THE GREAT COURSES®

Topic
Better Living

Subtopic
Health & Wellness

Nutrition Made Clear

Course Guidebook

Professor Roberta H. Anding
Baylor College of Medicine and Texas Children's Hospital

PUBLISHED BY:

THE GREAT COURSES
Corporate Headquarters
4840 Westfields Boulevard, Suite 500
Chantilly, Virginia 20151-2299
Phone: 1-800-832-2412
Fax: 703-378-3819
www.thegreatcourses.com

Copyright © The Teaching Company, 2009

Printed in the United States of America

This book is in copyright. All rights reserved.

Without limiting the rights under copyright reserved above,
no part of this publication may be reproduced, stored in
or introduced into a retrieval system, or transmitted,
in any form, or by any means
(electronic, mechanical, photocopying, recording, or otherwise),
without the prior written permission of
The Teaching Company.

Roberta H. Anding, M.S., R.D./L.D., C.D.E., C.S.S.D.

Director of Sports Nutrition
and Clinical Dietitian,
Baylor College of Medicine
and Texas Children's Hospital

Professor Roberta H. Anding received her B.S. in Dietetics in 1977 and her M.S. in Nutrition in 1980 from Louisiana State University. She is currently a licensed dietitian in the state of Texas, a registered dietitian with the American Dietetic Association, a certified diabetes educator, and a certified specialist in sports dietetics.

Professor Anding began her career at the Tulane Medical Center and School of Medicine in 1982, where she was a part-time Assistant Professor and outpatient clinical dietitian education coordinator. She joined the faculty of the University of Texas School of Nursing at Houston in 1986 as Assistant Professor of Clinical Nursing. She later joined the faculty of Rice University as an instructor in the Department of Kinesiology, where she currently provides individual instruction to student athletes and teaches a course in nutrition. Professor Anding is an instructor in nutrition and is the clinical dietitian and director of sports nutrition in the Adolescent Medicine and Sports Medicine Clinic at Baylor College of Medicine. She is also currently the dietitian for the Houston Texans NFL franchise.

In graduate school, Professor Anding's research focused on the essentiality of omega-3 fatty acid in the development of the central nervous system. Her current research interests include the development of an online nutrition and fitness curriculum for inner-city Girl Scouts that was featured on the Houston Texans website. With grant funding from the Women's Fund, Professor Anding researched the development of a carbohydrate-modified weight management program for overweight Hispanic youth. She also received

grant support from the Robinson Foundation for the innovative development of an educational DVD on weight management for adolescents.

Professor Anding has been honored with the Texas Dietetic Association's Texas Distinguished Dietitian Award in 2008 and its Media Award in 2006, the Houston Area Dietetic Association Media Award in 2004 and 2006, the Houston Area Dietetic Association Award for the Dietetic Internship Educator of the Year in 2001, and the John P. McGovern Outstanding Teacher of the Year Award while at the University of Houston School of Nursing. She has also been awarded the Houston Area Dietetic Association's Texas Distinguished Dietitian of the Year award several years running.

Throughout her career, Professor Anding has contributed to the publication of both scientific and consumer articles on nutrition and has authored several book chapters. She is a member of numerous state and local dietetic organizations, including the Sports and Cardiovascular and Wellness Nutrition Group of the American Dietetic Association. Professor Anding is the past chair of this national practice group. She is currently the American Dietetic Association media spokesperson for Houston, in which capacity she gives more than 100 media interviews per year. ■

Table of Contents

INTRODUCTION

Professor Biography i
Course Scope 1

LECTURE GUIDES

LECTURE 1
Why We Eat What We Do 3

LECTURE 2
Sources of Nutrition Fact and Fiction 6

LECTURE 3
Our Underappreciated Digestive Tract 9

LECTURE 4
It's All about the Calories! 12

LECTURE 5
Hydration—You Are What You Drink 15

LECTURE 6
Not All Carbohydrates Are Created Equal 18

LECTURE 7
Facts on Fiber 22

LECTURE 8
Protein—An Indispensable Nutrient 25

LECTURE 9
Fat, Fat Everywhere! 28

LECTURE 10
Vitamins—Spotlight on C 31

Table of Contents

LECTURE 11
Vitamins A and K—Multitaskers....36

LECTURE 12
Vitamin E—Fallen Hero; Vitamin D—Rising Star....39

LECTURE 13
B Vitamin Basics....42

LECTURE 14
The Major Minerals....46

LECTURE 15
The Highs and Lows of Sodium and Potassium....53

LECTURE 16
Iron, Zinc, Selenium—Balance Is Everything....58

LECTURE 17
Cardiovascular Disease—What Are the Risks?....66

LECTURE 18
A Heart-Healthy Lifestyle....69

LECTURE 19
The DASH Diet—A Lifesaver....72

LECTURE 20
Obesity—Public Health Enemy Number One....75

LECTURE 21
Healthy Weight Management....78

LECTURE 22
Metabolic Syndrome and Type 2 Diabetes....82

LECTURE 23
Dietary Approaches to Weight Management....85

Table of Contents

LECTURE 24
Nutrition and Cancer Prevention 88

LECTURE 25
Nutrition and Digestive Health 91

LECTURE 26
Prebiotics and Probiotics in Your Diet 94

LECTURE 27
Food Safety—It's in Your Hands 97

LECTURE 28
Demystifying Food Labels 100

LECTURE 29
Facts on Functional Foods 105

LECTURE 30
A Look at Herbal Therapy 108

LECTURE 31
Organic or Conventional—Your Choice 111

LECTURE 32
Fake or Real—Sugars and Fats 114

LECTURE 33
Creating Your Own Personal Nutrition Plan 117

LECTURE 34
Exercise and Nutrition—Partners for Life 123

LECTURE 35
The Future of Nutrition—Science and Trends 126

LECTURE 36
Nutrition Facts and FAQs 130

Table of Contents

SUPPLEMENTAL MATERIAL

Glossary 134
Bibliography 149
Credible Nutrition Websites 169

Scope:

This course is an invitation to a journey to wellness—an inspirational, practical, hands-on guide to understanding the science of nutrition and how what we eat and drink affects our bodies and our lives.

We begin with a revealing study of why we eat what we do and how we gather information about nutrition. We then take an in-depth look at the core of our body—our digestive tract. We continue with a detailed review of the essential building blocks of diet and nutrition—protein, carbohydrates, fat, water, fiber, vitamins, and minerals—learning about their critical roles in a healthy diet.

The lectures then turn to topics critically important to the American public: the dietary links to major chronic diseases and disorders such as diabetes, hypertension, obesity, heart disease, and disorders of the digestive tract. The lectures are full of informative advice on what these illnesses are and practical suggestions for how we can lower our risk for acquiring them. The intent of the lectures is not to preach or scold but to present a wise but realistic approach to nutrition. Among the best—and most encouraging—advice in this course is "Progress, not perfection." In other words, even small changes toward improving our diet and exercise choices can make a big difference in our health.

In later lectures, we take a balanced look at the pros and cons of sugar substitutes and fat replacers, organic and conventional foods, and herbal therapies. We also cover topics from the importance of food safety to reading food labels (they are more complicated—and more important—than you think!). We survey the latest types of products on supermarket shelves (probiotics, prebiotics, and functional foods) and discover exciting new advancements in the science of nutrition.

In keeping with its goal to be relevant and beneficial for everyone, the course provides all we need to develop nutrition and exercise plans that not only work but are sustainable. After all, effective diet and nutrition choices cannot be quick fixes characterized by hunger and deprivation—they are lifestyle choices that can lead to a longer and healthier life for anyone at any age. ■

Why We Eat What We Do

Lecture 1

The United States Department of Agriculture has showed us that Americans have increased their calories by 523 calories per day since 1970.

Americans are interested in nutrition, eating right, and increasing their physical activity. However, there is a disconnect between what we believe to be true and what we actually do. This course is designed to explain the misunderstandings regarding nutrition and replace them with science that you can understand and, most importantly, implement in your everyday life. I know this because I have been a clinical and registered dietician for 30 years. My job in this course is to take you on a journey to wellness.

Trends suggest that Americans are interested in eating right and increasing their physical activity. A recent trend study from the American Dietetic Association suggests that 43% of Americans believe that they are already eating well. The United States Department of Agriculture has showed us that Americans have increased their food intake by 523 calories per day since 1970. This course is designed to clarify the misconceptions around nutrition, and we are going to replace them with science that you can understand and implement in your everyday life. This lecture explores our reasons for why we eat what we do and some of our beliefs surrounding food.

Where do we get our information? An American Dietetic Association trend study suggests that since 2002, television as a source for nutrition information has decreased in popularity from 72% to 63%, and people perceive it as being about 14% credible; magazines are down from about 58% to 45%, with a perceived credibility of about 25%; newspapers have decreased from 33% to 19%; and the Internet has increased in popularity from 13% to 24%, and its perceived credibility is approximately 22%, though it has the widest variability of information.

We make our food choices based on taste, convenience, emotions, religion and culture, health beliefs, nutrition, medical conditions, and socioeconomic status. Nutrition is a relatively new science. Because we all eat, we are all experts, but our understanding of the science is lacking. Throughout this course, what might be challenging is uncovering the science about nutrition and food. Let's start looking at this science by going through a brief history of nutrition.

Nutrition is a relatively new science. Because we all eat, we are all experts, but our understanding of the science is lacking.

The first known reference to nutrition was by Hippocrates about 2500 years ago, when he said, "Let food be thy medicine and let medicine be thy food." The nutritional history of the United States began with Wilbur Atwater in the late 1800s. During the first 50 years of the 20th century, the discovery of essential nutrients highlighted nutritional science in the United States, as well as abroad. Casmir Funk in 1912 proposed the vital amine theory as a cure for most common nutritional diseases. He had learned that the milling of brown rice caused the removal of the bran, which decreased its nutritional value. In the early 1930s, William Cumming Rose made landmark contributions in the areas of protein metabolism and protein requirements. Ancel Keys' Minnesota Starvation Study took conscientious objectors to World War II and watched them lose about 25% of their body weight. He found that in individuals who significantly reduced their calories, their bodies adapted and their mental statuses changed.

The 1950s signaled the advent of fast food, though a meal then was around 700 calories. Diseases of nutritional excess have been the focus of nutritional science since the 1970s: in particular, the prevention or management of heart disease and the prevention of diabetes.

This course will turn to the science of nutrition for answers. We will talk about the building blocks: food digestion; proteins, carbohydrates, and fats; vitamins and minerals; calories; water; and fiber. We will explore nutrition-related disorders and how to combat them through good nutritional choices. These include cardiovascular disease, overweight and obesity, metabolic

syndrome, digestive disorders, cancer, and food safety. We will talk about nutrition in your own life: We will learn about food labels, herbal therapies, functional foods, and organic versus conventional foods. We will address some frequently asked questions along the way, and as we go through, we will replace the hype with the science and make this a personal road map to wellness. ■

Suggested Reading

Brown, A., *Understanding Food*.

Brown, J., *Nutrition Now*, unit 7.

Questions to Consider

1. What factors influence your food choices?

2. As we start this journey to wellness together, what do you feel are the biggest nutritional challenges for you and your family?

Sources of Nutrition Fact and Fiction

Lecture 2

How do you know when a product or a service or a device has, again, some reputable science or is it making a claim?

Just open a newspaper or magazine, turn on the television, or search "lose weight" on the Internet, and you will find promises of health and well-being readily available in a pill or a potion. How do you separate fact from fiction and avoid fraud? In this lecture, we will highlight the red flags of health fraud. Let's look at sources of nutrition information, as well as misinformation, to help you avoid becoming a victim of health fraud. I have had patients come in wanting to cleanse their colon. Mother Nature's recipe for colon cleansing is fiber, but a lot of weight-loss programs are just forcing diarrhea as a way of helping people lose water weight. In this lecture, we will come up with a good way to evaluate information, talk about good places to get information, and continue on our road map to wellness.

How do you separate fact from fiction? The challenge is getting reputable sources of information. The Food and Drug Administration highlights the red flags of health fraud. When you notice any of the claims or techniques below being used in product advertising, you need to ask the following: Is this fact or fiction? Could there be any harm to me if I do this?

- It is a quick and effective cure-all.
- It can treat a serious or incurable disease.
- Ads make claims of miraculous breakthroughs, secret formulas, or the hidden ingredient that your doctor does not want you to know about.
- Ads use useless medical terminology.
- Ads equate "all natural" with "all safe."

- Ads use personal testimonies, even from physicians, that claim amazing results.

- Ads create urgency and use terms like "limited availability" and "act now."

- There is a no-risk, money-back guarantee.

- There are promises of an easy fix for a complex condition, such as overweight or impotency.

Credible websites and sources of nutritional education and fitness information do exist. The American Dietetic Association (http://www.eatright.org) is the premier food and nutrition website. The American College of Sports Medicine (http://www.acsm.org) is the premier fitness organization. The Centers for Disease Control (http://www.cdc.gov) has solid, reliable information and a body mass index calculator. The Food and Drug Administration (http://www.fda.gov) gives you recall information and consumer warnings. The Food and Nutrition Information Center of the U.S. Department of Agriculture (http://fnic.nal.usda.gov) provides dietary guidelines.

To see the kind of policies and public health guidelines that have been promoted for Americans, we can take a look at some of the things that have happened in the 20th century that have significantly improved our health. In 1924, salt was fortified with iodine for the prevention of goiter, and that significantly reduced the number of Americans who developed goiter. In 1933, milk was fortified with vitamin D to prevent rickets. In the 1940s, policies were enacted to establish a standard of identity for foods claiming to be enriched: If a product was enriched, it had to contain thiamin, niacin, riboflavin, and iron. In 1998, the standard of identity was updated to include folic acid enrichment in response to the science linking folic acid deficiency in pregnant women to neural tube defects in developing fetuses.

Nutrition labeling laws, school lunch mandates, and dietary guidelines are all examples of public health policies intended to improve the health of Americans. However, not all policies have the intended outcome, and the most

notable is the Dietary Supplement Health and Education Act of 1994. This piece of legislation allows manufacturers to make what is called a structure function claim, such as that calcium can contribute to bone health. This has also shifted the burden of purity, safety, and efficacy from the manufacturer to the FDA. So now the FDA has to prove a supplement is dangerous, versus the manufacturer proving it is safe. A recent example is that 49 out of 61 weight-loss pills were inaccurately labeled.

A recent example is that 49 out of 61 weight-loss pills were inaccurately labeled.

People asking me about websites and good sources of nutrition information often ask, "What about those that are linked with medical schools?" If it is linked with a reputable organization, you are pretty much guaranteed to get really good information. For example, Sloan-Kettering (http://www.mskcc.org) and M. D. Anderson (http://www.mdanderson.org) are premier institutions involved in the management of cancer. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 2.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, Appendix: Resources You Can Use.

Questions to Consider

1. What examples of dubious medical claims made on product packaging can you think of?

2. Where do you get your medical information? How do you know your sources are reliable?

Our Underappreciated Digestive Tract

Lecture 3

According to the National Institutes of Health, between 60 and 70 million Americans are affected by digestive diseases.

Digestion takes the food we eat and makes it available to our bodies for the energy we need. This process goes virtually unnoticed and is often unappreciated unless there is a digestive disorder. Let's begin with the basic functions of digestion. In our mouth, chewing food breaks it up into smaller pieces and moistens it with salivary amylase. After this, food reaches the esophagus, where it encounters the first 1-way valve, the cardiac (or lower esophageal) sphincter. The process of digestion and satiety continues in the stomach, which is highly acidic but protected by a mucin layer. At the end of the stomach is the gastric sphincter, which controls the rate of emptying from your stomach to your small intestine. In the small intestine, we have a series of digestive enzymes that help in the breakdown of carbohydrate, protein, and fat, and this is where most of the digestive process occurs.

Other organs of the body make their contribution to this process. Bile is made by your liver and stored in your gall bladder, and it is needed for the emulsification of fat. Bile is 70% cholesterol. Bile is normally recycled; however, when the fiber in, for example, oatmeal binds to bile, that bile is eliminated when you have a bowel movement. Your body has to make more bile, so it removes cholesterol from your blood to make bile. The pancreas contributes valuable enzymes as well as hormones. The pancreas has the enzymatic function of making lipase, amylase, and protease. The pancreas has the endocrine function of releasing insulin, which is important in physiological processing and disease management.

Let's continue through the gastrointestinal tract. The small intestine is about 23 feet long, and its surface is covered with villi. Villi are small, finger-like projections that increase the surface area of the small intestine. Any disorder of the small intestine can cause malabsorption because of the loss of some of that absorptive surface area. On the tips of the villi are enzymes that digest

sugar. Within the deepest recesses of the villi are Peyer's patches, immune-secreting lymphoid tissue. The large intestine is connected to the small intestine by a series of 1-way valves and finishes the work of digestion in about 12 hours.

The large intestine is oftentimes where people end up with one of the more common gastrointestinal (GI) diseases: diarrhea. Diarrhea can be caused by GI irritants, such as food poisoning, and the losses of fluid can be excessive. Other causes of diarrhea include dumping syndrome and inflammatory bowel disease. Antibiotic use can cause diarrhea because it flattens the villi and kills all the bacteria in the large intestine. If you have significant diarrhea, your first line of defense is fluid; if it is from malabsorption, you should consume some light carbohydrates. You also may want to eliminate substances and foods that are not absorbed well.

Constipation is one of the most common intestinal problems in Western societies. The causes are multifactorial. Stress and long-term use of iron compounds can alter the way your nervous system performs and can shut down the last sphincter and cause difficulty having a bowel movement. Low fiber intake is the cause for most Americans. Low fluid intake and lack of exercise are other causes. The treatment for constipation is adequate intake of fiber and exercise.

A common question regarding the GI tract is what causes gas. Gas can be swallowed, by ingesting carbonated drinks or whipping cream, drinking from a straw, eating too fast, or chewing gum. The air goes into the gut and has to go out of the gut. Some acidic foods can promote gas formation. If you consume sugar alcohols, such as those in sugar-free gum, along with swallowing additional air while chewing the gum, the sugar alcohols are fermented in your gut by the bacteria and lead to gas. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 9.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 1.

Questions to Consider

1. Why is the digestive tract an underappreciated part of our bodies?

2. In considering your food preferences, what part of your digestive tract is the most underappreciated?

It's All about the Calories!

Lecture 4

With increasing portion sizes and decreasing physical activity, weight gain is inevitable. Here's a little fact for you. If you need 2000 calories a day, that's your average intake, but you consume an extra 100 calories a day, you're going to gain 10 pounds every single year.

Despite our societal focus on calories, which I contend most people do not count well, a basic understanding of metabolism can actually provide the foundation for developing and implementing lifelong strategies for managing weight. In this lecture, we learn how to calculate our basal metabolic rate and the number of calories that we require.

Total calorie needs are determined based on a number of factors, including basal metabolic rate, gender, age, muscle mass, exercise, and voluntary movement. Basal metabolic rate (BMR) is the number of calories that you need at rest for those functions that are not under your voluntary control. This includes your heart rate, digestion, respiration, maintenance of blood pressure, and body temperature. BMR is responsible in most of us for approximately 60%–75% of the calories we need per day. Your muscle mass determines your BMR, so men have a higher BMR than women because men have more lean muscle mass. Another source of calorie burning is the thermic effect of food, which means the calories it takes to digest your food. Depending on what foods you eat, this makes up about 10%–30% of your total energy expenditure. Exercise can augment or facilitate this dietary-induced thermogenesis.

Corel Stock Photo Library.

Increasing portion sizes make counting calories difficult. A muffin may be listed at 180 calories in a diet book but may actually contain as many as 440.

How many calories do we require? Total energy intake is the number of calories you take in, composed of protein, fat, and carbohydrate. Your total energy expenditure is determined by your BMR, the thermic effect of food, and your physical activity. To estimate your basal energy expenditure: Calculate your ideal body weight by using the Hamwi equation; then multiply your ideal body weight by 10 to get the calories you need per day for your BMR. You have to add back into this the amount of calories you are burning through purposeful activity and through nonexercise activity thermogenesis (NEAT).

Most people outeat their exercise.

Most people outeat their exercise. If you walk 3 miles, you burn around 300 calories, but if you eat a 450-calorie cookie, you outeat your exercise. In general, you should not account for the amount of calories you are taking in during average physical activity.

How do you add exercise into your caloric needs? Exercise and movement can be quantified by adding about 30% to your BMR if you are sedentary. If you are unbelievably active, you could double your BMR calories. If you fall in the middle, you can add about 50% to your basal energy needs.

The best calorie-burning activity is whatever you enjoy and will be able to sustain. The benefits of regular exercise far exceed controlling weight. The biggest benefit can come to people who are currently doing nothing; they get the greatest blood pressure–lowering effect just from starting any activity. Keep in mind that you need to lift weights to maintain functional lean mass. It takes burning 3500 calories to lose 1 pound of body fat. To lose 1 pound of body fat, at 100 calories per mile, you have to walk 35 miles. The challenge is sustaining an activity, enjoying it, and making it consistent.

Let's review some frequently asked questions. Can I rev up my basal energy needs? Yes: The more functional lean mass you add, the higher your basal metabolic rate. The Hamwi equation is for adults, but what are standards for children? Children require more energy than adults per pound of body weight. The best advice will come from your pediatrician. What are the best calorie-burning exercises? Whatever you enjoy! What are the best activities

for someone who is wheelchair bound or on crutches? They can stay fit with physical therapy. The challenge for all of us is always going to be staying lean and fit.

Worksheets:

Below are some websites that have worksheets to help you estimate your calorie intake.

Track your calories at http://www.nutritiondata.com/mynd/mytracking/welcome?returnto=/mynd/mytracking.

Determine the calories in the food you eat at http://www.calorieking.com.

Log in your food intake and exercise to see how you are progressing at http://www.fitday.com. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 10.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 2.

Questions to Consider

1. Why is dietary intake "all about the calories"?

2. Do you consider calories when you make food choices? What are some higher-calorie choices that might be better for you (i.e., "worth the calories")?

Hydration—You Are What You Drink

Lecture 5

Water is everywhere. … sometimes we underestimate the value of this in clinical nutrition. We'll start off by thinking our bodies are 65% to 70% water, plus or minus.

Improper hydration will result in either of 2 types of imbalances: dehydration or overhydration (hyponatremia). Both states have similar characteristics and can become quite serious or life threatening. During this lecture, we will discuss how to maximize your level of hydration and overcome the biological barriers to an appropriate level of hydration. In this lecture, we explore water.

We were taught that we need eight 8-ounce glasses of water per day. For some of us, this is not enough, and for others, it overestimates our needs. Our bodies are about 65%–70% water, but less so if you have more body fat because body fat is anhydrous. The function of water goes beyond refreshment. It serves as a transport vehicle and lubricant, provides the moisture for tears, and regulates heat loss.

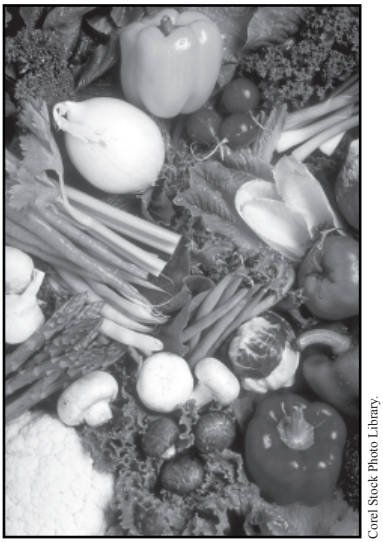
How do our bodies store water? The majority of water is stored around the cells and in the bloodstream. The average adult eliminates about 2.5 liters of water a day. Our food consumption is a source of fluid—about 17 ounces per day. Drinking 2 liters of fluid per day keeps most people hydrated.

The average adult eliminates about 2.5 liters of water a day.

Many factors influence fluid balance. One factor is heat. To cool you, sweat has to dry off your skin. Sweat does not evaporate when the humidity is high, and the body's response is to produce more sweat. In a cold environment, humidity is low, which is dehydrating. Airplane travel can also contribute to excess fluid loss. To test your hydration level, check your urine color. It should look like pale lemonade.

Thirst is a poor measure of hydration because there is a lag between the time you get dehydrated and the time you actually experience thirst. Also, the older we get, the less sensitive the thirst mechanism is. To measure your hydration level during physical activity, weigh yourself before and after exercising. A 1%–2% decrease in body weight can decrease your performance by 15%–20%.

The American College of Sports Medicine gives guidelines on what to drink. If you exercise less than an hour at moderate intensity, water is fine while you are exercising. If you are exercising out in the heat for more than 30 minutes, you probably need a sports drink. Sports drinks are intended to be used during physical activity because they provide fluid and electrolytes. You can calculate your sweat rate: the number of pounds lost in physical activity. Each pound lost is 16 ounces of sweat; to rehydrate, you need 16 to 24 ounces of fluid.



Corel Stock Photo Library.

Fruits and vegetables are 80% to 90% water.

Hydration imbalance means dehydration or overhydration. Dehydration is characterized by weight loss, confusion, dry skin that is hot to the touch, and possibly an elevated core body temperature. In a hot climate, dehydration can be dangerous and result in thermal injury. Individuals who are acclimating to a different environment are more prone to dehydration when exercising outside. Other causes of dehydration are excess diarrhea, vomiting due to gastrointestinal dysfunction, kidney disease, and diuretic medications. The best way to treat dehydration if it is not significant is replacing lost fluid orally. If it is significant dehydration, you can seek an intravenous fluid replacement. Overhydrating means drinking so much fluid that you dilute the

amount of sodium in your blood. The low sodium level can cause a cerebral edema, leading to death.

Other things can affect hydration status. If you are used to drinking coffee or tea, you have acclimated to that level of caffeine and do not lose a significant amount of fluid. However, energy drinks can have a dehydrating effect. Alcohol stimulates the body to produce more urine, so drinking excessive amounts of alcohol can cause dehydration. Medications and disease states can cause intentional or accidental dehydration.

Let's review some frequently asked questions. What is in these energy drinks? There is a significant amount of caffeine in energy drinks. There are also B vitamins and amino acids. We do not know the long-term consequences of energy drinks. What about coffee and tea? There are great phytochemicals and antioxidants in coffee and tea. Because the caffeine is wrapped in whole foods, it behaves differently from the caffeine in an energy drink. ■

Suggested Reading

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chap. 8.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 6.

Questions to Consider

1. Do you follow any type of hydration plan? If so, what is it? If not, what should it be?

2. What are the many forms in which you take in fluids during the day?

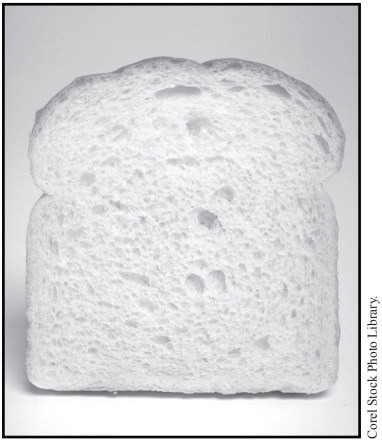
Not All Carbohydrates Are Created Equal

Lecture 6

Carbohydrates account for approximately 50% of the American diet. This much-maligned nutrient is actually a nutritional powerhouse.

The trouble with carbohydrates lies in our food selection and our changing food supply. The shift in the American food landscape has been associated with the development of chronic illness, most notably type 2 diabetes. Bodies have many defenses against having inadequate amounts of carbohydrate because it is the exclusive fuel of brains and muscles.

Carbohydrates are made up of carbon, hydrogen, and oxygen, and in foods they exist in multiple forms, from the simple to the complex. Food gets categorized by the number of glucose molecules contained within the carbohydrate. Simple carbohydrates, or simple sugars, include monosaccharides and disaccharides. Monosaccharides include glucose, galactose, and fructose; they do not exist in simple form in food. Disaccharides include sucrose, which is table sugar; maltose, which is malt sugar; and lactose, which is milk sugar. Disaccharides are 2 monosaccharides stuck together, and for every disaccharide, an enzyme splits it into monosaccharide form. Complex carbohydrates are groups of carbohydrates known as polysaccharides, which are 20 or more sugar units stuck together in chains or branches.



Corel Stock Photo Library.

Both a slice of bread and a piece of fruit contain 15 grams of carbohydrate.

Given their length, it takes longer to break these molecules down into their component parts to be absorbed.

Complex carbohydrates are categorized by the organization of these sugar units in space: Amylose is a long chain, and amylopectin is a branched chain that can hold water.

The function of carbohydrate is to ensure the optimum functioning of the body. The primary function is to serve as an energy source, at 4 calories per gram. Carbohydrate prevents ketosis, which is the accumulation of ketones that can cause nausea and other negative reactions. Carbohydrate spares protein so it can build and repair tissue. For most of us, carbohydrate should account for about 50% of our diet.

Nondiet soft drinks are the biggest source of simple sugars in the American diet.

Choose your carbohydrates wisely. If it is associated with a whole grain, it is an advantageous form of carbohydrate. Nondiet soft drinks are the biggest source of simple sugars in the American diet. Make wiser carbohydrate choices by reducing the consumption of all sweet drinks. Juice is a sweet drink that contains mono- and disaccharides. Choose 100% juice, and drink no more than 4 to 6 ounces daily. Add complex carbohydrates to your diet like vegetables, legumes, dried beans, and peas.

The glycemic index measures how quickly your blood sugar rises after the ingestion of a particular carbohydrate food. Major studies indicate that those who eat a diet of high glycemic index carbohydrates have the greatest risk of many chronic diseases. If you eat a high glycemic index food, you produce significantly more insulin. Insulin is an anabolic hormone, and the development of heart disease, high blood pressure, and cancer are all thought to have this anabolic response. If the carbohydrate is arranged in an amylopectin form, it can actually raise the blood sugar more quickly. Oatmeal, most whole grains, nontropical fruits, legumes, dried beans and peas, and minimally processed foods generally have a lower glycemic index.

The International Table of Glycemic Index and Glycemic Load Values from the *American Journal of Clinical Nutrition* provides the glycemic indexes of many foods. Here are a few sample values.

Table 1. Common foods and their glycemic indexes

Food	Amount	Glycemic index
	Grains	
All Bran	30 g	42
Cornflakes	30 g	81
Oatmeal/porridge	250 g	58
Barley	150 g	25
Waffles	35 g	76
	Fruits/vegetables	
Apple, raw	120 g	38
Banana, raw	120 g	52
Pineapple, raw	120 g	59
Carrot, raw	80 g	47
Potato, baked	150 g	85
	Other	
Lentils	150 g	29
Black-eyed peas	150 g	42
Jelly beans	30 g	78
Skim milk	250 g	32
Angel food cake	50 g	67

Source: Data adapted from Foster-Powell et al., "International Table."
Note: g = gram.

The dietary guidelines encourage consumers to eat minimally processed foods and limit sweeteners in their diet. However, most public health organizations in the United States have stopped short of endorsing the glycemic index as a way of evaluating food because of its complexity. There are times when a high glycemic index food is desirable. Major studies indicate that those who eat a diet with a high glycemic index will have more chronic illnesses.

Let's review some frequently asked questions. Are sugar substitutes bad for you? In general, they are deemed safe but are not recommended for children or pregnant women. What about individuals who are told to drink fruit juice; should they go above and beyond? No, it is better to get the phytochemicals and phytonutrients from consuming the fruit itself. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 3.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 1.

Questions to Consider

1. How do your dietary choices reveal that not all carbohydrates are created equal?

2. Why do you think carbohydrates have recently acquired such a bad reputation?

Facts on Fiber

Lecture 7

Let's define "fiber." Lots of different definitions exist, but the Institute of Medicine's Food and Nutrition Board defines total fiber as both dietary fiber and functional fiber. Dietary fiber is a nondigestible carbohydrate and lignins, the woody portions of the plant. Functional fiber is also a nondigestible carbohydrate. An example is the gummy fibers found in oatmeal, which lower your cholesterol and support immune function.

Another definition looks at the physical properties alone and labels fiber as water insoluble or water soluble. Water-insoluble fiber includes things such as celluloses and the lignins that provide structural dietary fiber. Water-soluble fiber absorbs and holds water. Fiber is found in complex carbohydrates, but it does not have 4 calories per gram.

The health benefits of fiber depend on the type of fiber that is predominant. Insoluble fiber is woody, and its primary role is to regulate bowel function, especially the movement of food through the intestines. Sources include whole-wheat products, nuts, and vegetables. Soluble fiber forms a gel when dissolved in water and can help lower cholesterol and control blood-sugar levels; oatmeal is a classic example. No food has exclusively soluble or insoluble fiber. Since different plants have different amounts and types of fiber, the best way to get an adequate amount of fiber is to eat a variety of high-fiber foods.

What are the benefits of a high-fiber diet? It can promote digestive health by preventing constipation through creating softer, bulkier stools that are easy to eliminate; solidifying loose and watery stools; and lowering the risk of hemorrhoids, irritable bowel syndrome, and diverticular disease. It can also help to lower blood cholesterol and prevent heart disease because water-soluble fiber can help to lower LDL. When you consume a lot of water-soluble fiber, it makes you feel full for longer and can be valuable in weight management. Water-soluble fibers, in particular, can help control blood-sugar levels by delaying the absorption of sugar. The jury is still out regarding the

effects of a high-fiber diet in the management of colorectal cancer.

Corel Stock Photo Library.

One cup of broccoli contains 2–3 grams of fiber.

How much fiber do you need? The Institute of Medicine's Food and Nutrition Board bases fiber recommendations on age and calorie intake. For men and women under the age of 50, they recommend 38 grams for men and 25 grams for women. Over the age of 50, it decreases to 30 grams of fiber for men and 21 for women. As we age, we can tolerate fewer calories, and fewer calories mean that you have less natural exposure to fiber. Be careful when you look online for the fiber content of foods, since a lot of it depends on the database that was used.

How do we increase the fiber content of our diet? Eat fruits and vegetables with the peel, if possible. Add lentils and black beans to casseroles, salads, and mixed dishes. Use brown rice instead of white rice. Choose high-fiber breakfast cereals.

Let's review some frequently asked questions. How can I add more fiber to my family's meals but avoid their complaints? One strategy is pureeing cauliflower and mixing it with potatoes to mask the cauliflower taste. What about fiber-rich choices when I eat out? Always think about eating fruits, vegetables, and whole-grain cereals. Choose the salad bar, or ask to double the vegetable side with your entrée. Is there an example of eating too much fiber? Yes, the man we talked about who developed a bezoar is one example. Remember to gradually increase the fiber in your diet, and your gut will adapt. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 14.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chap. 6.

Questions to Consider

1. Do you know what your dietary intake of fiber is?

2. If so, how should you alter it?

Protein—An Indispensable Nutrient

Lecture 8

Protein is an indispensable nutrient and can be found throughout every tissue in the body.

Protein composes the enzymes that act as a cofactor in chemical reactions and powers the hemoglobin that carries oxygen in the blood. At least 10,000 different proteins created and maintain you. Let's discuss the intricacies of protein.

Here is a brief history of protein. "Protein" comes from the Greek word meaning "primary." The Swedish chemist Berzelius first described it in 1838. Sanger earned a Nobel Prize in 1958 for sequencing the first protein, insulin, into its individual amino acids.

Protein is an indispensible nutrient. It must be consumed because your body has no other way of getting it. It can be found in every single tissue in the body. It is unique among nutrients because it contains about 16% nitrogen. At least 10,000 different proteins helped to build your body and help to maintain it. With genetic codes as a blueprint, protein is built from essential and nonessential amino acids.

Protein ... must be consumed because your body has no other way of getting it.

The most highlighted function of protein is building and repairing tissue. Mechanical proteins are found in muscle and are indispensible for muscular contraction. We also need protein for the immune function. Another function of protein is in the synthesis of enzymes. Proteins can be integral in the creation of an acid-base balance. Proteins transport drugs, vitamins, and minerals throughout our body. Protein is a source of energy. Protein can also help us in weight management.

For protein to function, the body needs a daily supply of amino acids to make new protein. We can store fat, and we have a small ability to store carbohydrate in our muscles and our liver, but we cannot store protein. If we do not replenish protein on a daily basis, we will lose protein from some part of our body; any loss of protein can represent loss of function. Complete proteins contain all of the essential amino acids that we need to build new proteins. These are mostly of animal origin; the exception is soybean. Incomplete proteins are missing an essential amino acid or do not contain an adequate amount; these include bread, nuts, rice, beans, and vegetables. You can combine proteins to complete incomplete proteins.

Corel Stock Photo Library.

Raw egg whites have a clear albumin structure. Heating the egg denatures that protein.

What are our protein needs? Textbooks list body weight in kilograms; to get from pounds to kilograms, divide by 2.2. Normal adult needs are 0.8 g per kilogram of your actual or ideal body weight depending on weight range, weight management plan, and whether you are physically active. During periods of active growth and development, protein requirements are higher: Infants require 2 g per kilogram of body weight, and adolescents need 1 g. If you are an athlete, you have rapid development and are trying to increase your muscular mass. Endurance athletes require between 1.2 and 1.4 g of protein per kilogram of body weight; strength athletes require 1.6 to 1.8 g. For the function of injury repair, the requirements are 1.5 to 2 g of protein per kilogram. For those with a significant thermal injury, protein requirements can exceed 2 g.

What about protein deficiencies? Marasmus is a calorie and protein deficiency, and a classic example is anorexia nervosa. Hypoalbuminemic malnutrition

is when there is low albumin in the blood, which can be caused by stress due to a physical insult to the body. Excess protein does not translate into increased function, but it can contribute to obesity because excess calories are always converted into body fat. A defect in amino acid metabolism can stop protein synthesis. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 17.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 1.

Questions to Consider

1. Considering what you have learned, how, if at all, will you alter your intake of protein?

2. Why do older people often reduce their intake of protein?

Fat, Fat Everywhere!

Lecture 9

Dietary fat is one of the most misunderstood concepts in human nutrition.

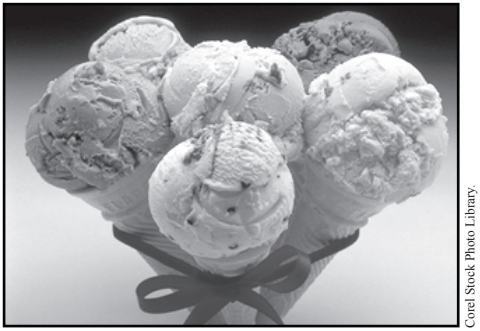
Not all fats are bad: Omega-3 fatty acids were the solution for an athlete who had inflammation in his joints and was struggling with pain. We will explore how fats are neither good nor evil, look at some essential terminology, discuss the consequences of the types of dietary fats, and discuss the basic functions of fat in the diet.

First, some terminology and general facts about fat. Fats are the most energy dense of all the macronutrients, at 9 calories per gram. Chemically, fats are made up of 3 elements: carbon, hydrogen, and oxygen. Saturated fats have a long carbon fatty-acid chain full of hydrogen ions. Unsaturated fats have double bonds that exist between carbon molecules. Trans fats are unsaturated vegetable oils that manufacturers hydrogenate to make more solid so that they last longer. More than 90% of the fat in our body is triglycerides, which are 3 fatty acids stuck to a glycerol backbone. Cholesterol technically does not contain fatty acids, but it is classified as a lipid because it has some of the same chemical and physical characteristics as lipids.

The average American is still consuming about 15% of total calories as saturated fat despite the recommend intake of 10% or less.

What are the functions of fat? It is an energy source. It provides thermal insulation that protects the vital organs from trauma. Fat serves as a vitamin carrier and hunger depressor. Fat is necessary for the production of many regulatory hormones. Fat is necessary for the production of structural components, such as brain development and function.

What is the difference between good and bad fat? Total fat has declined in the American diet, but the average American is still consuming about 15% of total calories as saturated fat despite the recommend intake of 10% or less. In the typical American diet, saturated fat comes about 34% from plant sources and the rest from animal sources. Health professionals recommend replacing some of the saturated fat and all trans fats with nonhydrogenated monounsaturated and polyunsaturated fats. Essential fatty acids are omega-3 fatty acids, which are found in the oils of coldwater fish and flaxseed oil, and omega-6 fatty acids, which are found in meat, corn oil, safflower oil, and sunflower oil.



Corel Stock Photo Library.

Saturated fats are found in meat, cheese, chocolate, whole milk, and ice cream.

There are no firm dietary needs or standards for fat. The American Heart Association encourages people to focus on replacing high-fat foods with vegetables, fruit, poultry, lean meat, unrefined whole grains, and fat-free or low-fat dairy products. They recommend the omega-3 fatty acids in fish. The American Heart Association and other organizations also recommend no more than 300 mg of cholesterol per day. The American Cancer Society is more aggressive and encourages a diet that contains only 20% of total calories from lipids to reduce the risk of certain types of cancer. A prudent recommendation is that 30% or less of your total calories should be from fat, and the majority should be unsaturated fat.

Let's look at fat deficiencies and excesses. Inadequate absorption of fat may be due to steatorrhea, which can result in severe vitamin states. Very low-fat diets can be associated with gallstones. Some of the disease states associated with fat excess will be discussed in later lectures.

Let's review some frequently asked questions. Are those butter substitutes, like Smart Balance and Benecol, good for us? Yes, they can actually provide a better balance of good fats and bad fats. Are there any health risks associated with omega-3 fatty acids? Yes, omega-3 fatty acids increase the tendency to bleed and can be a source of mercury. ■

Suggested Reading

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chap. 3.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 1.

Questions to Consider

1. What hidden fats do you sometimes eat?

2. Why must we be concerned not just about the total amount of fats we eat we but also about the types of fats?

Vitamins—Spotlight on C

Lecture 10

Now let's get vitamins under our belts. We will look at these organic substances starting with their bioavailability and the difference between water-soluble and fat-soluble vitamins. There are 13 different vitamins, and we begin our study with vitamin C.

Let's explore the world of vitamins. Too much of a good thing can be bad: One patient's chronic diarrhea was caused by 10,000 mg of vitamin C supplements. This lecture will explore the types and roles of vitamins to set the stage so we can study the functions, requirements, and potential toxicity of these chemicals.

Vitamins are organic substances. Except for vitamin D, vitamins must be consumed in the diet or through supplementation. Thirteen different vitamins have been isolated and categorized as either fat soluble or water soluble. A key concept in vitamin nutrition is bioavailability. Not all vitamins are singular compounds; vitamin E, for example, has 8 different isomers. There is also a difference between natural and synthetic vitamins. Food or a food component can sometimes increase or decrease the bioavailability of vitamins.

Corel Stock Photo Library.

Vitamin C enhances iron absorption.

Let's discuss fat-soluble and water-soluble vitamins. Fat-soluble vitamins dissolve and remain in the body's adipose tissue; these include vitamins A, D, E, and K. Toxic reactions can occur at low multiples of the recommended dietary allowances of these vitamins. Water-soluble vitamins act as coenzymes that combine with a larger compound to form an active enzyme; these include vitamin C, thiamin (B_1), riboflavin (B_2),

pyridoxine (B_6), niacin, panthenoic acid, biotin, folic acid, and vitamin B_{12}. If the diet contains less than 50% of the recommended value for a water-soluble vitamin, deficiencies can begin to show up within 4 weeks. Water-soluble vitamins are not stored to any great extent; the exception is vitamin B_{12}.

The most famous water-soluble vitamin is vitamin C, or ascorbic acid. Physiologically, vitamin C is an electron donor for 8 enzymes, allowing them to do their job better. Vitamin C comes from fruits and vegetables.

How much do you need? The recommended daily amount (RDA) means the amount sufficient to meet the requirements of nearly 98% of healthy individuals in particular life stages and gender groups. Males ages 19 to 90 require about 90 mg of vitamin C, and females in the same age group require 75 mg. According to the National Cancer Institute, people who eat plenty of fruits and vegetables are less likely to develop cancer; the institute encourages the consumption of 5 or more servings of fruits and vegetables. Some populations need more or less vitamin C than others, and the need varies with factors such as health status and lifestyle choices. Excess vitamin C has been linked with an increased prevalence of kidney stones. The upper limit of vitamin C intake should be about 2000 mg.

What about vitamin C and illnesses? Individuals taking vitamin C have reduced the duration of colds by about 8% for adults and 13% for children. A study on age-related eye disease indicated that taking 500 mg of vitamin C in addition to other dietary compounds shows the reduction of that disease. Plant-based diets can aid in the prevention of cancer, but most of the supplement studies looking at the prevention of cancer and heart disease are proving to be less than effective.

Let's review some frequently asked questions. What do we know about these new vitamin-enhanced waters? If you are vitamin deficient, they might be an option, but supplementing our way to good health is not the way to go. Can medication or another vitamin influence my vitamin C status? Some studies

suggest that vitamin C can interfere with prescription medication; large amounts of vitamin C may interfere with standard chemotherapy for cancer.

Table 2. RDA values for vitamin C

Infant, 0–6 mo	40 mg[a]
Infant, 7–12 mo	50 mg[a]
Child, 1–3 yr	15 mg
Child, 4–8 yr	25 mg
Male, 9–13 yr	45 mg
Male, 14–18 yr	75 mg
Male, 19–30 yr	90 mg
Male, 31–50 yr	90 mg
Male, 51–70 yr	90 mg
Male, >70 yr	90 mg
Female, 9–13 yr	45 mg
Female, 14–18 yr	65 mg
Female, 19–30 yr	75 mg
Female, 31–50 yr	75 mg
Female, 51–70 yr	75 mg
Female, >70 yr	75 mg
Pregnancy, ≤18 yr	80 mg
Pregnancy, 19–30 yr	85 mg
Pregnancy, 31–50 yr	85 mg
Lactation, ≤18 yr	115 mg
Lactation, 19–30 yr	120 mg
Lactation, 31–50 yr	120 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes: Applications*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: mo = month; mg = milligram; yr = year.
[a]These values are adequate intake.

Table 3. Dietary sources of vitamin C

Fruit	
1 cup honeydew melon	31 mg
1 medium kiwi	71 mg
1 cup mango	46 mg
1 orange	70 mg
1 cup papaya	87 mg
1 cup strawberries	98 mg
1 tangerine	22 mg
1 cup watermelon	12 mg
Juice	
1 cup orange juice	124 mg
1 cup tomato juice	45 mg
Fortified juice	
1/2 cup cranberry juice cocktail	45 mg
1 cup grape juice cocktail	60 mg
Vegetables	
1 cup Brussels sprouts, cooked	97 mg
1 cup red cabbage, raw	40 mg
1 cup cabbage, raw	26 mg
1 cup cabbage, cooked	56 mg
1 cup cauliflower, cooked	55 mg
1 cup kale, cooked	53 mg
1 cup mustard greens, cooked	35 mg
1 cup green peppers, raw	120 mg
1 cup green peppers, cooked	101 mg
1 cup plantains, cooked	17 mg
1 potato, baked	20 mg
1 sweet potato, baked	29 mg
1 cup sweet potato, canned	67 mg

1 cup sweet potato, canned, syrup-packed	21 mg
1 cup tomato, raw	23 mg
1 cup tomato, canned	22 mg

Source: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Vitamin C."
Note: mg = milligram. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 22, 26.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chaps. 4, 23.

Questions to Consider

1. Do you take a multivitamin? If you do, why do you take it? If not, why not?

2. Why do you think vitamin C should be the first vitamin we study?

Vitamins A and K—Multitaskers

Lecture 11

Vitamins A and K are important fat-soluble vitamins. In 1906, vitamin A was first mentioned in research stating that there were factors other than protein, carohydrates, and lipids that were necessary to maintain good health. Vitamin K was first discovered in 1929 in cholesterol research. Though these 2 vitamins have traditional roles, they also multitask in many roles in human nutrition.

As fat-soluble vitamins, vitamin A and vitamin K are more likely to be toxic, but they perform important functions. Vitamin A is related to vision, but it is a multitasker. Vitamin A is a necessary for rhodopsin, gene transcription, cell differentiation, T lymphocytes, embryonic development and reproduction, bone metabolism, hematopoiesis, and the maintenance of normal epithelial cells. Vitamin A also has antioxidant activity.

Let's look at the bioavailability of vitamin A. Three different forms of active vitamin A are retinol, retinal, and retinoic acid. These active forms need retinol-binding protein to store the vitamin in the liver. Carotenoids, such as beta-carotene, are inactive forms of vitamin A. The absorption of provitamins like beta-carotene depends greatly on the amount of lipid or fat ingested with the provitamin. Lutein and lycopene are carotenoids that have no vitamin A activity. They may prevent macular degeneration and prostate cancer. As a group, carotenoids function as antioxidants.

Current research indicates that beta-carotene supplements can cause oxidative DNA damage in lung epithelial cells and are associated with increased heart disease risk and a possible increase in gastrointestinal cancer. Foods that contain beta-carotene include carrots, sweet potatoes, and cantaloupes.

How much vitamin A do you need? The RDA values are as follows: males 19 to 70 years, about 900 micrograms (mcg); females 19 to 70 years, about 700 mcg. Deficiency can occur from inadequate dietary intake or from the

malabsorption of lipids. Health problems that may result from a deficiency include reduced night vision, which can cause night blindness; dry eyes or eye inflammation; Bitot's spots; and measles.

The tolerable upper limit of vitamin A is about 3000 mcg per day, or about 10,000 international units (IU); 20,000 IU during pregnancy can cause birth defects and spontaneous abortion. Health problems that may result from excess vitamin A include blurred vision and painful swelling of the long bones; gynecomastia; impotence and other sexual dysfunction; calcium loss that can lead to osteoporosis; irritability; nausea; headache; fatigue; dizziness; and diarrhea. Too much beta-carotene can cause yellow-orange skin.

Corel Stock Photo Library.

Carrots contain carotenoids, which can be converted to vitamin A.

The other multitasker is vitamin K. The 2 primary forms of vitamin K are phylloquinone (vitamin K_1), which comes from plants, and menaquinone (vitamin K_2), which comes from animals. The synthetic form is vitamin K_3. Vitamin K is needed for the normal clotting cascade of blood by the synthesis of blood proteins. It is also needed for production of Gla proteins and osteocalcin and may aid in the prevention of osteoporosis. Food sources include kale, spinach, cabbage, broccoli, and Brussels sprouts. The current adequate intake (AI) is 90 mcg for women and 120 mcg for men. Deficiencies of vitamin K are common among breast-fed infants and neonatal infants. Vitamin K can interfere with anticoagulant and antiplatelet drugs, and chronic antibiotic therapy prevents vitamin K synthesis from the bacteria in the gut. There is no known toxicity of vitamin K.

Let's review some frequently asked questions. It is disturbing to hear about the side effects of too much beta-carotene. Is it harmful to snack on carrots often? No, you are unlikely to have an adverse reaction from eating carrots. Were babies more prone to bleeding before they were given an injection of vitamin K at birth? Absolutely, so mothers that choose home births or alternative birthing centers must get the baby an injection of vitamin K.

If newborns are given shots of vitamin K, should they also have follow-up injections? No, once the baby starts to nurse or drink from a bottle, there will be natural bacterial growth in the gut. Should a breastfeeding woman take extra vitamin K? No, she does not need to. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 22, 26.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chaps. 4, 23.

Questions to Consider

1. Why are vitamins A and K considered multitaskers?

2. What food sources of these vitamins do you consume?

Vitamin E—Fallen Hero; Vitamin D—Rising Star

Lecture 12

Observational studies suggest that vitamin E might reduce chronic disease, but almost every major controlled trial has suggested that vitamin E is not the hero we once thought it was.

Our understanding of the fat-soluble vitamins E and D is changing. At first my husband refused to stop taking vitamin E, but I have convinced him that it is not the best idea. Vitamin E may have some benefit in the reduction of chronic disease, but most studies have failed to show that it can prevent chronic disease. In addition to the development of bone, vitamin D may be needed in the prevention and management of other conditions.

In addition to the development of bone, vitamin D may be needed in the prevention and management of other conditions.

Here are some vitamin E basics. It was discovered in 1922, as a vitamin deficiency that caused sterility in rats. It is fat soluble, and about 90% of your body's vitamin E is fat. Its primary role is as an antioxidant. It is part of the tocopherol family of compounds, which has 8 different forms. Studies suggested it might lower the risk of heart disease. Supplements are thought to reverse some of the age-related decline in immune function in nursing home residents. The American Cancer Society found that vitamin E taken for approximately 10 years can reduce the risk of bladder cancer.

The SELECT study demonstrated that a vitamin E and selenium combination does not prevent prostate cancer. Stay away from vitamin E supplements if you have vascular disease or diabetes.

Small amounts of vitamin E from several sources usually meet your daily requirement. Food sources include wheat germ oil, fortified breakfast cereals, sunflower seeds, almonds, safflower oil, hazelnuts, and most other nuts. Storage and cooking can affect the vitamin E requirement. The form of

vitamin E matters for the dietary requirements. The requirement is affected by polyunsaturated fat intake. The requirement for adults is in the range of 15 mg.

Are there disorders related to deficiency or excess? Vitamin E deficiency is rare. Vitamin E is relatively nontoxic; however, it may interfere with blood clotting. It has been linked with an increased risk of fetal heart defects.

Vitamin D is a fat-soluble vitamin that functions more like a hormone. In addition to bone health, it may aid in the prevention of diabetes, heart disease, multiple sclerosis, schizophrenia, and cancer. Vitamin D is a family of many compounds; the 2 most biologically active are ergocalciferol and cholecalciferol. The skin can make a version of vitamin D from cholesterol. Vitamin D's primary role is as a regulator.

Despite our ability to synthesize vitamin D, the Food and Nutrition Board has set requirements. Five micrograms, or 200 IU, per day is the current requirement for those under 50. The requirement is raised to 10 mcg for those ages 51 to 70 and to 15 mcg for those over 70. Many factors that can influence the synthesis of vitamin D in your skin, including where you live, skin color, use of sunscreen, time of day, clothing, and time of year. Food sources are few, and most are fortified, like milk, breakfast cereals, and orange juice. Natural sources are oily fish, egg yolk, and butter.

Are there disorders related to vitamin D deficiency or excess? Classic vitamin D deficiency disorders are rickets and osteomalacia. Vitamin D deficiency can increase the fracture rate in older Americans. Some experts suggest that the requirement for optimal blood levels may be as high as 2000 IU. Sun

Corel Stock Photo Library.

Natural sources of vitamin D include egg yolks, butter, and oily fish such as sardines.

exposure is not toxic, as the skin can downregulate the amount of vitamin D. Supplements can be toxic, but this generally occurs only with the fully activated form of vitamin D given in prescription supplements. Check your blood level of vitamin D at your next doctor's visit.

Let's review some frequently asked questions. Are there any other blood-level tests for vitamins that I should ask for? If you are over the age of 50, get your vitamin B_{12} level checked. If you suffer from migraines, you may want to get your riboflavin levels checked. Can vitamin E diminish scars or incision marks if rubbed on the skin? Vitamin E on the skin may act as a topical antioxidant, and there is no reason not to try it. Can I take vitamin D all at one time? Current science suggests that it is easily absorbed and there is no reason to split your dose. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 22, 26.

Insel, Turner, and Ross, *Discovering Nutrition*, chap. 9.

Questions to Consider

1. What prompts you to add a vitamin supplement to your diet: your doctor's advice, friends' suggestions, information you have read or seen, advertisements, or other reasons?

2. Why is vitamin E considered a fallen hero?

B Vitamin Basics

Lecture 13

The scientist who first discovered vitamin B soon learned that there was not just one B vitamin. Rather, it's a group of eight substances, necessitating the numbering system that we see today.

Let's look at B vitamins. Vitamin B is a group of 8 compounds: thiamin (vitamin B_1), riboflavin (vitamin B_2), niacin (vitamin B_3), pantothenic acid (vitamin B_5), pyridoxine (vitamin B_6), biotin (vitamin B_7), folic acid (vitamin B_9), and cyanocobalamin (vitamin B_{12}).

Thiamin, vitamin B_1, is part of a coenzyme that breaks down carbohydrate and powers protein synthesis. It helps in the production or synthesis of neurotransmitters. Heat and baking soda destroy thiamin. Thiamin likes acidic environments like the stomach. Thiamin deficiency can occur in as little as 10 days. There are 2 types of significant thiamin deficiency: wet beriberi and dry beriberi. Approximately 25% of alcoholics show symptoms of thiamin deficiencies. Thiamin does not have a known toxicity.

Riboflavin, vitamin B_2, extracts energy from carbohydrate, protein, and fat. Riboflavin may offer some relief from migraine headaches. Riboflavin can be destroyed by ultraviolet light. Riboflavin deficiency can occur in chronic alcoholics; the deficiency has also been seen in teenage girls who do not drink milk. Riboflavin deficiency can also make other B vitamin deficiencies worse, such as vitamin B_6 deficiency. Riboflavin is nontoxic, so no upper limit has been set.

Thiamin deficiency can occur in as little as 10 days.

Niacin, vitamin B_3, participates in over 200 enzymes both under normal conditions and during times of intense activity. Tryptophan is a precursor for niacin and provides about half of the niacin needed. Riboflavin, vitamin B_6, and iron are all needed to convert tryptophan to niacin. Pellagra is the niacin deficiency disease; the 4 signs of the disease are dermatitis, diarrhea, dementia, and death. Higher

does of niacin than the upper limit of 35 mg per day can be used to lower cholesterol. Rare side effects of high-dose niacin include niacin flush and elevated liver enzymes and blood sugar.

Vitamin B_6, pyridoxine, is needed for the functioning of more than 100 enzymes. It helps in protein synthesis, particularly that of nonessential amino acids. B_6 can be destroyed by heat. B_6 deficiency is rare, but when it occurs, it causes microcytic hypochromic anemia. Medicinal use and toxicity became prevalent when vitamin B_6 was linked with the treatment of premenstrual syndrome. The upper limit is 100 mg per day.

Folate, folic acid, is needed for amino acid metabolism, DNA synthesis, cell division, and neural tube development. One study suggested that women who took folate for more than 15 years had a significant reduction in colon cancer. Other studies suggest if the cancer is already present but undiagnosed, folate may actually fuel the fire. The body absorbs about 100% of folic acid in fortified foods and supplements if they are taken on an empty stomach. Heat can destroy up to 90% of food folate; vitamin C can aid in the protection of folate. Folate was one of the most common vitamin deficiencies in the United States until 1998. Folate deficiency results in poorly formed red blood cells, impairs the synthesis of white blood cells, and compromises the immune system. There are prescription medicines that act as folate antagonists; in these cases the deficiency is intentional. There is no real known toxicity, but large doses of folate can mask a B_{12} deficiency.

Vitamin B_{12} is unique to the B vitamin family because the body can store a supply of up to 2 years in the liver. B_{12} is needed in the production of red blood cells and maintenance of a normal central nervous system; B_{12} absorption requires the production of adequate stomach acid and intrinsic factor. B vitamin deficiencies can take years to develop. You can end up with a B_{12} deficiency if you are vegan, over the age of 50, or have had gastric bypass. Vitamin B_{12} has no toxicity.

Is there a relationship between B vitamins and heart disease? Yes. A deficiency of B_6, folate, or B_{12} can increase the level of homocysteine in the blood.

Table 4. B vitamin information at a glance

B vitamin	Function	Sources and stability	Dietary reference intake
Thiamin (B_1)	Breaks down carbohydrate.	Fortified cereals, pork, and navy beans. Destroyed by heat and baking soda.	Male, 19–70 yr: 1.2 mg Female, 19–70 yr: 1.1 mg
Riboflavin (B_2)	Supports energy metabolism.	Liver, fortified cereals, milk, and yogurt. Destroyed by UV light.	Male, 19–70 yr: 1.3 mg Female, 19–70 yr: 1.1 mg
Niacin (B_3)	Supports energy metabolism.	Meat, poultry, nuts, peanuts, and cereals.	Male, 19–70 yr: 16 mg Female, 19–70 yr: 14 mg Upper limit, adult: 35 mg
Pantothenic acid (B_5)	Synthesizes coenzymes important for fatty acid energy metabolism.	Beef, poultry, potatoes, and vegetables.	5 mg
Pyridoxine (B_6)	Amino acid metabolism.	Liver, fish, poultry, fruits, and whole grains. Destroyed by heat.	Adult, 19–50 yr: 1.3 mg Male, 50–70 yr: 1.7 mg Female, 50–70 yr: 1.5 mg Upper limit, adult: 100 mg
Biotin (B_7)	Fatty acid synthesis and metabolism, gluconeogenesis, and amino acid metabolism.	Liver, nuts, and eggs.	Adult, 19–50 yr:30 mg
Folate (B_9)	Metabolism of amino acids and synthesis of DNA; cell division and development of neural tube in fetuses.	Fortified cereal, spinach, broccoli, black and pinto beans, orange juice, and potatoes. Extremely vulnerable to heat.	Adult: 400 mcg Upper limit, adult: 1000 mcg
Cyanocobalamin (B_{12})	Folate absorption; synthesis of myelin.	Liver, meat, eggs, and milk.	Adult: 2.4 mcg

Table 4 continued

B vitamin	Disorders related to deficiency	Disorders related to toxicity
Thiamin (B_1)	Beriberi; "pins and needles" sensation.	No known toxicity.
Riboflavin (B_2)	Mouth sores and inflammation.	No known toxicity.
Niacin (B_3)	Pellegra.	Flushing and redness.
Pantothenic acid (B_5)	Rare.	No known toxicity.
Pyridoxine (B_6)	Microcytic hypochromic anemia.	Weakness; numbness.
Biotin (B_7)	Rare.	No known toxicity.
Folate (B_9)	Neural tube defects in fetuses; macrocytic anemia.	No known toxicity but can mask a B_{12} deficiency.
Cyanocobalamin (B_{12})	Pernicious and macrocytic anemias.	No known toxicity.

Source: Data from Northwestern University, "Nutrition Fact Sheets."
Note: yr = year; mg = milligram; mcg = microgram. ■

Suggested Reading

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chaps. 4, 23.

Insel, Turner, and Ross, *Discovering Nutrition*, chap. 9.

Questions to Consider

1. Which of the B vitamins do you feel is the most essential? Why?

2. Why do you think it took so long to get folic acid added to our food supply?

The Major Minerals

Lecture 14

Minerals are inorganic substances that the body needs in small amounts to build structural components, maintain various chemical gradients, and regulate normal functioning of enzymatic activity.

There are 7 major minerals, which are essential to life, and 14 trace minerals. Calcium and magnesium are major minerals of particular importance. The 7 major minerals that are essential to life: calcium, phosphorus, potassium, sulfur, sodium, chlorine, and magnesium; and the 14 trace minerals: iron, selenium, iodine, chromium, zinc, fluoride, copper, manganese, molybdenum, boron, silicon, vanadium, nickel, and strontium. Let's look at the difference between vitamins and minerals in human nutrition.

Vitamins catalyze chemical reactions in the body without becoming part of the reaction by-products; some minerals become part of the body's structure and chemicals. The bioavailability of minerals and food sources is affected by fiber-mineral interactions and the type of food consumed. Vitamins and minerals interact with each other in a way that affects how each is absorbed. In mineral-mineral interactions, minerals compete with each other for absorption because they are of similar molecular weight.

Calcium is the most plentiful mineral in the human body.

Calcium is the most plentiful mineral in the human body. Calcium is one of the skeleton's primary building blocks and plays many roles in secreting hormones and enzymes and regulating their activity. Some sources of calcium include skimmed milk, salmon canned with the bones, and tofu. The daily reference intake for calcium for males and females ages 19 to 50 is 1000 mg; for males and females ages 51 to 70, it is 1200 mg. The maximum amount of calcium you should consume per day is 2500 mg. The amount of calcium that is absorbed at one time is about 500 mg; if it is taken with other competing

minerals, absorption will be less than this.

Corel Stock Photo Library.

Barley is a good source of iron.

What about calcium deficiencies and excess? Calcium deficiency is often undetected because there are no symptoms until there is extensive bone mass loss. Diets high in protein and sodium can limit the bioavailability of calcium. Inadequate calcium intake can lead to increased risk of hypertension, osteoporosis, and possibly colon cancer. Too little vitamin D can also limit the amount of calcium being absorbed. Excess intake of calcium can lead to hypercalcemia.

Magnesium is another essential mineral and the fourth most abundant in the human body. Magnesium plays a role in bone mineralization, energy metabolism, muscle contraction, and nerve impulse transmission. It may be used to treat, manage, and prevent disorders such as cardiovascular disease, diabetes, and hypertension. Sources include anything with chlorophyll, tap water, almonds, unsweetened chocolate, cooked spinach, and whole grains. Daily reference intakes for magnesium are 420 mg for males ages 31 to 70 and 320 mg for females ages 31 to 70. The upper limit for magnesium intake is around 350 mg per day from supplements.

What about magnesium balance? A deficiency of magnesium can be caused or complicated by acidosis, alcohol abuse, diuretics, kidney or renal disease, and low or high protein intake. Symptoms of magnesium deficiency include confusion, hallucinations, nervousness, muscular weakness, tremors, and swallowing difficulties. Some medications can cause a magnesium deficiency: antibiotics, diuretics, and antineoplastic medications. Magnesium supplements may benefit patients who have trouble controlling their diabetes, are experiencing alcohol withdrawal, or are exhibiting malabsorptive disorders. Excess magnesium is filtered through the kidneys, so it is hard to overdose from dietary sources, unless you have a renal disease. Typical

symptoms of excess magnesium include nausea, vomiting, diarrhea, and low blood pressure.

Table 5. Dietary reference intakes for calcium

Infant, 0–6 mo	210 mg
Infant, 7–12 mo	270 mg
Child, 1–3 yr	500 mg
Child, 4–8 yr	800 mg
Male, 9–13 yr	1300 mg
Male, 14–18 yr	1300 mg
Male, 19–30 yr	1000 mg
Male, 31–50 yr	1000 mg
Male, 51–70 yr	1200 mg
Female, 9–13 yr	1300 mg
Female, 14–18 yr	1300 mg
Female, 19–30 yr	1000 mg
Female, 31–50 yr	1000 mg
Female, 51–70 yr	1200 mg
Pregnancy, ≤18 yr	1300 mg
Pregnancy, 19–30 yr	1000 mg
Pregnancy, 31–50 yr	1000 mg
Lactation, ≤18 yr	1300 mg
Lactation, 19–30 yr	1000 mg
Lactation, 31–50 yr	1000 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes: Applications*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: All values are adequate intake. mo = month; mg = milligram; yr = year.

Table 6. Sources of calcium

8 oz yogurt, fruit, low-fat	345 mg
1.5 oz Swiss cheese	336 mg
1.5 oz cheddar cheese	307 mg
1/2 cup frozen yogurt, vanilla	103 mg
1 tablespoon molasses, blackstrap	172 mg
3 oz sardines	325 mg
1/2 cup ice cream, vanilla	84 mg
1 cup cottage cheese, 2% fat	206 mg
1/2 cup collard greens, cooked from frozen	178 mg
1 oz almonds	75 mg
1 cup mustard greens, cooked	104 mg
1 orange	52 mg
1 cup okra, cooked from frozen	177 mg
1 cup broccoli, cooked from fresh	62 mg
3 oz halibut, baked	51 mg
1 cup navy beans	126 mg
1 cup kale, cooked from fresh	94 mg
1 cup spinach, cooked from frozen	291 mg[a]

Sources: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Calcium"; U.S. Department of Health and Human Services et al., *Dietary Guidelines*.
Note: oz = ounce; mg = milligram.
[a]The calcium in spinach has a bioavailablity of 0 mg, as it is bound to oxalic acid.

Table 7. Dietary reference intakes for magnesium

Infant, 0–6 mo	30 mg[a]
Infant, 7–12 mo	75 mg[a]
Child, 1–3 yr	80 mg
Child, 4–8 yr	130 mg
Male, 9–13 yr	240 mg
Male, 14–18 yr	410 mg
Male, 19–30 yr	400 mg
Male, 31–50 yr	420 mg
Male, 51–70 yr	420 mg
Female, 9–13 yr	240 mg
Female, 14–18 yr	360 mg
Female, 19–30 yr	310 mg
Female, 31–50 yr	320 mg
Female, 51–70 yr	320 mg
Pregnancy, ≤18 yr	400 mg
Pregnancy, 19–30 yr	350 mg
Pregnancy, 31–50 yr	360 mg
Lactation, ≤18 yr	360 mg
Lactation, 19–30 yr	310 mg
Lactation, 31–50 yr	320 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes: Applications*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: mo = month; mg = milligram; yr = year.
[a]These values are adequate intake.

Table 8. Sources of magnesium

1 oz pumpkin seeds, roasted	151 mg
1/2 cup tofu, firm	47 mg
1 oz peanuts	50 mg
1 cup chili with beans	64 mg
1 tablespoon wheat germ, toasted	23 mg
1/4 cup sunflower seeds	41 mg
1 packet instant oatmeal, plain	46 mg
1 cup black beans	120 mg
1 oz bran cereal	103 mg
1 tablespoon peanut butter, smooth	25 mg
1 oz cashews	745 mg
1 cup broccoli, cooked from frozen	24 mg
3 oz halibut, baked	91 mg
1 cup Raisin Bran cereal	77 mg
1 cup milk, skim	27 mg
1/2 chicken breast, roasted, no skin	25 mg
1 cup green peas, cooked from frozen	45 mg
1 potato, baked, with skin	57 mg
8 oz yogurt, plain, low-fat	39 mg

Sources: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Magnesium"; U.S. Department of Health and Human Services et al., *Dietary Guidelines*.
Note: Tap water is a source of magnesium, but the amount varies according to whether the water supply contains "hard" or "soft" water. Hard water naturally contains more minerals, including magnesium, than soft water.
oz = ounce; mg = milligram.

Let's review some frequently asked questions. What is the best time to take a supplement? Choose a time that works best for you, but keep in mind that some supplements can upset an empty stomach. Does a high-calcium diet increase the likelihood of kidney stones? The science suggests that it does not. Is the calcium in fortified foods bioavailable? It depends on the form of calcium, as well as whether it is a liquid or solid food. Does calcium need magnesium to function? Yes.

Why don't we hear about taking supplements for phosphorus, sulfur, and chlorine? Dietary deficiency of these minerals is unlikely. Are DRIs appropriate for everybody? No, DRIs are based on body weight and are designed for people who are well. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 24, 26.

Insel, Turner, and Ross, *Discovering Nutrition*, chap. 11.

Questions to Consider

1. Why do you think calcium and magnesium should be the first minerals we study?

2. Why is the bioavailability of a nutrient so important? Do you consider bioavailability when you take a supplement or plan your meals?

The Highs and Lows of Sodium and Potassium

Lecture 15

There's a lot of confusion about sodium and its partner in crime, potassium. We're going to take a look at these two very, very important electrolytes.

Sodium and potassium are important electrolytes that play a role in regulating fluid exchange within the body's compartments. These 2 minerals consequently play a major role in keeping blood pressure within the normal range. Along with the problem of sodium overconsumption is the underconsumption of its counterbalance, potassium.

Two very important electrolytes are sodium and potassium. Many people are surprised to learn that sports drinks may have less sodium than other drinks such as milk. Sodium and potassium pay a major role in normalizing blood pressure, which reduces your risk of congestive heart failure, coronary heart disease, kidney disease, and stroke.

Sodium intake in the United States regularly exceeds the RDA of less than 2300 mg. The body actually only requires 500 mg of sodium per day. Higher potassium intake helps to lower blood pressure by blunting the effects of sodium as well as reducing the risk of developing kidney stones and bone loss with age.

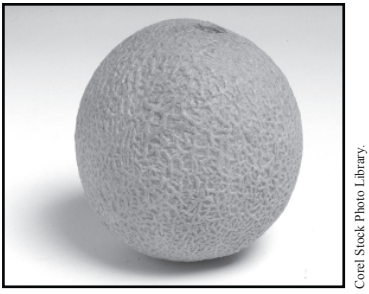
What are the functions and sources of sodium and potassium? They are necessary for the regulation of blood and other body fluids. They help nerves talk to one another and stimulate the action of muscular activity, proper gland function, and heart activity. They are also important for maintaining electrochemical gradients and membrane permeability in cells. Sources of sodium include salt, dill pickles, canned chicken soup, pretzels, and bread. Sources of potassium include sweet potato, plain nonfat yogurt, yellowfin tuna, noncured pork chop, and cantaloupe.

How much sodium and potassium are needed? Healthy adults should consume no more than 2300 mg of sodium per day. African Americans, individuals who are middle-aged or older, and individuals who have high blood pressure should aim to consume no more than 1500 mg of sodium per day. The absolute minimum requirements for sodium intake are different for younger age groups. Athletes or individuals working out for more than an hour are encouraged to drink a sports drink with at least 100 mg of sodium per 8 ounces while exercising. The daily intake requirement for potassium, for adults and adolescents, is about 4700 mg.

Sodium intake in the United States regularly exceeds the RDA of less than 2300 mg.

Your body works hard to keep the amount of sodium and potassium in your blood normal, but deficiencies and excesses can occur. "Hyponatremia" means low sodium in the blood. It can be caused by excess intake of fluid and overuse of nonsteroidal anti-inflammatory drugs. No upper safety limits have been established for sodium, but more than the recommended 2300 mg is associated with high blood pressure (and its risks) and edema. Potassium deficiency can develop due to medication-induced overexcretion of potassium or inadequate daily consumption. Potassium excess is called hyperkalemia, which is most often caused by abnormal kidney functioning. It can also develop from consuming salt substitutes.

Let's look at some practical tips for reducing sodium and increasing potassium in our diets. In the American diet, 77% of sodium comes from food processing, 12% is naturally occurring, 6% is added at the table, and 5% is added during cooking. Individual preference for salt is not fixed, so by reducing the amount of sodium in your diet, your preference for salt will decrease. Use other flavorings to help with the taste. Studies have also shown that the amount



Corel Stock Photo Library.

Sources of potassium include sweet potato, plain nonfat yogurt, yellowfin tuna, and cantaloupe.

of salt people add to their food at the dinner table is generally stable. It is most important to focus on food selection—more fresh, less processed, and less sodium-laden food items. Keep in mind that another invaluable way of reducing your blood pressure is to increase your potassium intake by eating more leafy green vegetables, root vegetables, and fruits from the vine.

Let's review some frequently asked questions. My aunt must eat a low-potassium diet, yet it seems that potassium is so important. What should she do? She needs to see a dietician. When there is a medical condition limiting an essential nutrient, the disease process takes priority. Diuretic medications can cause hypokalemia, but what about coffee and tea? Though they are diuretics, they function differently. Are salt tablets a good method of salt replacement? Yes, but you have to balance them with fluid intake. The requirement for potassium seems so high. Is this hard to achieve through dietary intake alone? Increasing fruits, vegetables, and dairy is a good way to achieve the requirement.

Table 9. Estimated absolute minimum requirements for sodium intake, by age

0–5 mo	120 mg
6–11 mo	200 mg
1 yr	225 mg
2–5 yr	300 mg
6–9 yr	400 mg
10–18 yr	500 mg
>18 yr	500 mg

Source: Data from Food and Nutrition Board et al., *Recommended Dietary Allowances*. Reprinted with permission from the National Academies Press. Copyright 1989, National Academy of Sciences.
Note: mo = month; mg = milligram; yr = year.

Table 10. Dietary reference intakes for potassium

Child, 1–3 yr	3000 mg
Child, 4–8 yr	3800 mg
Child, 9–13 yr	4500 mg
Adult or adolescent	4700 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes for Water*. Reprinted with permission from the National Academies Press. Copyright 2005, National Academy of Sciences.
Note: All values are adequate intake. yr = year; mg = milligram.

Table 11. Dietary sources of sodium and potassium

Sodium	
1 apple, raw, with skin	1 mg
1 cup sauerkraut	1560 mg
1 beef frankfurter	513 mg
1 cup cottage cheese, 2% fat	746 mg
3 oz sardines	430 mg
2 slices ham, extra lean	601 mg
3 oz turkey, light meat, roasted	54 mg
1 tablespoon soy sauce	902 mg
1 cup cornflakes	202 mg
5 large olives	192 mg
2 slices bologna	417 mg
1 oz potato chips, plain, salted	149 mg
Potassium	
1 medium sweet potato, baked	694 mg
1/4 cup tomato paste	664 mg
1 medium potato, baked, with skin	610 mg
8 oz yogurt, plain, nonfat	579 mg
3 oz halibut, cooked	490 mg
3 oz yellowfin tuna, cooked	484 mg
1/2 cup lima beans	484 mg

1/2 cup winter squash	448 mg
3 oz clams, canned	534 mg
1/2 cup white beans, canned	595 mg
3/4 cup tomato juice	417 mg
1/4 cup peaches, dried	398 mg
3 oz pork chop, center loin	382 mg
1/4 cup apricots, dried, uncooked	378 mg
3 oz rainbow trout, farmed, cooked	375 mg
1/4 medium cantaloupe	368 mg
1/8 medium honeydew melon	365 mg
1 cup milk, 1%–2% fat	366 mg
3/4 cup orange juice	355 mg
1/2 cup kidney beans, cooked	358 mg

Sources: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Sodium"; U.S. Department of Health and Human Services et al., *Dietary Guidelines*.
Note: mg = milligram; oz = ounce. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 24, 26.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide, chaps. 4, 7, 23.*

Questions to Consider

1. Why do we care about the highs and lows of sodium and potassium?

2. Which mineral do you feel is of more concern for you, sodium or potassium?

Iron, Zinc, Selenium—Balance Is Everything

Lecture 16

Iron, zinc, and selenium are 3 minerals that highlight the delicate dietary balance needed for lifelong optimal wellness. Think about these 3 minerals like dominos. When you knock down one, there is a consequence to be paid down the line.

Let's look at iron, zinc, and selenium. Iron is a component of hemoglobin, myoglobin, and many enzymes. Iron has an integral role in brain, myelin sheath, and neurotransmitter development; in the maintenance of the liver's detoxification system; and in the functioning of the immune system. About 10% of the dietary iron that you consume is absorbed by the body. Dietary iron comes as heme iron, found mainly in animal products, and nonheme iron, found in grains and plants. Iron absorption can be decreased by antacids, calcium, zinc, magnesium, phosphorus, lead, tannic acid, phytates, oxalates, and soy. Sources of iron include steamed clams and oysters. The daily reference intakes for iron are as follows: Males 19 to 70 years require 8 mg; females 14 to 18 require 15 mg; females 19 to 50 require about 18 mg; and females 51 to 70 require 8 mg.

About 10% of the dietary iron that you consume is absorbed by the body.

What about iron deficiency and excess? Deficiencies can result from chronic bleeding, malabsorption, or bioavailability issues. Those at risk for deficiency include children, women, repeat blood donors, and users of nonsteroidal anti-inflammatory drugs. Excessive amounts of iron act as an oxidant and can have very negative health implications. The upper limit of safety for iron is 45 mg per day for adults and 40 mg per day for teens and children.

Zinc is found in muscle tissue, bone, eyes, prostate glands, testes, skin, and kidneys. Zinc is an essential mineral for over 100 enzymes; it is necessary for strong cell membranes, wound healing, protein synthesis, DNA and RNA maintenance, blood clotting, taste perception, bone mineralization, healthy

thyroid function, normal cognition, and normal fetal development and pubertal growth.

There are conflicting results on the effectiveness of zinc lozenges against colds, but there may be a mild protective effect in zinc supplementation against age-related macular degeneration. The body absorbs between 15% and 40% of dietary zinc. Medicines and excess intake of iron, copper, and calcium can interfere with zinc intake. Sources include oysters, ground beef, pumpkin seeds, and soy nuts. The DRIs are as follows: Males 19 to 70 years need about 11 mg; females 19 to 70 years need 9 mg.

Corel Stock Photo Library.

Sources of dietary zinc include pumpkin seeds, oysters, ground beef, and soy nuts.

What about deficiency and excess of zinc? Deficiency is rare, but it is found in the elderly, children in low-income households, vegetarians, and alcoholics. The upper level for zinc for adults is 40 mg per day; zinc in excess of 80 mg a day can result in lower levels of HDL cholesterol, immunosuppression, the reduction of white blood cells, an interference with copper, defective cholesterol metabolism, and gastrointestinal disturbances.

Selenium's function is to reduce peroxide free radicals that are believed to cause aging and are implicated in various forms of cancer. Selenium works synergistically with vitamin E as an antioxidant, and it plays a valuable role in thyroid function. Plants are the most common dietary source of selenium, but the amount varies. Meat and poultry tend to be more reliable sources. High doses of iron, vitamin C, and heavy metals can decrease the absorption of zinc and selenium. The DRIs for selenium for adults are about 55 mcg, with an upper limit of 400 mcg. Dietary sources include Brazil nuts, oysters, oatmeal, and eggs.

Is selenium a good guy, a bad guy, or both? The SELECT study was designed to see the effects of selenium and other antioxidants in the prevention of prostate cancer, but the intervention group showed no difference from

the control group. In some studies, high selenium levels in the blood and low C-reactive protein suggested that selenium may reduce inflammation. Supplementation may offer some protection from basal cell carcinomas but an increased risk for squamous cell skin cancer.

What about deficiencies and excess? Selenium deficiency is most prevalent after gastric bypass surgery; medications can also have an impact on selenium status. Toxicity can exist, but it is usually at doses greater than 900 mcg per day.

Let's review some frequently asked questions. What is pica? Pica is a disorder in which individuals eat traditionally nonfood substances. I was given a medication for iron deficiency anemia. At what point do I stop taking the supplements or reduce my dose? This is a medical decision; your doctor must check your blood. ■

Table 12. Dietary reference intakes for iron

Infant, 0–6 mo	0.27 mg[a]
Infant, 7–12 mo	11 mg
Child, 1–3 yr	7 mg
Child, 4–8 yr	10 mg
Male, 9–13 yr	8 mg
Male, 14–18 yr	11 mg
Male, 19–30 yr	8 mg
Male, 31–50 yr	8 mg
Male, 51–70 yr	8 mg
Female, 9–13 yr	8 mg
Female, 14–18 yr	15 mg
Female, 19–30 yr	18 mg
Female, 31–50 yr	18 mg
Female, 51–70 yr	8 mg
Pregnancy, ≤18 yr	27 mg
Pregnancy, 19–30 yr	27 mg

Pregnancy, 31–50 yr	27 mg
Lactation, ≤18 yr	10 mg
Lactation, 19–30 yr	9 mg
Lactation, 31–50 yr	9 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes for Vitamin A*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: mo = month; mg = milligram; yr = year.
[a]This value is adequate intake.

Table 13. Dietary sources of iron

1 chicken liver, cooked	15 mg
1 oz pumpkin seeds, roasted	4.2 mg
¼ block tofu, firm	1.33 mg
3 oz lean lamb, cooked	2.3 mg
3 oz beef chuck roast, cooked	3.1 mg
1 square chocolate, unsweetened	4.93 mg
1 cup raisins	2.73 mg
1 cup pinto beans, cooked	3.75 mg
¼ cup sunflower seeds	1.22 mg
1 cup sweet potatoes, canned	2 mg
3 oz turkey, light meat, roasted	1.13 mg
1 packet instant oatmeal, plain	10.55 mg
½ cup spinach, cooked from fresh	3.2 mg
1 oz pistachios	1.19 mg
3 oz tuna, canned in water	1.3 mg
3 oz ground beef, 80% lean, cooked	2.11 mg

Sources: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Iron"; U.S. Department of Health and Human Services et al., *Dietary Guidelines*.
Note: mg = milligram.

Table 14. Dietary reference intakes for zinc

Infant, 0–6 mo	2 mg[a]
Infant, 7–12 mo	3 mg
Child, 1–3 yr	3 mg
Child, 4–8 yr	5 mg
Male, 9–13 yr	8 mg
Male, 14–18 yr	11 mg
Male, 19–30 yr	11 mg
Male, 31–50 yr	11 mg
Male, 51–70 yr	11 mg
Female, 9–13 yr	8 mg
Female, 14–18 yr	9 mg
Female, 19–30 yr	8 mg
Female, 31–50 yr	8 mg
Female, 51−70 yr	8 mg
Pregnancy, ≤18 yr	13 mg
Pregnancy, 19–30 yr	11 mg
Pregnancy, 31–50 yr	11 mg
Lactation, ≤18 yr	14 mg
Lactation, 19–30 yr	12 mg
Lactation, 31–50 yr	12 mg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes for Vitamin A*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: mo = month; mg = milligram; yr = year.
[a]This value is adequate intake.

Table 15. Dietary sources of zinc

3 oz beef chuck roast, cooked	7 mg
1 cup baked beans, canned	5.79 mg
1 tablespoon wheat germ	1.19 mg
8 oz yogurt, plain, low-fat	2.02 mg
3.5 oz turkey, light meat, cooked	1.71 mg
1 chicken liver, cooked	0.78 mg
1 oz almonds	0.87 mg
1 oz peanuts	0.94 mg
½ chicken breast, roasted, no skin	0.86 mg
1 cup lentils, cooked	2.51 mg
¼ cup sunflower seeds	1.69 mg

Source: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Zinc."
Note: oz = ounce; mg = milligram.

Table 16. Dietary reference intakes for selenium

Infant, 0–6 mo	15 mcg[a]
Infant, 7–12 mo	20 mcg[a]
Child, 1–3 yr	20 mcg
Child, 4–8 yr	30 mcg
Male, 9–13 yr	40 mcg
Male, 14–18 yr	55 mcg
Male, 19–30 yr	55 mcg
Male, 31–50 yr	55 mcg
Male, 51–70 yr	55 mcg
Female, 9–13 yr	40 mcg
Female, 14–18 yr	55 mcg
Female, 19–30 yr	55 mcg
Female, 31–50 yr	55 mcg

Female, 51–70 yr	55 mcg
Pregnancy, ≤18 yr	60 mcg
Pregnancy, 19–30 yr	60 mcg
Pregnancy, 31–50 yr	60 mcg
Lactation, ≤18 yr	70 mcg
Lactation, 19–30 yr	70 mcg
Lactation, 31–50 yr	70 mcg

Source: Data from Food and Nutrition Board, *Dietary Reference Intakes: Applications*. Reprinted with permission from the National Academies Press. Copyright 2000, National Academy of Sciences.
Note: mo = month; mcg = microgram; yr = year.
[a]These values are adequate intake.

Table 17. Dietary sources of selenium

1 large whole egg, poached	15.7 mcg
1 chicken liver	16.4 mcg
3 oz crab, cooked	34 mcg
¼ cup sunflower seeds	25.4 mcg
3 oz tuna, canned in water	55.8 mcg
¼ block tofu, firm	8 mcg
3 oz sardines, canned	44.8 mcg
1 tablespoon wheat germ	4.6 mcg
1 cup pasta, whole wheat, cooked	36.3 mcg
1 cup pasta, enriched, cooked	37 mcg

Source: Data from USDA Agricultural Research Service, "USDA National Nutrient Database: Selenium."
Note: mcg = microgram; oz = ounce. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 24, 26.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chaps. 4, 23.

Questions to Consider

1. What does balance have to do with your intake of iron, zinc, and selenium?

2. Now that we have covered vitamins and minerals, what changes will you make in your dietary intake?

Cardiovascular Disease—What Are the Risks?

Lecture 17

Cardiovascular disease is the number one cause of death and disability in the United States and most European countries.

Let's explore cardiovascular disease and its risk factors. Preventing cardiovascular disease must start in childhood. We will look at different types of cardiovascular disease, some modifiable and nonmodifiable risk factors, and how to be a better consumer in terms of predicting your risk.

Angina is severe chest pain generally considered to be from a lack of blood supply or oxygen to the heart muscle. Sometimes people describe it as discomfort, pressure, heaviness, or a tight feeling rather than a sharp pain; angina can be either stable or unstable. Its most common cause is coronary artery disease, which causes atherosclerosis. Oftentimes, heart disease begins to develop in childhood; in studies done with adolescents, it is found in most arterial walls. Of the 24 million individuals in the United States diagnosed with heart disease, often the first symptom is a heart attack or sudden cardiac death. For patients with high cholesterol and high triglycerides, diet and exercise play a key role in the prevention of cardiovascular disease.

Of the 24 million individuals in the United States diagnosed with heart disease, often the first symptom is a heart attack or sudden cardiac death.

What happens when you actually have a heart attack? Severe damage and cell death occur in the arterial wall, killing the heart tissue. The blood supply to the heart is interrupted due to the blockage of an artery, and the fibrous cap ruptures. White blood cells come in and cause the platelets to stick together, forming a clot within the arterial wall. A major cause of heart disease may not be the actual constriction of the arterial wall but the clot restricting blood flow.

What about a cerebrovascular accident, often known as a stroke? It is the same kind of process, but the brain tissue is damaged, with a subsequent loss of brain function due to an interruption in the blood supply to the brain. A thrombotic stroke is due a blood clot that causes a blockage. A hemorrhagic stroke involves bleeding into the brain. Stroke symptoms include dizziness, severe headaches, nausea, and vomiting—which often do not get our attention.

Another form of cardiovascular disease is congestive heart failure. This refers to structural or functional problems within the heart that impair its ability to provide adequate blood flow to the rest of the body. The nutritional causes of congestive heart failure include longstanding atherosclerosis and high blood pressure. The nutritional approach to avoiding congestive heart failure is consistent with that of other types of heart disease, plus the restriction of sodium.

Here are some risk factors for cardiovascular disease. One nonmodifiable risk factor is age, which often means an increase in blood pressure, blood lipids, glucose intolerance, the likelihood of metabolic syndrome, and diabetes. Lifestyle modification is effective at reducing these health risks.

Gender is another nonmodifiable risk factor. Men are improving at early identification and treatment, but women often have a higher risk of death because symptoms go undiagnosed or untreated. Genetics play a role. People who have a known predisposition should be aware of their dietary choices and physical activity. But physical activity cannot undo all the issues with diet and lifestyle. Major modifiable behaviors include quitting smoking, controlling blood sugar, controlling high blood pressure, controlling cholesterol, getting moving, and eating less.

Let's review some frequently asked questions. If my family members are diabetic, what good does it do to diet and exercise? Research shows that diet and exercise always count. My sister does not watch her weight and gets very little exercise, yet I am the one with heart disease. How come? This is due to genetic expression. The key message with all of this is regardless of your family history, regardless of your risk, you can always make a difference with exercise, diet, and lifestyle modifications. The other caution

here is if you have a preexisting disease, go to your physician and ask about modifying this advice to make it unique to you. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chaps. 26–27.

McArdle, Katch, and Katch, *Exercise Physiology*, chaps. 15–17, 32.

Questions to Consider

1. Are you or any members of your family at risk for cardiovascular disease? How?

2. Are you surprised that cardiovascular disease is among the leading health risks for Americans? Why or why not?

A Heart-Healthy Lifestyle

Lecture 18

We spoke in generalities before, but now we will talk about understanding and mitigating your own personal risk.

In this lecture, we explore the definition of a heart-healthy lifestyle. We will take a look at your diet and heart disease risk. First, we take a look at what your blood cholesterol and blood level of triglycerides should be. Total blood cholesterol should be less than 200 mg per deciliter for adults; it should be less than 170 mg per deciliter for children and adolescents. Triglycerides should be less than 150 mg when you fast.

High triglyceride count is often what drives heart disease risk and diabetes. There is an inverse relationship between triglycerides and HDL. Alcohol is metabolized close to fat, so excessive alcohol intake can elevate triglycerides. Simple sugars can increase triglycerides because they are linked with insulin excess. Omega-3 fatty acids can reduce triglycerides up to 40% when given in the range of 2 to 4 g per day.

Lipids cannot circulate freely in the blood, so they are bound to lipoprotein. Cholesterol is at the core of these lipoprotein structures. The amount of cholesterol is different among the lipoproteins, and it is a powerful indicator of heart disease risk. LDL cholesterol carries fat for deposition in cells. Increased LDL levels are associated with a higher risk of heart disease. The recommended LDL level is less than 100 mg per deciliter, but some agencies suggest that even lower is better. HDL cholesterol removes

Corel Stock Photo Library.

Excessive alcohol intake can elevate triglycerides.

surplus cholesterol and fat from tissues. The higher your HDL, the lower your heart disease risk. HDL greater than 60 mg per deciliter is a negative risk factor. Less than 40 mg per deciliter in men or less than 50 mg in women is a positive risk factor.

There are multiple methods to evaluate the risk of heart disease. A man with a total cholesterol value of 200 and HDL of 20 has a ratio of 10. This means he is at risk, because the science says a ratio greater than 4.5 indicates a higher risk of heart disease. Be sure to get your total cholesterol and lipid profile done to give you a clear idea of what your risk is.

One term emerging on the research scene is "homocysteine." Homocysteine is a highly reactive, sulfur-containing amino acid that is formed from the metabolism of an amino acid called methionine. Homocysteine may contribute to increased damage to the lining of the arterial wall that can lead to fatal blockages. An increased level of homocysteine in the blood is a result of increased consumption of protein-rich foods and insufficient consumption of vitamin-rich foods. Vitamins found in fresh foods can catabolize homocysteine.

There is another strategy for assessing your disease risk. You can request from your physician a C-reactive protein level, which is a measure of inflammatory response. High sensitivity C-reactive protein discriminates between general inflammation and heart disease–specific inflammation. Values in general should be less than 1 mg per deciliter.

The American Heart Association recommends no more than 300 mg per day of cholesterol from food.

Now that I know my risk, what can I do? Increase your intake of polyunsaturated and monounsaturated fats and decrease your intake of saturated fatty acids. Science suggests that 2 g of plant sterols per day can lower cholesterol by up to 10%. The American Heart Association recommends no more than 300 mg per day of cholesterol from food. Experts believe that elevated levels of insulin in your blood are an independent risk factor for heart disease. The risk of heart

disease in moderate alcohol drinkers is lower than in nondrinkers, perhaps due to polyphenols in red wine (which can also be found in fruit). Maintain a healthy weight. Exercise is a key factor in terms of burning calories and raising HDL. Eat a variety of nutrient-rich, low-fat, and low-cholesterol foods. Watch your portion sizes, and consider adding sterols to your diet. Drink in moderation. Do not smoke or chew tobacco in any form.

Let's review a frequently asked question. What about natural remedies, like Chinese red yeast extract or niacin to lower cholesterol or coenzyme Q10 for heart patients? The key take-home message with all of these remedies is buyer beware. Without a physician's guidance and monitoring, these can be potentially dangerous. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 21.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chaps. 26–27.

Questions to Consider

1. How can you have a heart-healthy lifestyle?

2. How can parents help their children establish heart-healthy lifestyles?

The DASH Diet—A Lifesaver

Lecture 19

About 1 in 3 Americans faces hypertension, or high blood pressure. Uncorrected hypertension can lead to chronic renal failure, congestive heart failure, heart attack, stroke, and arterial aneurysm.

What constitutes high blood pressure? For adults, normal blood pressure is 120/80 millimeters of mercury. Systolic pressure is the top number, which is the force of the blood when the heart beats. Diastolic pressure is the bottom number, which is the force in between heart beats. Under the age of 50, the diastolic number is the focus; over 50, it is the systolic number. Prehypertension is defined as a blood pressure from 121/81 to 139/89 millimeters of mercury.

What are the risk factors for high blood pressure? Ethnicity is a risk factor. Up to 40% of African Americans have hypertension. Age is a risk factor. Physical inactivity can increase the risk of high blood pressure. People who are obese are at 5 times greater risk. Diets high in sodium and low in potassium or vitamin D increase risks. Sleep apnea is a common and often overlooked cause. Cushing's syndrome can cause high blood pressure.

Other atypical causes include nonsteroidal anti-inflammatory drugs. Other individuals at risk are pregnant women and individuals with polycystic kidney disease, kidney tumors, or insulin resistance. The stress of everyday life can also cause elevations in your blood pressure.

The DASH diet focuses on a high content of fruits, vegetables, and low-fat dairy products and a low fat composition.

What about the DASH diet? This total dietary approach to managing food is one example of the whole food approach that has been endorsed by the American Dietetic Association. With the addition of sodium restriction and weight management, there is strong evidence that this approach can and does work. In general, the DASH diet focuses on

a high content of fruits, vegetables, and low-fat dairy products and a low fat composition.

What is the role of minerals and fats? For every 1-unit increase in the ratio of sodium to potassium excretion, there is a 24% increase in the risk of heart disease. Increasing calcium intake through supplements may actually increase the risk of heart disease and stroke in older women. Limiting saturated fat is great for the management of high blood pressure; increasing omega-6 and omega-3 fatty acids may also help control your blood pressure.

Here is an example of a DASH diet. Keep in mind these guidelines are based on calorie balance, but the general recommendation is that you should not consume less than the minimum number of servings in terms of portions.

- Eat 8 to 10 servings of fruits and vegetables a day to drive up potassium intake. Eat 6 to 8 servings of whole grains.

- Consume 2 to 3 servings of dairy—generally skim or low-fat milk or yogurt. Consume about 6 ounces of lean protein, including chicken and fish.

- Have about 2 to 3 servings of oil or other fats, including olive oil, peanut oil, safflower oil, and sunflower oil.

- Aim for 4 to 5 servings of beans, nuts, or seeds per week.

Let's review some frequently asked questions. My food does not taste salty; does that mean I have a low-sodium diet? No, just because a food does not taste salty does not mean it is low in sodium.

If I have to eat 8 to 10 servings of fruit, can I just drink more juice? By drinking more juice, you do get more potassium in your diet, but keep in mind the bigger picture—eating the whole fruit will give you more fiber and better control over portion size.

Is the DASH diet something that my whole family can do? Your whole family can be on this diet.

Is there anything that I can do to make food preparation easier? Make meals using whole ingredients, and when you do need to buy fast food, look for fruit or vegetable options.

Are there cookbooks for this diet? Anything from the American Heart Association integrates all this science and puts it into a usable form for consumers. The National Heart, Lung, and Blood Institute also has DASH recipes. For more examples of the DASH diet, go to http://www.dashdiet.org/. ■

Suggested Reading

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 2.

Questions to Consider

1. What aspects of the DASH diet do you already incorporate in your life?

2. What aspects of the DASH diet would you find most challenging to incorporate in your life?

Obesity—Public Health Enemy Number One

Lecture 20

Often cited as public health enemy number one, obesity has been on a steady rise since the early 1970s. Children and adolescents are the age group getting the biggest the fastest.

We are going to tackle the subject of overweight and obesity. The challenge with this topic is how to get ourselves more centered in our approach to overweight and obesity. Let's start with a few definitions. Overweight is defined as a body mass index (BMI) between 25 and 29.9. Obesity is a BMI of 30 or greater. Overfat refers to people who have a normal BMI but are carrying more of their weight as body fat.

Obesity is now a global problem. It contributes to ill health as the top global nutrition-related problem and is on the rise in every country in the world. A study in *The New England Journal of Medicine* suggests that any dietary strategy can work, but you have to stick with it. Children and adolescents are concerned with weight but do not recognize diet and calorie management as effective strategies.

[Obesity] contributes to ill health as the top global nutrition-related problem and is on the rise in every country in the world.

Let's look at factors in the development of obesity. There are biological factors: When both parents are morbidly obese, there is an 80% chance their children will be obese. It is estimated that your genetic makeup can account for 50%–90% of the variations in your ability to store body fat. Fat cells play a role in the development of obesity: hypercellular obesity, hypertrophic obesity, and hyperplastic obesity. Sex, age, and ethnicity all play a role in weight gain. There is also a science of satiety, which is under the control of 2 relatively newly discovered hormones, leptin and ghrelin.

Social and environmental factors can play a role in the development of obesity. Americans are more likely to be obese if they have a low socioeconomic status. Level of education is associated with body weight as well, but mostly only for women. The media also plays a role. Another factor is our built environment—for instance, whether our neighborhoods are walkable. Social factors also affect the way that we choose our food. There are lifestyle and behavior factors as well: Lack of exercise is a major factor contributing to obesity. There are also psychological factors: People eat to cope with stress or alleviate boredom.

How do we know if we are overweight? BMI is the gold standard of population-based measurements of overweight. A BMI of less than 24.9 is considered normal weight, between 25 and 29.9 is overweight; 30 or greater is obese. BMI is not necessarily the best tool for evaluating all individuals.

What about the health risks of being overweight or obese? The longer the obesity persists, the higher the risks. Overweight people are 2 to 6 times more likely to develop hypertension. Overweight people have increased risk for stroke, deep vein thrombosis, impaired cardiac function, high blood triglycerides, low HDL, insulin resistance, and type 2 diabetes. Obesity can be a risk factor for the development of cancer. Obese people are more likely to have degenerative joint disease; sleep apnea and mechanical breathing constraints, particularly during exercise; problems with anesthesia during surgery; and compromised wound healing. Other risks include gallbladder disease and nonalcoholic steatohepatitis. There is also a psychological burden: depression, stigmatization, bullying, and discrimination.

Losing weight can reduce disease biomarkers. People who are obese and lose as little as 5%–10% of their body weight can improve their blood pressure, insulin levels, glucose, cholesterol, and triglycerides. Health-care professionals treat obesity like a disease and will emphasize health and fitness over what you should weigh.

Let's review some frequently asked questions. What is weight cycling? Weight cycling is a pattern of losing and regaining weight repeatedly. There is an antidiet movement advocating for size acceptance. What do you

think about that? I think psychologically it is a good thing, but with size acceptance, often we are not calling obesity what it is—a disease. ■

Suggested Reading

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 30.

Questions to Consider

1. Why is obesity called public health enemy number one?

2. Why do you believe the incidence of obesity has increased so dramatically in the United States in recent years?

Healthy Weight Management

Lecture 21

How do we affect weight change? Total energy intake, I've got to reduce how many calories I'm taking in, and I've got to change how many calories I'm expending.

One strategy to prevent overweight and obesity and manage a healthy weight is to adopt a healthy weight management lifestyle. The challenge for all of us is focusing in on a lifestyle that includes eating healthy foods, getting exercise, thinking positively about our food choices and our body image, and learning how to cope with stress. How many of us have been successful in managing our weight?

To affect weight change, we have to reduce total energy intake and increase total energy expenditure. Total energy intake is determined by the amount of calories you take in as carbohydrate, protein, and fat. Total energy expenditure is how many calories you burn and is determined by your basal metabolic rate, the thermic effect of food, and your physical activity level.

If you are trying to prevent weight gain, restricting your diet by just 200 to 300 calories a day will help you manage your weight in the long term.

Along this path of optimal wellness, we have to take a look at goal setting. First, aim for a body weight that optimizes your health—that at least prevents or stops weight gain—and aim for metabolic fitness. Focus in on a lifestyle that includes healthy foods, exercise, positive thinking about body image, and coping with stress. If you develop a lifestyle for successful weight management during early adulthood, healthy behavior patterns have a better chance of taking hold.

The most effective strategy for controlling your weight is managing your energy balance. If you are trying to prevent weight gain, restricting your diet

by just 200 to 300 calories a day will help you manage your weight in the long term. MyPyramid.gov, an online tool, can help you balance your food intake. Overconsumption of food is always related to portion size. We have to realize that crash diets do not work.

How do I balance these energy sources? Fat intake should be lowered modestly to 20%–35% of your total daily calories. Carbohydrates should be between 45% and 65% of your total daily calories. In balancing energy sources, protein is a great way to eat something that is nutrient dense, but a diet that is higher in complex carbohydrates and moderate in protein is a better path to take. Protein should be in the range of about 10%–35% of your total calories.

The topic of eating habits gets us into more of the behaviors of food that are important to weight management. Physical activity is essential to weight management and promotes fitness and overall good health. Create a program that includes some kind of cardiorespiratory endurance as well as resistance training and stretching exercises. In addition, reframing the way we think about ourselves and our world by reducing stress and negativity will improve our behavior.

Corel Stock Photo Library.

Physical exercise is an important part of healthy weight management.

What do we know about life and long-term weight management success? For most individuals, initial success in weight loss relates poorly to their long-term success efforts. Physiologically, in addition to the changes in metabolism, there is a difference in fuel use, which affects your weight loss rate. When the weight loss slows, it means you are using more of your body fat as an energy source, so do not get discouraged. When weight loss plateaus occur, stick with your plan! Individuals who track their weight on the scale are more successful in the long term.

The American Dietetic Association lists 10 ways that you can cut calories. (Get the full list at American Dietetic Association, "Ten Ways.")

1. Get the facts—know what is in your food.
2. Limit alcohol.
3. Use smaller plates.
4. Order kid-size portions.
5. Serve in the kitchen; eat in the dining room.
6. Eat slowly.
7. Use plates—do not eat straight from the package or tray.
8. Eat plant foods—fruits, vegetables, and whole grains.
9. Switch to lower-fat dairy products.
10. Dull is better—food that appears shiny is likely high in calories.

What about individuals who struggle with being too thin? The causes are multifactorial: It can be an altered response to hunger and external cues including sense of time, distorted body image, metabolic and hereditary factors, prolonged stress, bizarre diet patterns or inadequate diets, or an underlying disease. To gain weight, they should eat small, frequent meals that are nutrient and energy dense; drink fluids at the end of the meal or between meals; use timers or other cues to prompt eating, and take a well-balanced vitamin and mineral supplement.

Exercise is still important, but they may want to do some isometric exercises or strength training to promote lean body mass gain and cut back a little bit on the aerobic activity. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 11–12.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 23.

Questions to Consider

1. Why are most weight problems considered lifestyle problems?

2. How do stress and other emotions affect your personal eating habits and food choices?

Metabolic Syndrome and Type 2 Diabetes

Lecture 22

The estimates in the United States are about 47 million Americans have metabolic syndrome. It's not the occasional person that is affected. This is really a public health epidemic.

In the United States, we have seen an explosion in our girth and a corresponding significant increase in diseases like metabolic syndrome and type 2 diabetes. This lecture will explore the health-care tsunami that these diseases represent and the prevention and treatment of these disorders.

We are going to explore the intricacies of metabolic syndrome and type 2 diabetes. A patient came to me with uncontrolled diabetes and asked for a diet and exercise program. I discovered that his toe had gangrene, so the exercise program would have worsened his condition. Metabolic syndrome and type 2 diabetes are a complex set of disorders, so we have to be vigilant in our understanding and management of them.

Metabolic syndrome and type 2 diabetes are consequences of the way we eat and exercise. Many people believe metabolic syndrome is not a disease but a clustering of risk factors: an increase in blood sugar, undesirable changes in blood fats, an increase in blood pressure, and the accumulation of body fat (central obesity). They believe it is our early warning system for type 2 diabetes. The causes of metabolic syndrome include being genetically predisposed, having excessive insulin resistance, and being inactive. To prevent metabolic syndrome, you have to moderate your weight.

Type 2 diabetes is the most common form of diabetes. In type 2 diabetes, the body makes insulin but does not use it effectively. Type 2 diabetes is diagnosed in those with a fasting blood sugar of greater than 126 mg per deciliter or an oral glucose tolerance test of greater than 200. Other factors that can raise blood sugar include medications and illness. Type 2 diabetes is increasingly more common in children.

There are a few factors that can influence the development of type 2 diabetes. Type 2 diabetes is genetic. However, the environment must be conducive to its development.

There have been major studies that indicate that lifestyle changes can prevent diabetes. The most dominant is the Diabetes Prevention Program. Dietary factors include controlling calories and controlling the amount and type of fat and carbohydrate intake. Diets rich in whole grains, which have magnesium, and cereal fiber have been shown to reduce the incidence of diabetes. Iron and sodium nitrate in meat may worsen insulin resistance in type 2 diabetes. Vitamin D is anti-inflammatory, which improves type 2 diabetes. Coffee, both decaffeinated and regular, and light to moderate amounts of alcohol demonstrated a decrease in the incidence of diabetes. Avoid high glycemic index foods, including juices.

Diets rich in whole grains, which have magnesium, and cereal fiber have been shown to reduce the incidence of diabetes.

Type 2 diabetes in children is directly related to the increasing levels of obesity in children. Our youngest patient at Texas Children's Hospital is 4, and complications of type 2 diabetes start to occur 10 to 15 years after the diagnosis, so that will be in her teens or 20s. Complications include neuropathy, retinopathy, and nephropathy. The cost of care for those with diabetes in 2007 was 2.3 times higher than for those without diabetes; as type 2 diabetes becomes a predominant type of diabetes in youth, we can expect to incur greater costs.

Let's review some frequently asked questions. What is type 1 diabetes? In type 1 diabetes, individuals do not produce insulin because their beta cells are no longer functioning. They are on insulin for the rest of their lives.

Is there a best practice for people with metabolic syndrome or type 2 diabetes? Reducing carbohydrate is a good management strategy.

Besides pigment changes, are there any other symptoms of insulin resistance? Belly fat.

Does sugar cause diabetes? It does not cause diabetes, unless it is contributing to obesity.

Can herbal therapies be used to treat diabetes? There is some science to suggest that actual cinnamon can help lower blood sugar. The problem is we have no true standards for the purity, safety, and efficacy of dietary supplements in the United States.

Is there a cure for diabetes? I do not think you can call it a cure in the medical sense, but if I can control all the comorbidities nutritionally, I would consider that a cure.

How do I combine all these dietary recommendations? The diets we recommend in this course are not so different; they all talk about controlling weight and exercise. In tweaking the DASH diet for those with metabolic syndrome, the key is reducing the carbohydrate even lower. A registered dietician can come up with the best plan for you. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 34.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 20.

Questions to Consider

1. Do you believe you or any members of your family are at risk for metabolic syndrome? If so, have you seen your health-care professional to discuss strategies for dealing with that risk?

2. What is the difference between type 1 and type 2 diabetes? How are they similar?

Dietary Approaches to Weight Management

Lecture 23

We're going to take a look at individuals who are successful losers, using data from the National Weight Control Registry. … so you can become a better consumer and better informed.

Research has found that moderately reducing food intake produces greater fat loss relative to the energy deficit. However, in a world where consumers want results yesterday, fad diets, pills, and supplements promise quick and easy fixes. This lecture will explain and critique some of the popular diets that exist today, as well as discuss methods for successful long-term weight management. Let's look at appropriate weight management strategies. We are going to take a look at what successful losers do and critique and explain some of today's popular diets.

The National Weight Control Registry gives us information on what successful losers do. They eat breakfast every day, weigh themselves at least once a week, exercise for approximately an hour every day, reduce their amount of television time to less than 10 hours per week, and they restrict calories and often follow a low-fat diet.

How can you tackle this strategy of weight management? You can get self-help books and manuals, use meal replacements, join self-help groups or go to a private counselor, physician, psychotherapist, or registered dietician. There are also commercial programs such as Jenny Craig and Nutrisystem.

In a world where consumers want results yesterday, fad diets, pills, and supplements promise quick and easy fixes.

The most popular and most controversial diet over the last 30 years has been the Atkins diet. It is a low-carbohydrate, ketogenic diet that says you can eat whatever you want as long as it is just from protein-containing foods. The success of this diet comes from the fact that when most people limit the amount of carbohydrate, they end up decreasing their total calorie intake due to taste

fatigue. The initial weight loss is largely due to dehydration, which does not necessarily reduce your body fat. Low-carbohydrate diets can also cause a significant reduction in lean mass, which reduces your basal metabolic rate.

This diet remains credible to some because you can see some improvement in health. The Atkins diet needs more long-term research on overall health risks.

When would you use a very low-calorie diet, something under 1000 calories a day? Individuals that have severe clinical obesity may be candidates for one of these programs. Advocates of these programs will suggest your limiting your daily calorie intake to between 400 and 800 calories of mostly high-quality, protein-containing foods. The most popular version is Medifast.

If we do not want to do the dieting extreme, what else can we do? Weight Watchers is probably one of the most successful commercial programs out there because it contains all the components of a successful diet. The South Beach diet was written by a cardiologist and is low-glycemic focused. Exercise is not a popular or effective "diet," but it prevents weight regain.

Over-the-counter drugs and dietary supplements for weight loss contain caffeine, benzocaine, or fiber. Ephedra helps with short-term weight loss, but it is dangerous in people with hypertension, heart disease, or diabetes. Two antiobesity drugs are approved by the FDA: Meridia, an appetite suppressant, and Xenical, which interferes with fat digestion and absorption. The benefits of drug therapy over behavioral modification interventions are modest at best—most people, although they will lose weight, cannot live on amphetamines.

The last resort is surgery, and it can be effective in individuals who have morbid obesity—a body mass index of greater than 40. Gastric banding reduces the size of the stomach by creating a smaller upper stomach, allowing smaller intake. Gastric bypass reroutes some of the small intestine so that it malabsorbs some calories. The results with gastric bypass or gastric banding are that patients lose substantially more weight in the initial phases;

however, the weight loss tends to plateau. The long-term effectiveness of this program depends on how people manage their eating.

What does work? Decrease your energy intake by 500 to 1000 calories below daily expenditure by moderately restricting food intake. Keep tabs on your habits and become involved in activities other than eating, especially fitness activities.

Let's review some frequently asked questions. Are there diets that are dangerous, and how do I know? If it sounds too good to be true, it probably is.

Should children go on weight reduction diets? Yes, given the magnitude of obesity, we put children and their parents on calorie-controlled plans.

What about fasting and colon cleaning for weight reduction? These are ineffective strategies for weight control. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 23.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 30.

Questions to Consider

1. Which of the dietary approaches mentioned seems to be the best fit for you and members of your family?

2. If different dietary approaches are best for various members of a family, how can the main food planner and buyer manage?

Nutrition and Cancer Prevention

Lecture 24

Prostate cancer is the leading form in men, and breast cancer is the leading form in women. Poor diet is estimated to account for 30%–35% of cancer cases.

Currently, cancer is the second leading cause of death in the United States. We explore the dietary strategies and lifestyle modifications needed to reduce cancer risk and touch on modifying these recommendations if the diagnosis of cancer has been made.

Cancer is cells gone wild. Our cells are constantly being exposed to DNA-damaging events such as sun exposure, tobacco, environmental chemicals, and alcohol. Damaged cells can have 2 specific fates: apoptosis or cell multiplication. When this aberrant cell growth develops its own blood supply, it is cancer. Eliminating tobacco, alcohol, and sun exposure can help prevent cancer.

Cancer is cells gone wild.

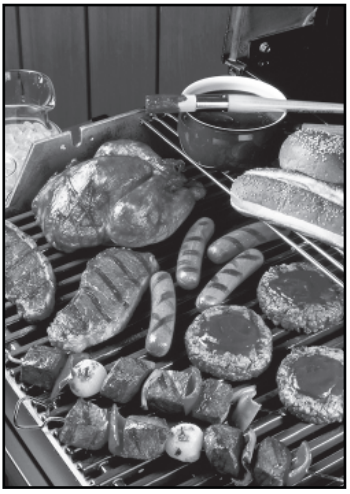
Food and nutrition can either act as a cancer cell promoter or killer. Diet and weight management can aid in the prevention of cancer. A plant-based diet might aid in cancer prevention as well. Mortality rates from both heart disease and cancer increase in tandem with red meat consumption. Reduce meat consumption and avoid grilling, since charred meat can increase the risk of cancer. Eat more whole grains. Regarding cancer prevention, the best approach is no alcohol. Avoid cured meats. Nitrosamines are cancer-causing compounds that are formed when meats are cured.

There are anticancer compounds in fruits and vegetables. When you are organizing your plant-based meals, color and variety of colors matter. Indoles, found in white and green cruciferous vegetables, downregulate the production of one of the stages of cell division in the cancer process. Indoles can also alter the effects of estrogen and promote cancer cell apoptosis.

Lycopene is the red pigment in tomatoes, pink grapefruit, and watermelon and has multiple roles in the prevention of cancer.

For the color gold, try turmeric: It has curcurmin, which is thought to induce cell apoptosis. However, it may reduce the effectiveness of chemotherapy. Yellow and orange produce, such as carrots, corn, and cantaloupe, have carotenoids, which were found to decrease the risk of breast cancer in postmenopausal women.

For blues, purples, and additional reds, try blueberries, raspberries, and strawberries. These contain anthocyanins, which can repair the DNA damage that is the first step of cancer development. Green tea is rich in polyphenolic compounds, most notably catechins, which can induce apoptosis.



Corel Stock Photo Library.

Grilling, and particularly marinating, can increase the charring of meat, which can increase the risk of cancer.

The double-edged sword here is soy. Whole soy may be protective against the development of breast cancer, but those who have breast cancer should probably avoid soy isoflavones.

Vitamins may play a role in the prevention of cancer. Folic acid is needed for DNA synthesis and may help in the prevention of pancreatic and colon cancer. Low levels of folic acid have been linked with breast cancer. Vitamin D from sunlight or from supplements may be effective in the prevention of breast cancer. However, data from the Women's Health Initiative showed no such effects. The American Cancer Society study suggested that those who take vitamin E for 10 years may reduce the risk of bladder cancer; however, the SELECT study demonstrated that taking vitamin E and selenium together was not an effective strategy for the prevention of prostate cancer.

Here are our take-home points: Control your weight, your life, and your food. Choose plant-based foods and beverages from the colors of the rainbow.

Let's review some frequently asked questions. What about nutritional needs during and after chemotherapy and radiation treatments for cancer? Your needs depend on the type of cancer and treatment—always consult your doctor or dietician.

Does coffee have any cancer-fighting properties? Coffee consumption may reduce the risk of liver cancer, but it may be associated with an increased risk of lung cancer.

Can I use a supplement for vitamin D if I am following the American Cancer Society's recommendation to avoid exposure to the sun? Yes. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 23.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chap. 22.

Questions to Consider

1. What nutrition and lifestyle steps can you take to prevent cancer?

2. Even if you take those steps toward cancer prevention, why is it still important to have regular checkups and testing?

Nutrition and Digestive Health

Lecture 25

About 60–70 million people are affected by digestive diseases per year.

Let's look at the normal digestion process while considering the most common disorders. I had a patient who was lethargic. Despite eating large amounts of animal protein, he had iron deficiency anemia. It turned out this was due to high levels of pain medication, which altered his digestive tract. Nutrition is a key player when it comes to digestive health.

The upper digestive tract includes the mouth, esophagus, and stomach. Let's start with oral diseases. Saliva is required for digestion and for moisture. In conditions such as radiation for head and neck cancer, saliva can be compromised; that moisture must be replaced with moist foods. Dysphagia is a chronic disruption of the normal swallowing mechanism. To prevent aspiration of liquid foods, we can add thickeners to prevent them from leaving the mouth quickly.

Nutrition is a key player when it comes to digestive health.

Gastroesophageal reflux disease (GERD) is a condition where the acidified stomach contents reflux into the esophagus. Many causes of GERD include changes in the pressure of the lower esophageal sphincter. Managing GERD means reducing acid production and preventing reflux by consuming a low-fat diet and avoiding certain foods. Other lifestyle strategies include losing weight, getting regular physical activity, avoiding known gastric irritants, eating small meals, eating slowly, sleeping with the head of the bed elevated, and controlling your intake of aspirin or nonsteroidal anti-inflammatory drugs.

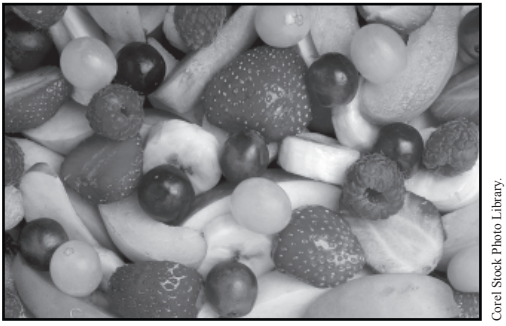
Antacids and medications designed to reduce acid production are popular, but any medication you take chronically may have a nutritional complication.

Now we get to the stomach, and to ulcer diseases. Ulcer symptoms include burning stomach pain, black tarry stools, nausea, vomiting, indigestion,

heartburn, and weight loss. Ulcers can occur both in the stomach and in the small intestine. The dietary and nutritional management for both are similar. *H. pylori* is a bacterium that can cause ulcers. Sometimes ulcers can be secondary to other diseases. Diets can be supportive and aid in the healing process.

There are many diseases and conditions that affect the small and large intestine. Let's examine irritable bowel syndrome. Symptoms include abdominal pain, chronic diarrhea, and chronic constipation. The syndrome is caused by visceral hypersensitivity; another contributor is stress or chronic anxiety. Treatments include a lower- or higher-fiber diet, depending on symptoms; eliminating foods to which the patient is sensitive; and consuming probiotics.

Lactose intolerance is one of the most common digestive conditions and can affect people of all age groups. Symptoms include discomfort after consuming milk products, usually within a couple of hours. The intolerance is due to an insufficiency of lactase; it can also be caused by an infection or inflammation of the intestinal tract. Being somewhat deficient in lactase is normal; however, most people can tolerate up to 12 g (grams) of lactose per day.



Corel Stock Photo Library.

You can increase your fiber intake by adding fruits, vegetables, nuts, and whole grains to your diet.

Celiac disease involves a sensitivity to gluten, which is a protein in grains such as wheat, barley, and rye. It is thought to be an autoimmune disorder. Symptoms may occur in the digestive tract or in other areas of the body. Some people are genetically predisposed to celiac disease. When individuals with celiac disease eat gluten, their immune systems attack, damage, and destroy the villi in the

small intestine that help their body absorb nutrients. The treatment for celiac disease is to eat a gluten-free diet.

Diverticular disease is an inflammation of the diverticula in the intestinal tract. Symptoms include abdominal pain, particularly tenderness in the lower left side. To avoid this disease, eat whole grains and a lot of fruits and vegetables to avoid constipation. Antibiotics are one of the mainstay treatments for diverticulitis, to reduce the inflammation. Recovery would generally involve a low-residue diet as well.

Let's review some frequently asked questions. How do I increase the fiber in my diet gradually? Start with fruits, vegetables, nuts, whole grains, and high-fiber breakfast cereals.

What about fiber supplements? Be careful. Fiber can alter your body's ability to absorb many minerals. If you have constipation, make sure you are not dehydrated. ■

Suggested Reading

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chap. 22.

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chaps. 30–31.

Questions to Consider

1. What digestive disorders have you experienced in your life? How have you dealt with them?

2. How has the study of various digestive disorders shown how disease often has a domino effect on our bodies?

Prebiotics and Probiotics in Your Diet

Lecture 26

Probiotics are the healthy bacteria found in foods and, now, as food additives or in functional foods. Prebiotics are the fuel that feeds probiotics.

Let's explore the exciting new arena of pre- and probiotics. Almost 30 years ago in my clinical practice, we had a significant number of tube-fed patients developing diarrhea. We added yogurt to their diet to blunt the diarrhea, though at the time we did not know why it worked. This lecture is going to explore the science of prebiotics and probiotics, as well as supplements that can help maintain good intestinal health.

Probiotics are healthy bacteria. They are found in foods and, now, as food additives or in functional foods. Examples include fermented foods like yogurt and soy products, some juices, and pickles and sauerkraut. Élie Metchnikoff first observed, in the early 1900s, that Bulgarian peasants who consumed fermented food and milk products lived longer and healthier lives. Probiotics are defined by the World Health Organization and the Food and Agriculture Organization as live microorganisms that, in adequate amounts, confer a health benefit. There is no true requirement for the amount of probiotic needed, because it can autopopulate in your gut.

Prebiotics feed the probiotics. Fiber compounds are the most significant prebiotics—specifically, inulin and its by-products, fructo-oligosaccharides and galacto-oligosaccharides. Major food sources of fructo-oligosaccharides include chicory root, Jerusalem artichoke, leeks, and onions. High-fiber breakfast cereals and bars use chicory root as a fiber source. Fructo-oligosaccharides are also being added to liquid nutritional meal replacements. Doses of above 15 g of prebiotics can cause gastric upset.

Let's take a look at the gut environment. At birth, your gut is sterile. It is colonized by bacteria, depending on the mode of feeding. The oligosaccharides from breast milk function as a prebiotic. The breast milk itself contains

probiotic bacteria that support immune function. The intestinal tract is also involved in the immune response through gut-associated lymphoid tissue.

Health claims are being made for prebiotics. Some studies suggest an improvement in blood sugar and blood cholesterol, but results are not consistent. Other claims include improved magnesium absorption and a slight increase in copper absorption. Prebiotics may also reduce atopic dermatitis, as well as infections in the first 2 years of life.

In general, probiotics can assist in optimizing health.

In general, probiotics can assist in optimizing health. *Lactobacillus acidophilus*–cultured dairy products can reduce vaginal yeast infections. Probiotics may prevent sexually transmitted diseases via changes in vaginal pH. *Lactobacillus* may also aid in the reduction of cholesterol.

Probiotics have recently been associated with a reduction of obesity in pregnant mothers. In those with lactose intolerance, *Lactobacillus* helps to provide an easily digested, high-calcium dairy product. *Lactobacillus acidophilus* and other probiotics have been shown to reduce diarrhea and other digestive diseases.

Supplements can create challenges. Concerns include whether they can be contaminated, the amount of probiotic needed, issues of probiotic viability, whether these products survive in stomach acid, and avoiding competing pathogenics. Although not all probiotics can withstand the very low pH in stomach acid, some produce significant amounts of lactic acid, which may inhibit the growth of unfriendly bacteria.

Are probiotics always safe? They are generally regarded as safe; however, those with altered immune systems should be cautious of products containing probiotics.

If you get enough fiber in your diet, then you are getting enough prebiotics. As for probiotics, consider adding some fermented foods to your diet.

Let's review some frequently asked questions. What happens if we do not consume probiotics or prebiotics? Our guts will be more nutritionally challenged.

Exposure to moisture may reduce the effectiveness of probiotics, but isn't our digestive tract full of moisture? Yes, but what you want to avoid is chronic exposure of the supplements to moisture, as in your bathroom or car.

Are there certain times in the life cycle that pre- and probiotics are important? Once antibiotics are used, pre- and probiotics are needed to repopulate the gut.

Should I add probiotic and prebiotic supplements to my children's or parents' diet? Unless they have an unusual gut disease, these are safe.

If I do not like yogurt or fiber, can I just take a pill? That is an option, but it is always best to eat whole foods. ■

Suggested Reading

Huffnagle and Wernick, *The Probiotics Revolution*.

Questions to Consider

1. What examples of probiotics and prebiotics do you already incorporate in your diet?

2. How do cultural differences affect our food choices?

Food Safety—It's in Your Hands

Lecture 27

Each year in the United States, food-borne illnesses affect 76 million people. These illnesses can be prevented to a certain extent by the consumer.

Foods become contaminated by 3 major methods: biological, chemical, or physical. Biological food contamination mainly occurs during the processing and preparation of foods. These problems may be traced to food preparers not washing their hands or not changing latex gloves when preparing different foods. Cutting boards can also be a source. More than 90% of all food-borne illnesses are caused by bacteria; of the bacteria we consume, only about 4% are pathogenic bacteria that can cause food-borne illnesses with gastrointestinal consequences. Common pathogenic bacteria include *Salmonella*, *Listeria*, *Shigella*, *E. coli*, *Campylobacter jejuni*, *Staph. aureus*, and *Clostridium botulinum*.

More than 90% of all food-borne illnesses are caused by bacteria.

Chemical food contamination can be a cause of illness. Chemical cross-contamination can be reduced by diligent washing. Skins of fruits and vegetables can become broken and contaminated with pesticides or other agricultural chemicals. Plant and animal toxins can also cause chemical contamination.

What about physical cross-contamination? This happens when foreign material, such as glass, bone, metal, or plastic, ends up in food. This is usually the result of an accident in a food production facility.

Certain populations experience more severe symptoms and are at higher risk for contracting a food-borne illness. These include infants and very young children, individuals greater than 65 years old, individuals with a compromised immune system or chronic illness, and pregnant women. The

usual symptoms of food-borne illness are diarrhea, abdominal cramping, chills, fever, vomiting, and dehydration.

The United States has food safety regulating agencies at the federal, state, and local levels. Once an illness develops, a local health agency is usually the first to respond. If it looks like it is an epidemic, state and federal agencies become involved, if necessary. At the federal level, there are 3 agencies involved: the Centers for Disease Control and Prevention, the Food and Drug Administration, and the USDA Food Safety Inspection Service. There is also a federal system called Hazard Analysis Critical Control Point, designed to keep our food supply safe.

What about prevention methods? The agencies' roles include developing legislation to regulate the safety of food processing and handling. Consumer behaviors that influence food safety include hand washing, drying hands with a paper towel, keeping food temperature away from the danger zone, thawing food properly, cooking foods to the appropriate internal temperature, discarding any food that is questionable, and separating raw meat utensils from other foods and utensils. People do not realize the importance of food safety in power outages and flooding. The USDA has useful emergency preparedness fact sheets on its website.

Cook foods to their appropriate internal temperature. You can use a kitchen thermometer to determine the internal temperature.

- Ground meats (beef, hamburger): 160°F.
- Beefsteaks: at least 145°F.
- Pork: 160°F.
- Poultry: 180°F.
- Eggs (casseroles): 160°F.

Let's review some frequently asked questions. How do I know the difference between symptoms of a food-borne illness and stomach flu? It is hard to know, because the symptoms are similar. If you ate at a picnic or an unknown restaurant, it might be food borne.

Can you leave a frozen lunch on your desk for a couple of hours? Consider using a thermometer to check the internal temperature—or refrigerate it.

What can I do to keep school lunches safe? Freeze your juice boxes or water bottles and use them as cold packs.

How can I tell if a weather emergency shut off my freezer when I was away from home? Put an ice cube in a plastic container in the freezer. If it has melted and reformed, the freezer was off.

Is it bad to put hot food right into the refrigerator? No, most hot foods should go straight into the refrigerator.

What can I do if my child does not like to wash her hands in hot water? Use slightly cooler water and find other incentives, like singing songs or rewarding her with stickers. ■

Suggested Reading

Brown, A., *Understanding Food*, chaps. 3, 27.

Brown, J., *Nutrition Now*, unit 32.

Questions to Consider

1. What changes will you make in your food preparation habits to ensure safety?

2. Considering your geographic location, local climate, access to food and other supplies, and other circumstances, when might you experience situations that would require emergency preparedness?

Demystifying Food Labels

Lecture 28

A tip for you might be not to be hooked in by an ingredient on the front label. You have to flip over the back of the package and read the food label.

In May 1994, the Nutrition Labeling and Education Act made vast changes to the regulations surrounding food labeling. The aim was to encourage consumers to make more healthful food choices and to encourage food manufacturers to make more nutritionally sound food items. All food labels must now provide certain specified information.

Here are some tips for healthier consumption. Always examine the back of the package for nutrition information. Pay close attention to the serving size and the number of servings in a package. Next, check the number of calories and the calories from fat. Make sure that the calories you are consuming are not mostly from fat. Aim for less than 5% of the daily value for fat, saturated fat, cholesterol, and sodium. Aim for more than 20% for fiber, calcium, iron, vitamin A, and vitamin C.

Aim for less than 5% of the daily value for fat, saturated fat, cholesterol, and sodium.

How do you recognize a sugar on a label? Added sugars include corn syrup, high-fructose corn syrup, maltose, dextrose, honey, maple syrup, and fruit juice concentrate. Remember that the ingredients in the food are listed from the most to the least by weight.

There are FDA-approved exceptions to every rule, including nutrients on a food label. "Total calories from fat" can be deleted from the food label if the food item has less than 0.5 g of fat per serving. The label can state "0 trans fat" if there is less than 0.5 g of trans fat per serving. "Total cholesterol per serving" can be deleted if the food has less than 2 mg of cholesterol per serving and if the product makes no claims about fat, cholesterol, or fatty acids. "Total fiber per serving" can be deleted if the product contains less

than a gram of fiber per serving. “Total sugars per serving” can be deleted if the food item contains less than a gram of sugar per serving and makes no claims about sugars, sweeteners, or sugar alcohol content. Grams of protein must always be listed, but the “percent daily value” can be deleted.

The FDA has established specific definitions for the terminology found in labeling and packaging. “Good source” means the food item must provide between 10% and 19% of the daily value for a given substance per serving. “Light” means the food item contains 50% or less fat than another brand or than the regular version of a food item made by the same manufacturer. “Fat free” means the food item has less than 0.5 g of fat per serving and no added oil or fat. “Low in sodium” means the food item has no more than 140 mg of sodium per serving. “High fiber” means the food item contains at least 5 g of fiber per serving.

A study showed that Americans may be making serious mistakes in food selection. Other studies confirm that food labels are useful in helping people monitor and reduce their fat intake, but they also acknowledge that there are populations that still need to be reached.

What is the future of nutrition labeling? Supermarkets may become bigger players in labeling products, which may create even more confusion for consumers. The numerous versions of labels and nutrition information can be detrimental for those with special needs. Front-of-package labeling will be trend based.

Let’s review some frequently asked questions. What’s the difference between “low fat” and “low calories”? “Low fat” means that the food item has less than 3 g of fat per serving. “Low calories” means that the food item has fewer than 40 calories per serving.

If I only have time to look at a couple of things on a label, what should they be? Look for portions per package, calories, and things that are important to your personal health.

Table 18. FDA food-labeling terms

Term	Meaning
	General terms
Good source	Provides 10%–19% of the daily value for a given substance per serving.
Free	This product is without (does not contain) whatever term precedes it.
Low	You can consume this item frequently without surpassing a nutrient's daily value.
Less	Contains at least 25% fewer calories from a specified nutrient than another brand or food item.
High; rich in; excellent in	Contains 20% or greater of a specified nutrient's daily value.
	Terms concerning fats
Fat-free	Has less than 0.5 g of fat per serving and has no added oil or fat.
Light	Contains 50% or less than another brand or than the "regular" version of the food item made by the same manufacturer (e.g., Kraft Mayonnaise versus Kraft Light Mayonnaise). However, with oils, "light" refers to the color.
Low-fat	Has 3 g or less of fat per serving.
Less fat	Contains 25% or less than another brand or than the regular version of the food item made by the same manufacturer.
Extra lean	Contains less than 95 mg of cholesterol, 5 g of fat, and 2 g of saturated fat per 100 g of poultry, seafood, or meat and per serving.
Lean	Contains less than 95 mg of cholesterol, 10 g of fat, and 4.5 g of saturated fat per 100 g of poultry, seafood, or meat and per serving.

Mono- and diglycerides	Ingredients in food that are forms of fat. Fat in food is found primarily as a triglyceride. A monoglyceride is added for creaminess and is a fatty acid esterified to a glycerol backbone.

Terms concerning fiber and sodium

High-fiber	Contains at least 5 g of fiber per serving.
Light	The item is low in calories and the manufacturer has reduced its sodium content by at least 50%.
Low in sodium	Has less than or equal to 140 mg of sodium per serving.
Very low sodium	Contains less than or equal to 35 mg of sodium per serving.
Sodium-free; salt-free	Has 5 mg or less of sodium per serving.

Terms concerning calories

Light	Has 1/3 fewer calories per serving than another food item (either from a competitor's brand or the same brand by the manufacturer).
Low-calorie	Has 40 calories or fewer per serving.
Calorie-free	Has fewer than 5 calories per serving.
Reduced-calorie	Has at least 25% fewer calories than another food item per serving (from the same or a different manufacturer).

Terms concerning cholesterol

Less cholesterol	Contains at least 25% less cholesterol compared to another food item and contains 2 g or less of saturated fat per serving.
Low-cholesterol	Has 20 mg or less of cholesterol and 2 g or less of saturated fat per serving.

Cholesterol-free	Has less than 2 mg of cholesterol and 2 g or less of saturated fat per serving.

Source: Data from U.S. Food and Drug Administration, *Guidance for Industry*.
Note: g = gram; mg = milligram. ■

Suggested Reading

Brown, A., *Understanding Food*, chap. 28.

Brown, J., *Nutrition Now*, unit 6.

Questions to Consider

1. How will you apply the suggestions for reading food labels when you shop?

2. What examples might you have of being misled by an advertisement or food claim on a particular product?

Facts on Functional Foods

Lecture 29

Many consumers believe that food is medicine, and as a dietician, I believe it can be, to a certain extent. Foods are designed to nourish us and part of that nourishment should be wellness-focused.

There has been growing concern over the research behind functional foods, and questions have been raised as to whether they really are "superfoods." Many consumers believe that food is medicine, and to a certain extent, it can be. However, we must be educated on which foods are really worth the extra punch they seem to be packing.

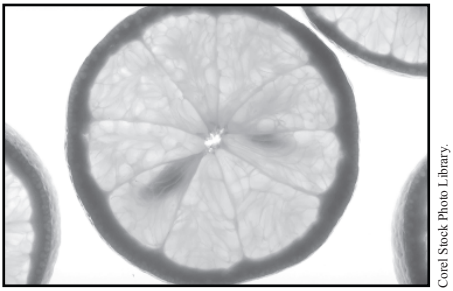
Let's explore functional foods. Foods are designed to nourish us, and part of that nourishment should be wellness focused. This lecture explores the definition of functional foods, gives examples of popular functional foods, explores terms used in functional food markets, and takes a look at regulations and policies regarding functional foods.

There is no legal definition of the term "functional food" in the United States. According to the American Dietetic Association, a functional food is a food that moves beyond the necessity to provide additional health benefits that may reduce disease risk or promote optimal health. Functional food categories include conventional foods, modified foods, medical foods, and foods for special dietary use.

Let's start with conventional foods. Oxygen radical absorbance capability (ORAC) is a system that gives a number to a food based on its ability to scavenge free radicals and neutralize them. Spices score high on ORAC rating tables, but the amount that you usually consume is so small that it adds little to your antioxidant intake.

All fruits, vegetables, and nuts confer antioxidant capability. These include cruciferous vegetables, tomatoes, and citrus fruit. The category of conventional foods also includes fermented dairy products, such as yogurt,

which use probiotics to ferment. Another conventional food is cranberry juice, which has proanthocyanidins that reduce the risk of a urinary tract infection.



Corel Stock Photo Library.

One study showed a 28% reduction in the risk of stomach cancer with a high intake of citrus fruits.

Another category is modified foods. These are modified through fortification, enrichment, or enhancement. Examples include calcium-fortified orange juice; folate-enriched bread; margarines enhanced with plant stanols or sterol esters; and energy drinks that include ginseng, guarana, or taurine. The challenge is that bioavailability information should be provided to educate the consumer on the actual amounts of the nutrient they are receiving.

Other categories are medical foods and foods for special dietary use. medical foods have been defined by the Orphan Drug Act. A type of medical food is oral supplements designed for specific medical purposes. Foods for special dietary use do not require medical supervision. Examples of foods for special dietary use include infant foods, gluten-free foods, lactose-free foods, and foods for reduced weight.

Evidence-based science is emerging that links diet to chronic disease reduction and other health outcomes.

Some 85% of consumers believe that certain foods may have health benefits that reduce the risk of chronic disease or other health concerns. Evidence-based science is emerging that links diet to chronic disease reduction and other health outcomes. There is a striving for a personalized approach to nutrition, and the wave of the future is food for the treatment of health conditions.

Is there regulation of functional foods? There is no specific regulatory framework for functional foods yet, because the movement is so new.

Currently, however, there are 3 claim categories that can be used: nutrient content claims, structure/function claims, and health claims. Establishing a cause and effect relationship with functional foods is controversial, because many factors influence food behaviors and mechanisms in the body. It is the job of the FDA and nutrition professionals to ensure that the consumer is provided with correct information.

Let's review some frequently asked questions. As a health-care professional and a mother, do you buy foods with functionality in mind? I tend to look at the whole food and not an individual ingredient.

How do I integrate functional foods into my family's diet? Choose fruits and vegetables from the colors of the rainbow; you can also look at margarines and cereals that have functional ingredients added.

Do I really have to eat mounds of healthy foods to acquire all the nutritional benefits? No, you should still watch your calorie intake. If you eat well, over time you will get enough of these wonderful nutrients in your food.

Should you go out and buy those really expensive exotic berry juices? You may want to save your money and stick to a greater whole food approach. ■

Suggested Reading

Eskin and Tamir, *Dictionary of Nutraceuticals and Functional Foods*.

Heasman and Mellentin, *The Functional Foods Revolution*.

Questions to Consider

1. What types of functional foods do you and your family incorporate into your diet?

2. Why is FDA regulation of food claims so important to the American consumer?

A Look at Herbal Therapy

Lecture 30

Optimum nutrition, disease prevention, and wellness, sometimes called "complementary care," are all concepts that resonate with many Americans.

Reasons for the use of herbal therapies are varied and include dissatisfaction with traditional medicine, the need to take charge of your own health care, and the belief that natural medicine is somehow safer than traditional medications. This lecture will explore the myths and realities of herbal medicine with an emphasis on a few of the most popular supplements. Let's explore the intricacies of herbal medicine and try to determine whether it is a healer or a hoax.

A study showed that from 1997 to 2002 there was an increase of herbal therapy use from about 12% to 18.6%. This means around 38 million Americans are using some form of herbal therapy. The predictors of use include being female; having an annual income greater than $65,000 a year; and having greater than a high school education—but users also include the uninsured. The popularity of herbal supplements is often media driven, so the list of the most popular herbal therapies shifts frequently.

Around 38 million Americans are using some form of herbal therapy.

Let's explore the Dietary Supplement Health and Education Act. In the early 1990s, the FDA decided to weigh in on the emerging interest in herbs as medicine. In 1994, the Dietary Supplement Health and Education Act passed, which allowed supplements to be marketed as "all-natural." This act left us with a structure/function claim and a significant number of loopholes.

The unintended consequence of this legislation is that a company does not have to prove that an herbal product is safe before it reaches the market. Products that are contaminated, contain too much of an active ingredient,

or contain undeclared substances can reach the market. FDA and consumer reports have found that 49 weight loss pills had undeclared substances. In the United States, removal of products or herbs from the market is rare. Unfortunately, oftentimes it takes a high-profile individual being injured, hurt, or killed.

What about popular supplements and current concerns? The banning of ephedra increased the use of bitter orange for weight loss; in combination with caffeine, it is demonstrated to promote weight loss, but there are drug interactions and side effects. St. John's Wort is used to manage mild to moderate depression but is ineffective for significant depression. Drug interactions and side effects may be significant. *Echinacea* is used to stimulate the immune system. Some experts recommend against it for those with asthma or allergies. Drug interactions may occur with immunosuppressive medications.

Garlic was traditionally used to lower cholesterol; however, it may not be effective. There is also a significant risk of bleeding if you use garlic with nonsteroidal anti-inflammatory drugs. Aloe vera is effective topically to promote healthy skin, but aloe latex is a strong laxative and can cause potassium depletion and kidney failure. Oral aloe vera may be effective for treating ulcerative colitis, but there are possible drug interactions.

Corel Stock Photo Library.

Garlic was thought to lower cholesterol, but it may not be effective.

Gingko biloba's leaves contain flavonoids and compounds that reduce blood clotting, so you should avoid it prior to surgery. Some parts of the plant are beneficial, and some are poisonous. There are possible drug interactions.

Ginseng is a multipurpose herb with various species. Ginseng may thin the blood and act synergistically with other herbs and medicines, so avoid it prior to surgery. As with other herbs, interactions may occur.

Let's review some frequently asked questions. Why is the FDA so opposed to the use of herbal medicines? The FDA is not opposed to their use but would like more information on purity, safety, and efficacy. Are there any labels you should look for to determine if an herbal supplement is safe? Yes, the NSF International seal, the ConsumerLab seal, and the Informed Choice seal. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 19.

Questions to Consider

1. Has this lecture changed your views about herbal therapies, their use, and their effectiveness? If so, how?

2. Why is it so important to tell your health-care professional not just about herbal therapies you are taking but about supplements you use?

Organic or Conventional—Your Choice

Lecture 31

Consumer purchases of organic products have increased by 20% each year, and organic foods have appeared in grocery stores worldwide. Are there significant health benefits to choosing organic foods?

Let's explore the world of organic products. We have to keep things in perspective. A client of mine stopped buying produce because organic produce it was too expensive and she refused to eat anything not organic. So she wound up eating more processed foods. Some 81% of consumers buy organic foods because they believe they have a higher nutritive value than conventional foods.

Organic is a legally defined term that describes the way farmers cultivate and process agricultural products. The term "organic" can be applied to produce, meat, dairy, poultry, and processed foods. Organic produce is designed to support soil and water conservation and reduce pollution. It does not allow for irradiation or genetically modified foods. Organic farmers use natural fertilizers and beneficial insects to reduce pests and diseases. Organically farmed animals are provided with organic feed and no antibiotics or growth hormones. Organically farmed animals are allowed to be free range and must be humanely slaughtered.

The USDA has guidelines for its organic certification program, but there are no national standards for organic seafood at this time.

Is organic produce more nutritious? Organic foods have fewer nitrates present. High nitrate content may cause methemoglobulinemia; cancers of the digestive tract, bladder, and ovaries; and non-Hodgkin's lymphoma. Omega-6 is considered to be an inflammatory fatty acid and has been linked to eczema. Conventional milk has higher omega-6 than organic. Studies have shown that organic crops contain more vitamin C, polyphenolic compounds, essential amino acids, total sugars, alpha-tocopherol, and phosphorus than conventional crops. Conventional food samples had equivalent amounts of

beta-carotene, yet higher levels of potassium, compared to organic food samples. Crude protein was significantly higher in the conventionally grown wheat product.

There are always concerns about pesticides. Pesticide consumption has been linked to solid tumor cancers, non-Hodgkin's lymphoma, and leukemia, as well as some childhood cancers. Organic foods have lower levels of pesticides than conventional foods. Dietary intake is the most common source of pesticide levels in the human body. The overall amount of pesticides on any fruit or vegetable poses a very small health risk to adults, but it can be a concern in children.

The foods that contain the most residual pesticides are peaches, apples, sweet bell peppers, celery, nectarines, strawberries, cherries, pears, grapes, spinach, lettuce, and potatoes.

The foods that contain the most residual pesticides are peaches, apples, sweet bell peppers, celery, nectarines, strawberries, cherries, pears, grapes, spinach, lettuce, and potatoes. Foods that contain the least amount of pesticides are papaya, broccoli, cabbage, bananas, kiwi, mangoes, pineapple, avocados, and onions.

Corel Stock Photo Library.

Avocados are among the foods that contain the lowest levels of pesticides.

So where does this leave us? The USDA does not claim that organic products are more nutritional than conventional products. No conclusive evidence suggests that organic foods are beneficial in the prevention of diseases or common health concerns. Organic foods may spoil faster because they have no preservatives. The bottom line is that you should follow personal preferences and your own opinion. Organic produce can cost 10%–30% more than conventional foods. Organic animal products and processed foods

may be up to 100% more expensive. This is because they are much more labor intensive.

Tips for consumers: Buy fresh produce in season; read labels; thoroughly wash both organic and conventional produce; if you are concerned about conventional fruits and vegetables, peel them.

Let's review some frequently asked questions. Are there certain times in the life cycle when eating organic is particularly important? In general, the more vulnerable the population, the greater the advantage to choosing organic.

Do vegetable washes and sprays remove all pesticides? Scrubbing fruits and vegetables with water for at least 30 seconds may be just as effective as washes.

If we prefer but cannot afford organic, should we just skip the fresh fruits and vegetables and take a multivitamin instead? No, fruits and vegetables have phytochemicals that pills do not. ■

Suggested Reading

Burke, *To Buy or Not to Buy Organic*.

Questions to Consider

1. What are the factors you consider when determining whether to purchase organic products?

2. Why do you think the demand for organic products has increased in recent years?

Fake or Real—Sugars and Fats

Lecture 32

Numerous products on the market are made with artificial sweeteners, fat replacements, and other additives, which makes it difficult to determine if what we are eating is real or fake.

Your preference for sweetness varies by genetics, exposure during early childhood, and whether you are full or hungry. Nearly a third of the extra sugars we consume are from sugar-sweetened soft drinks.

By definition, a nutritive sweetener is something that is sweet tasting and has energy. The common ones that you are familiar with are sucrose and fructose. These are usually easily digestible. Sugar alcohols are also nutritive sweeteners and include manitol, sorbitol, xylitol, maltitol, and hydrogenated starch. These are generally regarded as safe food additives, but they can cause gas, cramping, bloating, and diarrhea. Foods with sugar alcohols can be labeled "sugar free." They have a reduced glycemic response and dental caries risk and may have a prebiotic effect.

Nonnutritive sweeteners provide a sweet taste but no energy. Five nonnutritive sweeteners currently have FDA approval: acesulfame-K, aspartame, neotame, saccharin, and sucralose. They are anywhere between 160 to many hundreds of times sweeter than sugar and are noncariogenic. Aspartame (a.k.a. NutraSweet) generates a limited glycemic response, but acesulfame-K, neotame, saccharin, and sucralose generate no glycemic reaction. These nonnutritive sweeteners may be beneficial in managing diabetes, controlling weight, and preventing cavities.

Heating does not reduce the sweetening power of acesulfame-K, neotame, saccharin, or sucralose, though prolonged heat may cause a loss of sweetness with aspartame. Saccharin was once labeled as a carcinogen, but in 2000 this was removed from its label.

Both nutritive and nonnutritive sweeteners have very little evidence of detrimental long-term effects on overall health. Caution should be taken during childhood and pregnancy to avoid excessive amounts of nonnutritive sweeteners. The Institute of Medicine says that no more than 25% of calories consumed should be added sugars. Too much sugar in the diet may cause a person to decrease consumption of essential vitamins and minerals needed by the body to function. Excess sugar can contribute to obesity. Nonnutritive sweeteners have the potential to reduce calorie intake.

No more than 25% of calories consumed should be added sugars.

Diabetics may use nonnutritive sweeteners because they do not raise blood sugar. Nutritive sweeteners should not be completely restricted, but they have to be monitored. However, for those with type 2 diabetes, nonnutritive sweeteners can aid in weight control. No relationship has been established between the risk for common cancers or cancerous tumors and sweeteners.

Many processed foods contain fat replacers. These fat replacers must be able to copy some or all of the functional properties of fat. Most of the fat replacers are classified into 3 groups: carbohydrate based, protein based, or lipid based. Carbohydrate-based fat replacers absorb water to form gels that simulate a texture similar to fat. Protein-based fat replacers are made from milk, oftentimes whey protein. Lipid-based fat replacers are fat modified by chemical changes that will inhibit absorption.

Fat extenders generally reduce calories by diluting the fat with water in the form of an oil and water emulsion. Lipid analogs have many characteristics of fat but have a different digestibility and nutritional value.

If the substance is labeled as GRAS (generally regarded as safe), that means the FDA has evidence that it is safe to use in food. However, concerns have been associated with Olestra and polydextrose, both of which have the ability to cause stomach upset. If fat replacers are used in an overall diet plan that promotes the use of healthy fats and a variety of low-fat products, then a balanced calorie intake can be achieved.

Let's review a frequently asked question. How do I use applesauce or fruit purees as replacers in baked goods? Use them to replace about 50% of the oil in the recipe. You can reduce the fat in your foods, but fat-free foods are difficult to achieve. ■

Suggested Reading

Brown, A., *Understanding Food*, chaps. 20–21.

Duyff, *American Dietetic Association Complete Food and Nutrition Guide*, chaps. 3, 5.

Questions to Consider

1. What artificial sweeteners and fat replacers do you regularly use? How would your diet change if you could not buy artificial sweeteners or fat replacers?

2. Despite our increased use of these lower-calorie products, the American waistline is still expanding. Why?

Creating Your Own Personal Nutrition Plan

Lecture 33

What we're going to do is develop a step-by-step road map to a better eating plan … to help you to be able to review your health history, evaluate your weight, your body mass index, your health status, medications, and to design a basic plan.

Using a nutrition assessment process, you will be able to review your health history; evaluate your weight, body mass index, and medications; and design a basic plan. Keep in mind, this step-by-step guide does not replace advice from your physician or dietitian. Rather, it is intended to personalize the nutrition information you have learned.

We are going to develop a road map to a better eating plan. There are 4 basic assessments—A: anthropometric; B: biochemical; C: clinical; and D: dietary. Anthropometric measurements are body measurements. First, measure your height and weight. Then calculate your body mass index by take your weight in pounds, multiply it by 703, and divide that by your height in inches squared. A body mass index of greater than 25 is considered overweight, 30 or greater is obese, and less than 19.8 is underweight.

Next measure your waist circumference. If it's greater than 35 inches for a woman or greater than 40 inches for a man that means you are likely to develop prediabetes, or metabolic syndrome. If you are able to measure your body composition in a BOD POD, your body fat percentage should be less than 30% for women or less than 20% for men.

For a biochemical assessment, have a physician perform blood work for you. Then look at your cholesterol; your iron status: hematocrit, hemoglobin, and ferritin; and your mean corpuscular volume (MCV). Small red blood cells indicate possible iron deficiency. Large red blood cells mean that you might have B_{12} or folic acid deficiency.

Ask to have your vitamin D status checked. Urinalysis results indicate whether you have sugar or ketones in your urine. It can also indicate the urine concentration: High urine specific gravity indicates dehydration.

Clinical assessment includes any chronic illnesses or medications. Chronic illnesses often require dietary modifications. Medications can cause significant interactions and alter nutritional status.

Your dietary assessment is where you have to be very realistic. Remember, "Progress, not perfection." Half of your plate should be fruits and vegetables, one-fourth should be lean protein, and one-fourth should be whole grains. Alcohol and other liquids can make a big difference in your overall nutrition assessment plan.

To calculate calorie needs, first calculate your ideal body weight using the Hamwi equation (see Table 19) and multiply it by 10 to get your basal metabolic rate. To that, add up to 30% more calories if you are sedentary, 50% if you are moderately active, and 100% if you are active.

Ideal protein intake is 0.8 g per kilogram of your ideal body weight. (To convert pounds to kilograms, divide by 2.2.)

The goals of a nutrition assessment are to provide a baseline of nutritional needs, tolerances, limitations, and the ability to calculate basic nutrition needs. For example, we have a woman who is 5′4″ and weighs 180 pounds. Her ideal body weight is 120, so she needs to lose about 60 pounds. She is sedentary and has high blood pressure. The calorie needs to maintain her ideal body weight are 1500 to 1600 calories per day. She needs to measure her waist circumference for her prediabetes risk; walk 3 miles a day to burn 300 calories so that her diet will not have to be as restricted; use the DASH diet to control her blood pressure; and review her medications with her pharmacist.

Another example is a moderately active man who is 5′8″ and weighs 200 pounds. He has a 44″ waist and is prediabetic. Being moderately active, he needs to eat about 2300 calories to maintain his current weight. To lose

weight, he needs to exercise for 1 hour, 5 days a week, and reduce his energy intake. Because of his waist circumference, a Mediterranean diet plan would be a good fit. He might want to consult a registered dietician and review his medications with his pharmacist.

Let's review some frequently asked questions. How can I know if my family makes poor nutrition choices? Become a fruit and vegetable detective. Help them to prechoose their food; look for fruits and vegetables on the menu.

I work very long hours; how can I incorporate a good nutrition plan? You should plan your food for the week in advance; good nutrition does not just happen!

Portion sizes are so small; won't I be hungry all the time following a nutrition plan? No, your calorie needs might be high enough that you would need multiple servings at a meal.

Do children have special nutrition plan needs? Children need more calories than adults per pound of body weight.

Table 19. Sample nutrition plan

What to calculate	How to calculate it	Results	Goals
	Anthropometric assessment		
Height	Measure in inches.	_____	_____
Weight	Measure in pounds.	_____	_____
Ideal body weight	Use the Hamwi equation. For women: Allocate 100 lb for the first 5 ft and add 5 lb for each inch over 5 ft. For men: Allocate 106 lb for the first 5 ft and add 6 lb for each inch over 5 ft.	_____	_____

Body mass index	Multiply your weight in pounds by 703; divide this by your height in inches squared.	_____	_____
Waist circumference	Measure at belly button level in inches.	_____	_____
Body fat composition	Use BOD POD or underwater weighing.	_____	_____
	Biochemical assessment		
Pertinent blood test results	Make sure the blood work checks for cholesterol; iron status including hematocrit, hemoglobin, and ferritin; mean corpuscular volume; and vitamin D status.	_____	_____
Pertinent urinalysis results	Make sure the urinalysis checks for sugar, ketones, and urine specific gravity.	_____	_____
	Clinical assessment		
Chronic illnesses	List all chronic illnesses.	_____	
		_____	
Medications (prescription and over the counter)	List all medicines.	_____	
		_____	

Supplements (vitamins, minerals, herbal therapy)	List all supplements.	_____	
		_____	

Dietary assessment

(Results of food and exercise diary over 2 weeks)

Ideal caloric intake	Take your ideal body weight from above and multiply it by 10 to get your basal metabolic rate. To that, add up to 30% more calories if you are sedentary, 50% if moderately active, and 100% if active.	_____	_____
Actual caloric intake	Keep a daily food diary, consulting sources such as food labels or CalorieKing.com. Remember to verify portion sizes and the balance and quality of carbohydrates, proteins, and fats.	_____	_____
Alcohol and other beverage intake	Using nutrition labels, factor this into caloric average per day or week.	_____	_____
Exercise	Calculate average calories burned per day or week; use a fitness log, such as on FitDay.com.	_____	_____

Note: lb = pound; ft = foot. ■

Suggested Reading

Brown, J., *Nutrition Now*, units 29–31.

McArdle, Katch, and Katch, *Exercise Physiology*, chap. 28.

Questions to Consider

1. What are your ABCD assessment results?

2. What is your personal nutrition plan?

Exercise and Nutrition—Partners for Life

Lecture 34

Being healthy is not just a matter of what you eat. It's also a matter of being physically active throughout the day.

Many diseases and negative health conditions are related to having an inactive lifestyle and are preventable through routine physical activity and exercise. Exercise has physical health benefits: It reduces the risk of heart disease, hypertension, stroke, colon cancer, and breast cancer; it can help to build bone mass and prevent the bone loss associated with aging; and it can help to reduce the risk of obesity or control obesity and reduce diabetes.

There are also psychological health benefits: It increases feelings of well-being, decreases depression and anxiety, and helps to relieve stress. A better body image improves self-esteem and motivational levels.

The American College of Sports Medicine gives the following guidelines. For 5 days a week, do moderately intensive cardio for 30 minutes a day; or for 3 days a week, do vigorously intensive cardio for 20 minutes a day. For 2 days a week, do 8 to 10 strength training exercises with 8 to 12 repetitions of each exercise.

[Exercise] increases feelings of well-being, decreases depression and anxiety, and helps to relieve stress.

Weight bearing, or resistance, exercise helps build muscles and tone muscle fibers. Overloading the muscle allows it to adapt. There are different types of resistance training. Calisthenics uses your own body weight and no equipment. Fixed or constant resistance provides a constant amount of resistance through a full range of motion. Variable resistance is where the amount of resistance changes through the full range of motion.

Raise the weight in a deliberate and smooth manner. When you get the weight up to the fully contracted position, pause. Slowly shift from the raising to the lowering of the weight. To strengthen your muscles, make your muscles work against a gradually increasing resistance. Then increase the resistance, the number of repetitions or sets, or the intensity. Specificity is another training principle, but for an overall positive effect, you should strengthen all major muscle groups. To determine how much strength training is necessary use the FITT principle: frequency, intensity, time, and type.

Endurance exercise includes aerobic and anaerobic exercise. Aerobic exercise uses the body's ability to deliver oxygen to muscles for physical activity. Some of the benefits include reduced body fat, improved weight control, reduced blood pressure, decreased total cholesterol, improvement in heart and lung function, lowered resting heart rate, and improved glucose tolerance. Aim for a minimum of 3 days a week of aerobic exercise, with no more than 2 days off between sessions.

Anaerobic means without oxygen. This is short-lasting, high-intensity exercise. The benefits include the development of stronger, oftentimes bigger, muscles. For beginners who are not very fit, try interval training to incorporate anaerobic exercise.

Your exercise plan must also include the following. Stretching muscle groups increases flexibility and range of motion. It helps to protect muscles and tissues from injuries or tears. Hydration is important. Dehydration can impair exercise performance and can become life threatening. If you need some nutrition before exercise, consume a meal or a snack; during exercise for more than an hour, consume a sports drink; after exercise, consume adequate fluids and energy. Overall, increase your intake of whole grains, cereals, and legumes. Get 5 or more servings of fruits and vegetables a day. Consume adequate amounts of water throughout the day. It is important to develop a plan that feels right and will last for you.

Let's review some frequently asked questions. Do I have to do my half hour or hour of exercise all at one time? No, you can split it up.

Should I exercise when I am sick? No, you need to take a couple of days off. ■

Suggested Reading

Mahan and Stump, *Krause's Food, Nutrition, and Diet Therapy*, chap. 25.

McArdle, Katch, and Katch, *Exercise Physiology*, chaps. 3, 7, 23, 29, 32.

Questions to Consider

1. What proof do you have in your life or your family members' lives that exercise is medicine?

2. What is your personal exercise plan?

The Future of Nutrition—Science and Trends

Lecture 35

What's on the horizon in the science of nutrition? ... Well, I don't have a crystal ball, but I do see some trends.

I want to begin with some exciting, cutting-edge scientific advances in nutrition. Nutritional genomics encompasses 2 fields: nutrigenetics and nutrigenomics. Nutrigenetics is a field in which nutritional interventions are planned around the genetic expression of a disease. Nutrigenomics is about eating for your genotype and includes the study of the impact of environmental factors on gene expression.

What is the significance of nutritional genomics? Common dietary substances can act on the human genome to alter gene expression or structure. Under certain circumstances in some individuals, diet can be a serious risk factor for a number of diseases. Some diet-regulated genes are likely to play a role in the onset, incidence, progression, and/or severity of some chronic illnesses.

The degree to which diet influences the balance between healthy and disease states may depend on the individual's genetic makeup. Dietary intervention based on the knowledge of a nutrition requirement, nutritional status, and genotype can be used to prevent, mitigate, or possibly cure chronic diseases.

Chronic diseases have become the leading concern of public health. Most of the common disorders are diet related. All of these disorders represent an imbalance. A specific and individualized approach to the treatment of these diseases is needed, and a solution may be in the near future.

Let's explore examples of gene-nutrient interaction discoveries. The *APOA1* gene codes for the main protein in HDL cholesterol; this data would give you information on the type of HDL variant that you possess and what would be the most beneficial intervention. The *LIPC* gene codes for the enzyme

hepatic lipase. This determines your liver's ability to metabolize fat, which may determine if you will end up with fatty infiltration of the liver. In a study, women who consumed caffeine and had a variant of the vitamin D receptor (tt genotype) had considerably higher rates of bone loss than those who had the TT genotype.

Individuals with the *GSTT1*-null genotype who consume high levels of green tea do not have a protective effect against many forms of cancer.

What is the future of nutrigenomics? In reaction to findings, the functional food and nutrition supplement business will grow. More research is needed on the influence of specific nutrients on metabolic pathways and risk for chronic disease. This new approach of nutrient-gene interactions may redefine the practice of preventive medicine.

Another exciting new advance in the science of nutrition is metabolomics, which is a comprehensive profiling of individual metabolites, including food metabolites or metabolites in your own body processes. In the future, comprehensive direct assessment of your health will replace what we do now: looking at a single biomarker to treat disease.

About 70% of American adults are attempting to consume healthier diets.

Because metabolite information can change throughout a person's life, agreeing to have one's health evaluated through metabolomics may be an intermediary step between current practice and the use of nutrigenomics for assessing diet-related health concerns.

Metabolic changes in individuals are often due to environmental and lifestyle changes and aging. Possible health outcomes and vulnerabilities of individuals to metabolic stress may be predicted.

Let's look at some food-related trends. According to the Mintel Trends Study, about 70% of American adults are attempting to consume healthier

diets. There are diverging trends: American consumers want something quick and easy, but we also want foods that go back to basics. The Mintel study shows us that we want homemade meals, so we need to integrate homemade and convenience. Using whole foods instead of highly processed foods is a popular trend. Choosing whole grains has also become a priority. Dairy, pork, and beef intake have been reduced, while fruit and vegetable consumption has increased.

Let's review some frequently asked questions. When do you think nutritional genomics and metabolomics will be viable options? We already have some of these advanced diagnostics available, and reliable testing may become more commonplace within 5 years.

Do you feel that metabolomics will be used to counter the effects of aging? Possibly, but the environment is always going to play a significant role.

New foods show up on the market shelves all the time. How can I tell if they are good for me and my family? Go back to the basics: Is it a whole food? Is it minimally processed?

Are we doing better or worse now than when you started your practice when it comes to our eating habits? I believe we are doing worse. ■

Suggested Reading

Brown, J., *Nutrition Now*, unit 34.

Kaput and Rodriguez, "Nutritional Genomics."

Questions to Consider

1. If nutritional genomics and metabolomics were standard approaches in health care today, what questions would you like answered?

2. Which food trend do you most appreciate: back to basics or convenience? Why?

Nutrition Facts and FAQs

Lecture 36

Nutrition is a very broad and very personal subject. After all, we make choices about our diet and our family's diet every day, several times a day.

For the most part, we have ended the past 35 lectures with frequently asked questions regarding the lecture topic. This last lecture is devoted to some of the common questions about nutrition that I have been asked during my years as a registered dietician and professor of nutrition.

Let's start with some general questions. What is a nutrition counselor or dietician? A nutritionist can be anyone interested in nutrition, but a registered dietician has completed at least a 4-year degree and an internship, so that is the kind of health-care provider you are looking for. How do you find a good registered dietician? Ask for recommendations from friends or try the American Dietetic Association's website.

What should you consider when consulting with a dietician? Look at whether you connect with them, and make sure they do a thorough nutrition assessment.

Upon diagnosis of a disorder or condition that is affected by diet, what should I look for? Look for someone who is a specialist in that area of nutrition.

What information do I need to bring along? Bring any pertinent information. Write down what you normally eat and the times of day that you struggle.

What do you like best about being a dietician? The thing that makes this career choice fresh and interesting is no 2 people are the same.

What changes have you seen in the science of nutrition since you first began your practice? At first, it was about foods. About midway, it was about vitamins and minerals. Now it is a bit retro, back to whole foods.

Let's look at some diet and nutrition questions. What are the risks and benefits of being vegetarian? It is great to get more vegetables; the challenge is knowing enough about protein sources.

I became vegetarian to lose weight, so why have I gained weight? Keep in mind that calories rule and are always going to count—certain foods, like cheese and nuts, are high in calories.

Everybody in my family wants a different diet, so what is the best approach to meet their goals? Your core meals can be the same, but you can dress them up differently.

I got almost a million hits in an Internet search for herbs and weight loss. Are there any that work? Yes, but their safety is questionable.

Let's look at some nutrition and lifestyle questions. How do I break the unhealthy habit of eating a lot toward the end of the day? Recognize that the science says people do better eating 3 meals and maybe a snack in between; recognize where you are most vulnerable.

What do you think about black cohosh for the treatment of menopause symptoms? There is some evidence that it may be effective for hot flashes, but the purity and safety of supplements like these are not regulated, so it is a personal decision.

Can nutrition drinks make up for protein my aging mother does not eat? They can be useful, but taste fatigue may occur if she drinks them regularly. Always look for a whole food approach.

Are protein powders to build muscles beneficial or harmful? They can be beneficial. Just remember you still have to do the strength training to build muscle.

Is whey protein worth the cost? Whey protein is milk protein, so you can get it cheaper and more conveniently in milk.

Does the military provide a well-balanced diet in their meals that are ready to eat (MREs)? Yes, a great team of dieticians helped to design the MREs based on various activity levels.

Do you have any suggestions for someone who is worried that if she quits smoking, she will gain a lot of weight? Part of the addiction to smoking is the oral fixation. Try replacing it with air-popped popcorn or chewing gum.

Let's look at some beverage and nutrition questions. What are the long-term impacts of diet soda and its associated chemicals on our health? Nonnutritive sweeteners have been determined to be safe, but for long-term safety, always stick to moderation.

Are vitamin waters good for you? Very few people actually have vitamin deficiencies, and the majority of vitamin waters and flavor-enhanced waters contain some form of sugar—is this something you really want to drink?

Let's look at some disorder and nutrition questions. Is there such a thing as too little stomach acid? Yes, it is called achlorhydria. People think of stomach acid as a bad thing, but we need it.

My parents have lost their sense of taste as they have aged. Is there anything that I can do to improve their eating? Make sure that their food is flavorful.

Here are some final tips.

- Eat for balance and color.
- Watch out for shiny foods.
- Watch your portion size.
- Eat like a child.
- Move.

- Good nutrition is essential nutrients in the right amount plus the foods you love because you are you. ■

Questions to Consider

1. What question would you have for Professor Anding?

2. Which health-care professional would be best able to answer your question—a physician, a dietician, a pharmacist, a personal trainer, or someone else?

Glossary

ABC model of behavior: A model to help you to manage the events that trigger behaviors and the factors that reinforce them. A is the antecedent, the event, that might trigger B, the behavior, which is followed by C, the consequences.

acanthosis nigricans: A skin disease that can be an indication of insulin resistance. Characterized by hyperpigmentation where the skin bends, such as at the knuckles, neck, breast tissue, and fat folds.

active enzyme: Enzymes that help you use your metabolic pathways a little more effectively by accelerating chemical reactions.

adequate intake (AI): For items for which there is no recommended daily allowance established, the National Academy of Sciences sets an adequate intake.

albumin: A protein that transports drugs, vitamins, and minerals.

alpha-tocopherol: The most common form of vitamin E in food (as d-isomer) and in supplements (as dl-isomer).

amino acids: The 20 building blocks of protein. They assemble the necessary proteins following instructions from our genes.

amylase: An enzyme that digests carbohydrate.

anabolic hormone: A hormone that helps to build.

angina: Severe chest pain generally considered to be from a lack of blood supply or oxygen to the heart muscle; it can be stable or unstable.

anthropometrics: Measuring the body.

atherosclerosis: Damage to the walls of the arteries.

Atkins diet: A low-carbohydrate, ketogenic diet that allows you to eat whatever you want as long as it is from protein-containing foods.

basal metabolic rate (BMR): The amount of calories that you need at rest for those functions that are not under your voluntary control. Responsible for approximately 60%–75% of the calories you need per day.

beta cell: The type of cell that makes insulin in the pancreas; a direct consumer of vitamin D.

beta-glucan: The thicker fibers that are found in oatmeal; they lower your cholesterol and support the immune function.

bile: A fluid made by the liver and stored in the gall bladder; it is needed for the emulsification of fat.

bile stasis: Occurs when bile is stored in the gallbladder for too long and there is rapid development of gallstones.

bioavailability: The amount of a nutrient that your body can absorb and utilize.

biomarker: A distinctive biological substance or indicator found in body fluids or tissues and used as a sign of a normal or abnormal process or condition.

Bitot's spots: Superficial white or gray patches occurring on the eye membrane due to deficiency of vitamin A.

blood pressure: The force of the blood pumping against the arterial walls. Normal blood pressure is 120/80 millimeters of mercury. The top number is systolic pressure, which is the force of the blood when the heart beats; the bottom number is diastolic pressure, which represents the force in between heart beats.

BOD POD: A machine that uses air displacement to assess how much of your weight is lean mass versus body fat. Body fat percentage should be less than 30% for women and less than 20% for men.

body mass index (BMI): The gold standard of population-based measurements of overweight; there is a useful BMI calculator at http://www.cdc.gov. Take your weight in pounds, multiply it by 703, and divide by your height in inches squared; a BMI of less than 24.9 is considered normal weight, between 25 and 29.9 is overweight, and greater than 30 is obese.

calorie: A unit of measure that estimates how much energy is metabolized.

carbohydrate: A nutritional powerhouse that fuels the central nervous system and exercising muscle; it is composed of carbon, hydrogen, and oxygen.

central obesity: An accumulation of excess fat around the abdomen.

cerebrovascular accident: Often known as a stroke; an interruption in the blood supply to the brain in which brain tissue is damaged and there is a subsequent loss of brain function. Symptoms include dizziness, severe headaches, nausea, and vomiting. There are 2 kinds of strokes: thrombotic and hemorrhagic.

cholesterol: A fat-soluble alcohol that can be consumed but is predominantly made in the liver.

coenzymes: Small molecules that combine with larger compounds to form active enzymes.

combining proteins: A method to balance out the essential amino acids missing in incomplete proteins.

complete proteins: Proteins that contain all of the essential amino acids that we need to build new proteins. They are usually found in animal products such as milk, cheese, chicken, fish, and red meat, but also found in soybean.

complex carbohydrates: Groups of carbohydrates known as polysaccharides; they take longer to be broken down into their component parts than simple carbohydrates do and therefore are a healthier choice.

congestive heart failure: A form of cardiovascular disease in which structural or functional problems impair the heart's ability to provide adequate blood flow to the rest of the body.

coronary artery disease: A condition in which plaque in the blood vessels builds up and restricts blood flow, which deprives the heart muscle of oxygen.

C-reactive protein: A measure of inflammatory response; the higher your C-reactive protein, the greater your inflammatory response. A more sensitive measure is the high sensitivity C-reactive protein (hs-CRP).

diabetes: *See* **type 1 diabetes, type 2 diabetes**.

diet: What you eat. You can modify your diet to meet a particular interest or health goal, but the word "diet" does not imply weight reduction.

Dietary Approaches to Stop Hypertension (DASH) diet: A diet that focuses on a high content of fruits, vegetables, and low-fat dairy products as well as a low fat composition. It can lower blood pressure in some people to the same extent as drug therapy.

dietary fiber: Nondigestible carbohydrate; it comes from the lignins: the woody portions of plants.

dietary (daily) reference intakes (DRI): Recommended intakes for individuals developed by the Institute of Medicine's Food and Nutrition Board.

dry beriberi: A disease marked by nervous system damage, with no fluid accumulation, due to thiamin deficiency.

edema: Swelling due to fluid retention.

endogenous cholesterol synthesis: The cholesterol produced in your liver, which is almost always enough to meet the body's needs.

enzyme: A protein that facilitates something to happen. In the case of salivary amylase, it facilitates the breaking down of carbohydrate.

enzyme cofactor: A chemical-reducing agent or antioxidant in both intracellular and extracellular reactions.

ergogenic: Increasing capacity for activity.

essential amino acids: Amino acids that you must have in your diet because your body cannot produce them. They include histidine, leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine.

fats: Also known as lipids; the most energy dense of all the macronutrients, at 9 calories a gram. They are made up of carbon, hydrogen, and oxygen and function as an energy source, thermal insulator, hunger depressor, and vitamin carrier.

fat-soluble vitamins: Vitamins that are absorbed and stored in the body's fat stores or adipose tissue; these include vitamins A, D, E, and K. Toxic reactions can occur at much lower multiples of the recommended dietary allowances than with water-soluble vitamins.

ferritin: An iron-containing protein in cells that is a measure of your stored iron; sources include the oils of coldwater fish and flaxseed oil.

functional fiber: Nondigestible carbohydrate; the gummy fiber found in foods like oatmeal.

functional food: The American Dietetic Association defines a functional food as one that moves beyond necessity to provide additional health benefits that may reduce disease risk or promote optimal health.

g: Gram.

generally regarded as safe (GRAS): A designation given by the Food and Drug Administration to food additives generally recognized by experts to be safe.

ghrelin: A hormone that stimulates appetite.

glycemic index: A measurement of how quickly blood sugar rises after the ingestion of a particular carbohydrate food.

gynecomastia: Swelling of breast tissue in men.

Hamwi equation: Used to calculate ideal body weight. For women, allocate 100 lb for the first 5 ft of height, and allocate 5 lb for each inch over 5 ft For men, allocate 106 lb for the first 5 ft, and allocate 6 lb for each inch over 5 ft.

heart attack: An acute episode of heart disease due to decreased blood supply to the heart muscle.

hematopoiesis: Formation of blood components.

heme iron: Dietary iron that is found mainly in iron products.

hemoglobin: The protein on red blood cells that is responsible for oxygen transport; its partner, myoglobin, is the protein found in muscle tissue.

hemorrhagic stroke: A stroke defined as bleeding into the brain.

heterocyclic amines: The charred byproducts of grilling.

high-density lipoprotein (HDL) cholesterol: A blood protein that removes surplus cholesterol and fat from tissues, including the arterial wall; the higher your HDL, the lower your heart disease risk. There is an inverse relationship between triglycerides and HDL.

homocysteine: A highly reactive sulfur-containing amino acid that may increase in the blood as a result of heightened consumption of protein-rich foods and insufficient consumption of vitamin-rich foods. May contribute to damage to the lining of the arterial wall, which can lead to fatal blockages.

hydrochloric acid: A digestive acid in your stomach that denatures proteins.

hydrogenation: The process manufacturers of trans fat use to make the fat more solid; they add hydrogen to the double bonds in unsaturated fat. The consequence of hydrogenation is that they are twisting the molecule.

hypercalcemia: Elevated blood calcium.

hyperkalemia: A potassium excess most often caused by abnormal kidney or renal functioning, resulting in ineffective elimination from the body.

hypertension (or **high blood pressure)**: A blood pressure consistently higher than 140/90 millimeters of mercury. It can lead to congestive heart failure, heart attack, stroke, arterial aneurism, and chronic renal failure.

hypoalbuminemic malnutrition: Low albumin in the blood that can be caused by a stress response to a physical insult.

hyponatremia: An electrolyte abnormality due to low sodium levels from overhydration. It can cause the brain to swell and is characterized by lethargy and confusion, muscle twitching, and seizures; coma and death can occur.

ideal body weight: Calculated using the Hamwi equation (*See also* **Hamwi equation**).

incomplete protein: Proteins that are missing an essential amino acid or adequate amounts of amino acids. They are usually found in bread, nuts, rice, beans, and vegetables.

indoles: Found in cruciferous vegetables, they downregulate the production of one of the stages of cell division in the cancer process and act as negative estrogen regulators.

insulin: An anabolic hormone responsible for getting glucose and other essential nutrients into cells.

integrative medicine: Medicine that treats the whole person and his or her lifestyle and encompasses the physical, psychological, and spiritual self.

international units (IU): A unit of measurement. When tested according to an internationally accepted biological procedure, it is the quantity of a hormone, toxin, or vitamin that creates a specific effect.

intrinsic factor: A compound secreted by parietal cells in the stomach that absorbs vitamin B_{12} from food, which helps prevent pernicious anemia.

inulin: A significant prebiotic that is a fiber compound; its by-products are fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS).

keratinization: Thickening of cells.

ketogenic: Causing your body to burn fat faster than you can get rid of the waste products.

lactase: An enzyme on the tips of villi that digests lactose (milk sugar), so it can be absorbed.

leptin: A hormone that signals that the body has had enough food.

limiting amino acid: A missing essential amino acid that stops protein synthesis.

lipoprotein: The compound formed when lipids are bound to a carrier protein to allow the transport of the lipid through blood; cholesterol is at the core of these lipoprotein structures.

low-calorie diets: Diets under 1000 calories a day of mostly high-quality, protein-containing foods, such as Medifast; individuals that have severe clinical obesity may be candidates.

low-carbohydrate diet: Advocates of this diet suggest restricting carbohydrate to 20 g or fewer a day.

low-density lipoprotein (LDL) cholesterol: A blood protein that carries fat for deposition in cells, including the smooth muscle cells of your arterial walls; increased LDL levels are associated with a higher risk of heart disease.

macular degeneration: An eye disease involving the gradual loss of vision that develops especially in the elderly.

mcg: Microgram.

mean corpuscular volume (MCV): The size of the red blood cell; if you have small red blood cells, chances are you have an iron deficiency; if your red blood cells are large, you might have a deficiency of B_{12} or folic acid.

medical food: As defined by the Orphan Drug Act, "A food which is formulated to be consumed or administered enterally under the supervision of a physician and which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation."

metabolic syndrome: A clustering of risk factors including an increase in blood sugar and triglycerides, a decrease in HDL, an increase in blood pressure, and the accumulation of body fat. This is our early warning system that type 2 diabetes is on the way.

metabolite: A substance produced or used during metabolism.

metabolomics: A comprehensive profiling of individual metabolites including food metabolites or metabolites in your body processes.

mg: Milligram.

mono- and disaccharides: Simple sugars that contain either 1 or 2 sugars.

monounsaturated fats: Compounds that have only one double bond in a molecule; they are liquid at room temperature but get thick or viscous in the refrigerator. These can be considered heart-healthy.

mucin layer: The layer than lines the stomach and protects it by preventing it from digesting itself.

myelin sheath: The protective membrane in the central nervous system.

neurotransmitters: Chemicals that carry signals between nerve cells.

nonessential amino acids: Under circumstances of wellness, you can make nonessential amino acids in your body; they include alanine, arginine, asparagine, aspartic acid, cysteine, glutamine, glutamic acid, glycine, proline, serine, and tyrosine.

nonheme iron: Dietary iron that is found in grains and plants.

obesity: Any body mass index of greater than 30. The 3 different types of obesity that have been defined are hypercellular, hypertrophic, and hyperplastic.

omega-3 fatty acids: Highly unsaturated fat needed for the production of hormone-like compounds known as prostaglandins. Must be consumed in the diet.

omega-6 fatty acids: These tend to be overconsumed in the American diet and can increase inflammation. They are found in meat, corn oil, safflower oil, and sunflower oil.

organic: Something that has carbon as part of its structure.

organic food: A legally defined term that describes the way farmers cultivate and process agricultural products.

osteopenia: A bone mineral density value score of −1.0 to −2.5.

osteoporosis: A disorder characterized by weak and porous bones and a bone mineral density score of less than −2.5.

overfat: A condition in which body mass index may be normal, but more weight is body fat.

overload principle: That in order to get stronger, you have to make the muscle do more work than it can; overloading the muscle allows it to adapt.

overweight: A BMI of between 25 and 29.9.

oxygen radical absorbance capability (ORAC): A ranking system that gives a number to a food based on its ability to scavenge free radicals.

pancreatic lipase: An enzyme that digests fat.

Peyer's patches: Immune-secreting lymphoid tissues that are within the deepest recesses of the villi.

polyphenols: A group of compounds that may inhibit LDL oxidation, which stops arterial plaque formation. They are found in red wine, grape juice, dark berries, and cherries.

polyunsaturated fats: Compounds that have 2 or more double bonds in a molecule; they are liquid at room temperature.

prebiotics: Nondigestible food components that support the growth or activity of probiotics.

prehypertension: A blood pressure from 121/81 to 139/89 millimeters of mercury.

probiotic: Healthy bacteria added to foods; they can be found in yogurt.

prostaglandins: Hormone-like compounds formed from omega-3 fatty acids; they act as anti-inflammatories.

protein: From the Greek word *proteios*, meaning "primary." Protein can be found in every tissue in the body; its main function is to build and repair tissue.

psyllium fiber: The fiber that is found in many high-fiber breakfast cereals and in Metamucil; many commercial products designed for the treatment of constipation are based on psyllium.

recommended daily allowance (RDA): The dietary intake level you should have every day. It is sufficient to meet the requirements of nearly 98% of healthy individuals in particular life stages and gender groups.

rhodopsin: A pigment in the eyes' rods that is necessary to see black and white at night; vitamin A is a necessary constituent.

sarcopenia: The loss of about 3% of muscle mass per decade associated with aging; it contributes to a poor quality of life and increases the tendency to add body fat.

saturated fats: Long carbon fatty-acid chains that have no double bond because the whole molecule is saturated with hydrogen ions. Saturated fats are white and solid in their visible form.

standard of identity: A U.S. government regulation that sets the standards for foods to be labeled in a specific way.

stanol esters: Plant stanols that act as cholesterol mimics and attach to the cholesterol receptor in your gut to prevent the absorption of cholesterol.

statin resins: Medications that lower cholesterol by preventing it from being made in the liver; many studies suggest that statin resins can reduce the risk of a first heart attack.

steatorrhea: The malabsorption of fat that sometimes occurs as a result of genetic disorders, which can also result in severe vitamin states.

sweat rate: The number of pounds lost in physical activity. Each pound lost is 16 ounces of sweat; to rehydrate, you need about 16 to 24 ounces of fluid.

thermic effect of food: The calories it takes to digest your food.

thrombotic stroke: Occurs when an embolism breaks off and causes a blockage somewhere in the brain, most often due to the formation of a blood clot within a vessel.

total cholesterol: Composed of subfractions of other types of cholesterol; it is used as a screening tool.

total energy expenditure: How many calories you burn; determined by your basal metabolic rate, the thermic effect of food, and your physical activity level.

total energy intake: The number of calories you take in, composed of protein, fat, and carbohydrate.

total fiber: Defined by the Food and Nutrition Board of the Institute of Medicine as both dietary fiber and functional fiber.

trans fats: Unsaturated vegetable oils that manufacturers try to make more solid so they last longer.

transaminase: An enzyme that helps in the synthesis of nonessential amino acids.

triglycerides: Dietary fats that are made up of 3 fatty acids esterified to a glycerol backbone. More than 90% of the fat in our body is in this form, as is most of the fat in food.

type 1 diabetes: An autoimmune disorder in which the individual does not produce any insulin because the beta cells are no longer functioning; the individual is obligated to take insulin for the rest of his or her life.

type 2 diabetes: The most common form of diabetes, in which the body makes insulin, but it is not being effectively used by the body. Diagnosed in those with a fasting blood sugar greater than 126 milligrams per deciliter or an oral glucose tolerance test greater than 200.

underwater weighing: Also known as hydrostatic weighing; a method of measuring body composition.

unsaturated fats: Fats in which there are double bonds between the carbon molecules; they exist as monounsaturated and polyunsaturated fats.

vegan: A diet where all animal-based foods are eliminated.

villi: Small, finger-like projections that increase the surface area of the small intestine. On the tips of the villi are enzymes that digest sugar; within the recesses of the villi are Peyer's patches.

vitamins: Organic substances that must be consumed in the diet or through supplementation (the exception is vitamin D). Thirteen different vitamins have been classified into 2 major categories: fat soluble and water soluble; vitamins may be natural or synthetic.

voluntary movement: Movements such as fidgeting that are not exercise; also known as nonexercise activity thermogenesis (NEAT).

water-soluble vitamins: Vitamins that are dispersed in general in body fluids, not stored to any great extent, and probably need to be consumed on a daily basis. These include vitamin C and the B vitamins; if the diet contains less than 50% of the recommended value for a water-soluble vitamin, deficiencies can begin to appear within approximately 4 weeks.

wet beriberi: A disease marked by cardiac damage and fluid retention due to thiamin deficiency.

Bibliography

Afman, L., and M. Muller. "Nutrigenomics: From Molecular Nutrition to Prevention of Disease." *Journal of the American Dietetic Association* 106 (2006): 569–576.

Ahn, J., U. Peters, D. Albanes, et al. "Serum Vitamin D Concentration and Prostate Cancer Risk: A Nested Case-Control Study." *Journal of the National Cancer Institute* 100 (2008): 796–804.

Aiyer, H. S., M. V. Vadhanam, R. Stoyanova, et al. "Dietary Berries and Ellagic Acid Prevent Oxidative DNA and Modulate Expression of DNA Repair Genes." *International Journal of Molecular Sciences* 9 (2008): 327–341.

Ajani, U., C. H. Hennekens, A. Spelsburg, and J. E. Manson. "Alcohol Consumption and Risk of Type 2 Diabetes Mellitus among U.S. Male Physicians." *Archives of Internal Medicine* 160 (2000): 1025–1030.

American Academy of Family Physicians website. http://www.aafp.org.

American Cancer Society. "Can Cancer Be Prevented?" http://www.cancer.org/docroot/CRI/content/CRI_2_4_2x_Can_cancer_be_prevented.asp?sitearea=.

American College of Sports Medicine. "Guidelines for Healthy Adults under Age 65." http://www.acsm.org/AM/Template.cfm?Section=Home_Page&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=7764 (accessed April 15, 2009).

American Dietetic Association. "Nutrition and You: Trends 2008." http://www.eatright.org/ada/files/Overall_Findings_ADA_Trends_2008.pdf.

———. "Position of the American Dietetic Association: Fat Replacers." *Journal of the American Dietetic Association* 105 (2005): 266–275.

———. “Position of the American Dietetic Association: Use of Nutritive and Nonnutritive Sweeteners.” *Journal of the American Dietetic Association* 104 (2004): 255–275.

———. “Ten Ways to Cut Calories.” http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/home_9698_ENU_HTML.htm.

American Dietetic Association website. http://www.eatright.org.

American Heart Association. “Diet and Lifestyle Recommendations.” http://www.americanheart.org/presenter.jhtml?identifier=851.

———. “Risk Factors You Can’t Change.” http://www.americanheart.org/presenter.jhtml?identifier=3054454#heredity.

American Heart Association website. http://www.americanheart.org.

American Society of Interventional and Therapeutic Neuroradiology. “Brain Aneurysm Symptoms/Diagnosis.” http://www.brainaneurysm.com/aneurysm-symptoms.html.

Arsianoglu, S., G. E. Mroro, J. Schmitt, et al. “Early Dietary Intervention with a Mixture of Prebiotic Oligosaccharides Reduces the Incidence of Allergic Manifestations and Infections during the First Two Years of Life.” *Journal of Nutrition* 138 (2008): 1091–1095.

Auborn, K. J., S. Fan, and L. Goodwin. “Indole-3-Carbinol as a Negative Regulator of Estrogen.” *The Journal of Nutrition* 133 (2003; suppl. 7): 2470S–2475S.

Bae, J.-M., A. J. Lee, and G. Guyatt. “Citrus Fruit Intake and Stomach Cancer Risk: A Quantitative Systematic Review. *Gastric Cancer* 11 (2008): 23–32.

Benbrook, C., X. Zhao, J. Yanez, et al. “New Evidence Confirms the Nutritional Superiority of Plant-Based Organic Foods.” http://

www.organiccenter.org/reportfiles/5367_Nutrient_Content_SSR_FINAL_V2.pdf (accessed April 8, 2009).

Bisset, N. G., and M. W. Wichtl, eds. *Herbal Drugs and Phytopharmaceutcials*. Stuttgart, Germany: MedPharm GmbH Scientific Publishers, 1994.

Bjelakovic, G., D. Nikolava, R. G. Simonetti, and C. Gluud. "Antioxidant Supplements for the Prevention of Gastrointestinal Cancers: A Systematic Review and Meta-Analysis." *Lancet* 364 (2004): 1219–1228.

Bloomgarden, Z. T. "Type 2 Diabetes in the Young: The Evolving Epidemic." *Diabetes Care* 27 (2004): 998–1004.

Blumenthal, M., ed. *The Complete German Commission E Monographs Therapeutic Guide to Herbal Medicine*. Austin, TX: American Botanical Council, 1998.

Bodybuilding.com website. http://www.bodybuilding.com.

Bolland, M. A., P. A. Barber, and R. N. Doughty. "Vascular Events in Healthy Older Women Receiving Calcium Supplementation." *British Medical Journal* 336 (2008): 226–227.

Bolton, M., A. Van der Straten, and C. R. Cohen. "Probiotics: Potential to Prevent HIV and Sexually Transmitted Infections in Women." *Sexually Transmitted Diseases* 35 (2008): 214–225.

Bouchard, N. C., M. A. Howland, H. A. Grellar, et al. "Ischemic Stroke Associated with Use of Ephedra Free Dietary Supplement Containing Synephrine." *Mayo Clinic Proceedings* 80 (2005): 541–545.

Bright, G. "Low-Calorie Sweeteners—From Molecules to Mass Markets." In *Low Calorie Sweeteners: Present and Future*, edited by A. Corti, 3–8. Basel, Switzerland: S. Karger AG, 1999.

Broeder, C. E., et al. "The Effects of Either High-Intensity Resistance or Endurance Training on Resting Metabolic Rate." *The American Journal of Clinical Nutrition* 55 (1992): 802–810.

Brown, A. *Understanding Food: Principles and Preparation*. 2nd ed. Belmont, CA: Wadsworth/Thompson Learning, 2004.

Brown, J. *Nutrition Now*. 4th ed. Belmont, CA: Thomson Wadsworth, 2005.

Burke, Cindy. *To Buy or Not to Buy Organic: What You Need to Know to Choose the Healthiest, Safest, Most Earth-Friendly Food*. New York: Marlowe, 2007.

Centers for Disease Control and Prevention. "Diabetes Data and Trends." http://www.cdc.gov/diabetes/statistics/prev/national/figpersons.htm.

———. "FastStats: Heart Disease." http://www.cdc.gov/nchs/fastats/heart.htm.

Charlton, O., and M. K. Sawyer-Morse. "Effect of Fat Replacement on Sensory Attributes of Chocolate Chip Cookies." *Journal of the American Dietetic Association* 96, no. 12 (1996): 1288–1290.

Clarke, K., et al. "Promotion of Physical Activity in Low-Income Mothers Using Pedometers." *Journal of the American Dietetic Association* 107 (2007): 962–967.

ConsumerLab.com. "Product Review: Probiotic Supplements." http://www.consumerlab.com/reviews/Probiotic_Supplements_Including_Lactobacillus_acidophilus_Bifidobacterium_and_Others/probiotics/ (accessed April 30, 2009).

Cook, N. R., E. Obarzanek, and J. A. Cutler. "Joint Effects of Sodium and Potassium Intake on Subsequent Cardiovascular Disease." *Archives of Internal Medicine* 169 (2009): 8–15.

Dansinger, M. L., J. A. Gleason, J. L. Griffith, et al. “Comparison of the Atkins, Ornish, Weight Watchers and Zone Diets for Weight Loss and Heart Disease Risk Reduction: A Randomized Trial.” *JAMA* 293 (2005): 43–53.

DeBusk, R. “Diet-Related Disease, Nutritional Genomics, and Food and Nutrition Professionals.” *Journal of the American Dietetic Association* 109, no. 3 (2009): 410–413.

DeBusk, R., C. Fogarty, J. Ordovas, and K. Kornman. “Nutritional Genomics in Practice: Where Do We Begin?” *Journal of the American Dietetic Association* 105 (2005): 589–598.

Driskell, J. A., M. C. Schake, and H. A. Detter. “Using Nutrition Labeling as a Potential Tool for Changing Eating Habits of University Dining Hall Patrons.” *Journal of the American Dietetic Association* 108, no. 12 (2008): 2071–2076.

Duyff, Roberta Larson. *American Dietetic Association Complete Food and Nutrition Guide*. Hoboken, NJ: Wiley, 2006.

Dziezak, J. D. “Fats, Oils, and Fat Substitutes.” *Food Technology* 43, no. 7 (1989): 66–74.

Elliott, S. S., N. L. Keim, J. S. Stern, K. Teff, and P. J. Havel. “Fructose, Weight Gain, and the Insulin Resistance Syndrome.” *American Journal of Clinical Nutrition* 76 (2002): 911–922.

Ellis, K. A., G. Innocent, D. Grove-White, et al. “Comparing the Fatty Acid Composition of Organic and Conventional Milk.” *Journal of Dairy Science* 89 (2006): 1938–1950.

Elmer, G. W., C. M. Surawicz, and L. V. McFarland. “Biotherapeutic Agents. A Neglected Modality for the Treatment and Prevention of Selected Intestinal and Vaginal Infections.” *JAMA* 275 (1996): 870–876.

Environmental Protection Agency. "Consumer Factsheet on: Nitrates/Nitrites." http://www.epa.gov/safewater.dwh/c-ioc/nitrates.html (accessed April 8, 2009).

Environmental Working Group. "Grow Wiser about Buying Organic Foods." http://www.ewg.org (accessed April 8, 2009).

Eskin, Michael, and Snait Tamir. *Dictionary of Nutraceuticals and Functional Foods*. Boca Raton, FL: CRC Press, 2005.

Espy, M. "Ensuring a Safer and Sounder Food Supply." *Food Technology* 48, no. 9 (1994): 91–93.

Ferguson, L. "Nutrigenomics Approaches to Functional Foods." *Journal of the American Dietetic Association* 109 (2009): 425–458.

Finkelstein, E. A., I. C. Fiebelkorn, and G. Wang. "National Medical Spending Attributable to Overweight and Obesity: How Much, and Who's Paying?" *Health Affairs* W3 (2003): 219–226.

Florez, J. C. "Clinical Review: The Genetics of Type 2 Diabetes: A Realistic Appraisal in 2008." *Journal of Clinical Endocrinology & Metabolism* 93 (2008): 4633–4642.

Food and Nutrition Board, Institute of Medicine. *Dietary Reference Intakes: Applications in Dietary Assessment*. Washington, DC: National Academies Press, 2000.

———. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids*. Washington, DC: National Academies Press, 2002.

———. *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: National Academies Press, 2000.

———. *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate*. Washington, DC: National Academies Press, 2005.

Food and Nutrition Board, and National Research Council. *Recommended Dietary Allowances*. 10th ed. Washington, DC: National Academies Press, 1989.

Food Marketing Institute. "FMI Backgrounder: Natural and Organic Foods." http://www.fmi.org/media/bg/natural_organic_foods.pdf (accessed April 8, 2009).

Ford, E. S., W. H. Giles, and W. Dietz. "Prevalence of the Metabolic Syndrome among U.S. Adults: Findings from the Third National Health and Nutrition Examination Survey." *JAMA* 287 (2002): 356–359.

Foster-Powell, K., S. H. A. Holt, and J. C. Brand-Miller. "International Table of Glycemic Index and Glycemic Load Values." *American Journal of Clinical Nutrition* 76 (2002): 5–56.

Gallus, S., et al. "Artificial Sweeteners and Cancer Risk in a Network of Case-Control Studies. *Annals of Oncology* 18 (2007): 40–44.

Garrow, J. S., A. Ralph, and William Philip Trehearne James. *Human Nutrition and Dietetics*. 10th ed. Edinburgh, Scotland: Churchill Livingstone, 2000.

Genser, D. "Food and Drug Interaction: Consequences for the Nutrition/ Health Status." *Annals of Nutrition and Metabolism* 52 (2008; suppl. 1): 29–32.

German, J. B., S. Watkins, and L. B. Fay. "Metabolomics in Practice: Emerging Knowledge to Guide Future Dietetic Advice toward Individualized Health." *Journal of the American Dietetic Association* 105 (2005): 1425–1432.

Giacco, R., G. Clemente, D. Luongo, et al. "Effects of Short-Chain Fructo-Oligosaccharides on Glucose and Lipid Metabolism in Mild Hypercholesterolaemic Individuals." *Clinical Nutrition* 23 (2004): 331–340.

Gilroy, C. M., J. F. Steiner, and T. Byers. "Echinacea and Truth in Labeling." *Archives of Internal Medicine* 163 (2003): 699–704.

Gonzalez-Periz, A., R. Horrillo, N. Ferre, et al. "Obesity-Induced Insulin Resistance and Hepatic Steatosis Are Alleviated by Omega 3 Fatty Acids: A Role for Resolvins and Protectins." *FASEB Journal* 23, no. 6 (2009): 1946–1957.

Groff, J., and S. Gropper. *Advanced Nutrition in Human Metabolism*. 3rd ed. Belmont, CA: Wadsworth/Thompson Learning, 2000.

Gross, L. S., L. Li, E. S. Ford, and S. Liu. "Increased Consumption of Refined Carbohydrates and the Epidemic of Type 2 Diabetes." *American Journal of Clinical Nutrition* 79 (2004): 774–779.

Guthrie, J., and J. Morton. "Food Sources of Added Sweeteners in the Diets of Americans." *Journal of the American Dietetic Association* 100 (2000): 43–51.

Harrison C. "The (Still) High Cost of Organic Foods." http://www.alternet.org/environment/24821?page=1 (accessed April 8, 2009).

Harvard School of Public Health website. http://www.hsph.harvard.edu.

Hasler, C. M., A. C. Brown, and American Dietetic Association. "Position of the American Dietetic Association: Functional Foods." *Journal of the American Dietetic Association* 109 (2009): 735–746.

Heaney R. P., K. Raffety, M. S. Dowell, and J. Bierman. "Calcium Fortification Systems Differ in Bioavailability." *Journal of the American Dietetic Association* 105, no. 5 (2005): 807–809.

Heasman, Michael, and Julian Mellentin. *The Functional Foods Revolution: Healthy People, Healthy Profits?* Sterling, VA: Earthscan, 2001.

Heller, Lorraine. “Mintel Identifies Major Trends to Impact Food Industry.” Foodproductiondaily.com, May 9, 2006. http://www.foodproductiondaily.com/Supply-Chain/Mintel-identifies-major-trends-to-impact-food-industry.

Hrovat K. B., et al. “The New Food Label, Type of Fat, and Consumer Choice. A Pilot Study.” *Archives of Family Medicine* 3, no. 8 (1994): 690–695.

Hu, F., M. J. Stampfer, and J. E. Manson. “Trends in the Incidence of Coronary Artery Disease and Changes in Diet and Lifestyle in Women.” *The New England Journal of Medicine* 343 (2000): 530–537.

Huffnagle, Gary B., and Sarah Wernick. *The Probiotics Revolution: The Definitive Guide to Safe, Natural Health Solutions Using Probiotic and Prebiotic Foods and Supplements*. New York: Bantam Dell, 2008.

“Hypertension: What Works? Drugs Do—But a New Diet Is Sometimes Enough.” *Consumer Reports*, May 1999.

Insel, Paul M., R. Elaine Turner, and Don Ross. *Discovering Nutrition*. 3rd ed. Sudbury, MA: Jones & Bartlett, 2009.

International Food Information Council. “Consumer Attitudes Toward Functional Foods/Foods For Health—Executive Summary. http://ific.org/research/funcfoodsres07.cfm (accessed April 7, 2009).

———. “Functional Foods: Attitudinal Research. http://www.ific.org/research/funcfoodsres02.cfm (accessed April 7, 2009).

———. “Qualified Health Claims Consumer Research Project Executive Summary.” http://www.ific.org/research/qualhealthclaimsres.cfm (accessed April 7, 2009).

———. “Tailoring Your Diet to Fit Your Genes: A Global Quest.” http://www.ific.org/foodinsight/2006/jf/genesfi106.cfm (accessed April 7, 2009).

Jentjens, R. L., and A. E. Jeukendrup. "Effects of Pre-Exercise Ingestion of Trehalose, Glactose and Glucose on Subsequent Metabolism and Cycling Performance." *European Journal of Applied Physiology* 88 (2003): 459–465.

Jin, L., M. Qi, and A. Anderson. "Indole-3-Carbinol Prevents Cervical Cancer in Human Papilloma Type 16 Transgenic Mice." *Cancer Research* 59 (1999): 3991–3997.

Kajiyama, Y., K. Fuji, H. Takeuchi, et al. "Gingko Seed Poisoning." *Pediatrics* 109 (2002): 325–327.

Kaput, J. "Diet-Disease Gene Interactions." *Nutrition* 20, no. 1 (2004): 26–31.

Kaput, J., and R. L. Rodriguez. "Nutritional Genomics: The Next Frontier in the Postgenomic Era." *Physiological Genomics* 16 (2004): 166–177.

Kavanaugh, C. J., P. R. Trumbo, and K. C. Ellwood. "The U.S. Food and Drug Administration's Evidence-Based Review for Qualified Health Claims: Tomatoes, Lycopene, and Cancer." *Journal of the National Cancer Institute* 99 (2007): 1074–1085.

Kawamori, T., et al. "Chemopreventive Effect of Curcumin, a Naturally Occurring Anti-Inflammatory Agent, During the Promotion/Progression Stages of Colon Cancer." *Cancer Research* 59 (1999): 597–601.

Klis, J. B. "Continuing Trend: Reducing Fat and Calories." *Food Technology* 47, no. 1 (1993): 152.

Knowler, W. C., E. Barrett-Conner, S. E. Fowler, et al. "Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin." *The New England Journal of Medicine* 346 (2002): 393–403.

Kristal, A. R., et al. “Predictors of Self-Initiated, Healthful Dietary Change.” *Journal of the American Dietetic Association* 101, no. 9 (2001): 997.

Kummeling I., C. Thijs, M. Huber, et al. “Consumption of Organic Food and the Risk of Atopic Disease during the First 2 Years of Life in the Netherlands.” *British Journal of Nutrition* 99, no. 3 (2008): 598–605.

Langemead, L., R. M. Feakins, S. Goldthorpe, et al. “Randomized, Double Blind, Placebo Controlled Trial of Oral Aloe Vera Gel for Ulcerative Colitis.” *Alimentary Pharmacology & Therapeutics* 19 (2004): 739–747.

Lara-Villoslada, F., M. Olivares, and S. Sierra. “Beneficial Effects of the Probiotic Bacteria Isolated from Breast Milk.” *British Journal of Nutrition* 98 (2007; suppl. 1): S96–S100.

Lee, D. H., A. R. Folsom, and D. R. Jacobs. “Dietary Iron Intake and Type 2 Diabetes Incidence in Postmenopausal Women: The Iowa Women’s Health Study.” *Diabetologia* 47 (2004): 185–194.

Lee, I. M. “Physical Activity and Cancer Prevention—Data from Epidemiologic Studies. *Medicine and Science in Sports and Exercise* 35 (2003): 1823–1872.

Levine, J. A., N. L. Eberhardt, and M. D. Jensen. “Role of Nonexercise Activity Thermogenesis in Resistance to Fat Gain in Human.” *Science* 283 (1999): 212–214.

Liong, M. T. “Safety of Probiotics: Translocation and Infection.” *Nutrition Review* 66 (2008): 192–202.

Mahan, K., and S. Stump. *Krause’s Food, Nutrition, and Diet Therapy*. 11th ed. Philadelphia: Elsevier, 2004.

Mayo Clinic Staff. “Organic Foods: Are They Safer? More Nutritious?” http://www.mayoclinic.com/health/organic-food (accessed April 8, 2009).

Mayo Clinic website. http://www.mayoclinic.com.

McArdle, William D., Frank I. Katch, and Victor L. Katch. *Exercise Physiology: Energy, Nutrition, and Human Performance*. 6th ed. Baltimore, MD: Lippincott Williams and Wilkins, 2007.

McFarland, L. V., and S. Dublin. "Meta-Analysis of Probiotics for the Treatment of Irritable Bowel Syndrome." *World Journal of Gastroentergology* 14 (2008): 2650–2661.

McNutt, K. "Common Sense Advice to Food Safety Educators." *Nutrition Today* 32, no. 3 (1997): 128–133.

Mead, Paul S., et al. "Synopses: Food Related Illness and Death in the United States." *Emerging Infectious Diseases* 5, no. 5 (1999): 607–625.

Mela, D. J. "Nutritional Implications of Fat Substitutes." *Journal of the American Dietetic Association* 92, no. 4 (1992): 472–476.

Michos, E. D., and R. S. Blumenthal. "Prevalence of Low Low-Density Lipoprotein Cholesterol with Elevated High Sensitivity C-Reactive Protein in the U.S.: Implications of the Jupiter Study." *Journal of the American College of Cardiology* 553 (2009): 931–935.

"Mineral Deficiency and Toxicity." *Merck Manual of Patient Symptoms*. http://www.merck.com/mmpe/sec01/ch005/ch005a.html (accessed October 2, 2009).

Mital, B. K., and S. K. Garg. "Anticarcinogenic, Hypocholesterolemin, and Antagonistic Activities of *Lactobacillus acidophilus*. *Critical Reviews in Microbiology* 21 (1995): 175–214.

Mitchell, A. E., Y.-J. Hong, E. Koh, et al. "Ten-Year Comparison of the Influence of Organic and Conventional Crop Management on the Content of Flavonoids in Tomatoes." *Journal of Agricultural and Food Chemistry* 55 (2007): 6154–6159.

Moriarty, Naithani R., and B. Surve. “Organosulfur Compounds in Cancer Chemoprevention.” *Mini Reviews in Medicinal Chemistry* 7 (2007): 827–838.

Moshfegh, Alanna J., James E. Friday, Joseph P. Goldman, and Jaspreet K. Chug Ahuja. “Presence of Inulin and Oligofructose in the Diets of Americans.” *The Journal of Nutrition*. http://jn.nutrition.org/cgi/content/full/129/7/1407S (accessed May 1, 2009).

Mukherjee, A., D. Speh, E. Dyck, and F. Diez-Gonzalez. “Preharvest Evaluation of Coliforms, *Escheria coli*, *Salmonella*, and *E. coli* O157:H7 in Organic and Conventional Produce Grown by Minnesota Farmers.” *Journal of Food Protection* 67 (2004): 894–900.

Mullins, R. J., and R. Heddle. “Adverse Reactions Associated with Echinacea: The Australian Experience.” *Annals of Allergy, Asthma & Immunology* 88 (2002): 42–51.

Myers, J., A. Kaykha, S. George, et al. “Fitness versus Physical Activity Patterns in Predicting Mortality in Men.” *The American Journal of Medicine* 117 (2004): 912–918.

National Advisory Committee on Microbiological Criteria for Foods. “Hazard Analysis and Critical Control Point Principles and Application Guidelines: Adopted August 14, 1997.” http://www.cfsan.fda.gov/~comm/nacmcfp.html#princ.

National Institutes of Health. “National Digestive Diseases Information Clearinghouse.” http://digestive.niddk.nih.gov/statistics/statistics.htm (accessed October 2, 2009).

Nayga, R. M., Jr. “Retail Health Marketing: Evaluating Consumers’ Choice for Healthier Foods.” *Health Marketing Quarterly* 16, no. 4 (1999): 53–65.

Neuhouser, M. L., A. R. Kristal, and R. E. Patterson. "Use of Food Nutrition Labels Is Associated with Lower Fat Intake." *Journal of the American Dietetic Association* 99, no. 1 (1999): 45–53.

Northwestern University. "Nutrition Fact Sheets." http://www.feinberg.northwestern.edu/nutrition/fact-sheets.html (accessed October 1, 2009).

Nowack, R. "Cranberry Juice—A Well Characterized Folk-Remedy against Bacterial Urinary Tract Infection." *Wien Med Wochenschr* 157 (2007): 325–330.

NuVal. "How It Works. FAQs: The NuVal System." http://www.nuval.com/pages/Faq.aspx.

Organic Monitor. "The Global Market for Organic Food and Drink." http://www.organicmonitor.com/700140.htm (accessed April 8, 2009).

Palomer, X., J. M. Gonzalez-Clemente, F. Blanco-Vaca, and D. Mauricio. "Role of Vitamin D in the Pathogenesis of Type 2 Diabetes Mellitus." *Diabetes Obesity and Metabolism* 10 (2008): 185–197.

Peters, U., M. F. Leitzmann, N. Chatterjee, et al. "Serum Lycopene, Other Carotenoids, and Prostate Cancer Risk: A Nested Case-Control Study in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial." *Cancer Epidemiology, Biomarkers & Prevention* 16, no. 5 (2007): 962–968.

Pillai, U., J. Muzaffar, and S. Sen. "Grapefruit Juice and Verapamil: A Toxic Cocktail." *Southern Medical Journal* 102 (2009): 308–309.

Pittler, M. H., M. Kieser, and U. Holscher. "Ginkgo Biloba Extract for the Treatment of Intermittent Claudication: A Meta Analysis of Randomized Trials. *The American Journal of Medicine* 108 (1998): 276–281.

Pszczola, D. E. "Functional Ingredients Enhance Value of Low-Fat Foods and Micro Waved Foods." *Food Technology* 46, no. 4 (1992): 116.

Quigley, E. M. “Bacteria: A New Player in Gastrointestinal Motility Disorders-Infections, Bacterial Overgrowth, and Probiotics.” *Gastroenterology Clinics of North America* 6 (2007): 735–748.

Raben, A., T. Vasilaras, C. Moller, and A. Astruup. “Sucrose Compared with Artificial Sweeteners: Different Effects on Ad Libitum Food Intake and Body Weight after 10 Wk of Supplementation in Overweight Subjects.” *American Journal of Clinical Nutrition* 76 (2002): 721–729.

Reilly, P., and R. DeBusk. “Ethical and Legal Issues in Nutritional Genomics.” *Journal of the American Dietetic Association* 108 (2008): 36–40.

Rembialkowska, E. “Review: Quality of Plant Products from Organic Agriculture.” *Journal of the Science of Food and Agriculture* 87 (2007): 2757–2762.

Reynolds, P., S. E. Hurley, R. B. Gunier, et al. “Residential Proximity to Agricultural Pesticide Use and Incidence of Breast Cancer in California, 1988–1997.” *Environmental Health Perspectives* 113 (2005): 993–1000.

Riley, Dan. “Texans’ Rep Rules.” http://www.houstontexans.com/mobile/story.asp?story_id=3680 (accessed September 30, 2009).

Rodriguez, N. R., N. M. DiMarco, S. Langley, American Dietetic Association, Dietitians of Canada, and American College of Sports Medicine. “Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance.” *Journal of the American Dietetic Association* 109 (2009): 509–527.

Rossi, F., I. Bertuzzi, S. Comizzoli, et al. “Preliminary Survey on Composition and Quality of Conventional and Organic Wheat.” *Italian Journal of Food Science* 4 (2006): 355–366.

“Selenium.” Vitamin & Herb University website. http://www.vitaminherbuniversity.com/topic.asp?categoryid=2&topicid=1028.

Shalev, E., S. Battino, E. Weiner, et al. “Ingestion of Yogurt Containing *Lactobacillus acidophilus* Compared with Pasteurized Yogurt as Prophylaxis for Recurrent Candidal Vaginitis and Bacterial Vaginosis.” *Archives of Family Medicine* 5 (1996): 593–596.

Shearer, M. J. “Role of Vitamin K and Gla Proteins in the Pathophysiology of Osteoporosis and Vascular Calcification.” *Current Opinion in Clinical Nutrition and Metabolic Care* 3 (2000): 433–438.

Shelton, R. C., M. B. Keller, A. Gelenburg, et al. “Effectiveness of St. John’s Wort for Major Depression: Randomized Controlled Trial.” *JAMA* 285 (2001): 1978–1986.

Shurbsole, M. J., F. Jin, Q. Dai, et al. “Dietary Folate Intake and Breast Cancer Risk: Results from the Shanghai Breast Cancer Study.” *Cancer Research* 61 (2001): 7136–7141.

Silverthorn, Dee Unglaub. *Human Physiology, An Integrated Approach*. 4th ed. Menlo Park, CA: Benjamin/Cummings, 2007.

Smart Choices Program website. http://www.smartchoicesprogram.com/index.html.

Stalenhof, A. F., and J. de Graf. “Association of Fasting and Nonfasting Serum Triglycerides with Cardiovascular Disease and the Role of Remnant-Like Lipoproteins and Small Dense LDL.” *Current Opinion in Lipidology* 19, no. 4 (2008): 355–361.

Stevinson, C., M. H. Pittler, and E. Ernst. “Garlic for Treating Hypercholesterolemia: A Meta Analysis of Randomized Controlled Trials.” *Annals of Internal Medicine* 133 (2000): 420–429.

Sturm, R. “Increases in Morbid Obesity in the U.S.A.: 2000–2005.” *Public Health* 121 (2007): 492–496.

Tahiri, M., J. C. Tressol, J. Arnaud, et al. “Five-Week Intake of Short-Chain Fructo-Oligosaccharides Increases Intestinal Absorption and Status of Magnesium in Postmenopausal Women.” *The Journal of Bone and Mineral Research* 16 (2001): 2152–2160.

Thomas, D., and E. J. Elliott. “Low Glycaemic Index, or Low Glycaemic Load Diets for Diabetes Mellitus.” *Cochrane Database of Systematic Reviews*. January 21, 2009 (1): CD006296.

Tindale, H. A., R. B. Davis, R. S. Phillips, and D. M. Eisenberg. “Trends in Use of Complementary and Alternative Medicine by U.S. Adults 1997–2002.” *Alternative Therapies in Health and Medicine* 11 (2005): 42–49.

Tornwall, M. E., J. Virtamo, P. A. Korhonen, M. J. Virtanen, P. R. Taylor, D. Albanes, and J. K. Huttunen. “Effect of Alpha-Tocopherol and Beta-Carotene Supplementation on Coronary Heart Disease during the 6-Year Post-Trial Follow-Up in the ATBC Study.” *European Heart Journal* 25 (2004): 1171–1178.

Trujillo, E., C. Davis, and J. Milner. “Nutrigenomics, Proteomics, Metabolomics, and the Practice of Dietetics.” *Journal of the American Dietetic Association* 106 (2006): 403–413.

U.S. Cancer Statistics Working Group. “United States Cancer Statistics: 1999–2005 Incidence and Mortality Web-Based Report.” http://www.cdc.gov/uscs.

U.S. Department of Health and Human Services, and U.S. Department of Agriculture. *Dietary Guidelines for Americans, 2005*. http://www.health.gov/DietaryGuidelines/dga2005/document/default.htm (accessed October 2, 2009).

U.S. Food and Drug Administration. “Consumer Nutrition and Health Information.” http://www.cfsan.fda.gov/~dms/fdnewlab.html.

———. "FDA 101: Health Fraud Awareness." http://www.fda.gov/ForConsumers/ProtectYourself/HealthFraud/default.htm (accessed October 5, 2009).

———. "Food Labeling and Nutrition: Dietary Supplements Label Claims." http://www.cfsan.fda.gov/~dms/labstruc.html (accessed April 7, 2009).

———. "Food Labeling and Nutrition: Food Labeling and Nutrition Overview." http://www.cfsan.fda.gov/~dms/qatrans2.html#s3q3.

———. *Guidance for Industry: A Food Labeling Guide*. http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/FoodLabelingGuide/default.htm (accessed October 1, 2009).

———. "How to Understand and Use the Nutrition Facts Label." http://www.cfsan.fda.gov/~dms/foodlab.html.

———. "Legislation." http://www.fda.gov/opacom/laws/DSHEA.html.

———. "Orphan Drug Act." http://www.fda.gov/RegulatoryInformation/Legislation/FederalFoodDrugandCosmeticActFDCAct/SignificantAmendmentstotheFDCAct/OrphanDrugAct/default.htm (accessed September 30, 2009).

USDA Agricultural Research Service. "USDA National Nutrient Database for Standard Reference, Release 21." http://www.ars.usda.gov/Services/docs.htm?docid=17477 (accessed October 1, 2009).

USDA Economic Research Service. "U.S. Food Consumption Up 16 Percent Since 1970." http://www.ers.usda.gov/AmberWaves/November05/Findings/USFoodConsumption.htm.

USDA Food Safety and Inspection Service. "Safe Food Handling: A Consumer's Guide to Food Safety; Severe Storms and Hurricanes (2008)." http://www.fsis.usda.gov/Fact_Sheets.

Van Helden, Y. G., J. Keijer, A. M. Knaapen, S. G. Heil, J. J. Briedé, F. J. van Schooten, and R. W. Godschalk. "Beta-Carotene Metabolites Enhance Inflammation-Induced Oxidative DNA Damage in Lung Epithelial Cells." *Free Radical Biology & Medicine* 46, no. 2 (2009): 299–304.

Versteegen, M., and S. Neubauer. "Organic Foods: Are They a Safer, Healthier Alternative?" *Nutrition in Complementary Care* 11 (2008): 1–31.

Villegas, R., Y. T. Gao, Q. Dai, et al. "Dietary Calcium and Magnesium Intakes and the Risk of Type 2 Diabetes: The Shanghai Women's Health Study." *The American Journal of Clinical Nutrition* 89 (2009): 1059–1067.

Vogler, B. K., and E. Ernst. "Aloe Vera: A Systematic Review of Its Clinical Effectiveness." *The British Journal of General Practice* 49 (1999): 823–828.

Wadden, T. A., D. S. West, R. H. Neiberg, et al. "One Year Weight Loss in the Look Ahead Study: Factors Associated with Success." *Obesity* 17 (2009): 713–722.

Watson, J. L., R. Hill, P. W. Lee, et al. "Curcumin Induces Apoptosis in HCT-116 Human Colon Cancer Cells in a p21-Independent Manner." *Experimental and Molecular Pathology* 84, no. 3 (2008): 230–233.

Weihrauch, M. R., and V. Diehl. "Artificial Sweeteners—Do They Bear a Carcinogenic Risk? *Annals of Oncology* 15 (2004): 1460–1465.

Welsh, J. A., M. E. Cogswell, S. Rogers, H. Rockett, Z. Mei, and L. M. Grummer-Strawn. "Overweight Among Low-Income Preschool Children Associated with the Consumption of Sweet Drinks: Missouri, 1999–2002." *Pediatrics* 115 (2005): 223–229.

Whelton, S. P., A. Chin, Xue Xin, and He Jiang. "Effect of Aerobic Exercise on Blood Pressure: A Meta-Analysis of Randomized, Controlled Trials." *Annals of Internal Medicine* 136 (2002): 493–503.

Wickline, N. M. “Prevention and Treatment of Acute Radiation Dermatitis: A Literature Review.” *Oncology Nursing Forum* 31 (2004): 237–247.

Williams, C. M., and K. G. Jackson. “Inulin and Oligofructose: Effects on Lipid Metabolism from Human Studies.” *British Journal of Nutrition* 87 (2002; suppl. 2): S261–S264.

Williams, P. “Consumer Understanding and Use of Health Claims for Foods.” *Nutrition Review* 63, no. 7 (2005): 256–264.

Wilsgaard, T., H. Shcrimer, and E. Arnesen. “Impact of Body Weight on Blood Pressure with a Focus on Sex Differences: Tromos Study, 1986–1995.” *Archives of Internal Medicine* 160 (2000): 2847–2853.

Wolf, I., J. J. van Croonenborg, H. C. Kemper, et al. “The Effect of Exercise Training Programs on Bone Mass: A Meta Analysis of Published Controlled Trials in Pre- and Postmenopausal Women.” *Osteoporosis International* 9 (1999): 1–12.

World Health Organization. “Obesity and Overweight.” http://www.who.int/dietphysicalactivity/publications/facts/obesity/en (accessed April 14, 2009).

Yamaguchi, P. “Japan’s Nutraceuticals Today—Functional Foods Japan 2006.” http://www.npicenter.com/anm/templates/newsATemp.aspx?articleid=15160&zoneid=45 (accessed April 5, 2009).

Credible Nutrition Websites

General Information:

American College of Sports Medicine: http://www.acsm.org.
American Dietetic Association: http://www.eatright.org.
Centers for Disease Control and Prevention: http://www.cdc.gov.
Food and Nutrition Information Center of the U.S. Department of Agriculture: http://fnic.nal.usda.gov.
Food Safety and Inspection Service of the U.S. Department of Agriculture: http://www.fsis.usda.gov.
Mayo Clinic: http://www.mayoclinic.com.
National Institutes of Health: http://www.nih.gov.
U.S. Food and Drug Administration: http://www.fda.gov.

More Specific Topics and Lecture-Related Topics:

Lecture 1

Portion Distortion Quiz:
Part 1: http://hp2010.nhlbihin.net/oei_ss/PD1/slide1.htm.
Part 2: http://hp2010.nhlbihin.net/oei_ss/PDII/slide1.htm.

Fast Food Nutrition Facts:
http://www.dietfacts.com/fastfood.asp.

Nutrition for Kids:
http://www.eatright.org/ada/files/Snacks_for_Kids_English.pdf.
http://www.eatright.org/ada/files/Wendys.pdf.

Lecture 2

Health Fraud of the Past and Present and Tips for Recognizing Health Fraud:
http://www.fda.gov/fdac/features/2006/606_fraud.html.

Lecture 4

Body Mass Index and Daily Caloric Needs Calculator:
http://www.nutritiondata.com/tools/calories-burned.

Lecture 5

Hydration Needs and Tips—Staying Hydrated and Rehydrating:
http://www.mckinley.uiuc.edu/Handouts/hydrate_needs_exercise.html

Lecture 6

Carbohydrates, Lipids, and Protein Explained:
http://www.mckinley.uiuc.edu/handouts/macronutrients.htm.

Glycemic Index and Carbohydrate Needs Explained:
http://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/carbohydrates-full-story/index.html.

Lecture 7

Importance of Fiber and Your Daily Fiber Needs:
http://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/fiber-full-story/index.html.

Lecture 8

Carbohydrates, Lipids, and Protein Explained:
http://www.mckinley.uiuc.edu/handouts/macronutrients.htm.

Protein Intake for Athletes:
http://www.vanderbilt.edu/ans/psychology/health_psychology/Protein.htm.

Lecture 9

Dietary Fats Explained:
http://www.eatright.org/ada/files/Martek_Fact_Sheet.pdf.
http://www.eatright.org/ada/files/DIETARY_FATS.pdf.
http://www.americanheart.org/presenter.jhtml?identifier=3045789.
http://www.americanheart.org/presenter.jhtml?identifier=3049042.

Lecture 10

Vitamins—Functions in the Body and Food Sources:
http://www.nwhealth.edu/healthyU/eatWell/vitamins_2.html.

Lecture 14

Directory of Common Foods and Nutrients Contained: http://www.ars.usda.gov/Services/docs.htm?docid=17477.

Lecture 15

Minerals—Sodium and Potassium:
http://www.health.gov/DietaryGuidelines/dga2005/document/html/chapter8.htm.
http://www.eatright.org/ada/files/Mrs_Dash.pdf.

Lecture 17

Nutrition and Cardiovascular Disease:
http://www.eatright.org/ada/files/Metamucil_Fact_Sheet.pdf.
http://www.americanheart.org/presenter.jhtml?identifier=3038016.

Lecture 19

General Information:
http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf.
http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/media_3053_ENU_HTML.htm.

Lecture 20

Overweight, Overfat, and Obesity:
http://www.eatright.org/ada/files/Popular_Diets_Reviewed_2007.pdf.
http://www.americanheart.org/presenter.jhtml?identifier=4639.

Lecture 21

Personalized eating plans and interactive tools to help plan and assess your food choices:
http://www.mypyramid.gov/.

Lecture 22

General Information:
http://www.americanheart.org/presenter.jhtml?identifier=3044757.
http://www.americanheart.org/presenter.jhtml?identifier=3044762.
http://www.hsph.harvard.edu/nutritionsource/more/type-2-diabetes/.
http://www.diabetes.org/about-diabetes.jsp.

Lecture 23

National Weight Control Registry: http://www.nwcr.ws.
American Dietetic Association: http://www.eatright.org.

Lecture 24

MD Anderson Cancer Center: http://www.mdanderson.org.
Memorial Sloan-Kettering Cancer Center: http://www.mskcc.org.

Alcohol Intake and Breast Cancer:
http://www.breastcancer.org/tips/nutrition/ask_expert/2005_01/question_07.jsp.

Nutrition and Cancer Prevention:
http://www.eatright.org/ada/files/Eat_Your_Way_to_Better_Health.pdf.
http://prevention.cancer.gov/prevention-detection/lifestyle.

Lecture 25

General Information:
http://www.eatright.org/ada/files/Purdue_Fact_Sheet.pdf.

Lecture 27

Food Safety and Inspection Service of the U.S. Department of Agriculture:
http://www.fsis.usda.gov/factsheets/.

Food Safety and Food-Borne Illnesses:
http://www.foodsafety.gov/.

Lecture 28

Understanding and Reading Food Labels:
http://www.mayoclinic.com/health/nutrition-facts/NU00293.
http://www.eatright.org/ada/files/Shop_Smart.pdf.

Lecture 29

General Information:
http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/advocacy_934_ENU_HTML.htm.

Information on Specific Foods:
http://www.eatright.org/ada/files/Almond_Fact_Sheet.pdf.
http://www.eatright.org/ada/files/Barley.pdf.
http://www.eatright.org/ada/files/Hershey_Fact_Sheet.pdf.
http://www.eatright.org/ada/files/Mango.pdf.
http://www.eatright.org/ada/files/The_Plant_Sterol_Story.pdf.

Lecture 30

General Information:
http://www.eatright.org/ada/files/Supplements.pdf.
http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/advocacy_3311_ENU_HTML.htm.
http://www.umm.edu/altmed/.

Lecture 31

General Information:
http://www.ams.usda.gov/AMSv1.0/nop.

Lecture 33

Healthy Eating on the Run:
http://www.eatright.org/ada/files/Healthy_Eating_on_the_Run.pdf.

Rate Your Plate, by the University of Connecticut's Team Nutrition:
http://www.sp.uconn.edu/~cthompso/.

Log your food intake and exercise:
http://www.fitday.com/.

Determine the calories in the food you eat:
http://www.calorieking.com/.

DETERMINE questionnaire for older people from the American Academy of Family Physicians:
http://www.aafp.org/afp/980301ap/edits.html.

Lecture 34

American College of Sports Medicine: http://www.acsm.org.

Body Mass Index and Daily Caloric Needs Calculator (Estimate):
http://www.nutritiondata.com/tools/calories-burned.

Sports Nutrition and Nutrition for the Physically Active Adult:
http://www.gssiweb.com.

Lecture 36

American Dietetic Association: http://www.eatright.org.
American College of Sports Medicine: http://www.acsm.org.