

# Discovering NUCLTICE NUMBER OF THE STATE OF

Third Edition

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University of Florida





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To Philip and Claire with love and toyfuls.

To Allen, Mitchell, and Ted for their love, patience, and understanding.

To Donna and Mackinnon, the true stars who nourish my spirit.

# **Preface**

utrition has never been more exciting or important than it is today. New discoveries about nutrition and its importance in overall health emerge daily. Because we are committed to providing comprehensive and accurate information on the most pressing current issues, we have prepared this *Third Edition* of *Discovering Nutrition*. The overall content, organization, and features remain, but, within this framework, key topics and issues are updated with the newest information available.

Learning nutrition can be exciting and engaging. *Discovering Nutrition* takes students on a fascinating journey beginning with curiosity and ending with a solid knowledge base and a healthy dose of skepticism for the endless ads and infomercials promoting "new" diets and food products. We want students to learn enough about their nutritional and health status to use this new knowledge in their everyday lives. Our mission is to give students the tools to logically interpret the nutrition information provided by the evening news, on food labels, in popular magazines, and by government agencies. Our goal is to help them become sophisticated consumers of both nutrients and nutrition information. Hopefully, students will come to understand that knowledge of nutrition allows them to personalize information rather than follow every guideline issued for an entire population.

Discovering Nutrition is unique in its behavioral approach. It challenges students to act, not just memorize the material. Familiar experiences and choices draw students into each chapter and analogies illuminate difficult concepts. In addition, we address important topics that students are curious about, such as ethnic diets, functional foods, nutrient supplements, phytochemicals, vegetarianism, diets for athletes, food safety, and fad diets. We focus attention on alcohol, eating disorders, and complementary nutrition. Some instructors may wish to cover metabolism, so we included a Spotlight on Metabolism to provide a friendly tour of the metabolic pathways. Throughout the book, the relationship of diet and health is incorporated into appropriate chapters (e.g., lipids and cardiovascular disease, carbohydrates and diabetes).

Discovering Nutrition brings up-to-date nutritional research into your classroom. It features the latest standards: the Dietary Reference Intakes, 2005 Dietary Guidelines for Americans, and the USDA MyPyramid. Discovering Nutrition provides students with tools, such as the ancillary diet analysis software, to track and analyze their personal nutrient intakes. In addition, the book's Web site, <a href="http://nutrition.jbpub.com/discovering">http://nutrition.jbpub.com/discovering</a>, offers access to the constantly emerging developments in nutrition.

# **Dietary Guidelines for Americans**

The Sixth Edition of Dietary Guidelines for Americans places stronger emphasis on reducing calorie consumption and increasing physical activity. Eating a healthy balance of nutritious foods continues as a central point in the Dietary Guidelines, but simply balancing nutrients is not enough. Total calories also count, especially as more Americans are gaining weight. Because almost two-thirds of Americans are overweight or obese and more than half get too little physical activity, the 2005 Dietary Guidelines place a stronger emphasis on calorie control and physical activity. The report identifies several key recommendations. As you read the chapters, look for these recommendations highlighted in the margins.

# **USDA MyPyramid**

MyPyramid, which replaced the Food Guide Pyramid introduced in 1992, is part of an overall food guidance system that emphasizes the need for a more individualized approach to improving diet and lifestyle. MyPyramid incorporates recommendations from the 2005 Dietary Guidelines for Americans and uses interactive technology found on www.MyPyramid.gov. These interactive activities allow individuals to obtain more personalized recommendations for daily calorie levels based on the 2005 Dietary Guidelines for Americans. It also allows individuals to find general food guidance and suggestions for making smart choices from each food group. Concepts from MyPyramid and the Dietary

Guidelines are carried throughout the book and are fully integrated into the chapter text.

# Trans Fat Labeling

Discovering Nutrition delivers the tools for students to understand food labels, including the trans fat requirement, and to incorporate positive nutritional behaviors in their everyday lives. The Dietary Guidelines for Americans recommend reducing the intake of trans fats and saturated fats. The U.S. labeling requirement for trans fat provides a more complete picture of fat content in foods, allowing students and other consumers to choose foods low in trans fat, saturated fat, and cholesterol. The Food and Drug Administration estimates that trans fat labeling will prevent 600 to 1,200 cases of coronary heart disease and 250 to 500 deaths each year.

# **Bioterrorism and the Food Supply**

How safe is our food supply? In the aftermath of the terrorist attacks on the World Trade Center in September 2001 and the spread of anthrax through the mail, there is heightened concern over the vulnerability of our food supply to bioterrorism. Discovering Nutrition explores past attacks on U.S. and Canadian food supplies, points of vulnerability, and food safety strategies that students can use to help protect themselves.

# Updates to This Edition

Updates throughout the book include the latest DRIs, revised macronutrient chapters, the latest references, expanded coverage of diet and health, and much more. A chapter-bychapter breakdown of updates can be downloaded from www.jbpub.com. Highlights of specific updates are:

- Position statements from the ADA, AHA, ACSM, and Dietitians of Canada
- Added discussion of Japanese and Chinese diets
- Updated information on Eating Well with Canada's Food Guide
- Revised discussion of energy and weight management that includes additional information on gastrointestinal sensations and neurological and hormonal factors
- Expanded discussion on preventing eating disorders and how fashion and weight guidelines for models affect society
- Updated statistics on malnutrition and hunger in childhood, including food-insecure households and food banks
- Revised discussion of overweight and obesity in child-
- New figures showing MyPyramid for children and older adults

# **Accessible Science**

Discovering Nutrition makes use of the latest in learning theory and balances the behavioral aspects of nutrition with an accessible approach to scientific concepts. It is intended to be a comprehensive resource that communicates nutrition both graphically and personally.





We present technical concepts in an engaging, nonintimidating way with an appealing, stepwise, and parallel development of text and annotated illustrations. Illustrations in all chapters use consistent representations. Each type of nutrient, for example, has a distinct color and shape. Icons of an amino acid, a protein, a triglyceride, and a glucose molecule represent "characters" in the nutrition story and are instantly recognizable as they appear throughout the book.

This textbook is unique in the field of nutrition and leads the way in depicting important biological and physiological phenomena, such as emulsification, glucose regulation, digestion and absorption, and fetal development. Extensive graphic presentations make nutrition and physiological principles come alive. The illustrations use pictures to teach and are part of a multimedia package that coordinates the text with illustrations and software. The EatRight Analysis program is a fully integrated ancillary designed to help students track their diets, make choices, and hone their nutritional skills.

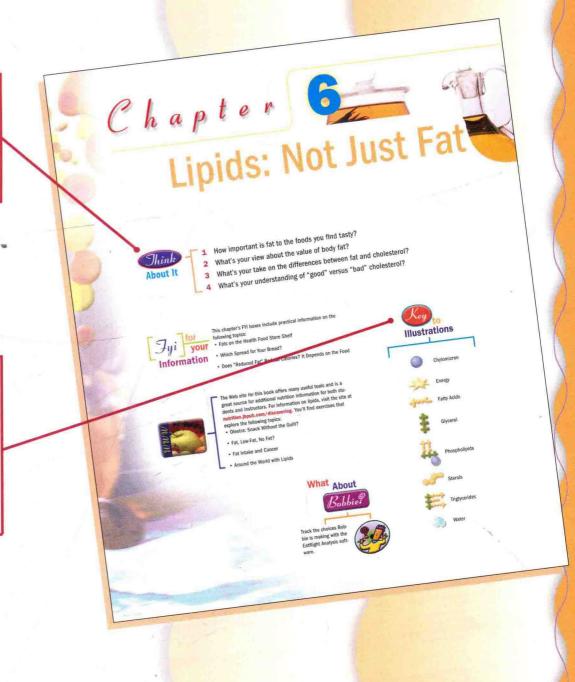
# The Pedagogy

Discovering Nutrition focuses on teaching behavioral change, personal decision making, and up-to-date scientific concepts in a number of novel ways. The interactive approach that addresses different learning styles makes it the ideal text to ensure a high likelihood of success by students. Beginning with Chapter 1, the material engages students in considering their own behavior in light of the knowledge they are gaining. The following pedagogical aids appear in most chapters.

Think About It questions present realistic nutritionrelated situations and ask students to consider how they would behave in such circumstances.

# The Key to Illustrations

identifies the icons students will encounter throughout the chapter. These chemical icons identify molecular components of nutrient molecules, making their construction and deconstruction visually and conceptually accessible.



Quick Bites are sprinkled throughout the book. They offer fun facts about nutritionrelated topics such as exotic foods, social customs, origins of phrases, folk remedies, and medical history.

334 Chapter 9 VITAMINS: VITAL K-TS TO HEALTH

# Quick Bites

And They Called It Cantaloupe he word cantaloupe comes from a papal garden in a small town near Rome named Can-taloupo. One-half of a medium cantaloupe has 466 RAE as beta-carotene.

These studies reflect food intake, not supplement use. To date, trials of These studies renect food intake, not supplement use. To date, thats of beta-carotene supplements for cancer prevention have been disappointing: paradoxically, megadose supplements are associated with increased lung cancer among smokers or those exposed to asbestos, is Beta-Carotene and Skin

Detary carotene una Okur Dietary carotenoids help protect the skin from damage by ultraviolet (UV) Dietary carotenoids neip protect the skin from damage by ultraviolet (UV) light. <sup>19</sup> One of the few proven effective uses of beta-carotene supplements is -light: One or the rew proven effective uses of Deta-carorene supplements is for people who are missing natural protection to ultraviolet (UV) light, due to a hereditary illness.<sup>20</sup>

# Antioxidants and Free Radicals

an antioxidant prevents the damaging effects of oxygen, Say, wait a minute. Oxygen's a good thing, sin't it? Certainly, you couldn't tive long without it!

But some forms of oxygen are very unstanded to the couldness of the couldn't tive long without it!

But some forms or oxygen are very unsta-ble. We call these unstable molecules "free radicals." They are extremely active and, when out of control, can attack or react with healthy out or control, can attack or react with health body cells, damaging fragile cell membranes and genetic material and changing the char-acter of fats and proteins. I Antioxidants "neu-tralize" or "quench" free radicals exping tham from happening averaging as particle with them from becoming excessive or getting out of control. Several vitamins act as antioxi-

Free radicals are generated during normal metabolism and they are normal substances. We put their destructive capabilities to good use. Their oxidizing action kills harmful microorganisms. They even destroy our body's own damaged cells, thus preventing cancer

Household bleach, a familiar oxidizing rousenoid pleach, a familiar oxidizing agent, is a good example of the "good guy-bad guy" nature of free radicals. Add it to dirty clothes, and it cleans them well, even willing germs. But add too much, and your clothes get holes. The sun's oxidizing rays are also bleaching agents, very helpful for white fabrics, but damaging to colors. Other examples of oxidative damage are the rusting of iron and the rancidity of fats.

Outside agents, such as tobacco smoke, toxic chemicals, excessive sunshine, and even some medical treatments, form free radicals in our bodies. In the presence of these

agents, our antioxidants are depleted more

Excessive oxidation in the body is problematic.<sup>2</sup> Chronic, excessive exposure to sun-shine, for example, is associated with age-related macular degeneration and age-related macurar degeneration and cataracts, two conditions that cause blindness. Researchers believe oxidative damage plays a role in these conditions; there's evidence that the carotenoids lutein and zeaxanthin help protect us from that damage. 3 The oxidizing rays of the sun also accelerate skin wrinkling and, worse, cause skin cancer, due in part to oxidative damage of skin cells, Other cancers may originate when cellular DNA is damaged by free radicals; foods rich in

DNA is damaged by free radicals; foods rich in antioxidants may prevent this damage.<sup>4</sup> There is good evidence that oxidation has a pivotal role in initiating atherosciencis. Free radicals oxidize blood lipids such as choles-terol; the damaged lipids are the deposited on the inside surface of artery walls. The on the inside surface of artery walls, the beginning of atherosclerotic plaques. Vitamin oegimms of adversescence pragues, viramm E, our major fat-soluble antioxidant, may help block this process.5

Vitamin C and, under some circum stances, riboflavin are other antioxidants, Some minerals such as selenium function in antioxidant systems as well. The antioxi dants often work in cooperation with each other. Vitamin C, a water-soluble antioxidant, restores vitamin E that is altered by its antioxidant activity. Selenium also works with vitamin E. In fact, to a certain extent, a selenium-rich diet can help treat a

Vitamins and minerals are only part of you victions and minerals are only part of you antioxidant defense. Your body makes many of its own antioxidants. Examples are glutathione, coenzyme Q<sub>B</sub> (ubliquinone), and superoxide dismutase. Several of these have now been put into supplements. To be a supplementation of the control of the c now been put into supplements. To have an effect, however, they must survive digestion be absorbed, and reach their site of activity in the body. Their value in supplement form remains largely unproved.

In addition to vitamins, fruits and vegetables contain many other antioxidants, which protect the plants from sunshine and other oxidants. These substances, along with other plant-produced chemicals, are sometim called phytonutrients, phytochemicals, or nutraceuticals. Ingesting them probably gives us the same protection they give the plant. Supplement manufacturers also put these substances—examples are the bioflavonoidsin pills and add them to beverages marketed as "health-promoting." In these forms, neither their value nor their safety have been proved.

- Jacob RA, Burri BJ. Oxidative damage and def Clin Nutr. 1996;63:985S-990S. Rock CL, Jacob RA, Bowen PE. Update on the I characteristics of the antioxidant more.

# For Your Information

sections offer more in-depth treatment of controversial and timely topics such as unfounded claims about the effects of sugar, whether athletes need more protein, and the usefulness of the glycemic index.

**Key Concepts** summarize previous text and highlight important information.

students to review material

and terms.

Label to Table helps students apply their new decisionmaking skills at the supermarket. It walks students through the various types of information that appear on food labels, including governmentmandated terminology, misleading advertising phrases, and amounts of ingredients.

160 Chapter 5 CARBOHYDRATES: SIMPLE SUGARS AND COMPLEX CHAINS

stevioside: A dietary supplement, not approved for use as a sweetener, that is extracted and refined from Stevial schausing because the second stevial second secon rebaudiana leaves.

stevia See stevioside.

dental caries [KARE-ees] Destruction of the enamel surface of teeth caused by acids that are created when bacteria break down sugars in the mouth.

Stevioside (also known as stevia) is derived from the stevia plant found Stevioside (also known as stevia) is derived from the stevia plant found in South America. This plant's leaves have been used for centuries to sweeting the steving of the steving of the steven and make tea. In Japan, stevioside has been used as a sweeten serious the steving of the sweeten steven and the steving of the steven leaves th er since the 19708. This substance is 300 times sweeter than sucrose, but I metabolism in the body has been incompletely investigated. Because the metabolism in the body has been incompletely investigated. Because the FDA has not approved stevioside as an additive nor accepted it as a GRAS FDA has not approved stevioside as an additive nor accepted it as a GRAS substance, it cannot be used in food in the United States. Although stevia substance, it cannot be used in food in the United States. Although stevia may be sold as a dietary supplement, its labels may not promote its use as a

Kay Concepts: Sweeteners add flavor to foods. Nutritive sweeteners provide energy, whereas non-nutritive sweeteners provide little or no energy. The body cannot tell the difference between sugars derived from natural and refined sources.

# Carbohydrates and Health

Carbohydrates contribute both positively and negatively to health. On Carbonydrates contribute both positively and negatively to heatin. On the upside, foods tich in fiber help keep the gastrointestinal tract healthy may reduce the risk of heart disease and cancer. On the downside, and the state of the contribute to weight usin poor purifier intake and tool and may reduce the risk of heart disease and cancer. On the downside,

# Label [to Table

his label highlights all the carbohydrate nis table nightights all the carbonydrate-related information you can find on a food label. Look at the center of the Nutrition Facts label and you'll see the Total Carbohydrates along with two of the carbohydrate "subgroups"—Dietary Fiber and Sugars. drate "subgroups"—bietary Fiber and Sugars.
Recall that carbohydrates are classified into simple carbohydrates and the two complex carbohydrates starch and fiber.

carbohydrates starch and fiber.

Using this food label, you can determine all three of these components. There are 19 total grams of carbohydrate, with 14 grams coming grams of carbohydrate. from sugars and 0 grams from fiber. This means the remaining 5 grams must be from starch, which is not required to be listed sepa-rately on the label. Without even knowing rately on the label. Without even knowing what food this label represents, you can ecipher that it contains a high proportion of sugar (14 of the 19 grams) and is probably sweet. If this is a fruit juice, that level of sugar would be expected; but if this is cereal, you'd be getting a lot more sugar than complex capbolydrates and probably wouldn't be making the best choice!

the best choice!

Do you see the 6% listed to the right of
"Total Carbohydrate"? This doesn't mean that

the food item contains 6 percent of its calothe tood item contains o percent or its calo-ries from carbohydrate, instead, it refers to the Daily Yalue for carbohydrates listed at the bottom of the label. There you can see there bottom of the label. There you can see there that a person consuming 2,000 kilocalories per day should consume 300 grams of carbohydrates each day. This product contributes 10 grams per serving, which is just 6 percent of the Daily Value of 300 grams per day. Note that the Percent Daily Value for fiber is 0%, because this food Item Lacks fiber.

that the Percent Daily value for fiber is U7%, because this food item lacks fiber.

The last highlighted section on this label, at the bottom of some Nutrition Facts labels, is the number of calories in a gram of carbohydrate. Recall that carbohydrates contain 4 kilocalories per gram, Armed with this infornation and the product's calorie information, can you calculate the percentage of calories that come from carbohydrate?

Here's how: 19 g carbohydrate × 4 kcal per g = 76 carbohydrate kcal

76 carbohydrate kcal ÷ 154 total kcal = 0.49 or 43% carbohydrate kcal

**Nutrition Facts** 

The Learning Portfolio at the end of each chapter collects—in one place—all aspects of nutrition information students need to solidify their understanding of the material. The various formats will appeal to students according to their individual learning and studying styles.

> Key Terms lists all new vocabulary alphabetically with the page number of the first appearance. This arrangement allows students to review terms they do not recall and turn immediately to the definition and discussion of it in the chapter. This approach promotes the acquisition of knowledge, not simply memorization.

> Study Points is a bulleted list that summarizes the content of each chapter with a synopsis of each major topic. The points are in the order in which they appear in the chapter, so related concepts flow together.



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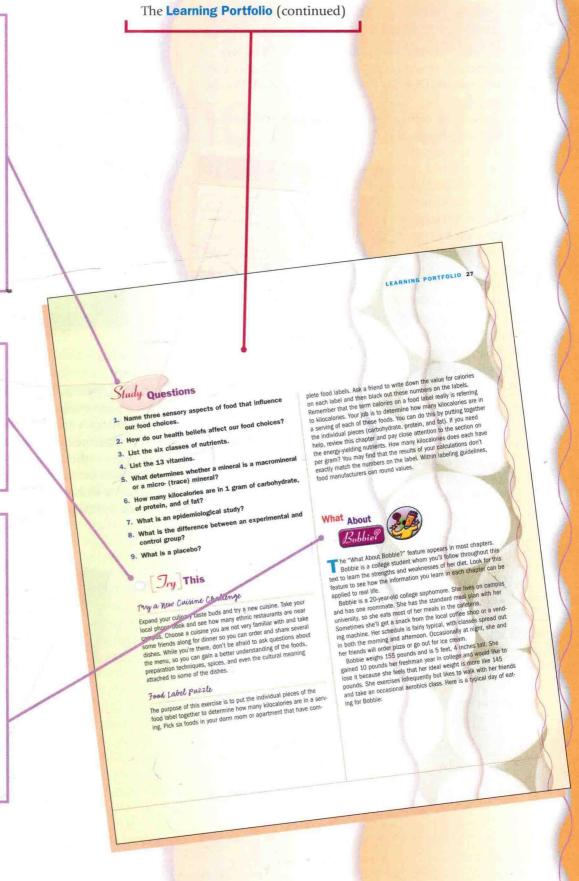
ABC model of behavior android obesity [AN-droyd] 301 negative energy bal. 287 appetite negative self-talk binge eaters 275 neuropeptide Y (NPY) oelectrical impedar 291 mexercise activity analysis (BIA) ogenesis (NEAT) BodPod 281 287 784 obesity body fat distribution 284 284 body mass index (BMI) 287 positive energy balance 284 284 built environ positive self-talk 275 290 energy balance resting energy 301 275 ture (REE) 279 275 resting metabolic rate energy intake 275 energy output restrained eaters 275 extreme obesity 291 satiation 308 275 276 gynold obesits skinfold me 275 287 287 sleep apnea 275 293 thermic effect of food hypercellular obesity (TEF) hyperplastic obesity 281 total energy exp (hyperplasia) (TEE) 289 trophic obesity underwater weighing 279 289 287 underweight [high-po-THAL-ah-284 very-low-calorie diets (VLCD) 306 waist circumfe etabolic fitness 279 287 weight cycling 295 reight manage 293

- Energy balance is the relationship between energy
- Food intake is regulated by hunger, sa lation, satiety, Food intake is regulated by nunger, smaller, satiety, and appetite, which are influenced by come of factors and appetite, which are influenced by come of factors and support of the factors and factors are factors and factors and factors are factors. meal. Satiety is the feeling of satisfaction and lack of hunger that determines the interval until the next nanger that determines the interval time next meal. Appetite is a desire to eat that is influenced by external factors such as flavors and smells, environmental factors, and cultural factors.
- Gastrointestinal stimulation, circulating nutrients, neurotransmitters, and hormones signal the brain to regulate food intake.
- The major components of energy expenditure are resting energy expenditure, the thermic effect of food, and energy for physical activity.
- Estimated Energy Requirements (EER) for adults precaumated energy requirements (EER) to addition age, height, weight, gender, and physical activity level.
- Body composition, age, gender, genetics, and hor sour composition, ege, genues, generales, enumeration activity affect the amount of energy used for resting
- The energy cost of physical activity is affected by a person's size and the intensity and duration of the
- Body composition, the relative amounts of fat and lean body mass, has a major influence on energy expenditure and risk of chronic disease.
- Body mass index—a ratio related to total body fatness and risk of chronic disease—is calculated with height

Study Questions encourage students to probe deeper into the chapter content, making connections and gaining new insights. Although these questions can be used for pop quizzes, they also will help students review the chapter, especially students who study by writing out material. They can check their work by looking at the Study Question Answers included in the back of the book and on the Discovering Nutrition Web site at http://nutrition.jbpub.com/ discovering.

Try This activities are for curious students who like to experiment. These suggestions for hands-on activities encourage students to put theory into practice. It will especially help students whose major learning style is experiential.

What About Bobbie? tracks the eating habits and healthrelated decisions of a typical college student so that students can apply the material they have learned in the chapter to a typical situation. By following the individual case of Bobbie, students move from understanding the general concepts to the specific application of new information. As a complement to this textual feature, the EatRight Analysis software allows students to track the various choices Bobbie makes as well as their own food choices.



# The Integrated Learning and Teaching Package

Integrating the text and ancillaries is crucial to deriving their full benefit. Based on feedback from instructors and students, Jones and Bartlett Publishers offers the following supplements.

Dietary analysis software is an important component of the behavioral change and personal decision-

making focus. EatRight
Analysis, developed by
ESHA Research and tailored by the authors,
enables students to analyze their diets by calculating their nutrient
intake and comparing it
to recommended intake
levels. It is available



INSTRUCTOR'S TOOLKIT TO ACCOMPANY

online (http://eatright.jblearning.com) and in a CD-ROM format.

Contact your Nutrition Representative for discount package opportunities.

The **Instructor's ToolKit CD-ROM** is a comprehensive teaching resource available to adopters of the book. It includes:

PowerPoint Presentation Lecture Slides

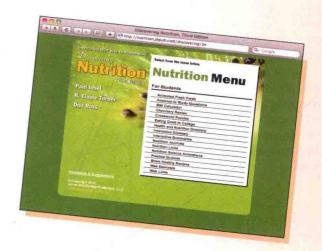
• Image and Table
Bank: Provides art
and tables that can
be imported into
PowerPoints,
tests, or used to
create transparencies



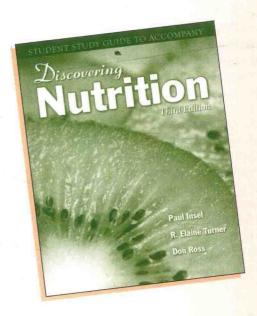
Computerized Test Bank

Contact your Nutrition Representative at http://health.jbpub.com.

The **Web site** for *Discovering Nutrition*, <a href="http://nutrition.jbpub.com/discovering">http://nutrition.jbpub.com/discovering</a>. offers students and instructors an unprecedented degree of integration between the text and the online world through many useful study tools, activities, and supplementary health information.



The Study Guide to accompany Discovering Nutrition contains a print version of the PowerPoint slides included in the Instructor's ToolKit with space for students to take notes. Students can concentrate better during lectures and take notes without having to copy down the text from slides. Also included are exercises for students to gain familiarity with the Key Terms in each chapter and ideas for making assessments of their own dietary habits.



# **About the Authors**

he Discovering Nutrition author team represents a culmination of years of teaching and research in psychology and nutrition science. The combined experience of the authors yields a balanced presentation of both the science of nutrition and the components of behavioral change.

**Dr. Paul Insel** is Adjunct Clinical Associate Professor of Psychiatry and Behavioral Sciences at Stanford University (Stanford, California). In addition to being the principal investigator on several nutrition projects for the National Institutes of Health, he is the senior author of the seminal text in health education and has co-authored several best-selling nutrition books.

Dr. R. Elaine Turner is a Registered Dietitian and Professor in the Food Science and Human Nutrition Department at the University of Florida (Gainesville, Florida) where she currently holds the position of Associate Dean in the College of Agricultural and Life Sciences. Dr. Turner has been teaching courses in introductory and life-cycle nutrition for more than 20 years. Her interests include nutrition labeling and dietary supplement regulations, computer applications in nutrition and education, maternal and infant nutrition, and consumer issues. Dr. Turner was named Undergraduate Teacher of the Year, 2000–2001, for the College of Agricultural and Life Sciences, and in 2004 she was recognized with a National Award for Excellence in College and University Teaching in the Food and Agricultural Sciences by the USDA.

Don Ross is Director of the California Institute of Human Nutrition (Redwood City, California). For more than 20 years he has co-authored multiple textbooks and created educational materials about health and nutrition for consumers, professionals, and college students. He has special expertise in communicating complicated physiological processes with easily understood graphical presentations. The National Institutes of Health selected his *Travels with Cholesterol* for distribution to consumers. His multidisciplinary focus brings together the fields of psychology, nutrition, biochemistry, biology, and medicine.

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