conditions, to treat a specific health condition, and to supplement conventional medical treatments. More than two-thirds of adults do not discuss their supplement use with a healthcare provider, often because they do not consider herbs or dietary supplements medications.^a This is alarming because some dietary supplements can affect the absorption of other nutrients, interfere with the absorption and metabolism of prescription medications, contribute to polypharmacy, and, in large amounts, have toxic or other negative effects on health. St. John's wort, for example, an herb used in the treatment of mild to moderate depression, can interfere with the action of many prescription medications.^a

The **News You Can Use** feature presents topics of special interest to students, usually anchored in current nutritional science research.

References

1. National Center for Complementary and Integrative Health, National Institutes of Health, U.S. Department of Health and Human Services. Complementary and alternative medicine: what people aged 50 and older discuss with their health care providers. Bethesda, MD: National Center for Complementary and Integrative Health; updated December 15, 2015. Retrieved from: <https://nccih.nih.gov/research/statistics/2010>. Accessed May 18, 2016.



The **Let's Discuss** feature provides prompts for class discussion.

Let's Discuss

What are students' personal experiences related to breastfeeding? Have any perceptions of breastfeeding been affected after reading about the benefits of breastfeeding? Do you know if you were breastfed, and if so, for how long?

Each chapter concludes with a **Learning Portfolio**, assembling an array of student-centered resources and activities.

The **Visual Chapter Summary** summarizes the chapter content in bullet form, complemented by important illustrations and photos found in the chapter.

Learning Portfolio

Visual Chapter Summary

Introduction

- As we study nutrition needs and recommendations throughout life, we must keep in mind these basic principles that are important for healthy eating regardless of age:
 - Poor nutrition status can result from either inadequate or excessive nutrition intake and can contribute to the development of certain chronic diseases.

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Energy Scale for Food

Calories = Energy	Protein:	Fats:
4 calories per gram	4 calories per gram	9 calories per gram

- Energy produced by the body, which is needed for a variety of functions, is provided by food and drink in the form of carbohydrates, proteins, and fats

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(macronutrients). Each macronutrient provides a specific amount of energy measured in calories.

- Energy needs vary from person to person and depend on such factors as basal metabolic rate (BMR) and activity level.

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- There are many components of healthy eating, with adequacy, balance, moderation, and variety in food choices being key characteristics.

Carbohydrate consumed by food and drink

↓

Broken down into sugar molecules in the stomach

↓

Sugar molecules move through the GI tract

↓

Sugar converted to glucose by the liver

↓

Excess carbohydrates stored in the body as glycogen

Process by which carbohydrates are converted to glucose for energy, or glycogen for storage.

Each chapter ends with an inventory of **Key Terms** and their definitions; all terms and definitions are also found in the end-of-text Glossary.

Learning Portfolio (continued)

Key Terms

activities of daily living (ADLs): Daily activities that people tend to do every day without needing assistance, such as eating, bathing, dressing, toileting, transferring (walking), and continence (holding their bowels and bladder).

andropause: A gradual but progressive decline in testosterone levels with age.

energy balance: When calories consumed equal calories burned.

functional fibers: Isolated, nondigestible forms of carbohydrate that have been extracted from starchy foods or manufactured from starches or sugars. They may have some of the benefits of naturally occurring dietary fibers, such as helping to prevent constipation or lowering blood glucose levels after meals.

menopause: A natural biological process in women that involves a decline in estrogen production. It typically occurs 12 months after the last menstrual period and marks the end of menstrual cycles.

orthorexia nervosa: An obsession with eating foods that one considers healthy and pure; a fixation on righteous eating.

resting metabolic rate (RMR): The number of calories needed to support basic functions, including breathing and circulation.

sarcopenia: Age-associated loss of skeletal muscle mass (lean body mass) and function. The causes of sarcopenia are multifactorial and can include disease, altered endocrine function, chronic diseases, inflammation, insulin resistance, and nutritional deficiencies. Sarcopenia is associated with muscle weakness, functional limitations, and disability, as well as impairments in cardiovascular capacity and metabolic health.

senescence: The inevitable decline in organ function and physiological function that occurs over time in the absence of injury, illness, or poor lifestyle choices. The process of growing old; senescence involves the accumulation of deleterious changes in cells that cause them to die more rapidly than they are replaced.

thermic effect of food (TEF): The increase in energy expenditure in response to the digestion, absorption, and storage of food.

Discussion Questions

- The physiological changes that occur during adulthood are inevitable. Choose one physiological change discussed in the chapter, and discuss healthy lifestyle habits that can help prevent or slow the decline in physical health that often accompanies aging.
- Discuss the many factors contributing to obesity. By what means is Healthy People 2020 aiming to promote healthy nutrition and weight?
- Outline a healthy adult's macro- and micronutrient needs and discuss how Estimated Energy Requirements can be calculated.
- You've just been hired as an intern with the Department of Public Health. Your manager asks you to write an overview of healthy eating and physical activity recommendations. What key recommendations would you include?

Activities

- Health Promotion: Create Your Own Awareness Program.** Based on the needs of your community, create plans for an awareness program that promotes healthy habits. Create a slideshow presentation using the following items to guide your presentation.
 - The name of your program (be creative!)
 - Why this program is needed (what are the issues?)
 - What will this program aim to do (how can the issues be solved/helped?)
 - What activities/programming will this program provide?
 - How will you measure the outcomes of the program?
 - What barriers might you face?
- Fad Diets: Debunking Bad Advice!** Find a fad diet or herbal/nutritional supplement of interest to you, and be prepared to answer the following questions:
 - What is product/diet, and what benefits does it claim to have?
 - What does the scientific evidence say about this product/diet? Is there any scientific evidence?
 - What possible harm can this product/diet cause?

Discussion Questions encourage students to probe deeper into the chapter content, making connections and gaining new insights.

Suggested **Activities** encourage students to put theory into practice.

Study Questions provide multiple-choice and true/false questions at the end of each chapter, testing students' knowledge of the information covered in the text. These can be utilized for student self-assessment or as homework material.

Study Questions

- Physiological functions begin to deteriorate increasingly after which age?
 - 25 years
 - 30 years
 - 35 years
 - 40 years
- Sarcopenia is a term that refers to a decline in organ function and physiological function caused by injury, illness, or poor lifestyle choices.
 - True
 - False
- Which physiological changes occur with aging?
 - Increase in LBM and increase in fat mass
 - Decrease in LBM and decrease in bone mass
 - Increase in bone mass and increase in estrogen
 - Increase in fat mass and increase in testosterone
- What is bone mass affected by?
 - Dietary micronutrient intake
 - The body's micronutrient stores
 - Level of physical activity
 - All of the above
- Factors that contribute to the obesogenic environment include all of the following except which one?
 - Lack of sidewalks
 - Expensive gym memberships
 - Reduced portion sizes at restaurants
 - Long commutes to and from work
- Healthy People has established benchmarks and monitored progress over time to help encourage community collaboration and empower individuals to make good health decisions.
 - True
 - False
- A "superfood" can help you lose weight.
 - True
 - False
- What is a characteristic of people who struggle with orthorexia nervosa?
 - They are focused on eating only vegan food.
 - They want to lose weight and be thin.
 - They vomit when they eat unhealthy foods.
 - They can feel superior to others in regard to their food habits.
- What is the Estimated Energy Requirement?
 - The additional calories needed by the body to support weight gain
 - The needed dietary energy intake to sustain energy balance
 - The number of calories needed to promote weight loss in obese adults
 - The energy required to promote health
- What is the basal metabolic rate?
 - The energy needed to support main body functions
 - The energy required to support activities of daily living
 - The energy required daily to support an exercise program
 - The energy required to metabolize the food consumed
- What is the thermic effect of food?
 - The energy required to facilitate exercise
 - The reaction that occurs when food is consumed
 - The energy required for the ingestion, digestion, and absorption of food
 - The energy required for the synthesis and secretion of hormones
- What are macronutrients?
 - Substances that provide vitamins and minerals to the body
 - Substances such as vitamin B₆, B₁₂, and zinc
 - Substances such as carbohydrates, protein, and fat
 - Substances that help the body preserve body temperature and cardiac output
- What is a function of carbohydrates?
 - Help repair cells in the body
 - Supply energy to the cells in the body
 - Maintain proper GI tract functioning
 - Promote heart function
- What are amino acids?
 - The basic structures of proteins
 - The basic structures of carbohydrates
 - The basic structures of fat
 - Substances needed for vitamin absorption
- What are micronutrients?
 - Substances such as carbohydrates, protein, and fat
 - Vitamins and minerals
 - Substances essential for the absorption of fat-soluble vitamins and carotenoids
 - Structural components of all the cells in humans
- Mrs. Jones is a 24-year-old woman who is breastfeeding her 2-month-old child. What are her caloric needs?
 - The same as the caloric needs of other 24-year-old females with the same level of activity, height, and weight.

Weblinks direct students to online resources relevant to the chapter content.

Weblinks

- **Minnesota Public Radio, "The Salt": Fad Diets Will Seem Even crazier After You See This**
<http://www.npr.org/sections/thesalt/2013/08/23/214912007/fad-diets-will-seem-even-crazier-after-you-see-this>
 Visit this provoking website to see a unique photo series visually representing fad diets!
- **Baylor College of Medicine Calorie Needs Calculator**
<https://www.bcm.edu/cnrc-apps/caloriesneed.cfm>
 Use this tool to estimate how many calories you need.
- **Choose MyPlate Interactive Tools: SuperTracker**
<http://www.choosemyplate.gov/supertracker-other-tools>
 Do you want to plan a healthy diet and track your physical activity? Use the Choose MyPlate SuperTracker to help you achieve your health and fitness goals.
- **USDA Choose MyPlate: Pregnancy and Lactation**
<http://www.choosemyplate.gov/moms-pregnancy-breastfeeding>
 Learn more about nutrition needs during pregnancy and lactation.
- **Interactive DRI Tool for Healthcare Professionals**
<http://fnic.nal.usda.gov/fnic/interactiveDRI/>
 Use this tool to calculate daily nutrient recommendations to assist you with planning your diet based on the Dietary Reference Intakes (DRIs).

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ACKNOWLEDGEMENTS

The completion of this edition of *Nutrition Across Life Stages* would not have been possible without the guidance, contributions, and support of so many people. We are grateful for the dedication and tremendous hard work of Elizabeth Peck, MS, RD, LD, our go-to for everything. We are fortunate to have Elizabeth's expertise in creating a robust instructor's package to accompany this edition.

To our mentor, advisor, and colleague, Paul Insel, we are deeply grateful to you for giving us the opportunity to work with you on numerous texts. Thank you for guiding us and encouraging us to pursue our passion.

We would like to thank our awesome team at Jones & Bartlett Learning for partnering with us on this undertaking. Sean, Taylor, Merideth, Alex, and Shannon: You

guys are *the best*. Thank you for believing in us and supporting us. Your advice, guidance, and dedication make it a pleasure to be working with you all. To all our contributors who put their expertise into this manuscript, we thank every one of you. Thank you to our reviewers who contributed thoughtful feedback and knowledge to this edition.

Thank you to our colleagues for their guidance, support, and contributions to our academic growth. We also want to express our sincere thanks to our past, present, and future students from whom we continually learn.

Finally to our families, we are genuinely appreciative of all the love, support, encouragement, and patience you give us.

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