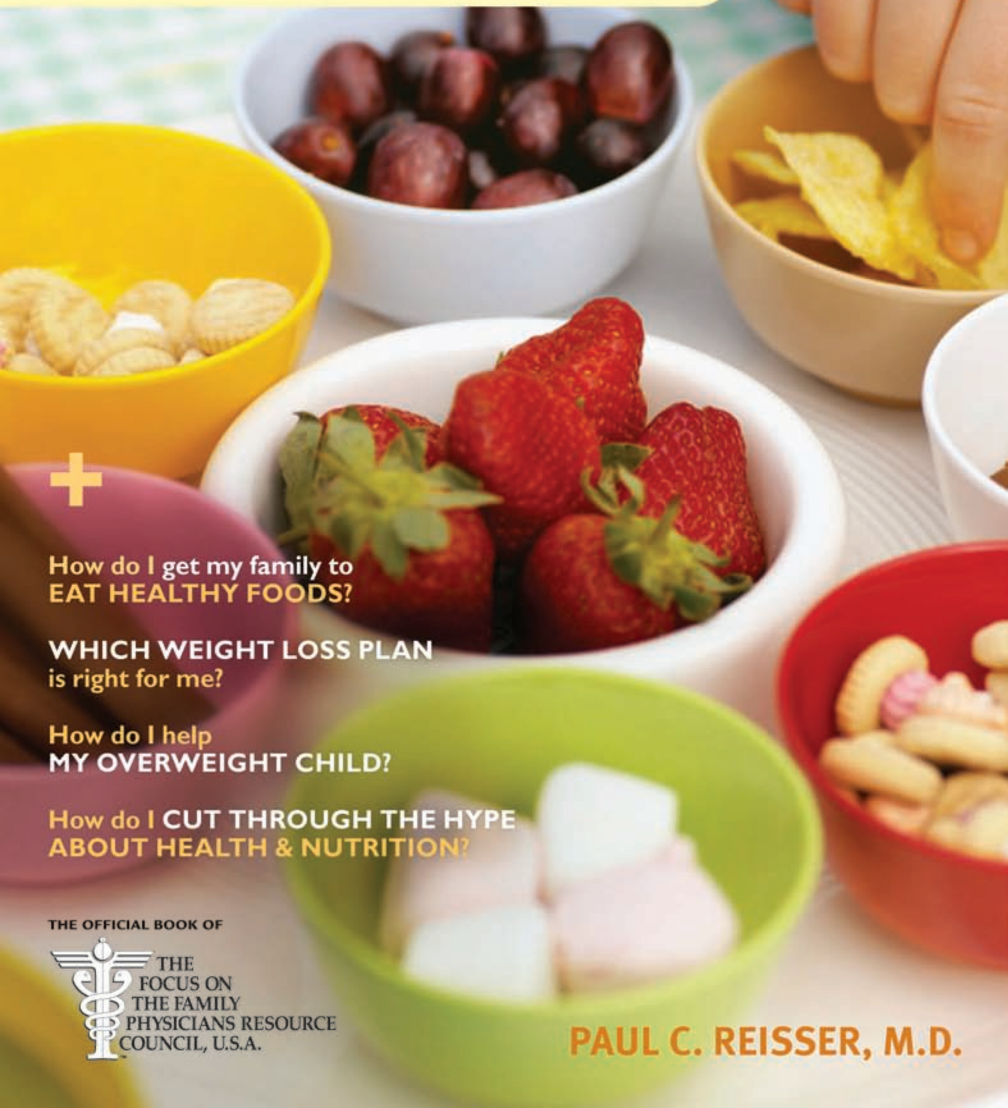
Busy Mom's GUIDE

to Family Nutrition



How do I get my family to EAT HEALTHY FOODS?

WHICH WEIGHT LOSS PLAN is right for me?

How do I help MY OVERWEIGHT CHILD?

How do I CUT THROUGH THE HYPE ABOUT HEALTH & NUTRITION?

THE OFFICIAL BOOK OF

THE FOCUS ON THE FAMILY PHYSICIANS RESOURCE COUNCIL, U.S.A.

PAUL C. REISSER, M.D.

BUSY MOM'S GUIDE
to Family Nutrition

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Tyndale House Publishers, Inc.
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THE OFFICIAL BOOK OF
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The information contained in this book provides a general overview of many health-related topics. It is not intended to substitute for advice that you might receive from your child's physician, whether by telephone or during a direct medical evaluation. Furthermore, health-care practices are continually updated as a result of medical research and advances in technology. You should therefore check with your child's doctor if there is any question about current recommendations for a specific problem. No book can substitute for a direct assessment of your child by a qualified health-care professional.

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Busy Mom's Guide to Family Nutrition

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FOREWORD

Fifty years ago, popular visions of the "world of tomorrow" included not only flying cars and routine trips to outer space, but also twenty- to thirty-hour workweeks and a bounty of leisure time for everyone by the end of the twentieth century. Instead, a decade into the twenty-first century, we are dealing with exponential increases in the complexity of our lives. We're working harder than ever to earn a living while juggling family responsibilities and a multitude of other commitments. Even when we're supposedly "off duty," there are always dozens of e-mails to wade through, cell phones ringing at all hours, and social networking sites beckoning night and day.

Furthermore, if we need information about anything, our favorite search engine will be happy to summon more websites than we can possibly visit. Yet this overabundance of information doesn't always satisfy our need for wisdom and insight—especially when dealing with issues related to health and nutrition. Indeed, it seems as if every day arrives with news of a dire warning about a food we once thought was perfectly good for us, or a surefire way to lose weight, or a "must-have" dietary supplement that costs $29.99 per month but will make us feel like a million bucks. How do we sort it all out?

For more than three decades, Focus on the Family has been a trusted resource for input and advice on parenting, marriage, and virtually any other subject that impacts families, including health. A few years ago, I had the privilege of serving as the primary author of the *Complete Guide to Family Health, Nutrition, and Fitness*, a product of Focus on the Family's Physicians Resource Council. I can say without hesitation that we took the word *complete* literally, addressing a vast number of topics, including health screening, basic nutrition, weight loss, exercise, emotional concerns, sleep, fatigue, sex, and many more. At one thousand pages, this was not a book to tuck into a handbag for a casual read over lunch. Because busy schedules aren't always compatible with the task of sifting through good and bad advice on the Internet or wading through the contents of a large book, we thought it would be helpful to distill the *Complete Guide*'s core concepts about nutrition and weight loss into a smaller volume, and update a few things while we were at it.

Our approach has been to start and stay with the basics, laying down principles that you can adapt to your family's life and tastes. We have framed key ideas in the form of questions and answers, and we have included a lot of practical advice while trying to avoid a cookbook approach (no pun intended) to this often-bewildering topic. If you're looking for quick fixes, you've picked up the wrong book. But if you want to get some "news you can use," you've come to the right place.

This book is one in a series of Busy Mom's Guides, all of which are intended to provide help and hope for important concerns of family life. By the way, we would be very pleased if these guides would prove useful to some busy dads as well.

Paul C. Reisser, M.D.
December 2011

CHAPTER 1

NUTRITIONAL BASICS

HAVE YOU EVER said to yourself:

- *Sure, I'd like my family to eat a healthier diet, but what does that really mean?*
- *I know I should read food labels in the grocery store, but what exactly am I looking for?*
- *Every month someone seems to come out with a new, surefire way to lose weight. I've tried most of them without success. What am I doing wrong?*
- *My kids gravitate toward fast food. How can I help them develop better eating habits?*

If you've been stymied by issues like these, I encourage you to read on. This book will help you make better-informed decisions about the foods you buy and prepare for yourself and your family. It should also help you better understand food labels and evaluate extravagant claims that are often made for diets or supplements.

Vince Lombardi, legendary coach of the Green Bay Packers, started every training season by announcing, "Gentlemen, this is a football." In that spirit, we begin our overview of nutrition with the fundamentals.

What is a nutrient?

If you stop and think about it, the utilization of food by our bodies is an incredible accomplishment and a marvelous feat of engineering. An enormous number and variety of substances that we chew and swallow (usually with some pleasure) are broken down into basic components that serve three general purposes:

1. To provide a steady supply of fuel for thousands of mechanical, electrical, and chemical processes that go on twenty-four hours a day
2. To build, maintain, and repair structures of incredibly diverse shapes, sizes, and constituents
3. To provide some degree of protection against certain destructive processes

We may buy the best fuel and additives for our car, but they can only power the engine and perhaps reduce some wear and tear. A vehicle that could take gasoline and other raw materials and then repair itself exists only in the realm of fantasy. The fact that our bodies do all of this and more without our awareness, supervision, or understanding is truly mind-boggling.

There are six types of nutrients: carbohydrates, fats, proteins, vitamins, minerals, and water. The first three are called macronutrients because we use them in substantial quantities. They are also known as energy-yielding nutrients because they provide the fuel we need for all of our bodily functions. Vitamins and minerals are called micronutrients because of the tiny amounts that we use. They do not provide any energy, but they play a number of important roles in releasing and regulating it. Macronutrients and vitamins are called organic compounds. The word *organic* has acquired all sorts of meanings over the years (such as “natural” or “unadulterated”) but it simply means that the substance contains carbon, the element found in every living thing. Minerals and water are inorganic, though no less important (or natural).

What are carbohydrates?

We hear a lot about “carbs” today, and based on what you have heard, you may think of carbohydrates as the staff of life or the root of all illness. Neither viewpoint is particularly accurate; we’ll try to explain what some of the fuss is about.

Carbohydrates fall into two basic categories: simple (commonly called sugars) and complex. Three of the most important simple carbohydrates are glucose, fructose, and galactose, which are also called monosaccharides because each consists of a single ring of carbon molecules. These are the building blocks of other carbohydrates.

- **Glucose.** The primary energy source for almost every cell in the body, glucose is called blood sugar when in the bloodstream. The body’s biochemical machinery is programmed to break down more complex carbohydrates into glucose or to convert the other simple sugars into it. The central nervous system has no fuel storage capability and requires a continuous flow of glucose. If blood glucose falls drastically (a condition called hypoglycemia), consciousness rapidly becomes cloudy. If blood glucose levels are not restored quickly, brain damage can result.

- **Fructose.** The sweetest of the sugars, fructose is abundant in fruits and honey and is readily converted to glucose.
- **Galactose.** This component of lactose appears only when lactose is digested.

The other important simple sugars are the disaccharides, which consist of two monosaccharides joined together. They are sucrose (also called table sugar), lactose (milk sugar), and maltose (malt sugar).

While the sugars consist of various combinations of glucose, fructose, and galactose, the complex carbohydrates are built almost entirely of huge numbers of glucose molecules chained together. Starch is the general term for a long chain of hundreds or even thousands of glucose molecules linked together and packed into certain parts of plants. Glycogen (which is made only by animals) also consists of chains of glucose molecules, though with many more branches. Found in muscle and the liver, it serves as a short-term fuel supply when food isn't available.

The chemical bonds that link the glucose molecules together in starch and glycogen can be readily broken down to provide glucose. In the third important type of complex carbohydrate, fibers, the chemical bonds linking the sugar molecules together cannot be broken during human digestion. Fibers are components of the cell walls of plants, and include cellulose, hemicellulose, pectins, gums, mucilages, and lignins.

We will take a closer look at starches and fiber later in this chapter.

Why do I sometimes seem to crave sugar?

Many books and articles have painted a vivid picture of the ways sugar can provoke mood and behavior disorders, including anxiety, depression, irritability, fatigue, and even violent or psychotic (delusional) episodes. A variation on this theme describes cravings or even outright addiction to sugar as a major cause of personal and social ills.

Is it possible to be addicted to sugar or carbohydrates? The answer is yes in the general sense that a person's desire for sweets or carbohydrate-rich foods (primarily starches) can range from pleasant enjoyment to craving to compulsive consumption of large amounts in the face of obvious consequences (such as obesity). The nature of craving and compulsion, however, is complex.

What drives excessive consumption?

1. We derive pleasure from the taste and feel of food, the relief of hunger, the time-out from a difficult day, camaraderie with family and friends, and associations with comforting memories.

2. Swings in blood glucose after eating sweets and refined carbohydrate foods may provoke a rebound hunger, which in turn leads to more eating.

3. Changes in brain neurochemistry are associated not only with increased (or decreased) appetite, but also with desires for certain foods. Carbohydrate cravings are often seen among people with certain types of endogenous depression—that is, depression related to alterations of chemical messengers or neurotransmitters in the brain, such as serotonin, norepinephrine, and dopamine.

What is hypoglycemia—and do I have it?

True hypoglycemia or low blood sugar is not a common event because, barring unusual circumstances, our bodies are designed to maintain adequate blood glucose levels at all costs. The normal range for blood glucose in humans is between 60 and 150 mg/dl.

The symptoms of true hypoglycemia typically appear when blood glucose drifts below 50 mg/dl. Fatigue, clouded thinking, light-headedness, anxiety, irritability, and restlessness arise from the brain, which is being deprived of its fuel. If hypoglycemia isn't rapidly corrected, confusion, seizures, loss of consciousness, and coma will follow.

A *very* small number of people have true reactive hypoglycemia, in which glucose rises and then plummets to dangerously low levels after they eat a meal loaded with carbohydrates. Many more, however, experience a drop that is not as severe, but enough to bring on a sense of fatigue, hunger, tremulousness, or other symptoms. An improvement in symptoms following a small snack is a clue that this might be occurring.

If there is any question that shifting blood glucose levels might be causing symptoms, there are three relatively simple ways to find out. One is to have a physician check your blood glucose when you are fasting, after a meal, when you feel poorly, or perhaps as part of a more formal glucose tolerance test, which measures blood sugar one and two hours after you drink a standardized load of glucose. If there is still some doubt, a glucose meter can be purchased at a pharmacy or discount store. (These are used routinely by type 1 diabetics to monitor their responses to food and insulin and by some type 2 diabetics to track their progress.) Your glucose levels can be checked as frequently as needed to clarify their connection (if any) to symptoms.

A second, very practical approach is to make a straightforward change in eating habits: take a time-out from foods that are likely to cause trouble. These include foods in which added sugars are listed as one of the first two ingredients.

Third, fluctuations in blood sugar can be avoided by eating smaller amounts of food more frequently. This very practical approach of eating smaller meals more often ensures that a steady flow of nutrients enters your digestive tract—and thus your bloodstream—throughout the day.

What are the different sugars I might find at home?

You might notice some of the following listed among the ingredients of the foods on your shelves.

- **Sucrose.** Also known as white sugar, table sugar, refined sugar, granulated sugar, cane sugar, and beet sugar, each teaspoon of sugar contains about 16 calories.
- **Powdered sugar.** Also known as confectioners' sugar, powdered sugar is basically white sugar pulverized to a fine consistency, with a little cornstarch added to prevent lumps from forming.
- **Raw sugar (partially refined sugar).** This sugar is brown and coarser than white sugar. True raw sugar is banned in the United States because it may contain unsavory ingredients such as bacteria and insect parts. The products sold here (such as Sugar in The Raw or "turbinado") have had impurities removed.
- **Brown sugar.** White sugar to which molasses has been added.
- **Molasses.** This thick, brown syrup is produced during the extraction and refining of sugar from cane.
- **Dextrose.** Another name for glucose.
- **Levulose.** Another name for fructose.
- **Invert sugar.** This mix of glucose and fructose occurs naturally (as in honey) or by chemical action on cane sugar.
- **Corn syrup.** A liquid (containing mostly glucose) derived from cornstarch.
- **High-fructose corn syrup.** Introduced in the mid-1960s, this form of corn syrup contains glucose and fructose, but

with a higher proportion (up to 55 percent) of fructose. This product is sweeter than corn syrup, cheaper than sugar obtained from sugar cane (but equally sweet), and not prone to crystallize, making it a popular sweetener that has been added to an enormous number of products. Between 1970 and 1999, high-fructose corn syrup consumption in the United States rose from 0.4 pounds to a peak of 45.4 pounds per person annually. However, as of 2010 this number has declined to 34.8 pounds per person per year.[1]

What about honey and its components?

Honey contains primarily glucose and fructose, but typically with a higher percentage of fructose, making most forms sweeter than white sugar. It also contains a small percentage of sucrose and other simple sugars. A tablespoon of honey contains about 64 calories (compared to about 48 calories in a tablespoon of sugar).

How can something that tastes as good as sugar be bad for me?

Sugar and obesity. The number of Americans, young and old, who are overweight or obese has increased dramatically over the past two decades, as has our national consumption of *added sugars*—that is, sugars in various forms that are added to foods during processing, preparation, or at the table. Based on data from the 2001 to 2004 National Health and Nutrition Examination Survey (NHANES), Americans averaged 22 teaspoons of added sugars (totaling 355 calories) per person per day. The front-runners in added sugar consumption were 14- to 18-year-old boys, who averaged 34.3 teaspoons per day (549 calories)—a solid 20+ percent of their total calories.[2]

Among the young, soft drinks—what some critics call "liquid candy"—are a major source of these calories. A typical 12-ounce canned soft drink contains the equivalent of about ten teaspoons of sugar, yielding 140 calories. This by itself represents the maximum daily intake of added sugars recommended by the American Heart Association for an adult male. But fast-food restaurants, convenience stores, and movie theaters sell soft drinks in colossal serving sizes ranging from 32 to 64 ounces, often with free refills. A 32-ounce nondiet soft drink packs more than 300 calories.

Fat storage. The contribution of sweets to obesity may involve more than calorie counts. In most people the metabolic response to surges of blood glucose from products containing a lot of simple sugars appears to promote fat storage. Unfortunately, the same may be happening with starches and other mainstays of the low-fat approach to eating that has been encouraged by government and health professionals for the past three decades.

Empty calories. One of the strongest arguments against the wholesale consumption of sugar is that it is basically a raw energy source without any additional nutritive value. No vitamins, minerals, fiber, or other useful compounds are present in a typical can of soda.

Enjoy a medium-sized orange and you get a total of 80 calories, of which about 56 come from sugars. But the orange also contains 7 grams of fiber, a gram of protein, a generous dose of vitamin C, and some vitamin A, iron, and calcium. Polish off a mere 5 ounces of a typical orange soda—less than half of a 12-ounce can—and you get the same number of calories, all from sugar in one form or another, plus a little caffeine to jangle your nerves and—that's all, folks! Drink the entire can, and you'll consume twice as many calories as the orange contains. Of course, using artificial sweeteners is one way to indulge your sweet tooth without consuming empty calories, but some have questioned their safety, as we'll discuss later.

Sugar vs. the teeth. Actually, sugar isn't the only culprit in causing tooth decay. Carbohydrates in any form serve as a food supply for bacteria within the mouth that produce enamel-eroding acid. What makes a carbohydrate bad for the teeth isn't necessarily how sweet it is—the bacteria can be as happy with raisins as with candy—but how long it hangs around inside the mouth.

Sticky, sugary foods are thus likely to be troublemakers, especially for those who don't brush after every meal. In general, the greater the percentage of one's daily calories that comes in the form of sugars, the greater the risk of dental caries (tooth decay).

Sugar and hyperactivity. The popular notion that hyperactivity or aggressive behavior in children is provoked by eating sugar has persisted for decades, despite a lack of any consistent support from scientific research. Numerous studies evaluating behavior and learning among children given variable amounts of sugar and artificial sweeteners have shown minimal, if any, objective impact.

If Johnny seems "amped up" after a few rounds of soft drinks, cake, and ice cream at a friend's birthday party, the sugar he gobbled up might seem like a prime suspect. But the general excitement, games, presents, and perhaps the caffeine lurking in the sodas are more likely to blame. Nevertheless, if parents notice that a child's behavior seems to take a turn for the worse whenever sugary foods cross his lips, it certainly wouldn't hurt him to stay away from them.

What are the different artificial sweeteners, and are they safe?

Over the past hundred-plus years, a number of substances have been discovered—nearly all of them by accident, by the way—that provide sweetness without calories. But are they safe? And do they really do any good in the long run? Here is a look at the three most widely used sweeteners: saccharin, aspartame, and sucralose.

Saccharin was discovered in 1879, and by 1907 it was used as a substitute for sugar in the diets of diabetics. With no calories, no metabolic by-products, and sweetness about five hundred times that of sucrose, saccharin was the only nonnutritive sweetener available in the United States through the 1970s. It is still added to a wide variety of products (including cosmetics and medications) and is the sweetener found in Sweet'N Low.

Saccharin generated controversy during the 1970s when it was reported that high doses were associated with an increased risk for bladder cancer in rats. Subsequent research failed to demonstrate a risk of bladder (or any other) cancer among human users. Furthermore, the rats had been given huge daily doses of sodium saccharin—on a dose-per-weight basis, an adult human would have to drink hundreds of cans of diet soft drinks every day to consume an equivalent amount. In 2000, a federally-mandated warning regarding the question of animal cancer, which had appeared on saccharin products since 1977, was removed.

While available evidence indicates that saccharin is safe when consumed in limited amounts, the Food and Drug Administration (FDA) has set an acceptable daily intake (ADI) for this sweetener at 5 mg per kg of body weight per day. For a 150-pound adult, this is about 350 mg of saccharin—roughly the amount in ten packets of Sweet'N Low.

Aspartame was discovered in 1965 and introduced in 1981 after extensive human and animal studies. (Some two hundred have been conducted to date.) Approved for use in one hundred countries, it is found in more than six thousand products and is the sweetener in Equal and NutraSweet. Aspartame consists of two amino acids, phenylalanine and aspartic acid, in a form which, when digested, yields these two molecules plus methanol. The amino acids are building blocks of naturally occurring protein, and methanol is found in foods in amounts larger than those generated by typical doses of aspartame.

Aspartame has been the object of a vigorous campaign (much of which has been waged on the Internet) blaming it for a vast array of symptoms and diseases. However, no professional organization (including the American Academy of Family Physicians and the American Academy of Pediatrics) or government agency (not only in the United States, but also in England, France, and Canada) has found these claims credible. Both physiology and research findings argue strongly against the breadth and severity of these hazards.

Sucralose is the only artificial sweetener derived directly from sucrose (table sugar). It is six hundred times as sweet as sugar but is not digested or absorbed by the intestine. Furthermore, it remains stable at high temperatures, so that it can be used in products that are cooked or baked. Sold as the sweetener Splenda, it has been approved for use in a wide variety of foods. Sucralose thus far has not earned any warning labels from the FDA or from health-regulatory organizations in thirty countries, based on more than one hundred studies over a twenty-year period. As with the other sweeteners, dire warnings about sucralose may be found on the Internet, though not from reputable sources.

Stevia, a plant native to Paraguay and a member of the chrysanthemum family, is a source of extracts which have been developed into a number of zero-calorie sweetening products. Stevia-derived sweeteners have been widely used in a number of countries (especially Japan) for decades. In 2008 the FDA granted certain refined stevia preparations containing the compound rebaudioside A (often called rebiana or Reb A for short) the status of "Generally Recognized as Safe" and allowed them to be used as sugar substitutes. (This was announced a few months after a joint United

Nations committee concluded that these substances were safe.) Commercial products containing rebaudioside A in the U.S. include Truvia and PureVia, which are roughly two hundred times as sweet as sugar and are used in a variety of zero-calorie drinks. The UN committee set an acceptable daily intake or ADI (that is, an upper limit) of rebaudioside A for adults at an amount equal to about twenty-nine packets of Truvia or eight 8-ounce sweetened beverages per day.[3] It should be noted that the FDA's decision did *not* apply to whole-leaf stevia or crude stevia extracts, of which a multitude are marketed in stores and on the Internet. Pending results of further research, it would appear prudent to use rebaudioside A sweeteners rather than stevia whole-leaf or extract products.[4]

One important question to ponder: Is there a long-term advantage to using products containing artificial sweeteners or to adding them to coffee or tea in place of sugar? The two major reasons would be to reduce the intake of calories for someone trying to lose weight and to limit sugar intake in diabetics. Both of these are worthy goals, but they may be undermined by other choices at the kitchen table. A number of studies have suggested that some dieters may rob Peter to pay Paul by reducing calories at one meal (or in one food) but adding many more elsewhere. Also, diabetics who are trying to prevent elevations in blood glucose by avoiding sugar need to remember that other unsweetened nutrients can also have a serious impact on blood glucose. Furthermore, the fact that a sweet food or drink is sugar-free doesn't guarantee that its other ingredients are good for you.

The bottom line: Artificial sweeteners appear to be safe when used in moderation, despite Internet alarms that are usually undermined by doubtful credibility and shrill rhetoric. Nevertheless, whether sweeteners offer long-term benefit to dieters and diabetics is questionable, and no one can be completely certain of their effects when used over a lifetime.

What is lactose intolerance?

All newborn mammals are designed to be nourished with mother's milk, which contains lactose as its primary carbohydrate. Appropriately called milk sugar, lactose is a disaccharide (two-sugar) molecule consisting of one glucose and one galactose molecule linked together. In this form it cannot be absorbed. An enzyme called lactase, produced in the lining of the intestine, breaks lactose into these two monosaccharide (single-sugar) molecules, which can then be absorbed and utilized.

After weaning, all land mammals dramatically decrease the production of lactase. Thus, if lactose shows up in the small intestine, some or most of it will not be broken down and absorbed. This may actually draw fluid into the bowel. Then, when lactose arrives in the colon (large intestine), an army of bacteria cheerfully ferments it, yielding both increased gas and the component sugars glucose and galactose. These cannot be absorbed by the lining of the colon, but instead draw ever more fluid into it. Bloating, cramps, gas, and diarrhea may result.

How do I know if I am lactose intolerant?

Lactose intolerance can develop early or late in life. It may also follow on the heels of any gastrointestinal illness that damages the lining of the small bowel or causes food to move through it more rapidly. The severity of symptoms depends on the person's age and ethnic background, as well as the amount of lactose. Typically, the amount present in 8 to 12 ounces of milk will provoke symptoms about two hours after it is swallowed. Usually lactose intolerance can be confirmed by a lessening of bowel symptoms (gas, cramps, rumbling, diarrhea) after a time-out from dairy products for several days, although specific medical tests for it are also available.

Can I still enjoy dairy products if I have lactose intolerance?

People with lactose intolerance can eliminate dairy products altogether or adjust their intake to include whatever amounts and forms they can handle without symptoms. Milk that has been pretreated with lactase is available along with regular milk in the dairy case at the store, as are various forms of lactase (such as Lactaid or Lactrase) that can be added to milk or taken before eating or drinking dairy products.

Often products such as ice cream or aged cheese will not provoke symptoms, and yogurts with live cultures are usually tolerated because the bacteria present generate lactase. Those who reduce or eliminate dairy products—especially if they are women over thirty-five—should make an effort to take adequate amounts of calcium from other dietary sources or supplements.

How is lactose intolerance different from a milk allergy?

Milk allergy is an entirely different problem from lactose intolerance. It involves an overzealous response of the immune system to protein in milk, most often seen among infants drinking formula derived of cow's milk.

As many as 7 percent of babies are allergic to cow's milk protein and manifest this problem in one of two ways. The less common is a sudden allergic response, with wheezing, swelling, hives, or even vomiting. Much more common (and often difficult to identify) is a slower reaction, which may include a variety of symptoms: failure to gain weight, irritability, and loose stools (occasionally containing blood).

If the infant's doctor suspects that cow's milk allergy is the problem, a soy-based formula may be tried, although about

15 percent of infants with the sudden type of reaction, and about half with the slower reaction, may react to soy-based formula as well. Should that occur, the doctor might recommend a hypo-allergenic formula, although these may be up to three times as expensive as regular formulas. This type of allergy to milk occurs much less frequently when an infant is breastfed.

What are starches?

The word *starch* comes from an old English word for "stiffen," inspired by the usefulness of some forms of starch in adding a little of that quality to clothing. As we noted earlier, starches consist of long chains of glucose molecules linked together and packed into certain parts of a variety of foods:

- **Grains.** These small, dry, one-seed fruit of cereal grasses include wheat, rice, corn, oats, and barley. We think of cereal, of course, as what we pour out of a box for breakfast, but a wondrous variety of foods derived from cereal grasses have fed the human race for millennia.
- **Legumes.** The fruits or seeds of the bean and pea family, legumes also include lentils and peanuts.
- **Tubers.** Also known as root vegetables, tubers possess a swollen segment of stem (usually underground) or root that plays a role in both reproduction and energy storage. Our most familiar tubers are potatoes and yams.

Are starches good or bad for you?

These foods have been the staple of cultivation around the world because they are both generous and generally inexpensive sources of carbohydrate fuel that can be prepared and consumed in a variety of ways. Their lack of fat content has given them a particularly esteemed status in the United States over the past thirty years, as dietary recommendations from government and professional groups stressed the importance of eating low-fat or nonfat foods. So why would a host of weight-loss programs such as the Atkins diet, Protein Power, and Sugar Busters! conclude that starch is the root of most of our dietary ills, including excessive weight?

To address that question, we need to take a closer look at what happens when we consume these foods. Traditionally, complex carbohydrate foods (including all of the various forms of starches) have been considered time-release sources of fuel. Eat a candy bar or drink a soda, and one can reasonably assume that the sugars it contains will gain rapid access to the bloodstream. (Indeed, they usually do.) Have a piece of bread or a baked potato, on the other hand, and it will take a while to disassemble all of those complex molecules and release their glucose into circulation—or will it? Depending upon what happened between their harvest and their arrival at the table, the constituents of many complex carbohydrate foods may be capable of releasing large amounts of glucose into the bloodstream very rapidly—even more rapidly, in fact, than sugar itself.

What is the glycemic index?

A measurement called the glycemic index (or GI) has been utilized in recent years (though more widely among dietary professionals in Canada, Europe, and Australia than in the United States) as an estimate of the tendency of a food to raise blood glucose. Healthy volunteers are given a specific amount of pure glucose to swallow, after which their blood glucose levels are measured several times over the next few hours. Then they consume other foods in amounts containing the same quantity of carbohydrate as the original glucose sample, and blood glucose levels are measured at the same time intervals. The responses of blood glucose to the food and to the pure glucose are compared using a computer program. The tests are repeated a number of times with different volunteers to smooth out the effects of individual differences in digestion and metabolism.

Glucose, the reference food, is given a GI of 100. For other foods, a GI of 70 or more is considered high; one less than 55 is considered low; and one between 55 and 70 is intermediate. Researchers in various parts of the world have generated tables of GIs for a gamut of foods, and the results are often surprising.

What kinds of carbohydrate foods have the highest glycemic index?

One would expect candy and soft drinks to lead the pack. They are, in fact, on the higher end of the list (especially jelly beans). But all of the following foods have a higher GI than white sugar: white, whole wheat, and rye bread; bagels; waffles; mashed, baked, or french fried potatoes; cornflakes; instant rice; corn chips and pretzels.

What foods tend to have a lower glycemic index? With few exceptions, vegetables, fruits (except dried dates), and legumes (peas and beans); pumpernickel and heavy, mixed-grain breads; milk and low-fat yogurt; and (surprise) most pastas, especially when lightly cooked (the so-called al dente style).

What is it about certain foods that raises their glycemic index?

Obviously, an abundance of simple sugars has an impact. But the preparation of many starch-laden foods (for example, baking or mashing potatoes) alters their physical characteristics in a way that allows them to be converted into glucose very rapidly. Unfortunately, one of the most common alterations of food over the past century—the processing and refining of grains, especially wheat and rice—significantly raises the GI of these everyday staples. For example, the outer bran and inner germ layers are removed from wheat in order to increase efficiency and stability in creating white flour, which may in turn be finely ground. These characteristics all lead to more rapid digestion and conversion into glucose, and thus more dramatic changes in blood sugar after these foods are eaten.

In the real world of real people eating real food (as opposed to a controlled laboratory setting), many factors impact how rapidly blood glucose changes after a meal. These include:

- **How much of a food is eaten.** Carrots have a moderately high glycemic index, but one would have to eat a huge number to provoke a dramatic effect on blood glucose.
- **What else is eaten with the food.** We rarely eat just one food at a time for a meal. If a high-glycemic-index carbohydrate is eaten with some protein and fat, absorption of the entire mix tends to be slower.
- **Individual characteristics of the eater** (such as age) may alter the rate at which food is digested and absorbed.
- **The presence of fiber.** Foods that are rich in fiber, such as vegetables and most fruits, are the true time-release sources of fuel. (Note that riper fruits tend to have a higher sugar content and thus a higher glycemic index.) Whole-grain breads, which are more abundant in fiber than their refined counterparts, may have a similar glycemic index if the flour has been finely ground. However, the benefits of their nutrients and fiber counterbalance the impact of their glycemic index.

If a food has a high glycemic index, does that make it bad?

While some advocates of low-carbohydrate diets seem to imply that high-glycemic foods are literal poison, the picture isn't quite that black-and-white. Carrots, beets, bananas, cantaloupe, papayas, and pineapples, for example, have a moderately high GI, but that hardly qualifies them as foods to be avoided at all costs.

Indeed, another factor that must be considered along with the glycemic index is the amount of carbohydrate in a given serving of food. The term *glycemic load* refers to a number obtained by dividing the glycemic index of a food by 100 and then multiplying it by the number of grams of carbohydrate in that portion. For example, even though a medium-sized carrot has a relatively high glycemic index of 92, it contains only about 4 grams of carbohydrate, and so its glycemic load is 3.7. Mashed potato has a similar glycemic index of 97, but a typical serving contains about 23 grams of carbohydrate, for which the glycemic load is 22—six times greater than that of the carrot.

That being said, a diet heavy on high-glycemic foods—especially those that are calorie dense and have little additional nutritional value—could cause problems for many people because of the physiological response that they are likely to provoke. Eating foods that provoke a rapid rise in blood glucose causes the pancreas to release a surge of insulin so that the glucose can be escorted into all of the cells that need it.

But there are some downsides to this response: First, a relatively rapid rise and fall of glucose may provoke hunger, which leads to—that's right—more eating. In fact, the hunger may last well after the blood glucose has risen again. If the desire for more food leads to another round of high-glycemic-index treats, the cycle may repeat itself. Second, insulin not only moves glucose into cells, it also promotes storage of any excess calories as fat and slows the use of fat as a source of energy.

We have gone into some detail to explain the concepts of glycemic index and glycemic load, but you should be aware that there is hardly a consensus among dietary experts as to their significance. For example, a major 2010 advisory report from the USDA regarding dietary guidelines for Americans has stated, "When selecting carbohydrate foods, there is no need for concern with their glycemic index or glycemic load. What is important to heed is their calories, caloric density, and fiber content."[5]

Why is fiber important?

Dietary fiber, the other major type of complex carbohydrate, plays a supportive but very important role in nutritional health. Remember that fiber is the component of plant foods that we cannot digest. (We do not obtain any fiber from animal or dairy products.) Soluble fiber partially dissolves in water, while insoluble does not. Sources of soluble fiber (such as gums and pectins) include many fruits (apples, pears, and strawberries), legumes (peas, beans, and lentils), oatmeal, and oat bran. Sources of insoluble fiber include many vegetables (carrots, celery, tomatoes, and zucchini), whole-grain breads and cereals (especially whole wheat), wheat bran, brown rice, and couscous. Soluble or not, since we can't use it for energy or building materials, what good is it?

1. **Fiber contributes to the time release of energy from carbohydrates.** Fiber slows both the release of food from the stomach and the absorption of digestible carbohydrate that accompanies it. This tends to prevent the spikes in blood glucose and insulin that we just described as potentially undesirable features of high-glycemic-index foods. Foods with a healthy component of fiber tend to have a lower glycemic index. A diet high in fiber may reduce the risk of developing type 2 diabetes.

2. **Fiber can help reduce overeating and weight gain.** Slowing the speed with which you consume a meal is a basic strategy in controlling the size of your food portions, and those higher in fiber content generally take longer to eat. Their larger bulk, increased even more by water they absorb, creates a feeling of fullness. Furthermore, they slow not only the stomach's rate of emptying food but also the passage of food through the small intestine, thus prolonging the sense of being full or even "stuffed."

3. **Fiber (especially the insoluble form) tends to soften and increase the bulk of stool.** It helps to move stool through the colon more rapidly. It thus can prevent or relieve constipation, the most common intestinal complaint in the United States (especially among the elderly). Wheat and oat bran appear to be particularly effective at this, as is psyllium seed, derived from a Mediterranean plant, which swells and becomes gelatinous when moist. Psyllium seed is used in many bulk laxatives such as Metamucil.

4. **Fiber (again, especially the insoluble type) helps prevent diverticulosis.** This is a common condition in which small pouches called diverticula form in the wall of the colon. Diverticula can bleed, become infected (a condition called diverticulitis), or even perforate, resulting in a serious infection within the abdomen. The soft, bulky stools produced by fiber in the diet are also less likely to form small, hard pellets that can lodge in the opening of the appendix, the first step in the development of appendicitis.

5. **Some studies have shown lower rates of colon cancer in populations that consume large amounts of fiber, compared with those on a low-fiber diet.** A reasonable explanation for this is that any potential carcinogenic (cancer-inducing) agents arriving in the intestine would be diluted and swept along by soft, bulky stools, and thus not allowed to have prolonged contact with the cells lining the colon. However, other research (including a Harvard study that followed eighty thousand women over sixteen years[6]) has not supported this particular benefit from eating dietary fiber.

6. **Finally, dietary fiber—especially soluble fiber found in oats (including oatmeal and oat bran) and apples—can**

lower blood cholesterol to a modest degree. This occurs when cholesterol floating through the digestive tract binds to the fiber and is carried out of the body in stool, rather than being absorbed. While the impact of dietary fiber on blood cholesterol levels is usually not as dramatic as may be seen with weight loss or medications, it has been demonstrated to reduce the risk for coronary artery disease.

How much fiber should we eat every day?

The Institute of Medicine of the National Academies recommends the following daily amounts:

- For adults fifty and younger: 38 grams for men and 25 grams for women.
- For adults fifty-one and older: 30 grams for men and 21 grams for women.[7]
- For children, the following amounts are recommended:[8]
  1–3 years: 19 grams
  4–8 years: 25 grams
  9–13 years: 26 grams for females; 31 grams for males
  14–18 years: 26 grams for females; 38 grams for males

How can I increase my daily dose of fiber?

The richest sources of dietary fiber are legumes (beans and peas), vegetables and fruits, and whole-grain products. You'll find less of it in refined grain products (white bread and cereals that aren't whole grain), and none in dairy or meat products. Here are a few ways to increase your family's daily dose of fiber:

1. **Buy bread that lists whole grains (wheat or otherwise) as the first ingredient on the label.** Look for at least 3 grams of fiber per slice. These breads tend to be heavier,

darker, and more flavorful. If you bake your own bread, use whole-grain flour for a fourth to a half (or more) of the amount of flour in your recipe. (You will need more yeast or baking powder—about a teaspoon more baking powder for every three cups of whole-grain flour.)

2. **Look for breakfast cereals with 5 grams or more of fiber per serving.** Often they include the words *bran* or *fiber* in the name or display it on the packaging, but check the Nutrition Facts label to see how much fiber is actually present. (Remember also that fiber content may not be the only virtue a cereal offers.) If these cereals don't suit your taste, try adding some unprocessed wheat bran to the cereals you like.

3. **Try some whole-grain variations on common products.** Two great substitutions are brown rice (rather than white) and whole wheat pasta, which contains more than twice the fiber found in regular pasta.

4. **Add more peas, beans, and lentils.** These foods are among the richest sources of dietary fiber.

5. **Eat a lot of fruits (at least three to four servings) and vegetables (four to five servings) every day.** (For children two to six, at least two fruit and three vegetable servings per day.) Some of the highest suppliers of fiber among fruits include raspberries, pears, blackberries, stewed prunes, papaya, and blueberries. Other good sources of fiber among fruits include raisins, strawberries, peaches, oranges, apricots, bananas, strawberries, and apples.

   Good vegetable sources of fiber include frozen mixed vegetables, spinach, artichoke, brussels sprouts, winter squash, and broccoli. Other vegetable fiber sources include carrots and corn, as well as the tubers: potatoes and sweet potatoes.

Should I try to avoid fats as much as possible?

Just as it is dangerous to cast carbohydrates—a major class of nutrients—in the role of villain, the same is true of fats. We have been told for decades that we should eat as little fat as possible and that doing so will keep us thin, but that approach hasn't worked. And now we hear other voices saying that eating fat is okay, and that doing so with gusto is apparently the way to lose weight. To complicate matters, the fat in so many of our favorite foods gives them the texture and flavor that we enjoy.

As it turns out, we need a certain amount of fat in both our diet and our body to live well. More than half of our ongoing energy needs at rest are supplied by fat stores. The percentage increases both when we're exercising and when we're deprived of food. In addition, body fat provides insulation against heat and cold, serves as a "shock absorber" if we're struck by a blunt object, and (when we have the right amount of it) gives our body an appealing shape. Certain types of lipids (the general term used for the chemical compounds that constitute fats) carry out very important structural and functional roles in the body.

What is cholesterol?

Cholesterol is a member of a class of compounds called sterols, which also includes vitamin D and the sex hormones (such as estrogen and testosterone)—vital molecules that are themselves derived from cholesterol. Cholesterol is necessary for the formation and maintenance of the complex membranes that surround every cell in our body. When they are going about their appointed errands, cholesterol molecules are our lifelong allies. But when floating through the bloodstream in excessive numbers, they can get us into trouble.

About 85 percent of the cholesterol in our body—in fact, all that you can possibly use—is generated internally, mostly by the liver, in quantities affected dramatically both by our genetics and our weight. The rest comes from animal sources in our diet: meats (especially the so-called "organ meats," such as liver and kidney), eggs, fish, and dairy products. The fact that so much of your cholesterol comes from within, rather than from food, helps explain why some people who are relentless meat-eaters and couch potatoes can still have ridiculously low levels of cholesterol, while some well-conditioned, fastidious vegetarians may be stuck with high levels. (These are, of course, exceptions rather than the rule. Dietary habits *do* play an important role.)

What does "good cholesterol" and "bad cholesterol" mean?

Lipids, including cholesterol, are generally not soluble in water. (Think of what happens when you pour a little vegetable oil into a pan of water: The oil clumps into droplets and dollops of various sizes, and floats to the surface.) Blood is essentially a water-based liquid. If cholesterol molecules were released directly into the bloodstream, they would likewise form clumps and would not disperse to all of the cells that need them. Instead, cholesterol molecules, as well as other lipid molecules such as the triglycerides, are escorted through the bloodstream by carrier proteins (called apoproteins) that *are* water/blood soluble. Apoproteins and various combinations of lipid molecules are packaged together to form lipoproteins, which researchers have sorted into categories based on their density. Two of these—the low-density lipoproteins (or LDL) and the high-density lipoproteins (or HDL)—are particularly important to our health.

LDL packages are loaded with more cholesterol and also have a tendency to contribute to the buildup of blood-blocking plaque. HDL packages, on the other hand, carry more protein and less cholesterol than LDL. More important, they help "clean up the mess" left by LDL, removing some of the excess cholesterol and other lipids from tissues and bringing them back to the liver. An abundance of research has shown that the more cholesterol you have associated with LDL, the more likely you are to have atherosclerotic disease congesting your arteries, putting you at greater risk for heart attack and stroke. The more you have riding on HDL, the more you will be protected from these all-important problems. It's not uncommon to hear about "bad cholesterol," referring to that which is attached to LDL, and "good cholesterol" that rides with HDL. In fact, cholesterol is cholesterol, but what makes it good or bad depends a lot on how much you have in circulation and the company it keeps.

What is the difference between a "bad fat" and a "good fat"?

You've probably heard that saturated fats and trans fats aren't good for you, and perhaps you're aware that omega-3 fatty acids and fish oils possess some sort of health benefit. If you look at food labels, you may see terms such as "polyunsaturated" and "partially hydrogenated" applied to a variety of products such as vegetable oils. Many of these ninety-nine-cent words have become part of our vocabulary, but what exactly do they mean? And what difference do they make? These terms refer to various arrangements of hydrogen and carbon molecules that are linked together in long chains called fatty acids. We could give you a chemistry lesson at this point about the different types of fatty acids, but doing so would require several diagrams and would make you drowsy. So we'll cut to the bottom line about these substances. Basically, a certain type of fat will be called saturated or unsaturated based on the type of fatty acid that is most abundant within it.

Saturated fats are the form that the body prefers to store for future energy needs, and so not surprisingly they are abundant in animal fat. Solid or waxy at room temperature, they have been generally considered the "bad guys" in the world of fats, although they are present in some of America's favorite foods—red meats, butter, cheese, whole milk, and ice cream—as well as coconut, palm, and other tropical oils. The primary concern about eating a lot of saturated fats, other than their rich supply of calories, is that they increase cholesterol levels—in particular, the LDL (low-density lipoprotein) or "bad" cholesterol—and are associated with a higher risk of developing congested arteries that can lead to heart attack or stroke. The American Heart Association and other organizations recommend that 10 percent or less of our daily calories come from saturated fat.

A simple chemical alteration among the majority of fatty acids changes "bad" saturated fats into "good" (or at least "better") monounsaturated fats. These types of fats are found in abundance in olive oil, canola oil, and peanut oil, as well as avocados and most nuts. They are liquid at room temperature but may solidify if refrigerated. They can be used by our body as fuel nearly as efficiently as saturated fats, but unlike saturated fats they appear to reduce cholesterol and LDL cholesterol in particular. In fact, some research indicates that a diet in which monounsaturated fats are abundant not only reduces LDL cholesterol but also tends to raise HDL ("good") cholesterol and lower triglycerides.

Another molecular alteration of fatty acids results in polyunsaturated fats, which are liquid both at room temperature and in the refrigerator. They also tend to lower cholesterol when substituted for saturated fatty acids. Indeed, a few decades ago this selling point led to a widespread shift from butter to various forms of margarine derived from polyunsaturated oils, on the assumption that these would be healthier for the heart. (There is, however, more to that story.) Food sources that are rich in polyunsaturated fats include vegetable oils made from corn, safflower, cottonseed, flaxseed, soybean, sunflower, and others, as well as fish oils.

What are trans fats?

Many years ago, food manufacturers realized that a process called hydrogenation would reduce the tendency of polyunsaturated fats to go rancid and thus keep their good flavor. This process also converts liquid oils into more solid, spreadable, and generally more appealing products. Sounds good so far, but unfortunately the law of unintended consequences was at work, canceling some of the benefits that partially hydrogenated polyunsaturated fats might otherwise offer.

It turns out that this process yielded an abundance of what are called trans fats, which raise LDL ("bad") cholesterol nearly as efficiently as saturated fats. While the saturated fats at least also raise the HDL ("good") cholesterol, trans fats do not. Furthermore, they may also raise triglyceride levels, so that these compounds may be at least as much of a threat to health—if not more so—than saturated fats.

How much trans fatty acid in the diet is too much? No one knows, although the American Heart Association has recommended that they provide no more than one percent of our daily calorie intake. Since 2006, the Food and Drug Administration (FDA) has required that the amount of trans fatty acids in foods be displayed on nutrition information labels. Food manufacturers meanwhile have been putting forth efforts to eliminate trans fats, and display "zero trans fat" as a badge of honor on products that have none present. In the next chapter we will look at ways to limit trans fats in your diet.

What about omega-3 (and omega-6) fatty acids?

Our bodies are able to manufacture all of the fatty acids we need from other materials in our diet—carbohydrates, fats, and proteins—except for two that have similar (and somewhat confusing) names: linoleic acid (abbreviated LA) and linolenic acid (abbreviated LNA). Because they must be taken directly from food sources, these are called essential fatty acids. From these two compounds, we make a number of other substances that play vital roles in immunity, clot formation, and the structure of cell membranes.

Linoleic acid is a compound known as an omega-6 fatty acid and is relatively abundant in our food supply, occurring in seeds and any polyunsaturated oils made from them, corn and peanut oils, and animal fat (including poultry). Linolenic acid is an omega-3 fatty acid and, unlike linoleic acid, is far less plentiful in our diet. It is found in flaxseed, walnuts, soybeans, canola, and their oils. It is also present in dark leafy green vegetables, though in lesser amounts.

A widely recommended response to the research supporting the benefits of omega-3 fatty acids is to add some to our diet in the form of fatty, cold-water fish—salmon, mackerel, lake trout, albacore tuna, herring, and sardines. While an ideal daily amount of omega-3 fatty acids has not been established, the American Heart Association recommends that the average adult have at least two servings of these fish every week, with some cautions for pregnant women.

Why is protein an important part of my diet?

If we think of carbohydrates primarily as a source of fuel for our body and fats as our long-term energy storage, proteins take the prize for the mind-boggling number of structures and functions in which they play a pivotal role. Altogether our body contains somewhere between ten thousand and fifty thousand different proteins. Of these, the functions of only about one thousand have been identified.

- **Proteins are critical ingredients of nearly every structure in the body.** This includes skin, bones, muscles, ligaments, internal organs on the "macro" scale, and all of the varieties of cells and their internal components on the "micro" scale.
- **Enzymes are incredible molecules that serve as catalysts for chemical reactions within the body.** The overwhelming majority of enzymes are proteins. A vast number of vital reactions would take place far too slowly at body temperature, and enzymes allow the various components of a reaction to interact at phenomenal speed. A single enzyme can facilitate several hundred reactions every second. These may involve the breaking down of nutrients into simpler compounds (the function of digestive enzymes secreted into the intestinal tract by the pancreas), assembling complex structures (including other proteins) out of simpler components, releasing energy, and hundreds of other functions. Life would not be possible without them.
- **All of the antibodies that help defend us from invading organisms are protein molecules.** For this reason, those who are malnourished have many problems, including the lack of resistance to infection.
- **Many hormones are proteins.** Hormones are chemical messengers created in one part of the body to produce a specific effect on another part of the body.
- **Proteins serve as carriers for a host of other substances, transporting them through the bloodstream.** For example, the carrier proteins called high-density lipoprotein (HDL) and low-density lipoprotein (LDL) play very important roles in transporting cholesterol throughout the

body and perhaps in increasing or decreasing the risk for coronary artery disease and heart attack.

- **Proteins circulating in the blood play a vital role in maintaining the proper balance of fluids within blood vessels, in tissues, and within cells.** They also are important in the regulation of the levels of acids and bases within body fluids. The acid-base balance must be maintained within very narrow limits for the body to function and survive.

- **While we normally think of carbohydrates and fats as our primary energy sources, the building blocks of protein called amino acids also serve as an energy source if calories from carbohydrate and fat are in short supply.** However, although we can store carbohydrate as glycogen and we have a virtually unlimited potential to store fat, we cannot store protein. If food is scarce and amino acids are needed as an energy source, protein from muscle and other body structures will be broken down to obtain them.

Do I need an enzyme supplement?

Many websites and nutritional advisers (of questionable credentials) claim that we need to take various enzyme supplements to aid digestion, give our "stressed" and "strained" pancreas a break, and provide any number of health services that our body apparently cannot do for itself. A variation on this theme is that enzymes found in plants are necessary for us to digest them; since cooking changes or alters these enzymes, we should eat only raw (also called "living") fruits and vegetables.

In fact, creating the enzymes we (or any other living thing) need is a specialized biochemical process, orchestrated by amazingly complex genetic blueprints for very specific purposes. Enzymes in our food are unceremoniously dismantled like any other protein, so that the amino acids they contain can be reassembled into other proteins that we need. They are not absorbed intact into the bloodstream. (This is why diabetics who require insulin must inject it. If taken by mouth, insulin would not be absorbed "as is" into the bloodstream to control glucose. Instead it would be disassembled into its component amino acids, which would then be absorbed to make other proteins.) Even our own digestive enzymes are themselves digested, and their amino acids recycled. Furthermore, the enzymes present in a fruit or vegetable are (or were) certainly important for the plant's well-being but weren't generated for our benefit, and they play no role in our ability to extract whatever we can use from it. (Remember also that there are structural elements of fruits and vegetables that we are not designed to digest. These provide fiber, which has numerous benefits that we have reviewed earlier in this chapter.)

With a few uncommon exceptions, the pancreas is quite capable of producing enough enzymes to digest our food without assistance from an expensive supplement. However, people who truly cannot produce or release enough enzymes because of significant damage to the pancreas or a condition such as cystic fibrosis (which can clog the ducts in the pancreas with sticky mucus, preventing enzymes from reaching the intestine) may in fact need supplemental enzymes. These are obtained from animal sources and typically utilize tiny pellets with an enteric coating that keeps them intact in the stomach, allowing release in the small intestine.

Note: One other potentially useful enzyme is lactase, which can be taken in various forms by people with lactose intolerance.