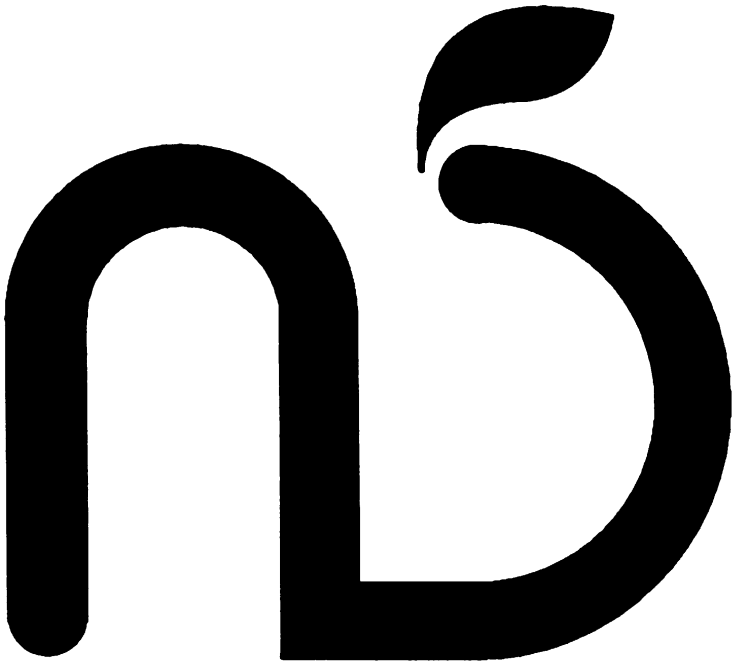

A Personalized Nutrition Education Program

developed by

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or

INTRODUCTION

Why You Should Be Concerned About What You Eat

Simply put, most diets have at least some nutrient deficiencies and excesses. And some of these nutrient deficiencies and excesses can cause disease. For example, low intakes of the antioxidant nutrients, such as vitamin C, vitamin E, and beta-carotene, are associated with heart disease and certain cancers.

On the other hand, excesses of some other nutrients, especially saturated fat, are also associated with heart disease and some cancers. We are a society plagued with overconsumption and undernutrition.

Nutritional imbalances are associated with heart disease, cancer, hypertension, Type II diabetes, osteoporosis, obesity, and other diseases and disorders. In fact, of the ten leading causes of death in the United States, diet plays a role in at least five, including the top three (heart disease, cancer, and stroke)! Some lifestyle choices, including the use of cigarettes and alcohol, and physical inactivity, also increase the chances for disease to happen.

On a personal level, changes in diet and nutrient intake can be used to treat or prevent diseases. In the long run, it is much easier and cheaper to prevent disease than it is to treat it after it occurs. Proper nutrition also gives the benefit of increased overall well-being. Who doesn't want to be able to deal with life's stresses better, to have more energy, to have greater mental clarity, etcetera?

On a national level, the best way to check the rising costs of health care in our country is to reduce the occurrence of the diseases associated with improper food intake. While early detection of disease is important, prevention makes the most sense in terms of cost. And that cost is measured not only in medical insurance and direct medical bills, but also in days missed on the job, resulting in a decrease in overall productivity. So, for the good of yourself *and* the country, let's eat better!

What's Included in Your Nutrition Book

- DIETARY ANALYSIS SECTION
  Following this introduction, the dietary analysis section begins. First, each section of the Computerized Dietary Analysis (CDA) will be explained using a SAMPLE printout (yellow pages). Next comes the actual printout of your dietary analysis (pink pages). Your CDA printout is three pages long and has four sections. Following your printout are two pages that guide you in how to use your dietary analysis results (yellow pages).

- CARBOHYDRATES, PROTEIN, FATS
  In Appendix 1, there is additional information on carbohydrates, protein, and fats. You will find the information divided into three categories: RDA for Adults, Major Sources, and Importance.

- VITAMINS
  Appendix 2 contains basic information on the vitamins. First covered are the fat-soluble vitamins, and then the water-soluble vitamins. As in Appendix 1, the information is divided into three categories: RDA for Adults, Major Sources, and Importance.

- MINERALS
  Appendix 3 provides basic information on the minerals. This information is also divided into three categories: RDA for Adults, Major Sources, and Importance.

- MISCELLANEOUS NUTRITIONAL INFORMATION
  Appendix 4 provides additional information on the nutrients covered in appendices 1, 2, and 3. Browse this section at your leisure.

- DIGESTION AND METABOLISM OF FOOD
  Appendix 5 gives you an overview of how your body digests food. It then explains how carbohydrates, fat, and protein are used as energy sources. It also demonstrates the importance of vitamins in energy production.

- HOW TO COMPUTE PERCENT OF CALORIES
  Appendix 6 shows you how to figure the percent of calories coming from carbohydrates, protein, and fats. In discussions of the prevention of heart disease and cancer, one thing that is almost always mentioned is fat. In particular, that Americans get too much of it in their diet. Usually it is recommended that we get less than 30% of our total dietary calories from fat. For some reason, the new food labels don't provide this information, but who cares, you'll be able to figure it out for yourself!

- RECOMMENDED NUTRIENT INTAKES FOR ADULTS
  Appendix 7 contains tables for the RDA (Recommended Dietary Allowances) and the ESADDI (Estimated Safe and Adequate Daily Dietary Intakes).

- MEASUREMENTS, CONVERSIONS, & ABBREVIATIONS
  Appendix 8 contains common U.S. and metric measurements. It also shows you how to convert one to the other. Some important abbreviations are included here.

- ABBREVIATIONS
  Appendix 9 provides additional abbreviations that are commonly found in nutrition and medical literature.

- REFERENCE VALUES
  Appendix 10 explains how the percents of the dietary goals were computed. This appendix will be of most interest to health professionals.

- GLOSSARY
  This section contains the definitions for over 500 words that are commonly found in nutrition and medical literature.

DIETARY ANALYSIS SECTION

About Your Computerized Dietary Analysis

Your computerized dietary analysis (CDA) is divided into four sections:

Section 1 contains a horizontal bar graph for 27 nutrients. Most people need at least 75% of the RDA (or other dietary goal) for each of these nutrients.

Section 2 also contains a horizontal bar graph. This graph contains six nutrients that many people get excessive amounts of. Usually it is better if you get no more than 100% of the RDA (or other dietary goal) for each of these six nutrients.

Section 3 lists the top four individual food sources for the following seven nutrient categories: calories, fat, cholesterol, saturated fat, sodium, dietary fiber, and sugar.

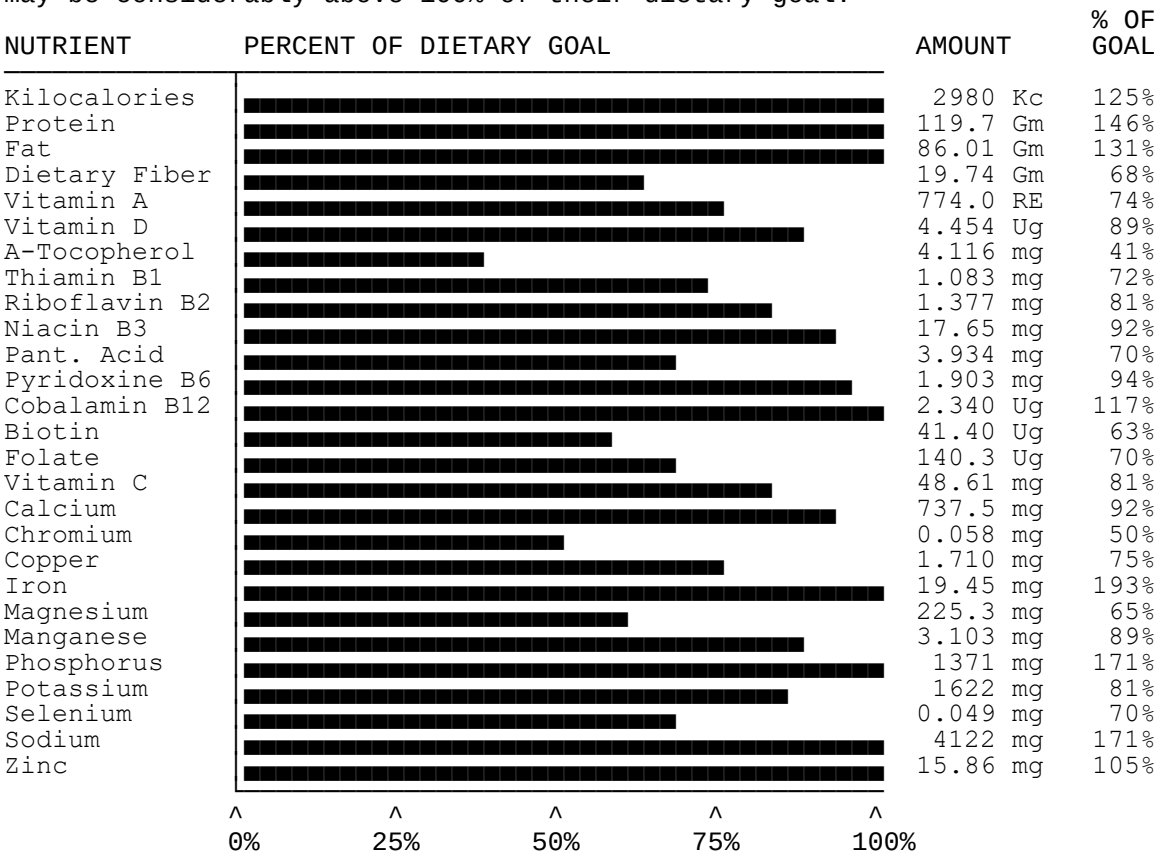
Section 4 compares your percent of calories from protein, carbohydrates, fat, and alcohol to the recommendations made by many health organizations.

THE NEXT FOUR SECTIONS EXPLAIN THE DIETARY ANALYSIS USING A ***SAMPLE*** PRINTOUT. YOUR ***PERSONAL*** PRINTOUT THEN FOLLOWS, BEGINNING ON PAGE 13.

Section 1: SAMPLE Dietary Goals Bar Graph

GENERAL DIETARY ANALYSIS OF DIET For: Sample Printout

1. Below is a bar graph that displays average daily nutrients that should be meeting the RDA, ESADDI, or other dietary goals. Nutrients that are not meeting their dietary goal may need to be increased to improve your diet. Just to the right of the bar graph is the actual amount of the nutrient. To the right of that is the percent of its goal. Some nutrients may be considerably above 100% of their dietary goal.

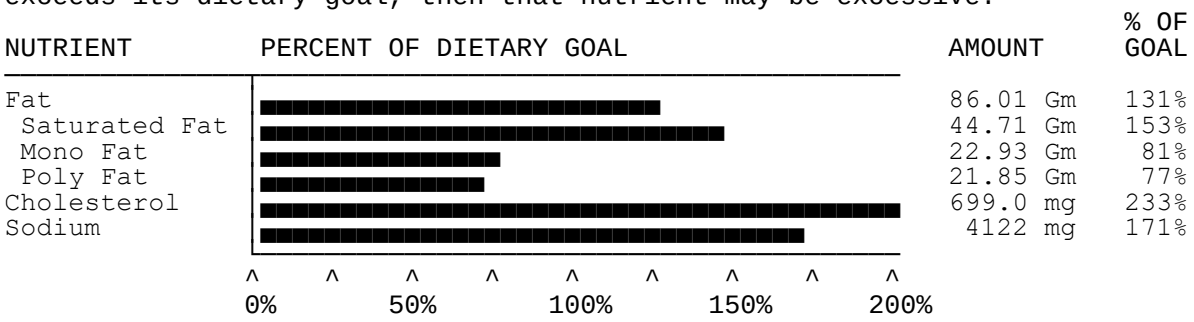


This graph goes from 0% to 100% of the Recommended Dietary Allowances (RDA), or other dietary goals, that have been established for these nutrients. For many people, an intake of at least 75% of the RDA may be enough. For most nutrients, it's okay to exceed 100% of the RDA. For example, you have to be careful not to get too much vitamin A and vitamin D (fat-soluble vitamins), but vitamin E (another fat-soluble vitamin) and the water-soluble vitamins have much larger margins of safety.

To the far right of the bars is a column of percentages with "% OF GOAL" at the top. Since the bar graph goes only to 100%, the numbers will show you how much above 100% of the RDA you are getting. The actual amount of the nutrient is also included.

Section 2: SAMPLE Excessive Nutrients Bar Graph

2. Below is a bar graph that displays nutrients that should equal, or be less than, 100% of their dietary goal (graph goes to 200%). If a nutrient exceeds its dietary goal, then that nutrient may be excessive.



This graph goes from 0% to 200% of the RDA goal values (or recommendations from other sources). Check the column to the right for nutrients that may be above 200% of the RDA. The graph shows six important nutrients that should not go above 100% of the dietary goal. If these nutrients exceed the dietary goal, they may be excessive for some people.

THE NEXT THREE PARAGRAPHS ARE FOR THOSE OF YOU WHO WANT TO GO BEYOND THE FACE VALUE OF THESE PERCENTS.

1. The percents refer to dietary goals. In the case of the fats, the goals are based on percents of total *recommended* calories. (The recommended calories were computed using the personal data you supplied, that is, age, sex, weight, and activity level. The recommended calorie amount is the reference value your protein and fat requirements are based.) Your *actual* calorie intake from your 4-day diet record probably varies somewhat from what was recommended. (See Kilocalories, the first nutrient analyzed in Section 1 of your printout.)

2. Remember, the goals are *percents* of total calories. So, if your bar graph for fat goes to 150%, that doesn't mean your fat intake was 150% of your total daily calorie intake (that would be impossible). Rather, it would mean that you had a fat intake 1.5 times (150%) the recommended intake of 30% of your total recommended calories, or 45% (1.5 x 30 = 45).

3. The above also applies to saturated fat, monounsaturated fat, and polyunsaturated fat, except that the recommendations are 10% of total calories for each of these nutrients. This means that if you had a bar graph for mono fat that went to 50%, it doesn't mean that your monounsaturated fat intake was 50% of your total daily calorie intake. What it means is that you had a mono fat intake half (50%) of the recommended intake of 10% of total recommended calories, or 5%. (Boy, I'm getting a headache just writing this!)

If all of this seems confusing, the third page (Section 4) of your CDA printout might help to clear things

up. This section uses bar graphs to compare your percent of calories from protein, carbohydrate, and fat, with the recommended levels, based on your *actual* calorie intake, as computed from your 4-day diet record.

FAT: An excess of dietary fat is associated with heart disease and some cancers. Most health authorities and organizations recommend a total fat intake of less than 30% of total calories (100% on this graph).

The current recommendations are: no more than 10% of total calories come from saturated fat, 10% from monounsaturated fat, and no more than 10% from polyunsaturated fat. These three add up to the 30% of total calories from fat. However, the recommendation is that we get *no more than* 30% of our calories from fat. It would be just fine if our intake of fat was only 20% or 25% of total calories. Even if we do get 30% of our total calories from fat, it would be better if we got, say, 5% from saturated fat, 20% from monounsaturated fat, and 5% from polyunsaturated fat. That's because monounsaturated fat is the best fat.

SATURATED FAT: This fat is an independent risk factor for heart disease. It is recommended that it be less than 10% of total calories (100% on this graph).

MONOUNSATURATED FAT: This fat seems to be the best. The current recommendation is that it be around 10% of total calories. However, if you have low intakes of saturated and polyunsaturated fats, it's okay to exceed 10% of total calories (or 100% on this graph). Therefore, if you have been trying to increase your intake of monounsaturated fats, your bar graph for this nutrient may be at 150% or even more. That would be okay if the bars for saturated and polyunsaturated fats were in the 25% to 75% range.

POLYUNSATURATED FAT: While consumption of this fat can lower LDL-cholesterol, it also lowers HDL-cholesterol. There is also some evidence that it may be associated with increased cancer incidence. It is recommended that it be less than 10% of total calories (100% on this graph).

CHOLESTEROL: While *dietary* cholesterol may not be much of a risk factor for heart disease, it is often associated with foods that contain saturated fat, sodium (salt), and iron, which are possible risk factors. The current recommendation is an intake of less than 300 mg per day.

SODIUM: For people who have salt-sensitive hypertension, it is particularly important for them to restrict their sodium (salt) intake.

Section 3: SAMPLE Top Four Nutrient Sources

3. TOP FOUR NUTRIENT SOURCES PER CATEGORY

Kilocalories:

4626	POTATO CHIPS-SOUR CREAM AND ONION	598.9 Kc	4 OUNCES
1407	OMELET-TWO EGGS-HAM AND CHEESE	532.0 Kc	2 ITEMS
2005	MCDONALDS-SAUSAGE MCMUFFIN WITH EGG	430.0 Kc	1 ITEM
4086	PIZZA SLICES-SAUSAGE-TOTINOS	390.0 Kc	3 PIECES

Fat:

1407	OMELET-TWO EGGS-HAM AND CHEESE	40.00 Gm	2 ITEMS
4626	POTATO CHIPS-SOUR CREAM AND ONION	38.33 Gm	4 OUNCES
4086	PIZZA SLICES-SAUSAGE-TOTINOS	30.00 Gm	3 PIECES
2005	MCDONALDS-SAUSAGE MCMUFFIN WITH EGG	29.40 mg	1 ITEM

Cholesterol:

1407	OMELET-TWO EGGS-HAM AND CHEESE	890.0 mg	2 ITEMS
102	EGG-SCRAMBLED/MILK/BUTTER	645.0 mg	3 ITEMS
2005	MCDONALDS-SAUSAGE MCMUFFIN WITH EGG	270.0 mg	1 ITEM
4086	PIZZA SLICES-SAUSAGE-TOTINOS	255.0 Gm	3 PIECES

Saturated Fat:

1407	OMELET-TWO EGGS-HAM AND CHEESE	14.60 Gm	2 ITEMS
2005	MCDONALDS-SAUSAGE MCMUFFIN WITH EGG	14.00 Gm	1 ITEM
4086	PIZZA SLICES-SAUSAGE-TOTINOS	12.84 Gm	3 PIECES
102	EGG-SCRAMBLED/MILK/BUTTER	11.40 mg	3 ITEMS

Sodium:

4086	PIZZA SLICES-SAUSAGE-TOTINOS	1620 mg	3 PIECES
1407	OMELET-TWO EGGS-HAM AND CHEESE	1196 mg	2 ITEMS
2005	MCDONALDS-SAUSAGE MCMUFFIN WITH EGG	920.0 mg	1 ITEM
4086	PIZZA SLICES-SAUSAGE-TOTINOS	12.84 Gm	3 PIECES

Dietary Fiber:

5594	CEREAL-SHREDDED WHEAT-SPOON SIZE	10.54 Gm	2 CUPS
5594	CEREAL-SHREDDED WHEAT-SPOON SIZE	10.54 Gm	2 CUPS
590	BROCCOLI-FROZEN-BOILED-DRAINED	7.300 Gm	1 CUP
641	PEAS-GREEN-FROZEN-BOILED-DRAINED	6.080 Gm	1 CUP

Sugar:

5159	SYRUP-MAPLE	24.00 Gm	2 TBSPS
5159	SYRUP-MAPLE	24.00 Gm	2 TBSPS
223	APPLES-RAW-WITH SKIN-2 3/4 INCH DIAMETER	18.40 Gm	1 ITEM
58	MILK-NONFAT/SKIM-MILK SOLIDS ADDED	10.80 Gm	1 CUP

Section 3 lists the top four individual food sources for the following seven nutrient categories: calories, fat, cholesterol, saturated fat, sodium, dietary fiber, and sugar. Health professionals are particularly concerned about the dietary intake of these seven nutrients. That is because research shows that these nutrients can significantly affect our health.

KILOCALORIES: The main concern with calories is when they are excessive. That is because an excess of energy intake often leads to obesity, and obesity is a risk factor in a number of diseases. When people weigh at least 20% above their ideal body weight, they increase their risk for hypertension, coronary artery disease, lipid disorders, and diabetes (NIDDM). Obesity is also considered a risk factor for some cancers, and it is associated with joint disease, gallstones, and respiratory problems, too.

FAT: Besides being a source of concentrated energy, excess fat consumption is associated with a number of diseases. It is believed that a reduction in total fat intake can reduce the risk of heart disease, some cancers, stroke, diabetes, and gastrointestinal diseases.

CHOLESTEROL: An elevated serum cholesterol level is associated with an increased risk for heart disease and stroke. However, *dietary* cholesterol has little effect on *serum* cholesterol. Nevertheless, it is wise to decrease your intake of high cholesterol-containing foods because these foods often contain excessive amounts of saturated fats and sodium, and little or no dietary fiber.

SATURATED FAT: Certain saturated fats can increase serum cholesterol levels, and they are also atherogenic (cause atherosclerosis).

SODIUM: The average American consumes 5-10 times the sodium that is needed. This sodium comes from numerous sources:

1. Protein foods, especially from animal sources, usually contain more sodium than do vegetables and grains, and fruits contain little or none.
2. Sodium chloride (common table salt).
3. Fast foods, restaurant foods, and convenience foods are often loaded with salt.
4. Canned and pickled foods.
5. Seafood.
6. Commercially softened water.
7. Some over-the-counter chewable antacid tablets.

For people who are at risk, reducing excess dietary sodium may decrease the risk for heart disease and stroke. Also, too much dietary sodium may contribute to osteoporosis.

DIETARY FIBER: In most cases, the concern here is an intake that is too little, not too much. A deficiency of dietary fiber increases the incidence of heart disease, cancer, diabetes, and gastrointestinal diseases. However, an *excessive* intake of some fibers (high phytate-containing) *may* contribute to osteoporosis by binding dietary calcium.

SUGAR: Whether coming from table sugar, honey, maple syrup, etc., sugar is a simple carbohydrate that

has no nutritive value except for calories. Not only that, but these "empty" calories can satisfy hunger, so they end up displacing calories that could be coming from foods that contain additional nutrients. Because of this, an overconsumption of sugar can lead to a variety of nutrient deficiencies, especially in children.

NOTE 1: If you have an excessive intake in any of these nutrient categories, you can reduce it by first focussing on the foods in each category that are excessive sources. Also, you may find that the same food is listed in more than one nutrient category. For example, many convenience foods and fast foods will show up under Kilocalories, Fat, Cholesterol, Saturated Fat, and Sodium. If you have excesses, these will be the most important foods to concentrate on.

NOTE 2: Please keep in mind that the foods listed in Section 3 are the top four food sources for each of these seven nutrient categories. Just because they are listed here does not mean that you need to reduce their intake. That may be necessary only when you have an *excessive* intake for the nutrient. Check with Sections 1 & 2 of your printout to see if you are getting too much of these nutrients.

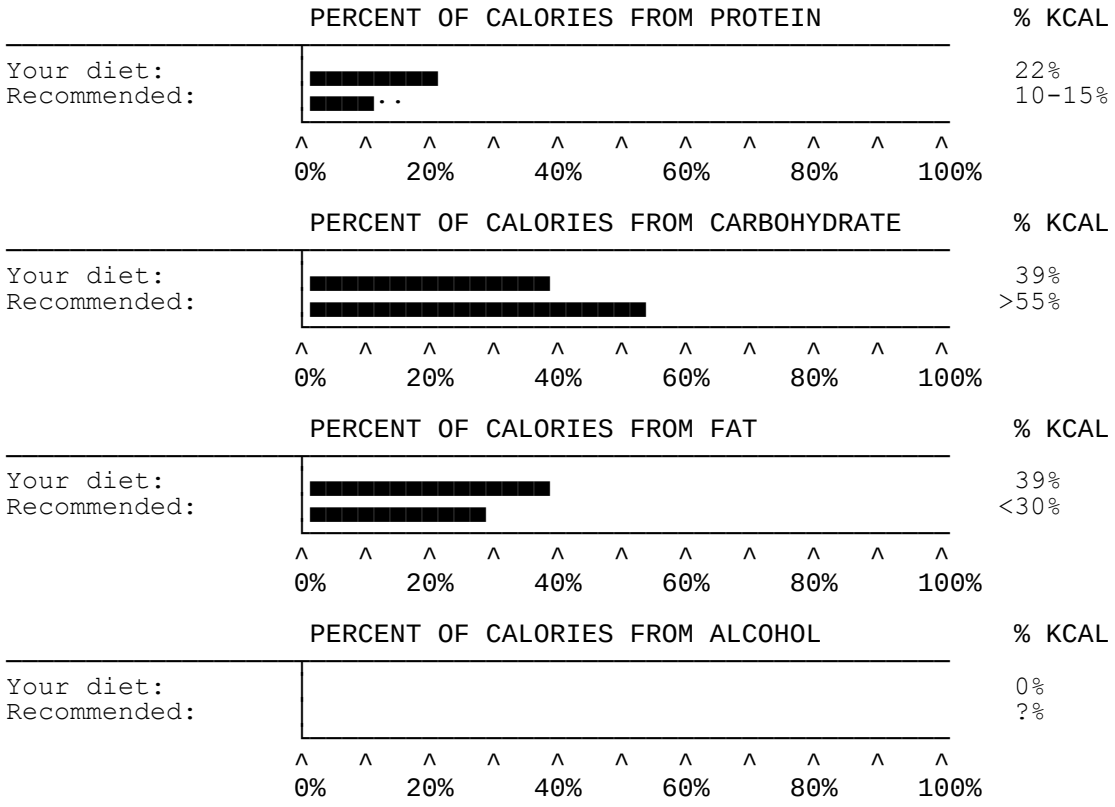
NOTE 3: In *your* printout, which starts on page 13, some of the foods listed in this section may not be the exact foods that you recorded during your 4-day diet record. That is because occasionally substitutions have to be made for the foods you listed. This is done because a particular food in the computer program may not have available the same portion measurement form that you used.

For example, let's say you ate a tomato and recorded it as 6332 TOMATO from the Food List. For this food selection, the computer program has three portion measurement forms (Gram, Ounce, Pound). But what if you had written the portion form as "Each"? Then there would have to be a computer search for a "Tomato" that had "Each" as a portion measurement form. One such possibility would have been 671 TOMATO-RED-RIPE-RAW, which has four portion measurement forms (Gram, Ounce, Pound, Each).

Section 4: SAMPLE % of Calories from Protein, Carbohydrate, and Fat

4. PERCENT OF CALORIES FROM PROTEIN, CARBOHYDRATE, FAT, AND ALCOHOL.

The four graphs below compare the percent of calories from protein, carbohydrate, fat, and alcohol in your diet to what is recommended. These recommendations are somewhat variable. For instance, it is recommended that the % of calories from protein should range between 10% to 15% of total calories. The % of calories from carbohydrates should be more than 55% of total calories. The % of calories from fat should be less than 30% of total calories. Finally, there is no formal recommendation for alcohol intake, although little or no intake is usually recommended. (NOTE: Because of rounding error, when your percents from each category are added together, the total may be slightly more or less than 100%.)



The final section of your printout focusses not on the weight of the nutrient, but on its amount of calories compared to the total amount of calories in your diet, and expressed as a percent. (See Appendix 5 on how this is done.)

PROTEIN: While the RDA for protein is based on body weight, usually if you are getting 10-15% of your calories from protein, it will be more than enough. As your total amount of calories goes up, your percent of calories from protein should go down, since your protein need is pretty much a fixed amount.

CARBOHYDRATE: The opposite of protein, as your total amount of calories goes up, your percent of

calories from carbohydrate should also go up. That is because usually your need for calories goes up when you are more physically active, and the best source of extra calories is carbohydrates (preferably complex carbohydrates), not protein or fat.

FAT: While the percents of needed calories from protein and carbohydrates vary, depending on the total amount of calories in the diet, it is usually best to keep your percent of calories from fat below 30%.

THE RESULTS OF *YOUR* PERSONAL COMPUTERIZED DIETARY ANALYSIS BEGIN ON THE NEXT PAGE.

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Don't get too sidetracked by the numbers. Look for trends and relationships. For example, how do your percent of calories from protein, fats, and carbohydrates compare with the recommendations? Are you consistently getting less than the RDA for many of the vitamins, minerals, and fiber, but more than the "RDA" for total fat, saturated fat, sodium, and cholesterol?

As you go through your dietary analysis, remember that there are appendices available to help you:

Appendices 1, 2, and 3 give you basic information (RDA, Major Sources, Importance) on the nutrients covered in your diet analysis.

Appendix 4 provides more in-depth information on many nutrients.

Appendix 5 teaches you about the digestion and metabolism of food.

Appendix 6 shows you how to compute the percent of calories coming from fats, protein, and carbohydrates in a food.

Appendix 7 summarizes the recommended nutrient intakes for adults.

Appendix 8 helps you with measurements, and converting measurements between metric and U.S. systems. Common abbreviations are also explained here.

Appendix 9 provides many of the abbreviations used in nutrition and medicine.

Finally, the glossary contains definitions for over 500 words used in nutrition and medicine.

How To Use Your Dietary Analysis Results

Your printout shows your dietary intake for 32 nutrients. The percents of the dietary goals are based on the information you supplied (age, weight, sex, and usual activity level). By looking at various sections of your printout and the appendices (1, 2, 3, and 4), you'll be able to identify nutrient deficiencies and excesses (in relation to established dietary goals), and then focus on the foods that are sources of these nutrients.

Kilocalories: Calories are mainly a concern when you are trying to lose or gain weight, or if you have diabetes. Section 1 of your printout shows whether or not you are in caloric balance, that is, significantly below or above 100%. (See Appendix 4, Kilocalories and Weight Management, for additional factors affecting weight.) If you want to lose weight, Section 3 of your printout, under the Kilocalories subsection, lists the top four foods providing calories in your diet. Simply reduce their serving size (or eliminate them altogether) and increase your intake of lower calorie foods. Low-calorie foods are essentially low-fat foods, and are usually vegetables, whole grains, legumes, fruits, reduced-fat dairy products, and lean, baked or broiled meat, poultry, and fish. See also Appendix 1, which lists lower- and higher-fat protein sources, and the major sources of fat.

NOTE: The accuracy of your diet analysis depends on the correctness of the information you supplied. If you considerably under-reported your food intake and/or overestimated your activity level, then the analysis may show that either you are not getting enough calories or that your diet is better than it really is.

Protein: Most people get more protein than they need. Section 1 of your printout shows your protein intake in grams, and also its percent of your dietary goal. If you are getting too little protein (less than 80-90% of your dietary goal), or too much protein (let's say over 150-200% of your dietary goal), check Appendix 1 (see Protein) for sources of protein that you may need to increase or decrease. Section 4 gives you the percent of your dietary calories coming from protein.

Fat: All four sections of your printout give information on your fat intake. If your diet contains excessive sources of these nutrients, use Section 3 (Fat, Cholesterol, Saturated Fat), Appendix 1 (see Fats), and Appendix 4 (see Fat) to help you make any needed dietary adjustments.

Carbohydrates: Your percent of total calories coming from carbohydrates is shown in Section 4 of your printout. Most of your calories (at least 55%) should come from complex carbohydrates. Appendix 1 (see Carbohydrates) provides basic information on carbohydrates, and Appendix 4 (see Carbohydrates) provides additional information.

Dietary Fiber: Most people don't get enough fiber. An intake of around 20-30 grams is considered to be good. Section 1 gives your fiber intake, and Section 3 lists the top four food sources of fiber in your diet. Appendix 1 (see Carbohydrates) lists good sources of fiber (fruits, complex carbohydrates, legumes) and

Appendix 4 (see Fiber) provides additional information on fiber.

Fat-Soluble Vitamins: Dietary levels of vitamins A, D, and E (A-tocopherol) are reported in Section 1 of your printout. If you are not taking vitamin supplements that contain vitamins A and D, a dietary intake of even two or three hundred percent of the RDA is no cause for concern. One reason is that the vitamin A amount includes beta-carotene, which is not toxic. However, if you consume a lot of oily fish, vitamin D fortified dairy products, *and* take a vitamin supplement containing vitamin D, you could be getting too much of this vitamin. On the other hand, vitamin E is very safe, and most adults can safely consume at least 1,000% of the RDA (ten times the RDA). Appendix 2 (see Vitamin A, Vitamin D, Vitamin E) lists sources of these vitamins, and Appendix 4 supplies additional information.

Water-Soluble Vitamins: Thiamin, riboflavin, niacin, pantothenic acid, pyridoxine, cobalamin, biotin, folate, and vitamin C, are water-soluble vitamins. If Section 1 of your printout shows that you have deficiencies of these nutrients, Appendix 2 lists good food sources, and Appendix 4 provides additional information. Don't be concerned if Section 1 shows that your diet is supplying several hundred percent of the RDA for any of these vitamins. These nutrients are very safe, and it is almost impossible to get too much from your food.

Minerals: Section 1 of your printout gives your dietary intake of calcium, chromium, copper, iron, magnesium, manganese, phosphorus, potassium, selenium, sodium, and zinc. Appendix 3 lists food sources for these minerals, and Appendix 4 supplies additional information. Unlike the water-soluble vitamins, it's better not to get too much of the minerals. One reason is that many of the minerals interact with one or more other minerals. For example, calcium/phosphorus/magnesium, sodium/potassium, and copper/iron/zinc are such mineral combinations. Too much of one mineral, such as calcium or zinc, could create a deficiency of its related mineral, magnesium or copper, respectively. With minerals, balance is best. Therefore, the objective should be to have a mineral intake fairly close to 100% of the dietary goals.

Final Note

Please keep in mind that your dietary analysis results are based solely on how accurately you completed your CDA questionnaire, so please don't make any life or death decisions based on this. Completing one dietary analysis that covers a few days won't give you a 100% accurate picture of your diet. There are a number of reasons why your CDA may have some inaccuracies, including:

1. You didn't always estimate accurately the amount of food eaten during the CDA period.
2. You didn't estimate accurately your usual activity level.
3. You changed your dietary habits during the CDA period.
4. The food lists didn't always have an exact match with the food you ate, or the way you prepared it.
5. The CDA food lists are based on averages. Foods can vary from region to region, and from season to season.
6. The USDA hasn't tested every food for every nutrient, so there can be gaps.
7. Your dietary habits are bound to change from season to season, or from year to year.
8. In addition to the above, occasionally substitutions have to be made for the foods you listed in your 4-day diet record. This is done because a particular food in the computer program may not have available the serving measurement form that you listed.

Nevertheless, done properly, a dietary analysis can provide valuable insights into a person's dietary habits, especially when it's done more than once.

If you make fundamental changes in your diet as a result of this nutrition program, you may want to consider a follow-up CDA 3-6 months from now. This would be a good way to measure the progress you make in improving your diet.

TABLE OF APPENDICES

APPENDIX 1: Carbohydrates, Protein, Fats

Carbohydrates

RDA FOR ADULTS: There is no recommended dietary allowance for carbohydrates. However, it is recommended that carbohydrates make up at least 55% of the total calories in a diet.

MAJOR SOURCES:

- Simple (sugars): Cane and beet sugars, molasses, maple syrup, honey, corn syrup, fruit and fruit juice.
- Complex: Whole grain cereals, pastas and breads, legumes (beans: lentil, kidney, soy, pea, etc.), starchy vegetables (potato, corn, yam, etc.).
- Fiber:

  Soluble: Oat bran, legumes, gums (guar, psyllium), barley, apple, pear, citrus fruit.

  Insoluble: Whole wheat bran, vegetables (especially raw).

IMPORTANCE: Major energy source; protein sparing; necessary for normal fat metabolism; other than in starvation states, glucose (from carbohydrate digestion) is the sole source of energy for the brain; many sources also provide dietary fiber.

Protein

RDA FOR ADULTS: 0.8 g/kg. One kilogram (kg) = 2.2 pounds. Therefore, the average 63 kg (139 lbs) woman needs: 63 kg x 0.8 g/kg = 50 grams of pure protein. The average 79 kg (174 lbs) man needs: 79 kg x 0.8 g/kg = 63 grams of pure protein.

To determine your protein requirement, simply divide your weight in pounds by 2.2. This will convert your weight in pounds to kilograms. Then multiply this number by 0.8. This will give you the amount of grams of protein you need, assuming that you have no special protein needs. Divide by 28 to convert grams to ounces.

MAJOR SOURCES:

- Lower fat: Baked or broiled lean beef, poultry (without skin), pork, and fish. Legumes, tofu, low-fat dairy products (skim and 1% milk, nonfat yogurt, cottage and diet cheeses), egg white.
- Higher fat: Fried beef, poultry, pork, and fish. Sausage, luncheon meats, hot dogs, hamburgers, nut butters, nuts and seeds, eggs, whole milk, cheeses. Most fast foods and convenience foods.

IMPORTANCE: Anabolism of tissue proteins; help maintain fluid balance; energy source; formation of immunoglobulins; maintenance of acid-base balance; important part of enzymes and hormones.

AMINO ACIDS: Proteins are made up of varying amounts and combinations of twenty amino acids, classified as: Indispensable, Conditionally Indispensable, Acquired Indispensable, & Completely Dispensable.

Fats

RDA FOR ADULTS: There is no recommended dietary allowance for fat. However, it is recommended that fat make up less than 30% of the total calories in a diet. (See Appendix 5 to learn how to compute percent of calories.)

MAJOR SOURCES:

- Saturated: Butter, bacon, animal fats (chicken, lard, tallow), coconut, cream, sour cream, cream cheese, egg yolk.
- Monounsaturated: Olive, canola, almond, and peanut oils. Animal fats (chicken, lard, tallow), hard margarines (stick), soybean oil margarine, avocado, nuts (peanuts, almonds, cashews, pistachio, macadamia), vegetable shortenings, egg yolk.
- Polyunsaturated: Safflower, sunflower, corn, and soybean oils. Soft safflower and corn oil margarines (tub), walnuts, Brazil nuts, seeds (sunflower, sesame, pumpkin).
- Cholesterol: Veal, lamb, beef, pork, chicken, organ meats, egg yolks, whole milk products (cheeses, ice cream, butter, cream), shrimp, lobster, clams.

IMPORTANCE: Concentrated energy source; protein sparing; insulation for temperature maintenance (body fat); supplies essential fatty acids; carries the fat-soluble vitamins.

APPENDIX 2: Vitamins*

FAT-SOLUBLE VITAMINS

Vitamin A (retinol; beta-carotene).
RDA FOR ADULTS: M**: 1,000 RE (3,333 I.U.); F**: 800 RE (2,667 I.U.).
MAJOR SOURCES: Liver, kidney, milk fat, fortified margarine, egg yolk, yellow and dark green leafy vegetables, apricots, cantaloupe, peaches.
IMPORTANCE: Essential for normal growth, development, and maintenance of epithelial tissue; essential to the integrity of night vision; helps provide for normal bone development; influences normal tooth formation; necessary for wound healing; toxic in large quantities (retinol, not beta-carotene).

Vitamin D (calciferol).
RDA FOR ADULTS: M: 5 mcg (200 I.U.); F: 5 mcg (200 I.U.).
MAJOR SOURCES: Vitamin D fortified milk, irradiated foods, some in milk fat, liver, egg yolk, salmon, tuna fish, sardines. Sunlight converts 7-dehydrocholesterol to cholecalciferol in skin.
IMPORTANCE: Really a prohormone; essential for normal growth and development; important for formation of normal bones and teeth; influences absorption and metabolism of phosphorus and calcium; toxic in large quantities.

Vitamin E (tocopherols and tocotrienols).
RDA FOR ADULTS: M: 10 α-TE (14.9 I.U.); F: 8 α-TE (11.9 I.U.).
MAJOR SOURCES: Wheat germ, vegetable oils, green leafy vegetables, milk fat, egg yolks, nuts.
IMPORTANCE: A strong antioxidant; may help prevent oxidation of unsaturated fatty acids and vitamin A in the intestinal tract and body tissues; protects red blood cells from hemolysis; role in reproduction (in animals); role in epithelial tissue maintenance and prostaglandin synthesis.

Vitamin K (menadione, phylloquinone, and menaquinone).
RDA FOR ADULTS: M: 80 mcg; F: 65 mcg.
MAJOR SOURCES: Liver, soybean oil, other vegetable oils, green leafy vegetables, wheat bran. Synthesized in the intestinal tract.
IMPORTANCE: Aids in production of prothrombin, a compound required for normal clotting of blood; Menadione, the synthetic form, is somewhat toxic in large amounts.

*See Appendix 6 for a more detailed breakdown of the RDA and ESADDI.
**M = male; F = female

WATER-SOLUBLE VITAMINS

Vitamin B1 (thiamin).
RDA FOR ADULTS: M: 1.5 mg; F: 1.1 mg.
MAJOR SOURCES: Pork, liver, organ meats, legumes, wholegrain and enriched cereals and breads, wheat germ, potatoes. Synthesized by intestinal bacteria.
IMPORTANCE: Combines with phosphorus to form thiamin pyrophosphate (TPP) necessary for metabolism of protein, carbohydrate, and fat; essential for growth, normal appetite, digestion, and healthy nerves.

Vitamin B2 (riboflavin).
RDA FOR ADULTS: M: 1.7 mg; F: 1.3 mg.
MAJOR SOURCES: Milk and dairy foods, organ meats, green leafy vegetables, enriched cereals and breads, eggs.
IMPORTANCE: Essential for growth; plays an enzymatic role in tissue respiration and acts as a transporter of hydrogen ions; coenzyme forms are FMN and FAD.

Vitamin B3 (niacin and niacinamide).
RDA FOR ADULTS: M: 19 mg NE; F: 15 mg NE.
MAJOR SOURCES: Fish, liver, meat, poultry, many grains, eggs, peanuts, milk, legumes, enriched grains. Synthesized by intestinal bacteria.
IMPORTANCE: As part of enzyme system (NAD), aids in transfer of hydrogen and acts in metabolism of carbohydrates and amino acids; involved in glycolysis, fat synthesis and breakdown, and tissue respiration; the niacinamide form does not cause flushing, but will not reduce serum cholesterol levels.

Vitamin B5 (pantothenic acid).
RDA FOR ADULTS: None. ESADDI is 4-7 mg.
MAJOR SOURCES: Present in all plant and animal foods; eggs, kidney, liver, salmon, and yeast are best sources; possibly synthesized by intestinal bacteria.
IMPORTANCE: As part of coenzyme A and other derivatives, pantothenic acid participates in energy release from protein, carbohydrate, and fat; required in the biosynthesis of fatty acids.

Vitamin B6 (pyridoxine, pyridoxal, and pyridoxamine).
RDA FOR ADULTS: M: 2.0 mg; F: 1.6 mg.
MAJOR SOURCES: Pork, glandular meats, cereal bran and germ, milk, egg yolk, oatmeal, and legumes. Synthesized by intestinal bacteria.
IMPORTANCE: As a coenzyme, aids in the synthesis and breakdown of amino acids and in the synthesis of unsaturated fatty acids from essential fatty acids; essential for conversion of tryptophan to niacin; essential for normal growth.

Vitamin B12 (cobalamin).
RDA FOR ADULTS: 2 mcg.
MAJOR SOURCES: Liver, kidney, milk and dairy foods, meat, eggs. Vegans require supplement.
IMPORTANCE: Involved in the metabolism of single-carbon fragments; essential for biosynthesis of

nucleic acids, nucleoproteins, and red blood cells; role in metabolism of nervous tissue; involved with folate metabolism; related to growth.

Biotin
RDA FOR ADULTS: None. ESADDI is 30-100 mcg.
MAJOR SOURCES: Liver, mushrooms, peanuts, yeast, milk, meat, egg yolk, most vegetables, banana, grapefruit, tomato, watermelon, and strawberries. Synthesized by intestinal bacteria.
IMPORTANCE: Essential component of enzymes; involved in synthesis and breakdown of fatty acids and amino acids through aiding the addition and removal of CO_2 to or from active compounds, and the removal of NH_2 from amino acids.

Carnitine
RDA FOR ADULTS: None. Classified as vitamin-like; the body can manufacture it.
MAJOR SOURCES: Foods of animal origin, especially red meats.
IMPORTANCE: Transports long-chain fatty acids into the mitochondria so that they may be oxidized for energy.

Choline (lecithin).
RDA FOR ADULTS: None. Classified as vitamin-like; the body can manufacture it.
MAJOR SOURCES: Choline: liver, oatmeal, soybeans, cauliflower, kale. Phosphatidyl choline: eggs, liver, soybeans, peanuts.
IMPORTANCE: Component of the neurotransmitter, acetylcholine, and of the phospholipids, sphingomyelin and phosphatidylcholine; important to the structure of all cell membranes, plasma lipoproteins, and pulmonary surfactant.

Folic Acid (folate, folacin).
RDA FOR ADULTS: M: 200 mcg; F: 180 mcg.
MAJOR SOURCES: Green leafy vegetables, organ meats (liver), lean beef, wheat, eggs, fish, dry beans, lentils, cowpeas, asparagus, broccoli, collards, yeast. Synthesized by intestinal bacteria.
IMPORTANCE: Appears essential for biosynthesis of nucleic acids; essential for normal maturation of red blood cells; functions as the coenzyme, tetrahydrofolic acid.

Inositol
RDA FOR ADULTS: None. Classified as vitamin-like; the body can manufacture it.
MAJOR SOURCES: Organ meats (liver, heart), whole grains, vegetables, nuts, legumes.
IMPORTANCE: As phosphatidylinositol, present in cell membranes; functions include the mediation of cellular responses to external stimuli, nerve transmissions, and regulation of enzyme activity; exerts lipotropic activity.

PABA (*para*-aminobenzoic acid).
RDA FOR ADULTS: None. Officially not classified as a vitamin.
MAJOR SOURCES: Organ meats, whole grains, eggs, dairy products, dark green vegetables.
IMPORTANCE: Red blood cell formation; metabolism of protein; topically used in sunscreens.

Vitamin C (ascorbic acid, ascorbate).
RDA FOR ADULTS: 60 mg.
MAJOR SOURCES: Fruits (especially citrus fruits), tomatoes, melon, peppers, green leafy vegetables, raw cabbage.
IMPORTANCE: Maintains intracellular cement substance with preservation of capillary integrity; co-substrate in hydroxylations requiring molecular oxygen; important in immune response, wound healing, and allergic reactions; increases absorption of nonheme iron.

APPENDIX 3: Minerals

Calcium
RDA FOR ADULTS: 800 mg; 1,200 mg for men and women 19-24 years.
MAJOR SOURCES: Milk, cheese, turnip and mustard greens, collards, kale, broccoli, sardines and salmon with bones.
IMPORTANCE: Builds and maintains bones and teeth; essential in clotting of blood; influences transmission of ions across cell membranes; required in nerve transmission and muscle contraction.

Chloride
RDA FOR ADULTS: None. Estimated safe minimum amount is 750 mg.
MAJOR SOURCES: Sodium chloride (table salt), seafood, milk, meat, eggs.
IMPORTANCE: Helps regulate acid-base equilibrium and osmotic pressure of body fluids; component of gastric hydrochloric acid.

Chromium
RDA FOR ADULTS: None. ESADDI is 50-200 mcg.
MAJOR SOURCES: Meat, clams, cheese, whole grains, brewer's yeast.
IMPORTANCE: Required for normal glucose metabolism; insulin cofactor.

Cobalt
RDA FOR ADULTS: None.
MAJOR SOURCES: Sardines, salmon, liver, peanuts, peas, wheat bran, oysters, meat.
IMPORTANCE: Necessary for synthesis of vitamin B12.

Copper
RDA FOR ADULTS: None. ESADDI is 1.5-3.0 mg.
MAJOR SOURCES: Liver, kidney, shellfish, nuts, poultry, legumes, raisins, chocolate.
IMPORTANCE: Facilitates the function of many enzymes and iron; may be an integral part of RNA and DNA molecules; role in development of connective tissue and blood vessels, and formation of phospholipids and melanin.

Fluoride
RDA FOR ADULTS: None. ESADDI is 1.5-4.0 mg.
MAJOR SOURCES: Fluoridated drinking water, tea, coffee, rice, soybeans, spinach, onions, lettuce.
IMPORTANCE: Helps protect teeth against tooth decay; may minimize bone loss.

Iodine
RDA FOR ADULTS: 150 mcg.
MAJOR SOURCES: Seafood, iodized salt.
IMPORTANCE: Necessary for synthesis of thyroid hormones. Thyroid hormones stimulate the basal rate of metabolism, oxygen consumption, and heat production. They are necessary for normal nervous

system development, and linear growth.

Iron
RDA FOR ADULTS: M: 10 mg; F: 15 mg.
MAJOR SOURCES: Liver, lean meat, poultry, oysters, dried beans, fortified cereals, dark green vegetables, dark molasses.
IMPORTANCE: Essential for the formation of hemoglobin and myoglobin, and oxygen transport; facilitates transfer of electrons in the electron transport chain.

Magnesium
RDA FOR ADULTS: M: 350 mg; F: 280 mg.
MAJOR SOURCES: Whole grains, nuts, dried beans and peas, green vegetables, legumes.
IMPORTANCE: Required for many coenzyme oxidation-phosphorylation reactions; nerve impulse transmissions; muscle relaxation; component of bone structure.

Manganese
RDA FOR ADULTS: None. ESADDI is 2.0-5.0 mg.
MAJOR SOURCES: Beet greens, blueberries, whole grains, nuts, legumes, fruit, tea.
IMPORTANCE: Essential for normal brain function; role in enzyme systems, collagen formation, bone growth, urea formation, fatty acid and cholesterol synthesis, and digestion of protein.

Molybdenum
RDA FOR ADULTS: None. ESADDI is 75-250 mcg.
MAJOR SOURCES: Beef kidney, cereal grains, legumes, dark green leafy vegetables (dependent on soil content where grown).
IMPORTANCE: Part of the enzymes, xanthine oxidase and aldehyde oxidase; possibly helps reduce incidence of dental caries; role in metabolism of purines and pyrimidines, and oxidation of sulfite.

Nickel
RDA FOR ADULTS: None.
MAJOR SOURCES: Nuts, legumes, shellfish, spinach.
IMPORTANCE: Possibly involved in hormonal membrane or enzyme activity.

Phosphorus
RDA FOR ADULTS: 800 mg; 1,200 for men and women 19-24 years.
MAJOR SOURCES: Meat, poultry, fish, eggs, milk, cheese, nuts, legumes.
IMPORTANCE: Builds and maintains bones, teeth, and cell membranes; component of nucleic acids and phospholipids; coenzyme functions in energy metabolism (ATP); buffers intracellular fluid pH.

Potassium
RDA FOR ADULTS: None. Estimated minimum safe range is 2,000-3,500 mg.
MAJOR SOURCES: Fruits, bananas, dried fruits, potatoes, milk, legumes, meat.
IMPORTANCE: Helps regulate acid-base equilibrium and osmotic pressure of body fluids; influences muscle activity, especially cardiac muscle.

Selenium
RDA FOR ADULTS: M: 70 mcg; F: 55 mcg.
MAJOR SOURCES: Grains, onions, meat, milk, vegetables. Levels variable: depends on selenium content of soil.
IMPORTANCE: May be essential for tissue respiration; associated with fat metabolism, vitamin E, and antioxidant functions (part of glutathione peroxidase).

Silicon
RDA FOR ADULTS: None.
MAJOR SOURCES: High-fiber cereal grains, especially oats.
IMPORTANCE: Apparent role in formation of connective tissue and bone matrix.

Sodium
RDA FOR ADULTS: None. Estimated safe range is 500-2,400 mg.
MAJOR SOURCES: Sodium chloride (table salt), seafood, animal foods, milk, eggs. Abundant in most foods except fruit.
IMPORTANCE: Helps regulate acid-base equilibrium and osmotic pressure of body fluids; plays a role in normal muscle irritability and contractility, and nerve transmission; influences cell permeability.

Sulfur
RDA FOR ADULTS: Need is satisfied by essential sulfur-containing amino acids.
MAJOR SOURCES: Protein foods, including meat, fish, poultry, eggs, milk, cheese.
IMPORTANCE: Functions in oxidation-reduction reactions; component in thiamin, biotin, lipoic acid, and some hormones (insulin).

Vanadium
RDA FOR ADULTS: None.
MAJOR SOURCES: Very little found in food: shellfish, spinach, parsley, mushrooms, whole grains.
IMPORTANCE: Apparent role may be in lipid metabolism or reproductive performance. Appears to mimic the action of insulin.

Zinc
RDA FOR ADULTS: M: 15 mg; F: 12 mg.
MAJOR SOURCES: Oysters, shellfish, herring, liver, eggs, legumes, milk.
IMPORTANCE: Component of many enzyme systems and of insulin; important in nucleic acid metabolism; role in energy metabolism, protein synthesis, collagen formation, alcohol detoxification, carbon dioxide elimination, sexual maturation, immune system, taste and smell functions.

APPENDIX 4: Miscellaneous Nutritional Information

Kilocalories and Weight Management

The term "kilocalories" (kcal) literally stands for 1,000 calories. However, when referring to food energy intake, one kilocalorie equals one calorie, although technically the "c" should be capitalized as Calorie (sometimes spoken as big "C" calorie).

On an equal weight basis, the four energy categories provide varying amounts of calories. For instance, one gram of protein or carbohydrate supplies four calories, one gram of fat provides nine calories, and one gram of alcohol supplies seven calories.

All things being equal, if your "% OF GOAL" for kilocalories is around 100%, then your weight should be in steady state, that is, you aren't losing or gaining weight. However, if you under-recorded your food intake or you overestimated your activity level, this percentage will be artificially low. In this case, a percentage *below* 100% would *not* necessarily mean that you could be *losing* weight because you are getting less than your body needs.

The reverse is also true. If you over-recorded your food intake or you underestimated your activity level, this percentage will be artificially high. In this case, a percentage *above* 100% would *not* necessarily mean that you could be *gaining* weight because you are getting more than your body needs.

In terms of total energy intake, there are other factors to consider in weight management. For example, it makes a difference where your calories are coming from. This means that, for the same amount of calories, it's easier to gain weight on a high-fat diet than on a high-carbohydrate diet. This is because your body doesn't have to work very hard to convert food fat into body fat, whereas your body has to "burn" a fair amount of energy (calories) to convert dietary carbohydrates into body fat.

Finally, there is metabolism to consider. Some people have a "fast" metabolism (high metabolic rate) and others have a "slow" metabolism (low metabolic rate). Factors that influence your metabolism include:

1. WHITE FAT VERSUS BROWN FAT: Brown fat is more metabolically active. It occurs mostly in the upper back and neck. The more brown fat you have, the more excess calories you will convert into heat, instead of storing as fat. This is called nonshivering thermogenesis. People with lots of brown fat can have that extra serving of dessert, because they know that their body will take those excess calories and convert them to heat. What a great way to reduce your utility bills! Exposure to cold may induce the body to manufacture more brown fat; another reason for taking cold showers.

2. FUTILE AND REDUNDANT CYCLES: In almost all cells, there are little energy factories called mitochondria. Among other activities, this is where cellular respiration (electron transport chain) and oxidative phosphorylation take place. Avoiding the technical stuff, let's just say that a lot of energy is used up here, mostly in the production of ATP (the energy currency of the body). Some people are more efficient in their production of ATP. This was a genetic advantage back in the days of the wooly

mammoth and sabre-toothed tiger. Food was often scarce, and the more you got out of your food's energy content, the greater your chances of survival. Unfortunately, in these days of plenty, it's a disadvantage to be energy efficient, because our bodies will just hoard those extra calories by storing them as fat. People who have inefficient bodies, have more energy cycles that are futile (essentially go nowhere, but produce heat) or redundant (go somewhere, but in a roundabout way, also wasting energy in heat production). Since these people "waste" more of their food energy, it is harder for them to gain weight.

3. ENDOCRINE GLAND ACTIVITY: Thyroid hormones regulate metabolism. People with an underactive thyroid have lower basal metabolic rates and have a harder time losing weight. The opposite is true for people with an overactive thyroid. The adrenal glands also influence energy consumption. When stimulated by stress or emotional excitement, they release epinephrine, which increases cellular activity. Other hormones, such as cortisol, growth hormone, and insulin, also influence metabolic rate.

4. LEAN BODY MASS: Lean body mass, such as muscle tissue, is more metabolically active than fat tissue (adipose). That is because this tissue contains more mitochondria. Therefore, all else being equal, people with more muscles can eat more without gaining weight than people with more fat. In fact, almost one fifth of the energy used for resting metabolism is expended by the skeletal muscles. Consequently, exercise can do two things for you to lose weight. First, the act of exercise burns up calories. And second, if you make more lean body mass (muscles), your body will burn more calories (instead of storing fat), even when you are sitting here, doing nothing but reading this sentence.

Protein

Protein is made up of amino acids. Amino acids, in turn, are made up of atoms of carbon, hydrogen, oxygen, nitrogen, and occasionally sulfur.

There are twenty amino acids used in the production of your body's proteins. Nine of these amino acids are classified as being indispensable (essential). This is because your body's synthesis of these amino acids is inadequate to meet your metabolic needs, and they must therefore be supplied as part of your diet. Four amino acids are classified as dispensable. They can be synthesized from indispensable amino acids. The remaining seven amino acids are classified as being conditionally indispensable. They can become indispensable (essential) under certain clinical conditions.

Proteins have six main functions:

1. In anabolic processes, proteins provide the amino acids required to build and maintain your body's tissues.
2. As an energy source, proteins are comparable to carbohydrates in supplying four calories per gram (4 kcal/g). Although, as an energy source, proteins are more expensive, both in terms of purchase (protein foods usually cost more than other foods) and in the amount of energy required for their metabolism.
3. Playing a major structural role in all body tissues, proteins are also necessary in the formation of enzymes, hormones, and various fluids and body secretions.

4. As antibodies, proteins are involved in the operation of the immune system.
5. Proteins also play a role in the transportation of various products. In the form of lipoproteins, they transport cholesterol, triglycerides, and fat-soluble vitamins. For transport, numerous vitamins and minerals are bound to special protein carriers. One protein, albumin, transports free fatty acids, bilirubin, and many drugs.
6. Finally, proteins are necessary for homeostasis. Albumin, and other proteins, help to maintain fluid concentrations and acid-base balance.

The RDA for protein is based on body weight. The formula is 0.8 g/kg. See Appendix 1 for a detailed explanation. The RDA Committee has recommended an upper limit of protein intake at no more than twice the RDA. National dietary surveys show that the average protein intake is around 100 grams (about 3½ ounces of pure protein). Since the "average" woman (63 kg or 139 lbs) needs about 50 grams of protein (63 kg x 0.8 g/kg) and the "average" man (79 kg or 174 lbs) needs about 63 grams of protein (79 kg x 0.8 g/kg), it is apparent that in the United States, many people are getting more than twice the RDA for protein.

There are a number of problems associated with this excess protein consumption. First of all, most of this excess comes from animal protein, and the production of animal protein requires more energy and natural resources than other foods. Second, animal protein tends to be high in fat, and it contains no fiber. Finally, with an excess intake of protein (animal or vegetable), there is loss of calcium in the urine. This can be one factor that contributes to osteoporosis.

One final note about protein requirements. Even if you exercise a lot, or you are a body builder, the chances are that you do not need to consume extra protein (you may already be getting twice your RDA). There are very few people who need more than twice their RDA in protein. If you are very active, your body needs additional carbohydrates, not protein. Even the trainers of professional football players know this, and now have their players eating pre-game meals high in carbohydrates from bread, pasta, and fruit, instead of high protein steak and eggs.

Fat

Dietary fat is included in the class of compounds called lipids. They are insoluble in water, but soluble in organic solvents, including ether. Although technically fats are lipids that are solid at room temperature, and oils are lipids that are liquid at room temperature, the term "fat" is often meant to include both fats and oils.

Dietary fats, such as butter, lard, olive oil, etc., usually consist of blends of fatty acids. Fatty acids are chains of carbon atoms, usually between four and twenty-two carbons long. Fatty acids can be saturated (no double bonds between the carbon atoms), monounsaturated (one double bond), or polyunsaturated (two or more double bonds).

The more unsaturated (or the shorter the carbon chain) a fatty acid is, the more likely it will be liquid at room temperature. This is why the oil in cold-water fish stays liquid. Their oils contain chains of 20-22 carbons, but they stay liquid because they are very unsaturated with 5-6 double bonds. Otherwise, cold-water fish would become solid like sticks of butter!

To make margarine (or shortening) from polyunsaturated vegetable oils, such as safflower, corn, soybean, and cottonseed, some of the carbon double bonds have to be converted into single bonds. This process, called hydrogenation, makes the vegetable oils less *un*saturated, and therefore, more likely to be solid at room temperature. This is a convenient characteristic, since most people want to "butter" their bread, not oil it.

One problem with hydrogenating vegetable oils is the production of *trans* fatty acids. Without getting into complicated organic chemistry, just think of a *trans* fatty acid as having hydrogens on opposite sides of the double bond. Most fatty acids have *cis* double bonds, where the hydrogens are on the same side of the double bond. It is becoming apparent that *trans* fatty acids (TFAs) have negative effects when it comes to us humans. There is evidence that they can elevate serum cholesterol and lower HDL (the so-called "good" cholesterol).

If you need to use margarine, get a spread, not a stick. The harder the margarine (stick), the more hydrogenated it is, and therefore the more TFAs it has. Better yet, blend a monounsaturated vegetable oil, such as canola oil or olive oil, with butter. Try 1 part oil and 2 parts butter. (Note: Don't melt the butter, just soften it enough so you can blend it with the vegetable oil. Store the blend in the refrigerator.) This "better butter" will give you a butter-spread that is softer than stick butter and contains much less saturated fat. And it won't have the TFAs found in margarine.

Certain saturated fatty acids (SFAs) seem to contribute to heart disease (principally myristic and palmitic). They can raise serum cholesterol and LDL, the so-called "bad" cholesterol. Some people are more sensitive than others to the cholesterol-raising effects of saturated fats.

For many years, polyunsaturated fatty acids (PUFAs) have been recommended over SFAs because of their ability to lower serum cholesterol. It now appears that PUFAs are not as great as they were thought to be. The problem is their tendency to oxidize (turn rancid), whether in the bottle or in the body. This can have several consequences, since oxidized substances put a strain the body's antioxidant systems and allow for free radical production. Free radicals can have the following harmful effects:

1. The free radicals produced by oxidized fatty acids can damage DNA, increasing the chance for a cell to become cancerous.
2. The free radicals from oxidized PUFAs may be the prime initiators of atherosclerosis (see A-tocopherol, later in this appendix).
3. Free radicals interfere with various cell functions.
4. Finally, one theory of aging focusses on the overall damage caused by free radicals.

For the above reasons, oils high in monounsaturated fatty acids (MUFAs) are now being recommended over high SFA- and PUFA-containing oils. That is because, with only one double bond, they are more resistant to oxidation. Oils that are naturally high in MUFAs include canola oil and olive oil. It is also possible to purchase high-oleic (monounsaturated) versions of some PUFA oils, such as safflower and sunflower. The label will say that they are high in MUFAs.

Dietary fat contains varying amounts of two essential fatty acids, linoleic and alpha-linolenic (α-linolenic).

These two fatty acids are called essential because they cannot be synthesized in the human body. These essential fatty acids (EFAs) serve as precursors of prostaglandins, thromboxanes, and leukotrienes. These hormone-like compounds participate in the regulation of blood pressure, heart rate, vascular dilation, blood clotting, lipolysis, immune response, and the central nervous system. Vegetable seeds and their oils can be good sources of the essential fatty acids, but non-seed oils, such as coconut oil, palm oil, and cocoa butter, are not.

In the body, fats are usually stored as triglycerides (TGs). Triglycerides, more correctly called triacylglycerols, are combinations of three fatty acids bound to glycerol, a type of alcohol. While increases in dietary fat can raise serum triglyceride levels, over consumption of simple carbohydrates, even fruits, can also elevate serum triglyceride levels. High levels of triglycerides may increase the risk of coronary heart disease (CHD).

Carbohydrates

Carbohydrates are the predominant source of food energy for animals. They get this energy directly through the consumption of grains, grasses, leaves, fruit, phytoplankton, etc. Or, as carnivores, they get it indirectly by eating animals that consume grains and other high-carbohydrate foods. Because plants make carbohydrates by directly using the sun's energy, high-carbohydrate foods are "cheap." That is, less energy is needed to produce these foods, as opposed to foods derived from animals.

Carbohydrates can be small or large molecules, but they are all based on the simple sugars (saccharides). The three main classes are monosaccharides (one sugar), disaccharides (two sugars), and polysaccharides (many sugars).

1. Monosaccharides: The main monosaccharides are glucose, fructose, and galactose. Glucose, also called dextrose, is the sugar normally found in blood. Under normal conditions, glucose serves as the main fuel for the brain. Fructose, also called fruit sugar, is the sweetest of the sugars. Along with glucose, it is commonly found in honey and fruit. Galactose does not exist naturally in the free state, but rather as part of the disaccharide, lactose.
2. Disaccharides: The main disaccharides are sucrose, maltose, and lactose. The "di" in disaccharide means two. So sucrose is made up of two sugars, namely glucose and fructose. Sucrose is also known as table sugar, and is found in sugar cane, sugar beets, honey, molasses, maple syrup, and fruit. Maltose is made up of two molecules of glucose. It is produced in the body during the breakdown (digestion) of starch. Lactose (milk sugar) consists of glucose and galactose. Many people lack the enzyme, lactase, to split (hydrolyze) this sugar, which results in digestive problems.
3. Polysaccharides: Common polysaccharides are starch, cellulose, and glycogen (also called animal starch). These long molecules consist of repeating units of glucose. When we eat starch-containing food, our bodies gradually break it down to the simple glucose molecules that are so essential. Excess sugar in the blood can be stored in the liver and muscles as glycogen. When our blood sugar levels are low, the liver can break down the glycogen to glucose, and then release it into the blood. Like starch and glycogen, cellulose (plant fiber) consists of chains of glucose molecules. However, unlike starch and glycogen, its repeating units of glucose are bound together in such a way that our bodies can't break them down.

Fiber
Fiber (or roughage), which comes from plants, is not broken down during human digestion. Fiber, therefore, is not an energy source, but nonetheless, it plays a major role in human health. (Note: Some fibers ferment in the colon and are energy sources for some of the bacteria residing there.)

Occasionally you may come across the term, crude fiber. The fiber content of foods was historically measured by subjecting food to digestion by acid and alkali. This process is much tougher on food than what occurs in the human digestive tract. Therefore, the term, dietary fiber, is used more often now. Depending on the fiber content, a food's dietary fiber value will be two to five times higher than its crude fiber value.

Dietary fiber is typically classified by one physical property; whether or not it dissolves in water. Water-soluble fibers are important because of their ability to hold water and form gels, and also because of their role as a substrate for fermentation by bacteria in the large intestine. Insoluble fiber forms the cell walls (cellulose, hemicellulose) and the woody parts of plants (lignin).

Soluble and insoluble dietary fibers contribute various physiologic effects in the body, including:

1. Fiber stimulates chewing, which increases saliva flow and gastric juice secretion.
2. Fiber fills the stomach, which produces a sense of satiety.
3. Dietary fiber increases fecal bulk, decreasing intraluminal pressure in the colon.
4. Fiber normalizes intestinal transit time. That is, depending on the fiber, it can help both constipation and diarrhea.
5. Soluble fiber can be a substrate for colonic fermentation. This can reduce cholesterol synthesis.
6. Soluble fiber delays stomach emptying and slows the rate of digestion and absorption of nutrients.
7. Soluble fiber can lower serum cholesterol levels by binding bile salts.

Because of the above physiologic effects of dietary fiber, there is now a lot of attention paid to the fiber content of food. Unfortunately, national dietary surveys indicate that the average person gets only one third to one half of the fiber recommended (20-30 grams). Why should we care? Because there is extensive scientific agreement that this low intake of fiber contributes to colon cancer and cardiovascular disease, and makes diabetes harder to control.

Vitamin A (Retinol, Beta-carotene)
Vitamin A is a fat-soluble vitamin. The RDA for adult males is 1,000 RE (retinol equivalents) and 800 RE for adult females. One retinol equivalent equals 1 µg of retinol (3.33 I.U.) or 6 µg or beta-carotene (10 I.U.). Vitamin A, as retinol, only comes from animal sources. It is also called preformed vitamin A. Beta-carotene (also written β-carotene), a carotenoid, comes from vegetable sources and is also called provitamin A. One molecule of beta-carotene can yield two molecules of vitamin A.

Vitamin A is important for vision, growth, bone development, development and maintenance of epithelial tissue, immunity, and normal reproduction. A deficiency can lead to night blindness, xerophthalmia (a serious eye condition), infections, and changes in the skin.

As a fat-soluble vitamin, retinol can be toxic. A chronic intake of as little as ten times the RDA can cause symptoms of toxicity. Even lower levels of retinol (5-10 times the RDA) can cause birth defects if taken during pregnancy. Beta-carotene is essentially nontoxic.

Vitamin D (Calciferol)

Vitamin D comes in two forms. Vitamin D_2, ergocalciferol, comes from plant sources (UV irradiated ergot), and vitamin D_3, cholecalciferol, comes from animal sources. When our skin is exposed to sunlight (actually ultraviolet rays), cholecalciferol is manufactured from a cholesterol precursor. Both forms are activated in the kidney. The active form, calcitriol, is actually considered to be a hormone. As calcitriol, vitamin D increases intestinal absorption of calcium and phosphate.

The RDA is 5 mcg (200 I.U.) for adult men and women. A vitamin D deficiency shows up as rickets in children, and as osteomalacia in adults. An excessive intake, called hypervitaminosis D, can cause high levels of calcium in the blood (hypercalcemia). This can lead to excessive calcification of bone and soft tissues. A chronic intake of as little as 2,000 I.U. (only 5x their RDA) can cause symptoms of toxicity in children. Of all the vitamins, vitamin D easily has the greatest chance for causing problems.

Vitamin E (A-tocopherol)

Vitamin E exists in a variety of forms. In supplements, you may see natural vitamin E as d-alpha-tocopherol, d-alpha-tocopheryl acetate, or d-alpha-tocopheryl succinate. The synthetic form will have a "dl" instead of a "d." In the future, natural vitamin E may be written as RRR-alpha-tocopherol, and the synthetic as all-rac-alpha-tocopherol.

Besides the alpha form of vitamin E, there also exists beta, gamma, and delta. If you purchase a vitamin E supplement that contains alpha-tocopher**ol**, the "ol" means that it also contains beta-tocopherol, gamma-tocopherol, and delta-tocopherol. However, the "I.U." on the label will only pertain to the alpha-tocopherol. These other forms of vitamin E have less known biological activity than the alpha form.

If a supplement has alpha-tocopher**yl** acetate, it means that it only contains the alpha form. The beta, gamma, and delta forms were removed. If a supplement contains alpha-tocopher**yl** succinate, it means that the vitamin E is in the dry form, not the oil form. Some people may find that it is easier to absorb the dry form.

In addition to the toco**pherol** form, vitamin E exists in the toco**trienol** form. The various versions of tocotrienol (alpha, beta, gamma, delta) are less biologically active than the tocopherols.

To confuse you even more, vitamin E is now expressed in milligrams of alpha-tocopherol equivalents (alpha-TE or α-TE). To help you convert milligrams of vitamin E to international units, one milligram of *natural* vitamin E equals one α-TE , which is equal to about 1.5 I.U. One milligram of *synthetic* vitamin E equals 0.74 α-TE. Therefore, on an equal weight basis, natural vitamin E has greater biological activity.

The RDA for vitamin E is 10 alpha-TE for adult males and 8 alpha-TE for adult females. In the usual American diet, most of the vitamin E (64%) comes from salad oils, margarine, and shortening. Fruits, vegetables, and grains supply another 18%. A deficiency of vitamin E is most likely to occur from a fat

malabsorption syndrome or lipid transport abnormalities (abetalipoproteinemia).

In food, vitamin E functions as an antioxidant to prevent the peroxidation of polyunsaturated fatty acids (keeps them from becoming rancid). In the body, it protects vitamin A from oxidation, and it does the same for cellular membranes.

The hottest theory on coronary artery disease (CAD) focuses on the oxidation of the LDL-cholesterol molecule (ox-LDL-C). If the diet contains polyunsaturated fatty acids (PUFAs), they will end up in the LDL molecule. PUFAs have a tendency to oxidize. It is theorized that the ox-LDL-C molecule can trigger events that lead to cholesterol plaque buildup. It is also theorized that if there is enough vitamin E in the LDL-C molecule, it will resist oxidation, and therefore be less likely contribute to CAD. Indeed, two recent intervention studies involving a total of 120,000 participants showed that an intake of at least 100 mg of vitamin E reduced the incidence of myocardial infarctions (heart attacks).

Vitamin E appears to be very nontoxic. Most adults can tolerate up to 100 times the RDA. People with bleeding disorders or who are taking blood-thinning drugs, should consult their physician before taking high-dose vitamin E supplements.

Vitamin B1 (Thiamin)
Thiamin, along with four other B-complex vitamins (riboflavin, niacin, pantothenic acid, biotin), has an essential role in energy metabolism. It is needed for membrane and nerve conduction, and also in the synthesis of pentoses (5-carbon sugars) and the reduced coenzyme form of niacin (NADH).

The RDA is 1.5 mg for adult males and 1.1 for adult females. Thiamin deficiencies are uncommon, except in alcoholics. Clinical signs of a thiamin deficiency will show up in the nervous and cardiovascular systems. If the deficiency continues, beriberi can develop. There are no known toxic effects from thiamin.

Vitamin B2 (Riboflavin)
Riboflavin combines with phosphoric acid to form two flavoprotein enzymes, flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD). FMN is required for the activation of vitamin B6. FAD is necessary for the conversion of the amino acid, tryptophan, to niacin. These coenzymes are also important in glucose and fatty acid metabolism.

The RDA is 1.7 mg for adult males and 1.3 mg for adult females. Deficiencies of riboflavin are fairly rare, and when they occur, are usually in combination with deficiencies of other water-soluble vitamins. Early deficiency symptoms include photophobia, burning and itching of the eyes, loss of visual acuity, and soreness and burning of lips, mouth, and tongue. There is no known toxicity level for riboflavin.

Vitamin B3 (Niacin, Niacinamide)
Niacin is the general term for nicotinamide (niacinamide) and nicotinic acid. Vitamin B3 combines with other molecules to form the coenzymes, nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP). These coenzymes are crucial in chemical reactions that release energy from carbohydrates, fats, and proteins. Niacin, but not niacinamide, has been used in high,

pharmacologic doses, to lower elevated serum cholesterol. This should only be done under the direction of a medical professional.

The RDA for niacin is 19 mg for adult males and 15 mg for adult females. The early stages of a niacin deficiency include muscular weakness, anorexia, indigestion, and skin eruptions. Dermatitis, dementia, and diarrhea are described as the "3 Ds" of pellagra, the severe deficiency of niacin. Used in the treatment of elevated cholesterol levels (hypercholesterolemia), niacin is used in amounts of 3 to 6 grams. Because large doses of niacin cause histamine release, people with asthma or peptic ulcers may need to avoid it at these dosages.

Vitamin B5 (Pantothenic Acid)

Vitamin B5 is found in the body in two predominate forms. As part of coenzyme A (CoA), it is required for releasing energy from dietary protein, carbohydrate, and fat. Also, in conditions of reduced food intake, such as dieting, CoA is used similarly to release energy from the stored fat in the body. As part of acyl carrier protein (ACP), it is essential in the body's production of fatty acids. (Actually, fatty acid production needs both ACP and CoA.) When there is a frequent excess of energy intake, especially from carbohydrates, these fatty acids are stored in the body as fat (adipose).

The ESADDI for pantothenic acid is 4 to 7 milligrams. Deficiencies in humans are rare, but when they occur, the symptoms include fatigue and depression. Supplementation of vitamin B5 can reverse gray hair in some rats, but unfortunately, there is no evidence that it will do the same for humans. This vitamin is very safe, and even extremely large doses (1,000 times the ESADDI) usually produce reactions no more severe than mild intestinal distress and diarrhea.

Vitamin B6 (Pyridoxine)

Vitamin B6 exists in three forms, plus there are two coenzyme forms. It is in the coenzyme forms that B6 is active (this is true of most of the vitamins and many minerals). Pyridoxine's coenzymes, pyridoxal phosphate (PLP) and pyridoxamine phosphate (PMP), function primarily in amino acid metabolism (transamination). Vitamin B6 is also involved in lipid metabolism, the release of glycogen from the liver, and the production of several neurotransmitters.

The RDA is 2.0 mg for adult males and 1.6 mg for adult females. Since vitamin B6 is important in amino acid metabolism, its requirement actually increases as the intake of protein increases. In fact, one theory of coronary heart disease considers the impact of homocysteine (a product of protein metabolism) on the process of cholesterol plaque formation. When the protein intake is high, there may not be enough vitamin B6 to prevent homocysteine formation. Also important in this process are adequate levels of folic acid and vitamin B12.

Classical deficiencies of vitamin B6 are rare, but some medications may interfere with its metabolism. For example, the use of some oral contraceptives may increase the need for it. Vitamin B6 is relatively safe at high levels of intake, but prolonged ingestion of doses over 200 mg have caused peripheral sensory neuropathies. Symptoms disappeared after its intake was discontinued.

Vitamin B12 (Cobalamin)
Since this vitamin almost exclusively comes from animal sources, strict vegetarians (vegans) may need to take supplementary B12. Fermented foods, such as tempeh, supply little cobalamin, but some cooked sea vegetables do contain sufficient amounts of this vitamin.

It actually takes several years of zero B12 intake to develop a deficiency, called pernicious anemia. Under ordinary conditions, if someone acquires this anemia, it is more likely because of a lack of intrinsic factor, a glycoprotein necessary for B12 to be absorbed in the intestine. To overcome a deficiency of intrinsic factor, a sufficient amount of oral vitamin B12 is needed whereby the amount absorbed from passive diffusion (around 3%) at least equals the RDA of 2.0 mcg. An alternative is to have it injected IM (intramuscular).

Biotin
Deficiencies of this vitamin are rare. Biotin is found in many foods, and it can also be synthesized by intestinal bacteria. Raw egg white contains avidin, a substance that blocks absorption of biotin. A daily intake of raw egg whites could cause a deficiency of this vitamin. Biotin apparently has no toxic effects.

Folate (Folic Acid, Folacin)
Folate is labile, and depending on how the food is processed, 50% to 95% of it can be lost. If little or no fresh food is eaten, the folate deficiency, megaloblastic anemia, can develop.

Recently, folate has gotten some publicity. Taken at adequate levels during early pregnancy, it apparently can reduce the incidence of neural tube defects. While the current RDA for pregnant women is 400 mcg, many researchers believe that it should be twice that amount.

Vitamin C (Ascorbic Acid, Ascorbate)
Vitamin C is probably the most "famous" of the water-soluble vitamins. In popularity, it's probably vitamin E's counterpart.

What's the difference between ascorbic acid and ascorbate? As can be guessed, ascorbic acid is the acid form of the vitamin. If you ingest it in this form, in your body it will soon associate with a mineral, usually calcium, but also other positively charged minerals. When it binds with a mineral, it forms a mineral salt, called an ascorbate (mostly calcium ascorbate). For people who have stomachs sensitive to ascorbic acid, mineral ascorbates can be purchased in pill form.

Vitamin C is known as the antiscorbutic vitamin because it prevents scurvy. While only 10 mg will prevent the classic clinical signs of scurvy, vitamin C has been used therapeutically at levels 1000 times that amount!

An interesting point about this vitamin is that almost all animals on the planet manufacture their own vitamin C from glucose. Except for the other primates (apes, monkeys, etc.), guinea pigs, and the Indian fruit bat, we're pretty much alone in not being able to make our own "C"!

Something else that's interesting: increased intakes of vitamin C are needed to maintain normal blood

levels under acute emotional or environmental stressors, such as trauma, fever, infection, or extreme temperatures. For all those animals that make their own vitamin C (around 99% of all animals), that's no problem because they just make more of the vitamin. Unfortunately, we humans are limited to what we get in our diet. An important point to ponder.

There are a number of myths about vitamin C that are harder to kill than the proverbial vampire. Myth #1 states that high intakes of vitamin C destroy vitamin B12. This is not true. This was the result of a well-known researcher who did some shoddy work. He won't admit his mistake, perhaps because he has a personal agenda against taking vitamins in general, and vitamin C in particular.

Myth #2 is also promoted by this same researcher. He thinks that people will drop like flies from iron overload if they take vitamin C. His reasoning is that ascorbic acid improves iron absorption (true), and that if they take megadoses of this vitamin with iron-rich food, they will get too much iron (false). While it's true that ascorbic acid will improve the body's absorption of nonheme iron (non-animal source), it only takes about 25-50 mg to do this. If his reasoning is right (which it isn't), then you shouldn't even eat a piece of fruit with your meals!

Myth #3 has to do with kidney stones. There is no evidence that this will happen. Most kidney stones form in an alkaline urine, and ascorbic acid acidifies urine, making calcium more soluble. And as far as urate and oxalate stones are concerned, recent evidence shows that massive doses of vitamin C (90,000 mg/day or 1,500 times the RDA) produce only a small increase in urinary oxalate concentration, and no change in urate or inorganic phosphate.

There is some concern about "rebound scurvy" happening to people who go from taking megadoses of vitamin C to little or none of the vitamin. To avoid this, if you are taking large amounts (over 1,000 mg), and you want to discontinue taking it, gradually reduce your intake over the period of one month.

You've heard about antioxidants and free radicals. Well, vitamin C is the preeminent antioxidant in the water-phase of the blood. Not only that, but it can help to protect the fat-soluble compartments in the blood by recycling vitamin E. Because of stress, pollution, heart disease, cancer, etc., many health professionals are now recommending an intake of 500 mg or more of this versatile vitamin.

Calcium

This macromineral is the most abundant mineral in the body, with 99% found in the bones and teeth. The crystalline structure of bone consists of hydroxyapatite, which is mostly calcium and phosphorus bound in a 5:3 ratio. Other minerals, such as fluoride, magnesium, sodium, and zinc, are also found in bone tissue. These minerals are combined with mucopolysaccharides and mucoproteins, which are organic matrices of special sugars and proteins.

While most of your body's calcium is stored in your bones, the remaining 1% serves many important roles, too. Calcium is necessary for nerve transmission, muscle contraction, regulation of heart beat, blood clotting, and other functions. To maintain proper serum calcium levels, your body is constantly adding and removing calcium from what is stored in bones. This regulation is controlled mostly by the hormones, calcitonin and parathyroid hormone.

Calcium absorption is regulated by many factors. Foremost, as with many minerals, the amount in your diet will influence how much is absorbed. For example, if your diet contains a lot of calcium, you'll absorb about 10-20% of it. Alternatively, if there is very little calcium in your diet, you'll absorb a greater percentage of it, maybe 30-40%.

There are many other factors that affect calcium absorption. Vitamin D, stomach acid, and lactose increase calcium absorption. Oxalic acid, phytic acid, excessive insoluble dietary fiber, mental stress, physical stress, and certain medications, are some factors that decrease calcium absorption.

Other factors that decrease calcium absorption, or increase calcium excretion, include a high-protein diet, consumption of caffeine-containing coffee and tea, physical inactivity, and low estrogen levels in women.

The RDA for calcium is 1,200 mg for males and females 11-24 years old, and for pregnant and lactating females. Otherwise, it's 800 mg for adults 25 and older. However, because of the high incidence of osteoporosis in postmenopausal women, many health professionals are recommending that women who may be at risk for getting osteoporosis, have an intake between 1,000 mg and 1,500 mg of calcium.

Many minerals have their mineral counterparts. The relationship may be of metabolic synergism or antagonism, competition for intestinal absorption, or whether they exist within cells (intracellular) or in the fluids surrounding cells (extracellular). Calcium has phosphorus and magnesium for counterparts. All three compete for absorption. In addition, whereas extracellular calcium is used as a neuromuscular stimulant, intracellular magnesium has relaxing effects on muscles and nerves.

Other mineral interrelationships include: sodium, chloride, and potassium; copper, iron, and zinc. Because of these connections, it is important not to have such an excess of one mineral that it affects its counterpart. The result could be what's called a relative deficiency (as opposed to an absolute deficiency).

What this means is that you could be getting the RDA of mineral A, but because you have an excessive intake of mineral B, it is as if you are not getting enough of mineral A! This is where your CDA can be helpful. It is easy to check these interrelationships by comparing your intake of each of the relevant minerals.

Chromium

This trace mineral is needed in very small amounts. Chromium doesn't have an RDA, but it does have an ESADDI of 50-200 mcg. To give you an idea of how much this is, it takes 1,000 mcg (microgram) to equal 1 mg (milligram). And it takes 1,000 mg to equal 1 g (gram), and there are 28 g in one ounce. That means you only need about three millionths of an once of chromium per day!

While you don't need much chromium, it is still very important. Chromium is believed to be part of the glucose tolerance factor (GTF). GTF's other components may be niacin and glutathione (a tripeptide consisting of the amino acids, glutamic acid, cysteine, and glycine).

Chromium has some kind of relationship with insulin, but the exact mechanics of this relationship are not known. What is known is that chromium is involved in the body's use of protein, fats, and especially, glucose. In terms of blood sugar levels, chromium can be helpful for those suffering from diabetes (mostly Type II) and hypoglycemia.

Chromium may also be important in heart disease. It appears that elevated blood glucose levels allow for the production of certain glucose-protein molecules that may contribute to coronary heart disease.

Copper
Copper has a number of functions in the body. It is important for several enzymes, one of which has to do with energy production (cytochrome c oxidase in the electron transport chain).

There is an extremely important enzyme that exists in three forms: bound to copper, zinc, or manganese. This enzyme is called superoxide dismutase (SOD), and it combats damage caused by a free radical, called superoxide. SOD is one of the most important enzymes that function as cellular antioxidants.

Copper is also important in iron metabolism, collagen production, bone health, and melanin synthesis. That copper is connected with proper bone health points out the importance of not relying solely on calcium intake to prevent osteoporosis. In fact, other trace minerals, including boron, fluoride, manganese, silicon, and zinc, are also important in preventing osteoporosis. (Note: while fluoride is necessary for proper bone health, too much makes bones brittle and subject to micro fractures.)

A copper deficiency can cause elevated serum cholesterol levels. On the other hand, copper can be toxic in cases of Wilson's disease, where there is an accumulation of excessive copper.

Iron
Iron is a component of a number of enzymes, metabolic proteins, and transport and storage proteins. Hemoglobin, the oxygen-carrying molecule in blood, contains iron. Myoglobin is a similar molecule found in muscle tissue. Iron is important to the immune system, and also plays a role in cognition (learning and thinking).

Iron deficiency anemia is common among menstruating women, especially if they diet frequently, are vegetarians, or exercise excessively. While iron supplementation is often warranted for these women, for most other people it is not necessary. This is especially true of men, most of whom are probably getting too much. The RDA for men is 10 mg, but because of their consumption of meat, and iron fortified cereals, bread, and pasta, many men get 2-3 times that. There is concern that this excess iron contributes to coronary artery disease through its oxidizing effects on the LDL-cholesterol molecule. In fact, it has been postulated that one reason why women suffer fewer heart attacks is their lower levels of iron.

Magnesium
A macromineral, magnesium is calcium's counterpart. It acts as a neuromuscular relaxant, but is important in energy production (ATP).

Magnesium is second to potassium as a positively charged (cation) intracellular electrolyte. This has importance in cellular water balance, intestinal motility, and hypertension.

Clinically, magnesium has been the subject of great interest. It has been used for certain forms of hypertension. It may also help to prevent coronary artery disease, and it has been used immediately after myocardial infarctions (heart attacks) to reduce the damage to the heart muscle.

Manganese
This trace mineral is a constituent of several enzymes. Manganese is associated with growth and reproduction, carbohydrate and lipid metabolism, and the formation of connective tissue, including bones. Deficiencies of manganese are uncommon.

Phosphorus
This macromineral is the second most abundant mineral in the body. It is an important constituent of bones, cell membranes, nucleic acids, and certain high-energy molecules, including ATP.

A deficiency of phosphorus is rare. Protein foods (meat, poultry, fish, eggs, dairy products) are high in phosphorus, and most people get more than enough protein. Also, many soft drinks use phosphate as a buffering agent to reduce the acidity. There is some concern that too much phosphorus, in relation to calcium, may be a factor in osteoporosis.

Potassium
This intracellular macromineral is extracellular sodium's antagonist. Working against sodium, it is involved in the maintenance of normal water balance and acid-base balance. As with calcium, it is important in the regulation of neuromuscular activity.

An excessive intake of sodium can lead to hypertension in some people. For these people, both reducing their sodium intake and increasing their potassium intake, can help.

Selenium
Selenium is a micromineral that seems to have only one function, that being part of the antioxidant enzyme, glutathione peroxidase. However, that is of no small significance.

Glutathione peroxidase works with vitamin E to protect the lipids in cell membranes from those nasty free radicals we keep hearing about. It may also aid in the synthesis of immunoglobulin and coenzyme Q_{10} (ubiquinone).

Sodium
This macromineral is the extracellular counterpart to intracellular potassium. It helps to regulate water balance, nerve impulses, and muscle contraction.

Most people get about ten times the sodium they need. Sources are table salt and protein foods, as well as convenience and fast foods. Increased consumption of fruits and vegetables can supply the necessary potassium to help offset excessive sodium intake.

Zinc

In humans, zinc is present in over 70 enzymes. It is involved in the metabolism of carbohydrates, protein, lipids, and nucleic acids. It is also important in bone metabolism, growth and sexual maturation, and the immune system.

This trace mineral has copper and iron for counterparts. There is some concern that excessive intakes of zinc may create a copper deficiency. On the other hand, high doses of iron or copper can create a zinc deficiency. Excessive intakes of fiber or phytates can also decrease zinc absorption.

APPENDIX 5: Digestion and Metabolism of Food

The eating of food does you no good if your body can't get at and use all the good things contained in it. This is a very complicated process, yet many people think this whole operation is limited to just digestion and excretion. Actually, your body deals with food nutrients in five stages: Digestion, Absorption, Transport, Metabolism, and Excretion. And this interplay involves more than just food, mechanical action, and digestive juices. The whole process is actually choreographed by about ten hormones. Even more complicated than that, one or more nutrients may stimulate one or more parts of the digestive tract to produce one or more hormones that will affect one or more parts of the digestive tract to do one or more things!

The first thing to do is become familiar with the anatomy of the digestive system. Essentially this system consists of the alimentary tract and several connected accessory organs. The alimentary tract starts with the mouth (teeth, tongue, cheeks), and is followed by the esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (cecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum), and finally the anal canal and anus. The accessory organs include the salivary glands, liver, gallbladder, and pancreas.

Digestion, Absorption, Transport, & Excretion

Mouth
As the food moves through your digestive tract, it is subjected to two categories of actions (mechanical and chemical), usually simultaneously. For instance, the digestive process obviously starts in your mouth. Here, the *mechanical* action of chewing reduces the size of food particles, and mixes them with the saliva produced in the salivary glands. The *chemical* action of saliva, which contains amylase (ptyalin), helps to break down starch into smaller units (dextrins) and sugar (maltose). Very little absorption of nutrients takes place here. From the mouth, food passes through the esophagus by the mechanical action called peristalsis, and is delivered to the stomach.

Stomach
In the stomach, food is also exposed to mechanical and chemical actions. The mechanical actions include churning (forward and backward movement of the gastric contents) and peristalsis (the movement of the food mixture toward the small intestine). The chemical actions of the stomach result from the secretion of gastric juice. This fluid includes the pepsins (enzymes) and hydrochloric acid. Gastric juice starts the digestion of food protein, preparing it for more thorough digestion in the small intestine. Some fat digestion also occurs here. Very little absorption takes place in the stomach, except for some water, alcohol, and certain drugs.

Small Intestine
As the acid content of the stomach (chyme) enters the beginning of the small intestine (duodenum), it is bombarded by a host of chemicals. The first order of business is to neutralize the acidic chyme. It is in the duodenum where pancreatic juice and bile are released. Among other things, pancreatic juice

contains bicarbonate, which reduces the acidity, just as baking soda can relieve an acid stomach. Also, the duodenum helps out by secreting an alkaline mucus. Bile is manufactured in the liver, and is stored and concentrated in the gallbladder. Bile acts as a soap on dietary fats, making them mix better (emulsify) with the rest of the fluids, which are water soluble.

While all aspects of digestion are important, the digestive enzymes play the greatest roles in the breakdown of nutrients, preparing them for absorption. The pancreas secretes many enzymes. The proteases digest proteins, lipase digests fats, and amylase digests starch. Of course, it's not as simple as that, and there are other pancreatic enzymes besides the ones just mentioned.

So, by the time your food has left the duodenum, dietary protein has been broken down to amino acids and small peptides, fat to fatty acids, and starch to simple sugar. It is in these "simple" forms that they are absorbed in the small intestine. However, that doesn't mean that absorption is a simple process. Far from it! Some nutrients are "lucky" and are absorbed through simple diffusion, somewhat like water being absorbed by a sponge. Other nutrients require a carrier, such as a special protein. Even more complicated, some nutrients require a carrier and energy, often in the form of ATP.

To make matters worse, some nutrients use the same carrier. That means that if there is an over abundance of one nutrient in a meal, it may "use up" the carrier that it shares with a different nutrient, decreasing the absorption of that nutrient. This is most likely to occur between certain amino acids, and between certain minerals. That is why an overconsumption of some amino acids can create deficiencies of other amino acids. However, this is more likely to occur with the minerals. Minerals that can compete for absorption include calcium, magnesium, and phosphorus; iron, copper, and zinc; and sodium and potassium. This is one reason why a balanced intake of nutrients is so important.

The nutrients are absorbed into, and then transported across, the intestinal mucosa. It is on the other side of the mucosa where the nutrients then enter the blood stream directly, or indirectly via the lymph vessels.
There are many ways nutrients are transported in the blood to be delivered to the cells that need them. The following is a summary:

- Proteins: Proteins are polypeptides. That means they consist of varying amounts and combinations of amino acids. During the digestive process, these polypeptides are gradually broken down to smaller and smaller units (oligopeptides to tripeptides to dipeptides to single amino acids). It is in the form of single amino acids that the original food protein is transported in the blood and delivered to the liver.
- Fats: Dietary fats are mostly triacylglycerols (triglycerides). That is, they contain three fatty acids linked to a glycerol backbone. During digestion and absorption, the molecule is split apart and then rejoined. Eventually, in the mucosal cell, the triglycerides are packaged with dietary cholesterol and phospholipids in a transport molecule called a chylomicron. The chylomicrons first enter the lymph system. They then make it into the blood stream and are eventually delivered to the liver. In the liver, they are repackaged into lipoproteins, and are then transported, via the blood stream, to various cells, including your fat cells (adipocytes). Lipoproteins exist in many forms, two of which, LDL and HDL, you have probably heard of.
- Carbohydrates: Starch (polysaccharides) and the more complex sugars (disaccharides) are broken

down to the simplest of sugars, the monosaccharides (glucose, fructose, galactose). Most of the sugar in the blood is glucose. Some of it is stored in the liver and muscles as glycogen, or used by the muscles and brain as a fuel source. Excess can be converted into fat (triglycerides) and stored in fat cells. Fiber remains pretty much unchanged and continues its path down the alimentary canal.

- Vitamins: The water-soluble vitamins are absorbed fairly easily, and are changed little as they enter the blood stream. The fat-soluble vitamins (A, D, E, K) are absorbed along with dietary fats, and likewise, first travel in the lymph system before entering the blood stream.
- Minerals: Mineral absorption and transport are more complicated. First, many minerals depend on specific acid or alkaline conditions (pH). Also, many require specific carrier molecules for absorption. Finally, many minerals rely on certain proteins to be carried in the blood. And remember, there can be competition for these carrier and transport molecules.

Large Intestine

The main function of the large intestine is the reabsorption of water, sodium, and potassium. In addition, certain fibers ferment here, and in the process, provide food for beneficial bacteria. Some of these bacteria can produce vitamins in varying amounts, including vitamins B1, B2, B12, biotin, and K.

The final residue of digestion collects in the rectum. It consists of water, bacteria, fats, undigested dietary fiber, intestinal cells, and the remains of digestive juices. This material remains here until defecation, when it is forced through the anal canal. Depending on the person, this may happen several times per day, or several times per week.

Metabolism of Food Nutrients

The preceding section showed the process of making available to the cells the nutrients contained in food. The body must then make use of these nutrients. This process is called metabolism. To sustain life, all animals need a supply of energy. In humans, the energy-producing nutrients are carbohydrate, fat, and protein. Metabolism includes the release of energy (catabolism) from sugar, amino acids, and triglycerides. It also encompasses the building of new compounds (anabolism).

Metabolism involves a number of pathways, including glycolysis, the Krebs cycle, beta-oxidation, the electron transport chain (including oxidative phosphorylation), gluconeogenesis, lipogenesis, glycogen metabolism, cholesterol metabolism, and the urea cycle. Since metabolism is *very* complicated, the following will only briefly cover what happens to dietary carbohydrates, fats, and proteins.

Carbohydrates

In terms of metabolism, the only carbohydrates that come into play are three sugars: glucose, fructose, and galactose. Even then, the only one of major significance is glucose.

GLYCOLYSIS: Glucose first enters the metabolic pathway called glycolysis. *Glyco* refers to glucose, sugar, or sweetness. *Lysis* refers to destruction or to setting free, releasing. So essentially, glycolysis means the break down of glucose. The glucose molecule, which contains six carbon atoms, is gradually changed and shortened to a three-carbon molecule. This pathway has about ten steps, some of which rely on vitamin B3.

GLYCOGEN PATHWAY: If your liver needs to store glycogen (animal "starch") for later use as an energy source, some of the excess glucose will enter the glycogen pathway. This pathway connects near the beginning of the glycolysis pathway. Glycogen literally means to produce sugar. If you need energy later (for example, several hours after a meal), your liver will convert the glycogen back into glucose, where it can reenter the glycolysis pathway. The glycogen pathway needs vitamin B6.

LIPOGENESIS: If you have an excess intake of glucose (from dietary carbohydrates), and you have plenty of glycogen, then just after the glycolysis pathway, the converted glucose molecule enters the lipogenesis pathway. *Lipo* means fat, and *genesis* means to come into being. Scientifically, this means that if you eat too much sugar, fat comes into being in your body! Very interesting. However, although an excess of carbohydrates can cause you to gain weight, this pathway uses energy. That's why, on an equal calorie basis, you will gain more weight from dietary fat than from carbohydrates. Nevertheless, too much is still too much. By the way, this pathway requires vitamins B1, B2, B3, B5, and biotin.

KREBS CYCLE: If your body needs energy, then the final glucose break down product from the glycolysis pathway will enter the Krebs cycle. (Before entering the Krebs cycle, this break down product must first be converted from a three-carbon molecule to a two-carbon molecule.) This cycle produces molecules that can later be converted into the energy unit, ATP. This cycle requires vitamins B1, B2, B3, and B5, and lipoic acid.

ELECTRON TRANSPORT CHAIN: Some molecules produced in the Krebs cycle enter this pathway, and, by a process called oxidative phosphorylation, ATP is manufactured. ATP (adenosine triphosphate) is called the energy currency of the body because so many chemical reactions require it to "jump start" them. This cycle requires vitamin B2, vitamin B3, iron, and copper.

GLUCONEOGENESIS: This is the pathway by which the body can manufacture glucose from noncarbohydrate sources. Usually these sources come from amino acids, lactate (lactic acid), and the glycerol backbone from triglycerides. This pathway requires vitamins B1, B3, B5, and B6 (amino acid metabolism), and biotin.

Fats

As mentioned before, most dietary fats are triglycerides. Fat is also primarily stored in the body as triglycerides. Triglycerides contain three fatty acids connected to glycerol, a type of alcohol. When your body needs extra energy, these triglycerides are broken down by a process called beta-oxidation (β-oxidation).

BETA-OXIDATION: This is the process by which chains of fatty acids are gradually shortened to two-carbon molecules in a series of repeating steps. The two-carbon molecules can then enter the Krebs cycle (see above). Eventually, more ATP energy units are produced. This pathway requires vitamin B2 and vitamin B5. For fatty acids that have more than twelve carbon units, carnitine is also needed. For fatty acids that have an odd number of carbon units, vitamin B12 and biotin are necessary.

CHOLESTEROL METABOLISM: Cholesterol is used as a building block in cell membranes, and is the precursor of steroid hormones, vitamin D, and bile salts. Cholesterol synthesis starts with a two-carbon

molecule. This is the same molecule produced after glycolysis (glucose break down) and beta-oxidation (fat break down). Starting with this 2-carbon molecule, it takes about thirty steps for your body to eventually manufacture a cholesterol molecule, which contains 27 carbon atoms! The third enzyme in this pathway is called HMG CoA reductase. This is the enzyme inhibited by some cholesterol-lowering drugs.

Proteins

During digestion, dietary protein is broken down to its single amino acids. Unlike glucose (from carbohydrates) and fatty acids (from fat), amino acids don't have a unique metabolic pathway. (There is the urea cycle, but that is for getting rid of unneeded parts of amino acids.) Absorbed amino acids are transported to the liver. In the liver, some amino acids may be split into several parts, and then these parts may be combined with the parts of other amino acids to make new amino acids. These processes, called oxidative deamination and transamination, require vitamin B6.

KREBS CYCLE: When your body needs energy, it can take some amino acids into the Krebs cycle, which, as discussed before, eventually leads to the production of ATP. However, protein is an "expensive" source of energy. That is because it requires much more energy to produce protein food (especially if it comes from animals), than it does to grow grains, the best source of food energy.

GLUCONEOGENESIS: Surprisingly, your body can even convert some amino acids into glucose! Again, as mentioned in the previous paragraph, protein would be an expensive way to increase your blood glucose.

UREA CYCLE: Amino acids get their name because they have an amino group attached to them. This amino group contains nitrogen, and when the amino acid is broken apart, the amino group is released as ammonia. When your body has an excess of ammonia, it is converted into urea, and is excreted by the kidney as urine.

APPENDIX 6: How to Compute Percent of Calories

STEP I Find the calorie concentration of the nutrient of interest:

CALORIE CONCENTRATION (of pure nutrient):

Fat	9 calories per gram (9 kcal/g)
Protein	4 calories per gram (4 kcal/g)
Carbohydrate	4 calories per gram (4 kcal/g)
Alcohol	7 calories per gram (7 kcal/g)[1]

STEP II Compute the calories of the nutrient per serving by multiplying the grams of the nutrient times its calorie concentration:

CALORIES FROM NUTRIENT = grams of nutrient x calorie concentration (kcal/g)

STEP III Compute the percent of the nutrient's calories in the food by dividing the calories from the nutrient by the food's total calories per serving, and then multiplying by 100 to convert the decimal fraction to a percent:

$$\text{PERCENT OF CALORIES FROM NUTRIENT (\% kcal)} = \frac{\text{calories from nutrient}}{\text{total calories}} \times 100$$

The next page gives an example of how to determine the percent of calories from fat, protein, and carbohydrates.

[1]As you can see, as far as calories are concerned, alcohol is closer to fat.

AN EXAMPLE: 1 cup of 1% low-fat milk has a total of 102 calories and contains:

Fat:	2.5 grams
Protein:	8.0 grams
Carbohydrate:	12.0 grams

From the preceding page, follow STEP I (calorie concentration), STEP II (calories from nutrient), and STEP III (percent of calories from nutrient).

FAT

Step I: 9 kcal/g

Step II: 2.5 g of fat x 9 kcal/g = 22.5 calories from fat

Step III: $\frac{\text{22.5 fat kcal}}{\text{102 total kcal}} \times 100 =$ 22% of milk's total calories come from fat[1]

PROTEIN

Step I: 4 kcal/g

Step II: 8 g of protein x 4 kcal/g = 32 calories from protein

Step III: $\frac{\text{32 fat kcal}}{\text{102 total kcal}} \times 100 =$ 31% of milk's total calories come from protein

CARBOHYDRATE

Step I: 4 kcal/g

Step II: 12 g of carbohydrate x 4 kcal/g = 48 calories from carbohydrate

48 fat kcal

Step III: ---------- x 100 = 47% of milk's total calories come from carbohydrate
102 total kcal

CALORIES FROM NUTRIENT:		PERCENT OF CALORIES IN MILK FROM:	
Fat:	22.5	Fat	22%
Protein:	32.0	Protein	31%
Carbohydrate:	48.0	Carbohydrate	47%
	102.5[2]		100%[3]

[1]So, 1% low-fat milk (by weight) actually is 22% fat (by calories).

[2]Individual calories from nutrients should add up to the total calories in the serving.

[3]Unless a food item contains alcohol or a lot of undigestible fiber, the percent of calories from fat, protein, and carbohydrate should add up to 100%.

APPENDIX 7: Recommended Nutrient Intakes for Adults

RECOMMENDED DIETARY ALLOWANCES (RDA),[1] Revised 1989.

	Males			Females			
NUTRIENT	19-24	25-50	51+	19-24	25-50	51+	Preg.
A (μg RE)[2]	1000	1000	1000	800	800	800	800
D (μg)[3]	10	5	5	10	5	5	10
E (mg α-TE)[4]	10	10	10	8	8	8	10
K (μg)	70	80	80	60	65	65	65
C (mg)	60	60	60	60	60	60	70
Thiamin (mg)	1.5	1.5	1.2	1.1	1.1	1.0	1.5
Riboflavin (mg)	1.7	1.7	1.4	1.3	1.3	1.2	1.6
Niacin (mg NE)[5]19	19	15	15	15	13	17	
B6 (mg)	2.0	2.0	2.0	1.6	1.6	1.6	2.2
Folate (μg)	200	200	200	180	180	180	400
B12 (μg)	2.0	2.0	2.0	2.0	2.0	2.0	2.2
Calcium (mg)	1200	800	800	1200	800	800	1200
Phosphorus (mg)	1200	800	800	1200	800	800	1200
Magnesium (mg)	350	350	350	280	280	280	320
Iron (mg)	10	10	10	15	15	10	30
Zinc (mg)	15	15	15	12	12	12	15
Iodine (μg)	150	150	150	150	150	150	175
Selenium (μg)	70	70	70	55	55	55	65

ESTIMATED SAFE AND ADEQUATE DAILY DIETARY INTAKES (ESADDI)[6]

NUTRIENT	Adults
Biotin (μg)	30-100
Pantothenic Acid (mg)	4-7
Copper (mg)	1.5-3.0
Manganese (mg)	2.0-5.0
Fluoride (mg)	1.5-4.0
Chromium (μg)	50-200
Molybdenum (μg)	75-250

[1]The allowances, expressed as average daily intakes over time, are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses.

[2]Retinol equivalents. 1 retinol eq. = 1 μg retinol (3.33 IU) or 6 μg β-carotene (10 IU).

[3]As cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

[4]α-Tocopherol equivalents. 1 mg d-α-tocopherol = 1 α-TE (1.49 IU).

[5]1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

[6]Because there is less information on which to base allowances, these figures are not given in the main table of RDA and are instead provided here in the form of ranges of recommended intakes.

APPENDIX 8: Measurements, Conversions, & Abbreviations

MEASUREMENTS

				Metric Equivalents (approx.)	
US Measurements				Volume (fluid)	Weight (fluid)*
1 teaspoon	=			5 milliliters	5 grams
1 tablespoon	=	3 teaspoons	=	15 milliliters	14 grams
1 ounce	=	2 tablespoons	=	30 milliliters	28 grams
1 cup	=	8 ounces	=	237 milliliters	227 grams
1 pint	=	2 cups = 16 fl oz	=	473 milliliters	454 grams
1 quart	=	2 pints = 32 fl oz	=	946 milliliters	907 grams
1 gallon	=	4 quarts	=	3.79 liters	3.63 kilograms
1 inch	=	2.54 centimeters			
1 pound	=	0.454 kilograms			

*Solid weight would be similar to fluid weight if the material were wet and packed. For example, cooked mashed potatoes compressed into a cup would weigh approximately 210 g, which is close to 227 g for a cup of a fluid. But a cup of dry, dehydrated potato flakes would weigh much less.

CONVERSIONS (approximate)

To Convert	To	Operation
Inches	Centimeters	Multiply by 2.5
Centimeters	Inches	Divide by 2.5
Pounds	Kilograms	Divide by 2.2
Kilograms	Pounds	Multiply by 2.2
Kilograms	Grams	Multiply by 1000
Grams	Milligrams	Multiply by 1000
Milligrams	Micrograms	Multiply by 1000
Ounces	Grams	Multiply by 28
Grams	Ounces	Divide by 28
Fluid Ounces	Milliliters	Multiply by 30
Milliliters	Fluid Ounces	Divide by 30

ABBREVIATIONS

US Measurements			Metric Measurements			Greek Letters		
tsp	=	teaspoon	ml (or mL)	=	milliliter*	α	=	alpha
tbsp	=	tablespoon	l (or L)	=	liter	β	=	beta
fl oz	=	fluid ounce	mcg or μg	=	microgram	γ	=	gamma
pt	=	pint	mg	=	milligram	Δ,δ	=	delta
qt	=	quart	g or gm	=	gram	ε	=	epsilon
oz	=	ounce	kg	=	kilogram	λ	=	lambda
lb	=	pound	mm	=	millimeter	μ	=	mu
			cm	=	centimeter	π	=	pi
			cc	=	cubic centimeter*	Ω,ω	=	omega

*1 cc = 1 ml

APPENDIX 9: Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
AA	amino acid	CAD	coronary artery disease
ac	before meals	CBC	complete blood count
ACE	angiotensin-converting enzyme	cc	cubic centimeter
ACTH	adrenocorticotropic hormone	CCK	cholecystokinin
ad lib or AD	as desired	CCU	coronary care unit
AD	Alzheimer's disease	CDA	computerized dietary analysis
ADH	antidiuretic hormone	CF	cystic fibrosis
AIDS	acquired immune deficiency syndrome	CHD	coronary heart disease
		CHF	congestive heart failure
Ala	alanine	CHO	carbohydrate
ALS	amyotrophic lateral sclerosis	chol	cholesterol
amt	amount	Cl	chlorine
ARC	AIDS-related complex	cm	centimeter
ARF	acute renal failure	CNS	central nervous system
Arg	arginine	Co	cobalt
As	arsenic	CoA	coenzyme A
Asn	asparagine	COPD	chronic obstructive pulmonary disease
Asp	aspartate		
ATP	adenosine triphosphate	CoQ	coenzyme Q, ubiquinone
B	boron	CPK	creatine phosphokinase
BAT	brown adipose tissue	CPR	cardiopulmonary resuscitation
BCAA	branched chain amino acid	Cr	chromium
BEE	basal energy expenditure	CRF	chronic renal failure
bid	twice daily	CSF	cerebrospinal fluid
BMR	basal metabolic rate	CT	computed tomography
BP	blood pressure	Cu	copper
BUN	blood urea nitrogen	CVA	cerebrovascular accident
c	cup	Cys	cysteine
C	centigrade; Celsius	DHA	docosahexaenoic acid
C	carbon	DJD	degenerative joint disease
Ca	calcium	DM	diabetes mellitus
CA	cancer	DNA	deoxyribonucleic acid

Dx	diagnosis	F	fluorine
dz	disease	FA	fatty acid
ea	each	FAD	flavin adenine dinucleotide
EAA	essential amino acid	FAS	fetal alcohol syndrome
EBV	Epstein-Barr virus	FBS	fasting blood sugar
ECG or EKG	electrocardiogram	Fe	iron
EEG	electroencephalogram	FFQ	food frequency questionnaire
EFA	essential fatty acid	fl oz	fluid ounce
EPA	eicosapentaenoic acid	FMN	flavin mononucleotide
equiv	equivalent	FSH	follicle-stimulating hormone
ERT	estrogen replacement therapy	g or gm	gram
ESADDI	Estimated Safe and Adequate Daily Dietary Intakes	GBD	gallbladder disease
		GE	gastroenteritis
ESRD	end-stage renal disease	GI	gastrointestinal
ETC	electron transport chain	Glc	glucose
ETOH	ethanol/ethyl alcohol	Gln	glutamine

Abbreviation	Meaning	Abbreviation	Meaning
		IBD	inflammatory bowel disease
Glu	glutamate	IBS	irritable bowel syndrome
GTF	glucose tolerance factor	ICU	intensive care unit
GTT	glucose tolerance test	IDDM	insulin-dependent diabetes mellitus
GU	genitourinary		
Hb	hemoglobin	IHD	ischemic heart disease
HCG	human chorionic gonadotropin	Ile	isoleucine
HCl	hydrochloric acid	IM	intramuscular
HCT	hematocrit	in or "	inch
HDL	high-density lipoprotein	IU	international unit
Hgb	hemoglobin	IUD	intrauterine device
hGH	human growth hormone	IV	intravenous
His	histidine	K	potassium
HIV	human immunodeficiency virus	kcal	kilocalorie
HPN, HTN	hypertension	kg	kilogram
Hx	history	L or l	liter
I	iodine	lb	pound

LBM	lean body mass	Ni	nickel
LD or LDH	lactate dehydrogenase	NIDDM	non-insulin-dependent diabetes mellitus
LDL	low-density lipoprotein		
LE	lupus erythematosus	NSAID	nonsteroidal anti-inflammatory drug
Leu	leucine		
LGA	large for gestational age	OA	osteoarthritis
LH	luteinizing hormone	OCA	oral contraceptive agent
Lys	lysine	oz	ounce
m	meter	P	phosphorus
MAO	monoamine oxidase	Pb	lead
mcg or μg	microgram	pc	after meals
MCT	medium-chain triglyceride	PCM	protein-calorie malnutrition
mEq	milliequivalent	PEM	protein-energy malnutrition
Met	methionine	per diem	per day
mg	milligram	PG	prostaglandin
		pH	hydrogen ion concentration
Mg	magnesium	Phe	phenylalanine
MI	myocardial infarction	PKU	phenylketonuria
ml	milliliter	prn	as necessary
mm	millimeter	pro	protein
Mn	manganese	Pro	proline
Mo	molybdenum	pt	patient
MSG	monosodium glutamate	PT	prothrombin time
MUFA	monounsaturated fatty acid	PTH	parathyroid hormone
N	nitrogen	PTT	prothrombin time
Na	sodium	PUFA	polyunsaturated fatty acid
NaCl	sodium chloride	PVD	peripheral vascular disease
NAD	nicotinamide adenine dinucleotide	qh	every hour
		qid	four times daily
NE	niacin equivalent	qt	quart
NEC	necrotizing enterocolitis	RA	rheumatoid arthritis
NG	nasogastric	RAST	radioallergosorbent test

Abbreviation	Meaning	Abbreviation	Meaning
		RBC	red blood cell

RDA	Recommended Dietary Allowances
RDS	respiratory distress syndrome
RE	retinol equivalent
Redox	oxidation-reduction
REE	resting energy expenditure
RQ	respiratory quotient
RMR	resting metabolic rate
RNA	ribonucleic acid
Rx	treatment
SDAT	senile dementia of the Alzheimer type
Se	selenium
Ser	serine
SFA	saturated fatty acid
SGA	small for gestational age
SIDS	sudden infant death syndrome
SOD	superoxide dismutase
STD	sexually transmitted disease
Sx	symptoms
TB	tuberculosis
tbsp or T	tablespoon
TC	total cholesterol
TE	tocopherol equivalent
TEE	total energy expenditure
TEF	thermic effect of food
TFA	*trans* fatty acid
TG	triglyceride
Thr	threonine
TIA	transient ischemic attack
TIBC	total iron-binding capacity
tid	three times daily
TP	total protein
TPN	total parenteral nutrition
Trp	tryptophan
TSH	thyroid-stimulating hormone
tsp or t	teaspoon
Tyr	tyrosine
UA	urinalysis
UA	uric acid
URI	upper respiratory infection
UTI	urinary tract infection
UV	ultraviolet radiation
V	vanadium
Val	valine
VLDL	very low-density lipoprotein
WBC	white blood cell count
wk	week
wt	weight
yo	years old
yrs	years
Zn	zinc

APPENDIX 10: The Program's Reference Values

All the nutrients analyzed in this program have to be compared with a reference value (RV) if percents of goals are to be computed. Reference values can be the RDAs, ESADDIs, or other dietary goals. Usually a nutrient's value is divided by the RV to figure its percent of the reference value. For example, the dietary goal (reference value) for cholesterol intake is set at 300 mg/day. If your cholesterol intake was 400 mg/day, then the program divided your intake of 400 mg/day by the RV of 300 mg/day, and the result would be 1.33. This number would then be multiplied by 100 to get its percent, or 133%. This means that if your cholesterol intake was 400 mg/day, then it was 133% of the recommended intake of 300 mg/day (or 1.33 times).

Kilocalories: There is no universal RV for calories. Instead, an RV was computed based on your age, sex, weight, and physical activity (all provided by you). The computer program used this RV to establish your protein (Section 1) and fat (Sections 1 & 2) requirements. But remember, these requirements are really dietary goals set by most health professionals for the *average* person. You, as an individual, may need more or less than these dietary goals.

Protein, Carbohydrate, and Fat: As mentioned above, Section 1 (for protein and fat) and Section 2 (for the fats) used the kilocalorie RV. However, for Section 4 of your analysis, the reference values for these three nutrients came from percents of your actual average daily kilocalorie intake (not your kilocalorie RV). Also, the protein RV was not based on the 0.8 g/kg formula (see Appendix 1). Instead, as with carbohydrate and fat, percent of total calories was used (as reported in Section 4 of your printout, and explained in Appendix 5).

- PROTEIN: The recommendation is that the calories from protein should make up 10-15% of total dietary calories. Since it is awkward to use a range, 12% was used as the RV.
- CARBOHYDRATE: The recommendation is that the calories from carbohydrates should make up at least 55% of total dietary calories. The carbohydrate RV used was 58%.
- FAT: The recommendation is that the calories from fat should make up no more than 30% of total dietary calories. The fat RV used was 30%.

Saturated, Monounsaturated, and Polyunsaturated Fats: The recommendations have been that each of these groups of fatty acids make up 10% each of total dietary calories (or 30% total; see Fat above). Recent research findings suggest that it would be better to get lower percentages of saturated and polyunsaturated fats, and a higher percentage of monounsaturated fats. However, since this is still being debated, this program used the following RVs: SFAs (10%); MUFAs (10%); PUFAs (10%). Remember, Section 2 of your CDA used your kilocalorie RV, not your actual calorie intake.

RDA: RDA reference values were used for 16 vitamins and minerals (see Appendix 6). RDA RVs are based on age and sex.

ESADDI: ESADDI reverence values were used for 5 vitamins and minerals (see Appendix 6). ESADDI RVs are based solely on being an adult. ESADDI values differ from the RDA in that they represent a range of

values, whereas RDA values are specific numbers. It is awkward to compare a specific dietary intake to a range of values. Therefore, for each ESADDI range of values, an average was computed, and that figure was used as the RV. For example, biotin has an ESADDI range of 30-100 mcg. The average would be 65 mcg (30 + 100 = 130. 130 ÷ 2 = 65), and 65 mcg was the RV used for biotin. Likewise was done for the other four ESADDI nutrients analyzed by this program.

Sodium and Potassium: These two nutrients have neither RDA nor ESADDI values. Nevertheless, there are estimated safe ranges of intake for each (see Appendix 3). For sodium, it is 500-2,400 mg, and for potassium, it is 2,000-3,500 mg. This program used 2,400 mg for the sodium RV, and 2,000 mg for the potassium RV.

GLOSSARY

ABETALIPOPROTEINEMIA: A disorder characterized by an absence from plasma of low-density lipoproteins, leading to a variety of problems associated with fat metabolism.

ABSORPTION: the process whereby nutrients pass through the intestines into the blood stream to be used by the body.

ACETOACETIC ACID: one of the ketone bodies composed of two molecules of acetyl-CoA; the end product of incomplete fatty acid oxidation, which may exist in starvation or in uncontrolled diabetes.

ACETONE: a dimethyl ketone with a pleasant ethereal odor that is the end product of unoxidized acetoacetic acid.

ACETYLCHOLINE: a neurotransmitter; acts as a vasodilator and depresses cardiac function.

ACHLORHYDRIA: an absence of hydrochloric acid in gastric juice that can accompany aging.

ACID: a compound yielding a hydrogen ion in a polar solvent, such as water; any chemical compound that has a sour taste.

ACID-BASE BALANCE: dynamic state of equilibrium with regard to hydrogen ion concentration in the body.

ACIDOSIS: the excessive accumulation of acid or hydrogen ions, or the loss of base from the body.

ACIDURIA: presence of acid in the urine.

ACQUIRED INDISPENSABLE AMINO ACIDS: may become indispensable in immaturity, in states of metabolic disorder, and/or during severe stress. Include: cysteine, tyrosine, arginine, citrulline, taurine.

ACRODERMATITIS ENTEROPATHICA: a genetically transmitted eczematous disease linked to malabsorption of zinc.

ACTIVE SITE: that part of the enzyme surface on which the reaction take place.

ACTIVE TRANSPORT: movement of substances across a membrane against the concentration gradient, requiring energy expenditure.

ACUTE: sharp or intense; disease or illness that begins suddenly, reaches a peak rapidly, and then subsides after a short period.

ADENOSINE TRIPHOSPHATE (ATP): a high-energy molecule involved in energy metabolism and RNA synthesis; required for many chemical reactions in the body.

ADIPOSE: of or related to animal fat; the fat found in adipose tissue.

ADRENAL GLANDS: glands located at the upper end of each kidney. The cortex produces estrogen, androgen, progesterone, aldosterone, and cortisone; the medulla produces epinephrine and norepinephrine.

ADRENOCORTICAL HORMONES: hormones of the adrenal cortex: aldosterone and cortisone.

AEROBIC: living or occurring only in the presence of oxygen.

AEROBIC CAPACITY: the maximum amount of air that can be moved in and out of the lungs in a given amount of time.

AEROBIC EXERCISE: exercise that increases oxygen uptake and improves cardiovascular fitness, such as jogging, brisk walking, or cycling.

AFLATOXIN: a potent and sometimes lethal (carcinogenic) fungal toxin that can be found on peanuts and cereal grains, particularly in climates of high temperature and humidity.

AGE-ASSOCIATED OSTEOPOROSIS (Type II): a loss of density in both cortical and trabecular bone that occurs in elderly of both sexes after age 70; characterized by wedge fractures of the thoracic vertebrae that lead to back pain, loss of height, and "dowager's hump."

ALBUMIN: a protein in the blood which serves as an indicator of protein status; contributes to maintenance of appropriate osmotic pressure and fluid balance between extracellular and intracellular fluids.

ALCOHOL DEHYDROGENASE: a liver enzyme that converts ethanol to acetaldehyde; the first step in

alcohol metabolism.

ALDOSTERONE: an adrenocortical hormone that acts on the distal tubules of the kidney to resorb sodium and water, and to excrete potassium.

ALKALOSIS: excessive accumulation of base, or the loss of hydrogen ions or acid from the body.

ALLERGEN: a substance that is capable of producing an allergic response in the body.

ALLERGY: a hypersensitive state caused by the interaction of an allergen with an antibody.

ALPHA-TOCOPHEROL: the form of vitamin E having the highest biologic activity.

AMENORRHEA: absence or abnormal stoppage of menses. Often occurs in females who regularly exercise vigorously, and in females who have low percents of body fat.

AMINO ACID (AA): an organic compound containing an amino group (NH_2) and a carboxyl group (COOH), which functions as one of the building blocks of protein.

AMINO GROUP: NH_2; one nitrogen and two hydrogens.

AMYLASE: an enzyme found in the saliva (ptyalin) and small intestine that hydrolyzes starch to dextrin and maltose.

AMYLOPECTIN: a form of starch; branched chains of glucose units.

AMYLOSE: a form of starch; long straight chains of glucose units.

ANABOLISM: the building up in the body of complex chemical compounds from smaller, simpler compounds, usually with the use of energy.

ANAEROBIC: living or occurring without the presence of oxygen.

ANAPHYLAXIS: an acute, often severe, and sometimes fatal immune response that may affect any body system.

ANDROID FAT DEPOSITION: deposition of fat around the waist and upper abdomen; "apple-shape" fat distribution.

ANEMIA: a deficiency in the size or number of RBCs, or in the amount of hemoglobin they contain that limits the exchange of oxygen and carbon dioxide between the blood and the tissues.

ANEURYSM: the ballooning out of an artery wall at a point where it has been weakened by deterioration.

ANGINA PECTORIS: chest pain with sensations of suffocation caused by temporary reduction of oxygen to the heart muscle through narrowed, diseased coronary arteries.

ANGULAR STOMATITIS: inflammation at the corners of the mouth.

ANOREXIA NERVOSA: an eating disorder characterized by refusal to eat and a loss of at least 25% of body weight. Also, body image, sense of control, and family and social relationship abnormalities.

ANTACID: an agent that neutralizes acid in the stomach, esophagus, or first part of the duodenum.

ANTIBODY: a protein molecule from the immune system that counteracts the effects of invading organisms and other foreign species.

ANTICHOLINERGIC AGENT: blocks the effects of the parasympathetic nervous system that are mediated by acetylcholine.

ANTIDIABETIC AGENT: drug used to control diabetes; lowers blood glucose levels.

ANTIDIURETIC HORMONE: a hormone secreted by the posterior pituitary that is responsible for resorption of water by the distal portion of the kidney tubules, and thus the control of water excretion.

ANTIGEN: any substance that can elicit the formation of an antibody specific for that substance when introduced into a foreign species.

ANTIHISTAMINE: an agent that prevents histamine from acting on body tissues.

ANTIOXIDANT: an agent that inhibits oxidation and thus prevents rancidity of oils or fats or the deterioration of other materials through oxidative processes; includes vitamins C and E, beta-carotene, SOD, coenzyme Q, catalase, glutathione.

ANTIVITAMIN: a substance that interferes with the synthesis or metabolism of vitamins.
APPETITE: a natural desire to eat, especially when food is present.

ARACHIDONIC ACID: an unsaturated 20-carbon fatty acid that is a precursor of prostaglandin synthesis.

ARRHYTHMIA: abnormal rhythm of the heartbeat.

ARTERIOSCLEROSIS: thickening, hardening, or loss of elasticity of the walls of the arteries.

ARTERY: a vessel that carries blood away from the heart.

ASCORBIC ACID: one form of vitamin C.

ASPARTAME: a dipeptide sweetener composed of the amino acids, phenylalanine and aspartic acid.

ASSIMILATION: after food is broken down by digestion, it is then absorbed (assimilated) by passing through the intestinal walls.

ATHEROGENIC: having the capacity to initiate, increase, or accelerate the formation of atheromas.

ATHEROMA: mass of plaque composed of lipids, cholesterol, and degenerated, thickened arterial intima occurring in atherosclerosis.

ATHEROSCLEROSIS: a thickening and narrowing of the walls of the large and medium-sized blood vessels caused by the invasion of lipids, primarily cholesterol and other materials, into the intimal or inner layer to form plaque. The major type of arteriosclerosis.

ATROPHY: wasting of a cell, tissue, or part.

ATROPHIC GASTRITIS: chronic inflammation of the stomach lining with loss of mucosal cells and reduced secretion of hydrochloric acid (HCl).

AUTONOMIC NERVOUS SYSTEM: the division of the vertebrate nervous system that regulates involuntary actions, as of the intestines, heart, and glands, and comprises the sympathetic nervous system and the parasympathetic nervous system.

AVIDIN: the protein in raw egg whites that binds biotin.

BASAL ENERGY EXPENDITURE (BEE): the

APOENZYME: an enzyme before attachment of its coenzyme or prosthetic group; nonfunctional.
amount of energy used in 24 hours by a person who is lying quietly, 12 hours after the last meal, in a comfortable temperature and environment. The energy expended in maintenance of basal metabolic processes or involuntary activities in the body (respiration, circulation, gastrointestinal function, muscle tone, and body temperature) and functional activities of organs.

BASAL METABOLIC RATE (BMR): the basal energy expenditure expressed as kcal/kg body weight/hr.

BASE: a water-soluble, bitter compound capable of neutralizing an acid to form a salt; yields a hydroxyl ion.

BERIBERI: thiamin deficiency disease; affects peripheral nerves and the heart.

BETA-CAROTENE: a precursor of vitamin A found in plant foods, especially dark green and deep yellow vegetables and fruits.

BETA-OXIDATION: the process of fatty acid catabolism, in which two-carbon fragments are removed in succession from the carboxyl end of the chain.

BICARBONATE: an alkaline secretion of the pancreas that helps to neutralize the acidic chyme.

BILE: a bitter, alkaline brownish-yellow or greenish-yellow liquid that is secreted by the liver, stored in the gallbladder, and discharged into the duodenum and that aids in digestion, chiefly by saponifying fats; made from cholesterol.

BILE ACID SEQUESTRANT: a medication that adsorbs cholesterol-containing bile acids and prevents their absorption back into the blood stream.

BIOAVAILABILITY: the degree to which a drug or other substance becomes available to the target tissue.

BIOCHEMICAL MALNUTRITION: abnormal levels of constituents (in body fluids and waste products) indicative of normal nutritional state that can be attributed to excess or deficiency of nutrient intake; precedes clinical malnutrition.

BIOFLAVONOID: naturally occurring flavone or coumarin derivatives having the activity of the so-called vitamin P; found in brightly colored fruits and

vegetables.

BIOLOGICAL VALUE: a measure of protein quality; the amount of protein nitrogen that is retained from a given amount of protein nitrogen that has been digested and absorbed.

BLOOD-BRAIN BARRIER: a barrier composed of the cells lining the blood vessels in the brain, which are highly selective in what they allow to pass into the brain.

BODY IMAGE: a mental picture a person has of his or her physical self.

BODY IMAGE DISTORTION: an abnormal or untrue view of one's body size.

BODY MASS INDEX (BMI): weight divided by height (kg/m^2); a definition of the level of adiposity.

BOLUS: the portion of food swallowed at one time.

BONE REMODELING: the process by which bone is continually dismantled and reformed in order to repair itself, grow, adapt to stresses and strains, and furnish calcium for other body needs.

BOTULISM: food poisoning caused by the toxin produced by *Clostridium botulinum.*

BRADYCARDIA: abnormal slowness of the heart rate and pulse.

BRANCHED-CHAIN AMINO ACIDS: the amino acids valine, isoleucine, and leucine.

BROWN ADIPOSE TISSUE (BAT): fat located in the scapular area that is involved in heat production for cold adaptation, and possibly burning off excess energy; especially important in hibernating animals.

BULIMIA NERVOSA: an eating disorder that is characterized by periods of binging and purging, unrealistic ideas about food, and distortion of body image.

CALCIFICATION: the process in which calcium, phosphorus, and other minerals crystallize on the collagen matrix of a growing bone, hardening it.

CALCITONIN: a hormone that opposes the action of parathyroid hormone in regulating blood calcium levels and bone mineralization.

CALCITRIOL: metabolically active form of vitamin D produced by the kidney and which functions as a hormone.

CALMODULIN: a protein that relays calcium's messages.

CALORIE: the amount of energy required to raise the temperature of 1 ml of water at a standard initial temperature by 1° C.

CANCER CACHEXIA: the weak, malnourished, and emaciated condition that results from cancer.

CAPILLARY: a small vessel that branches from an artery, connecting the artery to a vein. This is where the exchange of oxygen, nutrients, and waste materials takes place.

CARBOHYDRATES: organic compounds that consist of carbon, hydrogen, and oxygen. Often abbreviated CHO. In their simplest form, the general formula is $C_nH_{2n}O_n$. They vary from simple sugars containing from 3 to 7 carbon atoms to very complex polymers.

CARBOXYL GROUP: COOH; one carbon, two oxygens, and one hydrogen; a characteristic of all organic acids.

CARCINOGEN: a substance which produces cancer.

CARDIOMYOPATHY: a subacute or chronic disorder of the heart muscle.

CAROTENEMIA: the presence of high levels of carotene in the blood resulting in yellow appearance of the skin.

CAROTENOIDS: yellow or red pigments found in carrots, sweet potatoes, leafy vegetables, milk fat, and egg yolk; some can be converted into vitamin A in the body; some appear to be protective against cancer.

CARPAL TUNNEL SYNDROME: tingling and numbness in part of the hand and wrist, and shooting pains up the arm, caused by swelling of tissue surrounding a nerve that passes through the wrist bones. Associated with repetitive movements. Now called repetitive strain injury.

CASEIN: the principal protein of cow's milk.

CATABOLISM: the breaking down in the body of complex chemical compounds into simpler ones, often accompanied by the liberation of energy.

CATALYST: a substance that speeds up a chemical reaction without being changed itself.

CATHARTIC: a strong laxative; purgative.

CELIAC DISEASE: condition resulting from lack of the enzyme necessary to break down the protein in gluten present in wheat and some other grains; results in diarrhea, steatorrhea, and general malabsorption, unless gluten is eliminated from the diet.

CELLULOSE: a structural carbohydrate in plant material that resists hydrolysis in the human digestive tract.

CEREBROVASCULAR ACCIDENT (CVA): a stroke or aneurysm in the brain.

CHEILOSIS: fissures of lips and mouth due to dietary riboflavin deficiency.

CHELATE: a complex formed between a metal ion and a polar molecule.

CHEMICAL SCORE: a rating of the quality of a test protein arrived at by comparing its amino acid pattern with that of a reference protein.

CHOLECALCIFEROL: vitamin D_3; animal derived.

CHOLESTASIS: retention and accumulation of bile in the liver due to factors within or outside the liver.

CHOLESTEROL: the chief steroid in the body; found in all tissues, especially the brain, nerves, adrenal cortex, and liver. It is a constituent of bile and serves as a precursor of vitamin D. Cholesterol within the body comes from two sources: (1) exogenous, or dietary, cholesterol, chiefly from egg yolk, liver and other organ meats, and dairy products; and (2) endogenous cholesterol, synthesized by the liver and other organs, such as the adrenal cortex, skin, and intestines. Cholesterol circulates in the blood as lipoprotein in combination with protein and other blood lipids. LDL fractions are strongly related to the incidence of coronary heart disease, while HDL fractions are inversely related to this disease.

CHOLECYSTOKININ: a hormone produced by the upper intestinal mucosa that stimulates contraction of the gallbladder and secretion of pancreatic digestive enzymes.

CHOLESTYRAMINE: a drug used to lower blood cholesterol or lipid levels.

CECUM: the large blind pouch forming the beginning of the large intestine.

CHRONIC: prolonged; a disease that develops slowly and persists for a long time, possibly for the remaining years of life.

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD): any disorder, such as asthma, chronic bronchitis, and pulmonary emphysema, marked by persistent obstruction of bronchial air flow.

CHYLOMICRONS: droplets consisting of triglyceride, cholesterol, phospholipids, and protein that are the form by which absorbed long-chain triglycerides and cholesterol are transported from the intestine into the intestinal blood or lymphatic system.

CHYME: the semifluid, homogeneous, gruel-like material produced by the gastric digestion of food that is expelled by the stomach into the duodenum.

CIRRHOSIS: irreversible liver damage involving death of liver cells and their replacement by scar tissue; often associated with alcoholism.

CLINICAL MALNUTRITION: changes in skin, hair, membranes, or growth that can be attributed to an excessive or deficient intake of a nutrient or nutrients.

COBALAMIN: vitamin B12, a cobalt-containing complex.

COENZYME: a nonprotein compound, usually a vitamin or mineral, which forms the active portion of an enzyme.

COFACTOR: a mineral that, like a coenzyme, works with an enzyme to facilitate a chemical reaction.

COLLAGEN: the major protein of the white fibers of connective tissue, cartilage, and bone, which is insoluble in water.

COLON: the section of the large intestine extending from the cecum to the rectum.

COMPLEMENTARY PROTEINS: two or more proteins whose amino acid profiles complement each other in such a way that the essential amino acids missing from each are supplied by the other.

COMPLETE PROTEIN: a protein containing all the amino acids essential in human nutrition in adequate amounts.

COMPLETELY DISPENSABLE AMINO ACIDS: extensively synthesized in the body and not essential
CONDITIONALLY DISPENSABLE AMINO ACIDS: amino acids that become indispensable under certain conditions. Include: tyrosine, cysteine. Cysteine and tyrosine can reduce the requirements for the indispensable amino acids methionine and phenylalanine, respectively.

CONES: the cells of the retina that respond to bright light and are responsible for color vision.

CONGENITAL: existing at, and usually before birth.

CONGESTIVE HEART FAILURE (CHF): a syndrome caused by heart disease, which is characterized by breathlessness, chest pain, and abnormal sodium and water retention by the kidney.

CONSTIPATION: a condition in which the frequency or quantity of defecation is reduced.

CORONARY HEART DISEASE (CHD): impairment of circulation in the vasculature of the heart due primarily to the deposition of arterial fatty plaque; also called coronary artery disease (CAD).

CORTICAL BONE: the compact bone of the shaft that surrounds the medullary cavity.

CORTISOL: the major adrenal cortical steroid influencing carbohydrate metabolism. It increases the release of glucose from the liver, stimulates gluconeogenesis from amino acids, and decreases peripheral use of blood glucose.

CRETINISM: a chronic condition due to congenital lack of thyroid secretion, marked by arrested physical and mental development, dystrophy of the bones and soft parts, and lowered basal metabolism.

CRUCIFEROUS VEGETABLES: a group of vegetables named for their cross-shaped blossoms (broccoli, Brussels sprouts, cabbage, cauliflower, turnips, rutabagas), which may help to prevent certain cancers.

CRUDE FIBER: the amount of plant material remaining after being subjected to treatment with acid and alkali.

components of the diet. Include: alanine, glutamic acid, aspartic acid, glycine, serine, proline, glutamine, asparagine.

COMPLEX CARBOHYDRATES: the polysaccharides (starch, glycogen, and some fibers).
CYANOSIS: a blue discoloration of the skin reflecting excessive concentration of reduced hemoglobin in the blood due to poor oxygenation.

CYSTIC FIBROSIS: a congenital disease of mucous glands throughout the body, usually developing during childhood and causing pancreatic insufficiency and pulmonary disorders.

CYTOCHROME: any electron transfer hemoprotein.

CYTOCHROME P450 SYSTEM: an enzyme system in the body that transforms drugs and other endogenous materials to water-soluble compounds so that they can be excreted.

DEFECATION: the act of voiding the rectum to eliminate waste.

DEHYDRATION: excessive loss of body water.

DELANEY CLAUSE: a clause of the Food Additive Amendment that prohibits the use of any substance shown to cause cancer in animals or humans.

DEMENTIA: irreversible deterioration of intellectual faculties with accompanying emotional disturbance resulting from organic brain disorder.

DENATURATION: "unraveling" or breaking down of the shape (tertiary structure) of proteins by mechanical agitation, heat, cold, acidity, or alkalinity.

DEOXYRIBONUCLEIC ACID (DNA): the nucleic acid present in the chromosomes ultimately responsible for protein synthesis and the transmittance of genetic information.

DERMATITIS: inflammation of the skin.

DEXTRIN: an intermediate product of starch hydrolysis. Composed of short glucose chains.

DEXTROSE: glucose produced by the hydrolysis of corn starch.

DIABETES MELLITUS: a disorder of carbohydrate, fat, and protein metabolism resulting from a lack of insulin secretion by the pancreas.

DIABETIC KETOACIDOSIS: acidosis accompanied by the accumulation of ketone bodies in the body tissues and fluids; caused by a lack or inadequacy of insulin.

DIARRHEA: abnormal frequency and liquidity of DIETARY FIBER: the amount of plant material remaining after treatment with digestive enzymes and reduction with acid and alkali.

DIGESTION: the process whereby ingested food is converted into material suitable for assimilation for synthesis of tissues or liberation of energy. Usually involves hydrolysis.

DIGLYCERIDE: a lipid with two fatty acid chains attached to the glycerol molecule.

DIPEPTIDE: two amino acids bonded together by a peptide bond.

DISACCHARIDE: a sugar capable of being digested to two monosaccharide molecules; sucrose, maltose, lactose

DISPENSABLE AMINO ACIDS: amino acids can either be synthesized from indispensable amino acids or from appropriate carbon skeletons readily manufactured in the cell; glutamate, alanine, aspartate, glutamine.

DIURESIS: increased secretion of urine.

DIURETIC: a drug (“water pill”) that promotes diuresis.

DIVERTICULITIS: inflammation of diverticula.

DIVERTICULOSIS: presence of diverticula that are herniations of the mucous membrane through the muscular layers of the colonic wall; common among older people and may be related to low fiber intake.

DOCOSAHEXAENOIC ACID (DHA): an omega-3 fatty acid found in fish.

DUMPING SYNDROME: a complex physiologic response to the rapid emptying of the gastric contents into the jejunum.

DUODENUM: the beginning portion of the small intestine, starting at the lower end of the stomach and extending to the jejunum.

stools.

DIASTOLIC BLOOD PRESSURE: the blood pressure when the heart muscle is relaxed and blood is entering the heart chambers.

DYSENTERY: an infection of the GI tract caused by an amoeba or bacterium, causing severe diarrhea.

DYSPEPSIA: discomfort in the abdominal region following eating.

DYSPHAGIA: difficulty in swallowing.

DYSTROPHY: any disorder arising from defective or faulty nutrition.
EATING DISORDER: abnormal behaviors related to food and eating that may include starving, binging, vomiting, laxative abuse, or excessive exercise accompanied by bizarre ideas about food, unrealistic body image, and psychologic and developmental abnormalities.

ECZEMA: a noncontagious inflammation of the skin, marked mainly by redness, itching, and the outbreak of lesions that discharge serous matter and become encrusted and scaly.

EDEMA: the abnormal accumulation of fluid in the intercellular tissue spaces or body cavities.

EICOSANOID: any of the biologically active substances derived from arachidonic acid, eicosatetraenoic acid, and eicosapentaenoic acid, including the prostaglandins, thromboxanes, and leukotrienes.

EICOSAPENTAENOIC ACID (EPA): an omega-3 fatty acid found in fish.

ELECTROLYTE: substances in solution with a positive electrical charge (sodium, potassium, calcium, magnesium) or a negative charge (chloride, CO_2, phosphorus, sulfate, lactate).

ELECTRON TRANSPORT CHAIN (ETC): along with the process of oxidative phosphorylation, enables the production of ATP, the energy "currency" of the body.

ELIMINATION DIET: an eating plan in which individual foods suspected of causing intolerance or allergic reactions are omitted for a period of time in order to determine if there is an improvement in the individual's condition.

EMBOLISM: when a thrombus breaks loose and causes sudden closure of a blood vessel.

EMETIC; an agent that causes vomiting.

EMULSIFYING: converting two liquids into a suspension in which one liquid is distributed in small globules throughout the body of a second liquid, usually between an oil-based liquid and a water-based
ENDOGENOUS OPIATES: morphine-like compounds produced in the brain in response to pain, stress, certain drugs, and exercise. They act as internal tranquilizers, reducing arousal level.

ENRICHED FOOD: a food to which nutrients have been added, usually to replace some of the nutrients lost in processing.

ENTERAL NUTRITION: the delivery of nutrients directly into the stomach, duodenum, or jejunum.

ENTEROHEPATIC CIRCULATION: the recurrent cycle in which bile salts and other substances excreted by the liver pass through the intestinal mucosa and become reabsorbed by the hepatic cells and re-excreted.

ENTEROPATHOGENIC ORGANISM: any organism, usually bacterial, that causes intestinal disease or disturbance.

ENZYME: a protein, secreted by cells, that acts as a catalyst to induce chemical changes in other substances, without being changed itself.

EPINEPHRINE: a hormone secreted by the adrenal medulla; a potent stimulant resulting in increased heart rate and force of contraction, vasoconstriction or vasodilation, relaxation of bronchiolar and intestinal smooth muscle, glycogenolysis, lipolysis, and other metabolic effects.

EPITHELIUM: membranous tissue, usually in a single layer, composed of closely arranged cells separated by very little intercellular substance, and forming the covering of most internal surfaces and organs and the outer surface of the body.

ERGOCALCIFEROL: vitamin D_2; plant derived.

ERGOGENIC AID: a substance or practice that increases energy or work output.

ERYTHROCYTE: mature red blood cell (RBC).

ERYTHROPOIESIS: the production of red blood cells

liquid.

ENDOCRINE GLAND: any of the ductless glands, such as the thyroid or adrenal, the secretions of which pass directly into the bloodstream from the cells of the gland.

ENDOGENOUS: produced from within.

(RBCs).

ERYTHROPOIETIN: a hormone that stimulates the bone marrow to produce RBCs.

ESADDI (Estimated Safe and Adequate Daily Dietary Intakes): recommended ranges of appropriate intake of those nutrients for which not enough information is available to establish an RDA.
ESSENTIAL AMINO ACIDS (EAA): see indispensable amino acids.

ESSENTIAL FAT: the body fat located in specific sites that is necessary for survival; about 4% to 7% of body weight.

ESSENTIAL FATTY ACIDS (EFA): linoleic and alpha-linolenic acids, which cannot be produced by the body and must be provided in the diet.

ESTERIFY: to combine an acid and an alcohol with elimination of a molecule of water, forming an ester.

ESTROGEN REPLACEMENT THERAPY (ERT): administration of synthetic estrogen to replace the natural hormone, which declines after menopause.

EXOGENOUS: derived or developed externally.

EXTERNAL CUE THEORY: the theory that some people eat in response to such external factors as the presence of food, or the time of day, rather than to such internal factors as hunger.

EXTRACELLULAR: occurring outside the cells.

EXTRACELLULAR WATER: the water in the plasma, lymph, spinal fluid, and secretions.

FAT: a mixture of triglycerides.

FAT CELL THEORY: the theory that during the growing years, fat cells respond to overfeeding by increasing in number; that the number of fat cells becomes fixed before adulthood, and that the number regulates hunger, so that an individual overfed during

infancy or childhood will always have the desire to overeat.

FATFOLD TEST: a clinical test of body fatness in which the thicknesses of folds of skin in several areas of the body are measured with a caliper.

FAT-SOLUBLE VITAMINS: those vitamins that must be dissolved in dietary fats in order to be absorbed
FATTY LIVER: an early stage of liver deterioration seen in several disease, including kwashiorkor and alcoholic liver disease.

FATTY STREAK: a small, flat, yellow-gray area composed mainly of cholesterol within an artery; probably an early stage of atherosclerosis.

FERMENTATION: enzymatic decomposition of carbohydrates that is anaerobic and ends with the production of alcohol.

FERRITIN: an iron-apoferritin complex that is a major storage form of iron, found in liver, spleen, bone marrow, and reticuloendothelia cells.

FERROUS IRON: divalent form of iron; form in which iron is absorbed.

FETAL ALCOHOL SYNDROME: a syndrome resulting from fetal exposure to the teratogenic effects of alcohol.

FIBER (ROUGHAGE): compounds of plant origin that are not capable of hydrolysis by enzymes in the human gut.

FIBROCYSTIC BREAST DISEASE: characterized by formation of small cysts containing fluid.

FOOD ALLERGY: an adverse reaction to a food that is mediated by an immunologic mechanism; occurs consistently after consumption of that food and causes functional changes in target organs; food hypersensitivity.

FOOD DIARY: a means of assessing nutrient intake by asking an individual to record the types and amounts of all foods and liquids consumed over a certain number of days.

FOOD FREQUENCY QUESTIONNAIRE: a means of assessing nutrient intake in which individuals are asked to indicate how frequently they consume particular foods; may also include the amount of each food consumed.

(vitamins A, D, E, K).

FATTY ACID: a straight carbon chain (usually 4-22 carbons long) terminating in a carboxyl group at one end, and a methyl group at the other; has the general formula $C_nH_{2n}O_2$ when fully saturated; originates from the hydrolysis of fats.

FOOD INTOLERANCE: an adverse reaction to a food caused by toxic, pharmacologic, metabolic, or idiosyncratic reactions to the food or chemical substances in the food.

FORTIFIED: refers to the addition of nutrients to a food, often not originally present, and often added in amounts greater than might be found there naturally.

FREE RADICAL: an atom or molecule that has at least one unpaired electron; highly reactive, they can damage structures in the body; neutralized by antioxidants.

FREE-RADICAL THEORY: a theory that relates aging to cellular damage caused by free radicals.

FRUCTOSE: a monosaccharide occurring in fruit, honey, and some vegetables; the sweetest of the monosaccharides.

GALACTOSE: a monosaccharide produced by the hydrolysis of lactose by digestive enzymes.

GALACTOSEMIA: an inborn error of metabolism resulting in the presence of lactose in the blood; symptoms include jaundice, enlarged liver and spleen, anorexia, weight loss, vomiting, diarrhea, cataract formation, and mental retardation.

GALLBLADDER: the organ that stores and concentrates bile.

GALLSTONE: a small stone formed by the accumulation of bile salts and can block the bile duct.

GASTRIC GLANDS: glands in the stomach wall that secrete gastric juice into the stomach.

GASTRIC JUICE: the secretion of the gastric glands in the stomach. Contains mostly hydrochloric acid and pepsins.

GASTRIC MOTILITY: the spontaneous peristaltic movements in the stomach that mix food and gastric secretions and move food through the stomach and into

the duodenum.

GASTRIC ULCER: an ulcer of the gastric mucosa that is not associated with excessive gastric acid secretion, but rather with disruption of the gastric mucosal barrier.

GASTRIN: a hormone elaborated by the pyloric mucosa that stimulates hydrochloric acid secretion by the parietal cells.

GLAND: an organ that excretes materials and manufactures substances not needed for its own metabolic function.

GLOSSITIS: inflammation of the tongue.

GLUCAGON: a hormone produced by the alpha islets of the pancreas that stimulates the conversion of glycogen to glucose, and gluconeogenesis in the liver to bring about a rise in plasma glucose levels.

GLUCOCORTICOID: the group of corticosteroids predominantly affecting carbohydrate metabolism through promotion of gluconeogenesis and liver glycogen deposition and elevation of blood glucose levels.

GLUCONEOGENESIS: the formation of glucose from noncarbohydrate molecules, such as glycerol and the carbon skeletons of amino acids.

GLUCOSE: the simple sugar formed by the breakdown of complex carbohydrates; blood, corn, grape, or starch sugar.

GLUCOSE TOLERANCE FACTOR (GTF): a potentiator of insulin action, thought to be comprised of niacin, glutathione, and trivalent chromium.

GLUCOSURIA: the presence of sugar in the urine.

GLUTATHIONE: a tripeptide composed of glutamic acid, cysteine, and glycine; it performs three functions: 1) the destruction of peroxides and free radicals; 2) a cofactor for several enzymes; and 3) the detoxification of harmful compounds.

GLUTATHIONE PEROXIDASE: a selenium-containing enzyme that is the major active form of selenium in tissues; participates in antioxidant reactions and protects tissues against damage from free radicals, especially hydrogen peroxide formed within the cell.

GLUTEN-FREE DIET: a restrictive eating pattern in which foods containing the protein gluten are

GASTRITIS: inflammation of the stomach.

GASTROENTERITIS: inflammation of the stomach and the intestines.

GASTROINTESTINAL TRACT (GI tract): the system of the body responsible for the intake, digestion, and absorption of nutrients; the main organs are the stomach and intestines.

eliminated; these foods include wheat, rye, barley, and oats.

GLUTEN-SENSITIVE ENTEROPATHY (Celiac Disease): a malabsorption syndrome precipitated by the ingestion of gliadin-containing foods (wheat, rye, oats, barley), and characterized by a flattening of the villi of the small intestine.

GLYCEROL: a three-carbon alcohol; a sweet oily fluid obtained by the saponification (conversion into soap) of fats and oils.

GLYCOGEN: storage form of carbohydrate in animals. Broken down to yield glucose.

GLYCOGENESIS: the synthesis of glycogen.

GLYCOGENOLYSIS: the splitting up of glycogen in the body tissues, yielding glucose.

GLYCOLIPID: a compound containing an alcohol, fatty acids, and a carbohydrate.

GLYCOLYSIS: the breaking down of glucose to pyruvate (aerobic; with oxygen) or to lactate (anaerobic; without oxygen).

GLYCOPROTEIN: a special class of proteins that have a carbohydrate group attached.

GLYCOSURIA: an abnormally high level of glucose in the urine occurring in diabetes mellitus.

GLYCOSYLATED HEMOGLOBIN: a laboratory test estimating glucose association with hemoglobin; used to examine how well a diabetic is controlling his blood glucose level.

GOITER: a chronic enlargement of the thyroid gland, visible as a swelling at the front of the neck, which is usually associated with iodine deficiency.

GOITROGENIC EFFECT: an effect of substances in some foods (cabbage, turnips, rapeseeds, peanuts,

cassava, soybeans) capable of producing goiter.

GOUT: a group of disorders of purine and pyrimidine metabolism characterized by hyperuricemia and deposition of urate crystals in joints.

GRAS (Generally Recognized As Safe): a list, established by the FDA in 1958, of food additives that had long been in use and were believed safe.

HEAVY METAL: any of a number of mineral ions, such as mercury and lead, so called because they are of relatively high atomic weight. Many heavy metals are poisonous.

HELICOBACTER PYLORI: the pathogenic microorganism associated with the development of atrophic gastritis.

HEMATOCRIT: the volume percentage of RBCs in the blood.

HEMATOPOIESIS: the formation of blood cells in the bone marrow.

HEME: the nonprotein, insoluble iron protoporphyrin constituent of hemoglobin.

HEME IRON: the form in which iron occurs in meat, fish, and poultry.

HEMICELLULOSES (Noncellulose Polysaccharides): a group of high molecular polysaccharides that resemble cellulose but are more soluble and more easily decomposed.

HEMODIALYSIS: removal of certain elements from the blood by virtue of differences in rates of their diffusion across a semipermeable membrane while the blood is being circulated outside the body.

HEMOGLOBIN: the iron-containing pigment in RBCs which carries oxygen to the cells.

HEMOLYSIS: disruption of the integrity of the red blood cell membrane causing release of hemoglobin.

HEMOLYTIC ANEMIA: anemia caused by shortened survival of mature RBCs.

HEMOPROTEIN: protein linked to a metal-porphyrin compound.

HIGH-DENSITY LIPOPROTEIN (HDL): a plasma lipid/protein complex rich in phospholipid and cholesterol; considered to be of benefit in reducing the risk of cardiovascular disease.

GYNOID FAT DISTRIBUTION: deposition of fat in the thighs and buttocks; "pear-shape" fat distribution.

HARD WATER: water containing high concentrations of calcium and/or magnesium.

HEARTBURN: a burning pain in the esophagus caused by the back-flow of gastric contents and acid.

HISTAMINE: a chemical in the body tissues that constricts the smooth bronchial tube muscles, dilates small blood vessels, allows fluid leakage to form itchy skin and hives, and increases secretion of stomach acid. It is implicated as the mediator if immediate hypersensitivity.

HOMEOSTASIS: a tendency to stability in the internal environment of the organism; achieved by a system of control mechanisms activated by negative feedback.

HORMONE: a chemical substance secreted into the blood stream by one organ which affects the function of another organ.

HORMONE-SENSITIVE LIPASE: an enzyme within the adipose cell that catalyzes the release of free fatty acids from the cell.

HUNGER: craving for food more pronounced than appetite.

HYDROCHLORIC ACID: an acid secreted by the parietal cells in the lining of the stomach that helps in protein digestion.

HYDROGENATION: the process of adding hydrogen to the double bonds and thus increasing the saturation of fatty acids; can convert oils into semi-solids.

HYDROLYSIS: a chemical process whereby a compound is cleaved into two or more simpler compounds. Hydrolysis is effected by the action of acids, alkalies, or enzymes. See digestion.

HYDROPHOBIC: water hating. A substance that does not dissolve in water. Also called lipophilic (fat loving).

HYDROXYAPATITE: a crystalline structure in bone, consisting of calcium phosphate and calcium carbonate in an organic collagen matrix that gives strength and

rigidity to bones and teeth.

HYPERCALCEMIA: excess calcium in the blood.

HYPERCHOLESTEROLEMIA: when blood cholesterol is above normal limits.

HYPERGLYCEMIA: increased glucose concentration in the blood above normal limits.

HYPERKALEMIA: abnormally high level of potassium in the blood.
HYPERTENSION: persistently high arterial blood pressure.

HYPERTROPHY: increase in tissue size by an increase in cell size.

HYPERVITAMINOSIS A: condition resulting from excessive intakes of preformed vitamin A over an extended period; leads to liver damage.

HYPOALLERGENIC: a substance that has a low capacity for inducing hypersensitivity (allergic reaction).

HYPOCALCEMIA: below normal levels of calcium in the blood.

HYPOCHLORHYDRIA: deficiency of hydrochloric acid in the gastric juice.

HYPOCHROMIC: having less than normal color; used to describe a RBC with a below-normal hemoglobin content.

HYPOGLYCEMIA: abnormally low level of sugar in the blood which results in symptoms caused by compensatory sympathetic nervous system activity.

HYPOKALEMIA: abnormally low level of potassium in the blood.

HYPONATREMIA: low blood sodium level.

HYPOTHALAMUS: a brain center that integrates signals about the blood's temperature, glucose content, and other conditions.

IATROGENIC: disorder caused by a drug, treatment procedure, or diagnostic procedure.

IDIOPATHIC: self-originated; of unknown causation.

ILEUM: the portion of the small intestine extending

HYPERLIPIDEMIA: excess lipids in the blood.

HYPERLIPOPROTEINEMIA: excess lipoproteins in the blood.

HYPERNATREMIA: high level of sodium in the blood.

HYPERPLASIA: increase in tissue size by an increase in the number of cells.

from the jejunum to the cecum.

IMMUNE SYSTEM: a combination of cells and proteins that assists in the host's ability to fight foreign substances, such as viruses and harmful bacteria; includes the liver, spleen, thymus, bone marrow, and lymphatic system.

IMMUNOGLOBIN: antibodies; specialized proteins with a capacity to combine chemically with the specific antigens stimulation their production.

INDISPENSABLE AMINO ACIDS (Essential Amino Acids): amino acids for which synthesis is inadequate to meet metabolic needs and that must be supplied in the diet. Include: leucine, isoleucine, valine, tryptophan, phenylalanine, methionine, threonine, lysine, histidine.

INFLAMMATORY BOWEL DISEASE (IBD): a general term for inflammatory diseases of the bowel of unknown etiology, including Crohn's disease and ulcerative colitis.

INITIATING EVENT: an event caused by radiation or chemical reaction that can give rise to cancer.

INSENSIBLE WATER LOSS: water lost with air expired from the lungs or sweat evaporated from the skin.

INSOLUBLE FIBER: cellulose and some hemicelluloses that do not dissolve in water.

INSULIN: a pancreatic hormone that promotes glucose utilization, protein synthesis, and the formation and storage of neutral lipids.

INSULIN-DEPENDENT DIABETES MELLITUS (Type I): diabetes usually occurring in childhood and characterized by abrupt onset of symptoms: insulinopenia, dependence on exogenous insulin to sustain life, and a tendency to develop ketoacidosis.

INTERCELLULAR: between the cells.

INTERCELLULAR (INTERSTITIAL) WATER: the water between and around the cells.

INTERMITTENT CLAUDICATION: a complex of symptoms characterized by absence of pain or discomfort in a limb when at rest, and severely increasing pain during walking.

INTESTINAL FLORA: the bacteria normally present in the intestines.

ION: an atom or molecule that has acquired a net electric charge by gaining or losing electrons.

IRRITABLE BOWEL SYNDROME (IBS): an abnormal stooling pattern associated with symptoms of intestinal dysfunction that persists for longer than 3 months.

ISCHEMIA: deficiency of blood in a tissue, due to functional constriction or actual obstruction of a blood vessel.

ISCHEMIC HEART DISEASE: damage to the heart from a decreased blood supply and insufficient oxygen.

JAUNDICE (Icterus): yellowish discoloration of skin, mucous membranes, and certain body fluids caused by an accumulation of bile pigments in the blood, either from reduced excretion resulting from failure of the liver, or from increased production of bile pigments from hemoglobin.

JEJUNUM: the section of the small intestine between the duodenum and the ileum.

KERATIN: a water-insoluble protein found in hair and nails.

KETOACIDOSIS: a pathologic condition resulting from the accumulation of acid accompanied by the presence of ketone bodies.

KETONES: compounds derived from the oxidation of a secondary alcohol; produced when the body is relying almost entirely on stored fat for energy, such as in uncontrolled diabetes mellitus, or prolonged fasting or starvation.

KETOSIS: clinical condition is which ketone bodies accumulate in the blood and appear in the urine; acetone odor is apparent in the breath.

INTESTINAL MOTILITY: the rhythmic contractions of the intestinal muscle layer that move the intestinal contents along the passageway.

INTRACELLULAR: within the cell.

INTRINSIC FACTOR: a glycoprotein secreted by the gastric glands necessary for the absorption of vitamin B12; its secretion is impaired in pernicious anemia.

IODOPSIN: the light-sensitive pigment of the cones in the retina.

KILOCALORIE (KCAL OR CAL): 1,000 calories (small "c" calories); sometimes written as Calorie (big "C" calorie). Usually in nutrition, whether the "C" in calorie is capitalized or not, it means kilocalorie. The term kilocalorie is less confusing.

KREBS CYCLE: also called tricarboxylic acid cycle (TCA) or citric acid cycle; the main source of energy in the mammalian body, and the end toward which carbohydrate, fat, and protein metabolism are directed.

KWASHIORKOR: a form of protein-energy malnutrition associated with extreme dietary protein deficiency and characterized by hypoalbuminemia, edema enlarged fatty liver.

LABILE: Likely to undergo chemical change; unstable; labile nutrients are affected by light, oxygen, heat, etc.

LACTALBUMIN: protein found in the whey component of milk.

LACTASE: the intestinal enzyme that hydrolyzes lactose to glucose and galactose; necessary for digestion of milk and milk products.

LACTIC ACID: a product from glucose metabolism in anaerobic metabolism.

LACTOBACILLUS ACIDOPHILUS: a bacterium that can reside in the colon and inhibit the growth of bacteria that might be harmful. In milk or yogurt, reduces the lactose level.

LACTOOVOVEGETARIAN: a vegetarian who consumes dairy foods and eggs in addition to plant foods.

LACTOVEGETARIAN: a vegetarian who consumes dairy foods in addition to plant foods.

LACTOSE: a disaccharide composed of glucose and

galactose; the principal sugar found in mammalian milk.

LACTOSE INTOLERANCE: an inability to digest lactose to galactose and glucose because of a deficiency of lactase.

LEAN BODY MASS (LBM): the total of all body components except storage lipid.

LECITHIN (Phosphatidylcholine): a choline-containing phospholipid that is found in all plant and animal tissues, and frequently functions as an emulsifier.
LEUKOTRIENE: an eicosanoid whose function is the communication among the various types of cells involved in immunosurveillance, inflammation, protection against infection, and immune responses.

LIGAND: an organic molecule that donates the necessary electrons to form coordinate covalent bonds with metallic ions; for example, as oxygen is bound to the central iron atom of hemoglobin.

LIGNIN: a noncarbohydrate material sometimes included in fiber determination that is a major component of the woody portion of plants.

LIMITING AMINO ACID: the essential amino acid found in the shortest supply relative to the amounts needed for protein synthesis in the body.

LINOLEIC ACID: an essential fatty acid; a polyunsaturated fatty acid with 2 double bonds and 18 carbon atoms, found in linseed (flax seed), safflower, cottonseed, soybean, corn, and fish oils and in animal tissues.

LINOLENIC ACID: polyunsaturated fatty acid with growth-promoting effect; contains three double bonds and 18 carbon atoms, and can be synthesized in the body from linoleic acid.

LIPASE: an enzyme in pancreatic juice that digests fats.

LIPID: any of numerous fats (and oils) and fat-like materials that are generally insoluble in water, but soluble in common organic solvents; by definition, fats are solid at room temperature and oils are liquid at room temperature.

LIPOGENESIS: the transformation of nonfat food materials into body fat.

LIPOIC ACID (lipoate; lipoamide): classified as a

LEGUMES: the fruit or pod of beans, peas, lentils, etc.

LESION: a wound or injury; a pathological alteration of tissue.

LEUKOCYTE: white blood cell; classified as granular or nongranular.

LEUKOPENIA: a reduction in the number of white blood cells in the blood.

sulfur-containing fatty acid; a component of the enzyme that converts pyruvate to acetyl CoA.

LIPOLYSIS: the breaking down of fat.

LIPOPHILIC: fat loving. A substance that dissolves in fat. Also called hydrophobic (water hating).

LIPOPROTEIN: a combination of a lipid and protein, possessing the solubility of proteins; lipoproteins act as agents of lipid transport in the lymph and blood; chylomicrons, HDL, VLDL, LDL.

LIPOPROTEIN LIPASE: an enzyme that catalyzes the hydrolysis of fats present in chylomicrons and lipoproteins; found in various tissues and important in mobilization of fatty acids from depot fats.

LIPOTROPIC: pertaining to substances preventing or correcting the fatty liver of choline deficiency.

LISTERIOSIS: infection by listeria bacteria; produces diarrhea, vomiting, meningitis, and endocarditis.

LONG-CHAIN FATTY ACID: a fatty acid containing 13 to 27 carbons; 16 to 18 are most common.

LOW-DENSITY LIPOPROTEIN (LDL): a lipid/protein complex circulating in the plasma, transporting most of the blood cholesterol. This lipoprotein fraction is implicated in the risk of cardiovascular disease.

LUMEN: the inner open space of a tubular organ, as of a blood vessel or an intestine.

LYMPH: a clear fluid that flows through lymph vessels and is collected from the tissues throughout the body; its function is to nourish tissue cells and return waste matter to the blood stream.

LYMPH GLANDS: located along the lymph vessels,

they trap foreign material and produce lymphocytes.

MACROBIOTIC VEGETARIAN: persons who consume vegan or vegetarian diets which also involve non-animal food avoidances and extensive use of unprocessed, unrefined foods, especially brown rice and other whole grains.

MACROCYTIC ANEMIA: anemia characterized by larger than normal RBCs, increased mean corpuscular volume, and mean corpuscular hemoglobin.

MACROMINERAL: a naturally occurring, homogeneous, inorganic substance required by humans
MANNITOL: a sugar alcohol that exists in fruit, is poorly digested, and yields about half as many calories as glucose.

MARASMUS: a chronic form of protein-energy malnutrition in which the deficiency is primarily of energy.

MEDIUM-CHAIN FATTY ACID: a fatty acid with 8 to 12 carbons.

MEDIUM-CHAIN TRIGLYCERIDES: triacylglycerols with fatty acids of 8 to 12 carbons in length that are short enough to be absorbed directly into the portal blood.

MEGALOBLASTIC ANEMIA: anemia characterized by the presence of large, immature, abnormal RBC progenitors in the bone marrow; characteristic of a folic acid or vitamin B12 deficiency.

MELANIN: a dark pigment found in the skin, retina, and hair.

MENADIONE: synthetic form of vitamin K.

MENAQUINONE: vitamin K synthesized by bacteria.

MENOPAUSE: the period of cessation of menstruation, occurring around age 50.

METABOLIC RATE: an expression of the rate at which oxygen is used by the body.

METABOLISM: the chemical processes consisting of anabolism and catabolism; responsible for the production of energy, biosynthesis of important substances, and degradation of various compounds.

METALLOTHIONEIN: an abundant nonenzymatic zinc-containing protein.

in amounts of 100 mg or more per day; calcium, phosphorus, magnesium, sulfur, sodium, chloride, potassium.

MALABSORPTION: abnormal or inadequate gastrointestinal absorption of nutrients.

MALTASE: the intestinal enzyme that hydrolyzes maltose into glucose units.

MALTOSE (MALT SUGAR): a disaccharide composed of two glucose units.

METHYL: CH_3, derived from methane and occurring in many important organic compounds.

MICELLE: a particle containing lipids and bile salts that moves fatty acids from the intestinal lumen to the intestinal mucosa for absorption.

MICROCYTIC ANEMIA: anemia characterized by smaller than normal erythrocytes and less circulating hemoglobin; usually caused by a deficiency of iron.

MICROMINERAL (Trace Element): a naturally occurring, homogeneous, inorganic substance required by humans in amounts of less than 100 mg per day.

MICROVILLI: projections from the membranes of the cells of the villi; area of nutrient absorption.

MILK-ALKALI SYNDROME: a condition of alkalosis brought about by very excessive consumption of milk, calcium-containing antacids, or other alkaline substances; most likely to occur in older people with peptic ulcer.

MINERALOCORTICOID: adrenocortical hormones that regulate electrolyte balance; aldosterone is the most potent.

MITOCHONDRIA: organelles that are the principal energy source of the cell, and contain the cytochrome enzymes of terminal electron transport, and the enzymes of the Krebs cycle, fatty acid oxidation (beta-oxidation), and oxidative phosphorylation.

MODIFIED FOOD STARCH: starch that has been treated with a variety of chemicals so that it can still function as a thickening agent but can also form solutions with cold water that maintain stability in the presence of acid, freezing, and thawing.

MOLECULE: the simplest structural unit that displays the characteristic physical and chemical properties of a compound.

MONOGLYCERIDE: a lipid with one fatty acid attached to the glycerol molecule.

MONOSACCHARIDE: a sugar incapable of being digested to a simpler form; glucose, fructose, galactose.

MONOUNSATURATED FATTY ACID (MUFA): a fatty acid containing one double bond.

MORBID OBESITY: a state of adiposity in which body weight is 100% above the idea.
MUSCULAR DYSTROPHY: an inherited disease in which the muscles gradually weaken.

MUTAGENIC: capable of producing changes in DNA or chromosomal structure, resulting in permanent alteration in the genetic information carried by DNA.

MYALGIA: pain in a muscle or muscles.

MYOCARDIAL INFARCTION: heart attack; condition resulting from the occlusion of a coronary artery and interruption of the blood supply to cardiac tissue.

MYOGLOBIN: a ferrous protoporphyrin protein, similar to hemoglobin, that is present in muscle and stores oxygen.

MYOPATHY: any disease of the muscle.

MYXEDEMA: a disease caused by decreased activity of the thyroid gland in adults; characterized by dry skin, swellings around the lips and nose, mental deterioration, and a subnormal basal metabolic rate.

NECROTIZING ENTEROCOLITIS: a disease seen in infants which involves degeneration of a part of the intestinal tract.

NEOPLASM: an abnormal new growth of tissue; tumor.

NEPHRITIS: kidney disease resulting in some loss of function.

NEPHROSIS: any disease of the kidney, but especially when characterized by purely degenerative lesions of the renal tubules.

NET PROTEIN UTILIZATION (NPU): a measure of

MUCOPOLYSACCHARIDE: a compound comprising protein and carbohydrate found in connective tissue, collagen, and bone matrix; a more modern term is glycosaminoglycan.

MUCOUS MEMBRANE: the membrane lining all bodily channels that communicate with the air, such as the respiratory, and alimentary tracts, the glands of which secrete mucus.

MUCUS: a mucopolysaccharide (a relative of carbohydrate) secreted as a protective, lubricant coating by glands in the mucous membrane.

protein quality; the amount of protein nitrogen tant is retained from a given amount of protein nitrogen eaten.

NEUROPATHY: noninflammatory lesions related to functional disturbances in the peripheral nervous system.

NEUROTRANSMITTER: any chemical that results in the transmission of nerve impulses between neurons in the brain and nerves.

NEUTROPENIA: a reduction in the blood neutrophil (granulocyte) count often leading to an increased susceptibility to bacterial and fungal infections.

NEUTROPHIL: a granular leukocyte.

NICOTINAMIDE: niacinamide; a form of vitamin B3 that doesn't cause a flush.

NICOTINIC ACID: niacin; vitamin B3.

NIGHTBLINDNESS: poor vision in dim light or at night as a result of vitamin A deficiency.

NITROGEN BALANCE: relating to protein, it is the amount of nitrogen consumed as compared with the amount of nitrogen excreted in a given period of time.

NITROSAMINES: carcinogenic derivatives of nitrites that may be formed in the stomach when nitrites combine with amines.

NONHEME IRON: the form of iron found in eggs, grains, vegetables, and fruits, and which is less well absorbed than heme iron.

NON-INSULIN-DIABETES MELLITUS (Type II): diabetes characterized by a gradual onset with minimal or no symptoms of metabolic disturbance and no

requirement for exogenous insulin to prevent ketonuria and ketoacidosis.

NOREPINEPHRINE: hormone produced by the adrenal medulla that increases blood pressure by constricting the blood vessels; released predominantly in response to hypotension.

NORMOCHROMIC: normal color.

NORMOCYTIC: normal size.

NONSTEROIDAL ANTI-INFLAMMATORY DRUG (NSAID): type of drug used to treat osteoarthritis, rheumatoid arthritis, and other pain; available over the counter as aspirin, acetaminophen (e.g., Tylenol),
NUTRIENT DENSITY: the concentration of nutrients in a food. The higher the nutrient density, the higher the food quality.

OBESITY: a state of adiposity in which body fatness is at least 20% above the ideal.

OCCLUSION: the shutting off of the blood flow in an artery.

OLEIC ACID: an 18-carbon, monounsaturated fatty acid.

OLIGOSACCHARIDE: a carbohydrate that upon hydrolysis yields 3 to 10 monosaccharide units.

OMEGA NUMBER: the number of the carbon molecule with the first double bond, as counted from the methyl end of the fatty acid; for example, written as n-3 or ω-3 (or n-6 or ω-6).

OMEGA-3 FATTY ACIDS (n-3 or ω-3): fatty acids with the first double bond located at the third carbon from the methyl end of the hydrocarbon chain; most important are alpha-linolenic acid (ALA) found in flax seed oil, and its derivatives eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) found in fish oils.

OMEGA-6 FATTY ACIDS (n-6 or ω-6): fatty acids with the first double bond located at the sixth carbon from the methyl end of the hydrocarbon chain; most important is gama-linolenic acid (GLA) found in evening primrose and borage seed oils.

OPSIN: the protein of the visual pigments. Vitamin A is a helper nutrient, attached to opsin to form the pigment, rhodopsin.

proprionic acids (e.g., Ibuprofen), and other classes.

NUCLEIC ACID: a member of either of two groups of complex compounds found in all living cells, and composed of purines, pyrimidines, carbohydrates, and phosphoric acid.

NUCLEOPROTEIN: any of a group of substances found in all living cells and viruses, and composed of a protein and a nucleic acid.

NUTRIENT: a substance obtained from food and used in the body to promote growth, maintenance, and/or repair. The six classes of nutrients are carbohydrate, fat, protein, vitamins, minerals, and water.

ORGANELLE: a specialized part of a cell that resembles and functions as an organ.

ORGANIC: denoting chemical substances containing carbon.

OSSIFICATION: the natural process of bone formation.

OSTEOARTHRITIS (Degenerative Arthritis): noninflammatory degenerative joint disease occurring mainly in older persons, characterized by degeneration of the joint cartilage, hypertrophy of bone at the margins, and changes in the synovial membrane.

OSTEOMALACIA: a condition of impaired mineralization of the bones caused by vitamin D and calcium deficiencies.
OSTEOPENIA: insufficiency of bone resulting from reduced production or increased breakdown of the bone.

OSTEOPOROSIS: a loss of bone density to the point that the skeleton is unable to sustain ordinary stresses, and fractures develop.

OXALIC ACID: an organic acid found in certain leafy vegetables (rhubarb, spinach, chard, beet greens) that binds with calcium and inhibits its absorption from these foods.

OXIDANT: the substance that is reduced and that, therefore, oxidizes the other component of an oxidation-reduction system; may cause the production of free radicals.

OXIDATION: a reaction in which electrons are removed from a molecule. Usually the combination of a substance with oxygen.

PARASYMPATHETIC NERVOUS SYSTEM: the part of the autonomic nervus system that, in general, inhibits or opposes the physiological effects of the sympathetic nervous system, as in tending to stimulate digestive secretions, slowing the heart, and dilating blood vessels.

PARATHYROID HORMONE (PTH): controls the calcium level in the blood. Secreted by the parathyroid gland.

PARENTERAL NUTRITION: the delivery of nutrients directly into the circulation; can be either peripheral or central, total or supplemental.

PECTIN: a noncellulose polysaccharide made up of units of a derivative of galactose that is found in fruit.
PERNICIOUS ANEMIA: a macrocytic, megaloblastic anemia caused by a deficiency of vitamin B12.

PEROXIDATION: the addition of an oxygen atom at a double bond in an unsaturated fatty acid; can occur in the body or in food; can be caused by certain free radicals.

pH: the concentration of hydrogen ions (H^+); the lower the pH, the stronger the acid.

PHENYLKETONURIA (PKU): an inherited disease caused by a lack of an enzyme necessary for converting the amino acid, phenylalanine, into the amino acid, tyrosine.

PHLEBITIS: inflammation of a vein; marked by infiltration of the coats of the vein and by the formation of a thrombus.

PHOSPHOLIPID: a triglyceride in which one of the fatty acids is replaced by a substance containing phosphorus; lecithin is a common phospholipid.

PHYLLOQUINONE: vitamin K from plants.

PHYTIC ACID (Phytate): a phosphorus-containing compound found in the outer husks of cereal grains that binds with calcium and inhibits its absorption.

PICA: an abnormal craving to consume unusual substances such as clay, chalk, laundry starch, and dirt.

PLACEBO: an inert, harmless medication given to provide comfort and hope.

PLAQUE: a patch or small differentiated area on a

PELLAGRA: niacin deficiency disease.

PEPSIN: a digestive enzyme found in gastric juice that catalyzes the breakdown of protein to peptides.

PEPTIC ULCER: an eroded lesion in either the esophageal, gastric, or duodenal mucosa resulting from the action of acid in gastric juice.

PEPTIDE: any compound of low molecular weight that yields two or more amino acids on hydrolysis; constituent part of proteins.

PERISTALSIS: the movement of the intestine, or other tubular structure, characterized by waves of alternate circular contraction and relaxation of the tube by which the contents, such as food, are propelled onward.
body surface (e.g., skin, mucosa, or arterial endothelium) or on the cut surface of an organ such as the brain. In terms of heart disease, refers to mounds of lipid material, mixed with smooth muscle cells and calcium, which are lodged in the artery walls.

PLASMA: the clear, yellowish fluid portion of blood, lymph, or intramuscular fluid in which cells are suspended.

POLYDIPSIA: chronic, excessive thirst, as seen in diabetes mellitus or diabetes insipidus.

POLYMER: any of numerous natural and synthetic compounds of usually high molecular weight consisting of up to millions of repeated linked units, each a relatively light and simple molecule.

POLYP: in the colon, a mushroom-like growth that can progress to cancer.

POLYPEPTIDE: ten or more amino acids bonded together by peptide bonds.

POLYSACCHARIDE: a carbohydrate that upon hydrolysis yields more than 10 monosaccharide units.

POLYUNSATURATED FATTY ACID (PUFA): a fatty acid containing two or more double bonds; common in vegetable oils.

POLYURIA: excessive urination; common in diabetes.

POSTMENOPAUSAL OSTEOPOROSIS (Type I): a loss of density primarily involving the trabecular bone and characterized by fractures of the distal radius and crush fractures of the lumbar vertebrae.

POSTPRANDIAL: after a meal.

PRECURSOR: a substance from which another, usually more active or mature substance is formed.

PREFORMED VITAMIN A: form of vitamin A present in animal foods.

PROMOTER: a substance that does not initiate cancer, but that favors its development once the initiating event has taken place.

PROSTACYCLIN: prostaglandin I_2; a potent natural inhibitor of platelet aggregation and a powerful vasodilator.

PROSTAGLANDIN: any of a class of physiologically
PROTEIN EFFICIENCY RATIO (PER): a measure of protein quality; the grams of weight gained by growing animals per gram of protein fed.

PROTEIN ENERGY MALNUTRITION: a class of clinical disorders resulting from varying combinations and degrees of protein and energy deficiency; infants and children are particularly vulnerable; early symptoms include loss of appetite, easy fatigability, loss of weight, and retarded growth. Also called protein-calorie malnutrition.

PROTEIN-SPARING ACTION: the contribution of nutrients from carbohydrate and fat that allow amino acids to be used to build body proteins.

PROTEIN TURNOVER: the exchange of amino acids among organs within the body.

PROTEOLYTIC: relating to or effecting the decomposition of protein; proteolytic enzymes digest food proteins.

PROTHROMBIN: the protein in blood plasma needed for blood clotting.

PSORIASIS: a chronic, noncontagious skin disease characterized by inflammation and white, scaly patches.

PTEROYLGLUTAMIC ACID: folic acid.

PURINES: the nitrogenous bases, adenine and guanine, which are constituents of nucleoproteins, whose metabolic end-product is uric acid.

PUTREFACTION: enzymatic decomposition of
active hormone-like substances present in many tissues, with effects such as vasodilation, vasoconstriction, stimulation of intestinal or bronchial smooth muscle, uterine stimulation, and antagonism to hormones influencing lipid metabolism; produced in the body from omega-3 (n-3) and omega-6 (n-6) polyunsaturated fatty acids.

PROSTHETIC GROUP: a coenzyme that is physically part of its enzyme.

PROTEASE: an enzyme that breaks peptide bonds found in protein.

PROTEIN: a complex nitrogenous compound made up of amino acids in peptide linkages; involved in structures, hormones, enzymes, muscle contraction, immunological response.
proteins with the production of foul-smelling compounds, such as hydrogen sulfide, ammonia, and mercaptans.

PYRIDOXAL PHOSPHATE (PLP): a coenzyme containing vitamin B6 that is necessary for transamination reactions.

PYRUVATE: the end product of glycolysis; can be converted into lactate or acetyl CoA.

RANCID: having a musty, rank taste or smell due to fats that have oxidized and decomposed with the liberation of fatty acids.

REACTIVE POSTPRANDIAL HYPOGLYCEMIA: abnormally low concentration of blood glucose within 2 to 5 hours after eating.

RECOMMENDED DIETARY ALLOWANCES (RDA): recommendations for the average amounts of nutrients that should be consumed daily by healthy people in the US.

RECEPTOR SITE: a chemical structure on the cell membrane where a hormone or antigen binds.

RED BLOOD CELL (RBC): hemoglobin-enriched blood cells responsible for the transport of oxygen from the lungs to tissues.

REDUCED: altered by a chemical change involving a gain of electrons.

REFERENCE PROTEIN: egg protein; used by FAO/WHO as a standard against which to measure the quality of other proteins.

REFINED FOOD: a food from which the coarse parts have been removed. With respect to grains, a product from which the bran, germ, and chaff have been removed.

RENAL INSUFFICIENCY: inability of the kidney to excrete waste materials and conserve water, electrolytes, and other important molecules to the extent needed.

RESORPTION (Bone): the loss of bone matrix and mineral.

RESTING ENERGY EXPENDITURE (REE): the amount of energy used by a person in 24 hours when at rest, 3 to 4 hours after a meal.

RESTING METABOLIC RATE (RMR): the energy expended by a person at rest, expressed as kcal per kg
RIBONUCLEIC ACID (RNA): a nucleic acid found in all cells, consisting of ribose, phosphate, and the bases adenine, guanine, cytosine, and uracil.

RICKETS: a disease of abnormal ossification of the bone caused by a deficiency of vitamin D; occurs in growing children.

RODS: the cells of the retina that respond to dim light and convey black and white vision.

ROTATION DIET: an eating plan in which several foods known to cause allergic reactions or which are not tolerated, are eaten on separate days, and then only every fourth or fifth day for each food.

SACCHARIDES: carbohydrates; classified as mono-, di-, tri-, and polysaccharides according to the number of monosaccharide groups composing them.

SALMONELLOSIS: any disease caused by a salmonella infection, which may manifest as food poisoning with acute gastroenteritis, vomiting, and diarrhea.

SALT-SENSITIVE HYPERTENSION: hypertension that appears to respond to salt intake.

SAPONIFICATION: the process of hydrolyzing fats into soaps and glycerol by the addition of alkali.

SATIETY: the condition of being full or gratified beyond the point of satisfaction.

SATURATED FATTY ACID (SFA): a fatty acid with

of body weight per hr.

RETINA: the layer of light-sensitive cells lining the back of the inside of the eye; consists of rods and cones.

RETINAL: the aldehyde form of vitamin A, active in the eye.

RETINOL: the form of vitamin A with the highest biologic activity.

RHEUMATOID ARTHRITIS: chronic inflammatory systemic disease primarily of the joints, marked by changes in the synovial membranes and joint structures, and by atrophy and rarefaction of the bones.

RHODOPSIN: the light-sensitive pigment of the rods in the retina.

the formula $C_nH_{2n}O_2$ that has no double bonds and that contains all the hydrogen it can hold.

SCURVY: vitamin C deficiency disease.

SENILE DEMENTIA OF THE ALZHEIMER TYPE (SDAT): degenerative brain disease occurring beyond middle age and resulting in changes in behavior and in loss of memory, cognitive function, and speech.

SENSITIZATION: exposure to an antigen or allergen that results in the development of hypersensitivity.

SEROTONIN: a neurotransmitter produced from the amino acid, tryptophan, that assists in relaxation and sleep.

SERUM: the cell-free fluid that remains after the fibrin clot and blood cells are removed.

SET-POINT THEORY: the theory that a certain body weight is physiologically normal for each person, and that the body will resist deviation from that weight.

SHORT-CHAIN FATTY ACID: a fatty acid with 6 carbons or less.

SIMPLE CARBOHYDRATE: a simple form of sugar (mono- and disaccharides): glucose, fructose, galactose, sucrose, lactose, maltose, and other "oses".

SIMPLE PROTEINS: proteins such as globulins and albumins that yield only amino acids on hydrolysis.

SOFT WATER: water containing a high sodium

concentration.

SOLUBLE FIBER: pectins, gums, mucilages, and some hemicelluloses that form gels with water, and contribute to the lowering of serum cholesterol levels.

SORBITOL: a sugar alcohol occurring naturally in fruits; in mammals is found in some tissues such as the lens of the eye.

SPASTIC COLON: increased or uncontrolled contractions of the colon; irritable bowel syndrome.

SPORTS ANEMIA: a transient anemia seen in heavily training athletes characterized by a decrease in the RBC count, hemoglobin concentration, and packed cell volume, but with normal RBC morphology.

STARCH: a polysaccharide, composed of glucose, found only in plants. It occurs in both the amylose form
SUGAR ALCOHOLS: sugar-like substances (mannitol, sorbitol, xylitol) which are derived from fruits or dextrose; they are absorbed slower and metabolized differently than other sugars, and are not readily used by ordinary mouth bacteria.

SUPEROXIDE DISMUTASE (SOD): an enzyme protecting against damage from accumulating superoxide radical by reducing the radical to hydrogen peroxide and oxygen; requires copper, zinc, or manganese.

SYMPATHETIC NERVOUS SYSTEM: the portion of the autonomic nervous system that opposes the parasympathetic nervous system.

SYNAPSE: the gap between one nerve cell and the next nerve cell it communicates with. Neurotransmitters are the agents that facilitate the communication.

SYNDROME: a group of signs and symptoms that collectively indicate or characterize a disease, psychological disorder, or other abnormal condition.

SYNERGIST: a structure, agent, or physiologic process that aids the action of another.

SYNOVIAL FLUID: a clear, viscid, lubricating fluid secreted by membranes in joint cavities, sheaths of tendons, and bursae.

SYNTHESIS: the process of building up; the formation of complex compounds from simpler compounds.

and the amylopectin form.

STEATORRHEA: excessive amounts of fat in the feces, as seen in malabsorption syndromes.

STEROL: a compound composed of carbon, hydrogen, and oxygen atoms arranged in rings like those of cholesterol.

STOMATITIS: inflammation of the oral mucosa or soft tissues of the mouth.

SUCRASE: the intestinal enzyme that hydrolyzes sucrose to glucose and fructose.

SUCROSE: ordinary table sugar; a disaccharide composed of glucose and fructose found in sugar cane, sugar beets, molasses, maple syrup, maple sugar, fruit, vegetables, and honey.

TACHYCARDIA: rapid heart rate, usually above 100 beats per minute.

TERATOGEN: an agent or disease state capable of causing congenital malformations and other serious deviations from normal fetal development.

TETANY: muscle twitching, spasms, and eventually convulsions that can be caused by low levels of blood calcium or magnesium.

THERMIC EFFECT OF FOOD (TEF): the fraction of the total energy expenditure contributed by the processes of digestion, absorption, and metabolism of food; the increase in metabolism that is stimulated by eating.

THERMOGENESIS: the production of heat in organisms.

THROMBOXANE: an eicosanoid that is a potent inducer of platelet aggregation; also a vasoconstrictor, it is a physiologic antagonist to prostacyclin.

THROMBUS: a stationary clot; can grow large enough to close off a blood vessel.

THYROXIN: an iodine-containing hormone secreted by the thyroid gland to regulate the rate of cell metabolism (basal metabolic rate).

TISSUE: a collection of similar cells and the intercellular substances surrounding them. There are four basic tissues in the body: 1) epithelium; 2) the connective tissues, including blood, bone, and cartilage;

3) muscle tissue; and 4) nerve tissue.

TOCOPHEROL: vitamin E.

TOCOPHEROL EQUIVALENT (TE): basis for expressing the vitamin E activity of compounds as compared to the activity of 1 mg (1.49 I.U.) of alpha-tocopherol (natural vitamin E).

TOTAL ENERGY EXPENDITURE (TEE): the sum of the resting energy expenditure, energy expended in physical activity, and the thermic effect of food; the energy expended by an individual in 24 hours.

TRABECULAR BONE (Cancellous Bone): the spongy bone in the knobby ends of the long bones, the iliac crest, scapula, and vertebrae.

TRANSAMINATION: the transfer of an amino group from an alpha-amino acid to an alpha-keto acid; requires vitamin B6.
TRIPEPTIDE: three amino acids bonded together by peptide bonds.

TROPHIC EFFECTS: the stimulation of cell reproduction and enlargement.

TYRAMINE: an amino acid that can be synthesized in the body from tyrosine and stimulates the release of epinephrine and norepinephrine; also found in various food products, including aged cheeses and red wine; may cause migraine headaches.

ULCERATIVE COLITIS: chronic, recurrent ulceration of the mucosa and submucosa in the colon.

UNDERWEIGHT: a body weight 15% to 20% below the accepted weight standard.

UREA: the chief nitrogenous end-product of protein metabolism, and the chief nitrogenous constituent of urine.

UREMIA: an excess of urea in the blood.

URETHRA: the tube through which urine from the bladder passes out of the body.

URP (Unique Radiolytic Product): a product formed during the irradiation of food.

URTICARIA: a skin condition characterized by intensely itching welts; caused by allergic reactions to internal or external agents, by infections, or by psychic stimuli.

TRANS FATTY ACIDS: stereoisomers of the naturally occurring *cis* fatty acids; artifacts of the hydrogenation process; found in margarines and vegetable shortenings.

TRANSFERRIN: a protein synthesized in the liver that transports iron in the blood to the erythroblasts for use in heme synthesis.

TRANSIT TIME: the interval between the time when food is ingested and when the residue of that digested food is evacuated from the rectum.

TRANSKETOLASE: an enzyme essential in carbohydrate metabolism that requires thiamin (B1) as a coenzyme.

TRIGLYCERIDE (TRIACYLGLYCEROL): a lipid consisting of three fatty acid chains bound (esterified) to a glycerol molecule.

VASOCONSTRICTOR: agent that causes the blood vessels to decrease in diameter.

VASODILATOR: agent that causes blood vessels to increase in diameter.

VEGAN: a person who consumes only foods of plant origin and excludes all animal protein from the diet.

VEGETARIAN: a person who consumes primarily plant foods (grains, legumes, vegetables, and fruits) and eliminates meats, poultry, and fish from the food pattern; dairy foods and eggs may be consumed.

VEIN: a vessel that carries blood back to the heart.

VERY LOW-DENSITY LIPOPROTEIN (VLDL): a triglyceride-rich endogenous complex of lipid and protein for transport in the blood.

VILLI: finger-like projections from the folds of the small intestine.

VITAMIN: organic substances found in food in minute quantities which are essential for normal growth and metabolism, and that cannot be synthesized by the body.

WATER-SOLUBLE VITAMINS: vitamin C and the B-complex vitamins; those which dissolve in water.

WHEY PROTEINS: the proteins remaining in the watery fraction of milk after the curd and cream have

been removed.

WHITE ADIPOSE TISSUE: repository for triglyceride; a cushion to protect body organs and an insulator to preserve body heat.

WHOLE GRAIN: a grain that retains much of the material of its outside layers, except the chaff.

YO-YO EFFECT: the process of losing and gaining eight several times throughout a lifetime; characterized by a greater fatness after each cycle.

XERODERMA: a dry, rough, discolored state of the skin, with the formation of a scaly desquamation.

XEROPHTHALMIA: in the eye, the collective symptoms of vitamin A deficiency.

XEROSIS: abnormal dryness of the skin, mucous membranes, or conjunctiva.

XYLITOL: a noncariogenic (doesn't cause tooth decay) sugar alcohol absorbed one fifth as fast as glucose, and often used in sugarless chewing gum.