My friend Bob LeRoy is one of the most knowledgeable speakers and writers on nutrition that I know. When he spoke for TVS in January 2003, he gave me this useful summary of nutrition basics, which I think serves as a good reference. By way of introduction, Bob has been Nutrition Advisor to the North American Vegetarian Society since 1990. He holds an M.S. degree in Nutrition and Public Health, and Ed.M. in Community Nutrition Education, and is a Registered Dietitian. He also earned certifications as Fitness Instructor and Exercise Test Technologist from the American College of Sports Medicine. He has lectured on topics related to nutrition, health and vegetarian eating at over 60 locations. –Dilip

Good Nutrition

A Look at Vegetarian Basics

"Scientific data suggest positive relationships between a vegetarian diet and reduced risk for several chronic degenerative diseases and conditions, including obesity, coronary artery disease, hypertension, diabetes mellitus, and some types of cancer... It is the position of The American Dietetic Association (ADA) that appropriately planned vegetarian diets are healthful, are nutritionally adequate, and provide health benefits in the prevention and treatment of certain diseases."

-- Position Paper of The American Dietetic Association on Vegetarian Diets, 1999

Vegetarianism: satisfying our eating needs without using meat, poultry, fish. In the U.S., medical researchers have been noticing that this ancient approach, rooted in early human history, is a winning idea!

”Many scientific studies show that eating fruits and vegetables (especially green and dark yellow vegetables and those in the cabbage family, soy products, and legumes) protects against cancers at many sites, particularly for cancers of the gastrointestinal and respiratory tracts. Grains are an important source of many vitamins and minerals such as folate, calcium, and selenium, which have been associated with a lower risk of colon cancer in some studies. Beans (legumes) are especially rich in nutrients that may protect against cancer... Consumption of meat, especially red meat, has been associated with increased cancer risk at several sites, most notably colon and prostate."

-- Nutrition and Diet Recommendations published by American Cancer Society, 2000

We as a nation have some catching up to do: our per person consumption of vegetables, whole grains and beans is only a fraction of that of other nations such as China. The burgers and phenomenally fatty or seductively sweetened offerings at "fast food" establishments are very popular. There is vast room for improvement in American public health, and a vegetarian way of eating can help. This booklet can begin to show the way toward making wise food choices, based on the most recent scientific evidence.

Carbohydrates

A vegetarian diet is usually rich in carbohydrates, which are the most efficient source of body fuel. Simple sugars, as found in fresh fruits and vegetables, are the "instant energy" form of carbohydrate. Starches are the complex form which, when supplied by whole natural foods, provides sustenance over an extended period. Complex carbohydrates are
found in whole grains (such as products made from brown rice or whole wheat), legumes and vegetables, particularly the starchy vegetables such as potatoes, yams, corn, winter squash and various root vegetables. Wrongly maligned as "fattening", carbohydrates are actually filling. Like proteins, they contain approximately four calories per gram; fats have almost nine. A man who needs 3,000 calories daily would have to eat 29 potatoes or 37 apples or 46 oranges to maintain his body weight if no other foods were used.

Carbohydrates are not as easily turned into body fat as are dietary fats because carbohydrates burn more efficiently as fuel in times of demand. Excess carbohydrate calories are stored in the liver and muscles as glycogen (an energy reserve for work and exercise) until storage limits are reached. In contrast, dietary fat circulates through the blood and readily becomes part of fat tissues.

Nutritionally inferior foods such as white rice, white flour, white sugar and the breads and other foods made with them have given their quality cousins a bad reputation. These highly processed items are not recommended, but even they can be handled by the body more effectively than fatty foods.

Whole grains still retain their naturally occurring vitamins, minerals, phytochemicals and fiber, and are preferred sources of complex carbohydrates. These include whole wheat products, rolled oats, brown rice, whole corn meal products, popcorn, whole rye products, buckwheat, unpearled barley, millet, and the less familiar amaranth, kamut, quinoa, grain sorghum, spelt, teff and triticale. Most of the world's traditional caloric staple foods appear on this list.

Legumes, also important providers of complex carbohydrates worldwide, include members of the pea family (green and yellow peas, chickpeas, lentils, green soybeans) and many beans commonly used in the U.S.: aduki, black, black-eyed, fava, great northern, lima, mung, pink, pinto, red chili, red kidney, white navy. Yellow soybeans and peanuts are two legumes of different composition: they furnish more calories from fat than from complex carbohydrates.

Whole grains, legumes and starchy vegetables are more useful in helping keep blood sugar levels stable than are any other foods. They give support to physical energy and alertness through gradual effects over many hours.

The largest section of the U. S. Department of Agriculture Food Pyramid is devoted to foods supplying most of their calories as complex carbohydrates. The American Dietetic Association, National Institutes of Health, and American Academy of Pediatrics have formally declared that most of our calories should NOT come from protein, fat, or sugars and sweeteners. The medical and sports medicine professions have since the mid-1980's agreed that even for diabetes patients and athletes, more than half the daily calories should be drawn from complex carbohydrates.

Protein

Protein

We break down the proteins in our foods into their amino acid building blocks, which our bodies use to construct tissue proteins, hormones, enzymes and other substances crucial to our existence. When we take in more protein than we need for these purposes, we burn the excess as fuel. This surplus protein is not as desirable an energy source as is either carbohydrate or fat, since in using its calories we must discard its nitrogen-related portions. Thus we burden the liver and kidneys with additional excretion tasks.

How much protein do we need? This may be the most discussed nutrition question in society, but we can study many different scientific observations and eventually combine them into one easy-to-remember guideline. First, it is important to note that international organizations dealing with hunger and malnutrition problems have long shared this consensus: protein deficiency basically only appears as a public health problem when there is calorie deficiency, or else the range of foods available is terribly narrow. This means that when people simply have enough food to eat, overall, and any modest range and variety of food choices, they tend not to experience protein deficiency. Thus it would make sense to describe our protein needs as a percentage of our total calorie needs.

Assuming that we have sufficient food, and some diversity of it, how much of that food needs to provide us protein? One suggestion comes from the makeup of human breast milk: 6.1 to 7.5 percent of its calories are derived from protein. The World Health Organization has stated that, given adequate total calories, a minimum of 5 percent of those calories must come from protein... but a 10 percent level is more desirable. If we look back through several decades of recommendations made by major national and international nutrition bodies throughout the world, we find that nearly every guideline for adequate protein consumption has fallen into the range of 8 to 10 percent of overall calories.

As a final reference on desired protein quantity, let’s examine the U.S. Recommended Dietary Allowances. RDA’s show figures for total calories and for grams of protein in each of 18 different age- and gender-sorted groups. One gram of protein from commonly available foods would supply us anywhere from 2.44 to 4.36 calories, according to U.S.D.A. data. We may assume that a diet of mixed foods will provide approximately

3.5 to 3.75 calories for each gram of protein (an all-plant-based diet would offer no more than 3.5). Thus, we can see what percentage of calories from protein the RDA's actually propose for each group of people.

Infants are assigned 5.75 to 7.5 percent of calories from protein, much like the content of breast milk. Children up through 10 are matched with 4.3 to 5.25 percent of calories from protein. Females 11 to 50 receive 7 to 8.52 percent of calories from protein, and under pregnancy or lactation conditions this increases to 8.04 to 9.03 percent. Males 11 to 50 are assigned 6.3 to 8.15 percent. Persons over 50 are given the recommendation of 9.21 to 10.27 percent of calories from protein. Clearly, there is extensive evidence that a range of 8 to 10 percent of calories derived from protein should be adequate for the broad spectrum of people who are eating varied diets with enough food, and who are not suffering from unusual illnesses.

In addition, there is currently widespread agreement in the nutrition profession that when protein is drawn from a wide variety of natural foods, not just from one or two food families such as starchy root vegetables, the quality of the overall protein consumed will be adequate. There is no longer much support for the idea that meticulous simultaneous "combining" of different proteins is necessary.

How do we obtain 8 to 10 percent of calories from protein on a plant-based diet? Effortlessly! Protein is not confined to a few headline-making foods, but is distributed through all whole natural foods. Look at these examples of protein in plant-derived foods:

· 10 to 36%-dark green leafy vegetables
· 25 to 43%-mushrooms, asparagus, sprouts
· 16 to 39%-(fresh or dried) beans, peas, other legumes
· 11 to 20%-flax, sunflower, pumpkin and sesame seeds
· 6.6 to 11%-onions, turnips, rutabagas, carrots, Jerusalem artichokes, peppers, pumpkin
· 15 to 36%-other cabbage-family vegetables
· 7.2 to 15%-whole grains, carob, most sea vegetables
· 13 to 15%-tomatoes, beets, okra, celery, cucumbers, eggplant, radishes, summer squash
· 4.6 to 16%-nuts
· 6 to 9%-oranges, strawberries, figs, potatoes, parsnips, butternut/acorn/hubbard squash

Obviously, any diverse random mixture of whole natural vegetarian foods will supply enough protein to meet this guideline. Only sweet potatoes and some other starchy roots, plus coconuts, avocadoes and most fruits contain a lower percentage of their calories as protein than do the foods above. We must remember, though, that refined concentrated-fat and concentrated-sweetener foods have had virtually all their original protein content removed, and these relatively "junky" foods will not contribute to our protein needs.

Another important issue is that of protein overconsumption. In recent decades, at least 14 percent of total calories in the U.S. has come from protein, while people on the average are eating more calories than their bodies require. Protein overuse has implications for the risk of several major diseases, as noted in the renowned Study of Diet and Disease in China, one of the largest and most comprehensive epidemiological projects ever conducted. T. Colin Campbell, principal researcher, published the conclusion that of all the 300 variable lifestyle characteristics evaluated in the subjects, the one most associated with heightened risk of coronary heart disease, strokes, cancers, diabetes, osteoporosis and elevated serum cholesterol was the total amount of animal-derived proteins consumed. This relationship was independent of the fat, saturated fat or cholesterol content of foods eaten.

It has been known for decades that excess consumption of protein, particularly animal protein, dramatically increases the body's calcium excretion and heightens risks of osteoporosis. More recently, allergenic responses to animal-origin food proteins have been linked to the occurrence of auto-immune diseases. For example, extensive scientific research has linked risk of childhood-onset insulin-dependent diabetes to certain cow's milk proteins. Further, dairy products are more likely than other foods to flare up the symptoms of lupus erythematosus, ulcerative colitis and rheumatoid arthritis. It has been known since the 1800's that cow's milk proteins instigate allergenic reactions in a greater number of people, and in a greater number of children or infants, than do any other foodstuffs. It has long been understood that asthma may emerge as a complicating symptom of this kind of allergy for some people.

The possibility of allergenic responses, even when involving plant-based foods and totally unrelated to auto-immune disease, is a strong reason to avoid extreme overconsumption of protein, and to diversify protein

sources. Eating large amounts of a single kind of food protein may sensitize one to it in an allergic way, though modest use over a lifetime may never cause the slightest trouble. Since processed soy products like tofu, which averages 61% of its calories from protein, are increasingly being used by vegetarians, much to the exclusion of numerous other foods, caution about avoiding soy overdosing may be prudent.

Fats

Fats enhance flavor of foods and increase satiety by slowing the emptying of the stomach. In our bodies they transport fat-soluble vitamins such as D, K and the antioxidants A and E, and they are integral parts of mammary tissue and of all cell membranes . The essential fatty acids linoleic and alpha-linolenic acid must be supplied by our food. A balanced diet of vegetables, fruits, whole grains, beans, seeds and unprocessed nuts can provide these antioxidants and essential fats without burdening us with many fat calories. However, in reality, most U.S. people take in nearly all of their fats from animal-derived foods and processed vegetable oils, and they overconsume them in alarming amounts. Thus, we need guidance both about reducing fats in our diets and about shifting toward different kinds.

Fats and Our Blood

Major sources of fat in the typical diet are animal products such as meat, fish, poultry, cheese, whole milk, eggs, butter and lard, and refined vegetable fats (margarine and shortenings, salad and cooking oils, hardened fats used as ingredients). Animal fats, coconut and palm oil, and cocoa butter are mostly saturated. In essence, this means that these fats are solid at room temperature, and physiologically, it means that they are one of the greatest factors in raising blood cholesterol levels. They help clog arteries and increase the likelihood of death by heart attack. Coronary heart disease, stroke and male impotence are all illnesses of impaired blood circulation usually caused by buildup of fatty plaques on artery walls.

Cholesterol is manufactured in the livers of most animals and is used for hormone production. We humans make all that we need, yet most people get a daily overload from eating meat, fish, poultry, eggs and dairy products. Extra cholesterol resists breakdown, deposits in tissues and contributes to atherosclerotic plaque. Vegetarians generally have lower levels of serum cholesterol than do meat-eaters, and vegans (who eat no animal products) have the lowest of all.

Food processors often take “unsaturated” vegetable oils and pump additional hydrogen into them to give them solidity, as in the production of margarine and shortening. These hydrogenated fats (also known as “trans” fatty acids) are seen as ingredients in countless baked goods and some peanut butters. Scientific consensus is that they worsen blood cholesterol content and increase coronary artery disease risk just as do naturally saturated fats.

Another primary risk factor for heart disease is obesity. Vegetarian diets tend to make weight control a bit easier because they are usually less calorie-dense than the diets of non-vegetarians. This means that a similarly sized plate of food would, on the average, contain fewer calories. This is partly because the two kinds of food most associated with vegetarians - vegetables and fruits - have very high water content and so by their nature are extremely low-calorie foods. This is also due to the fact that fat contains more than twice as many calories by weight as does either protein or carbohydrate. Because most animal-based foods are very high in fat, the move toward vegetarian eating usually involves some further calorie reduction.

Yet another primary risk factor for heart disease is high blood content of homocysteine. This amino acid, made in the body from other sulfur-containing amino acids, seems to initiate some artery wall damage, paving the way for buildup of fatty cholesterol-laden plaques. Homocysteine levels generally remain well under control if the body consumes enough folic acid, vitamin B6 and vitamin B12. Folic acid and vitamin B6 are plentifully supplied by a diet rich in vegetables, whole grains and beans. Vitamin B12 sources are discussed under “Vitamins.” An excess supply of sulfur-containing amino acids can be promoted by overconsumption of proteins, particularly of animal-derived proteins.

Too Much Fat

The U.S. diet has for decades averaged 40-44 percent of calories coming from fat. Even conservative nutritionists recommend a reduction to 30 percent, and many physicians and biochemists are convinced that adults should slash total fat to 10 percent of calories while improving its quality. Cutting the overall fat content (regardless of what foods it comes from) of one's diet to well below the "American norm" offers several clear health advantages:

- speeds movement of digesting food through the colon, thus:
  --reducing absorption of any toxins or cancer-causing agents there may be.
  --reducing re-absorption of a woman's estrogen, helping to control one risk factor for breast cancer.

- helps avoid potentially dangerous blood pressure increases in the hours after a meal by reducing the fatty sludging of blood cells.

- reduces the body's load of vulnerable fatty molecules which could suffer oxidation damage by "free radical" chemicals (this damage is part of the development of some major diseases).

- makes it a bit easier for our insulin to do its work of controlling blood sugar levels.

Populations who eat higher-fat diets usually show greater incidence of many kinds of cancer than do those eating lower-fat diets. However, scientific research is unclear about what in people's lifestyles causes this. For example, how do we separate the effect of the amount of fat from that of the kind of fat? ... and how do we separate the effect of animal-derived fat from that of animal-derived protein?

Essential Fats Which Must Come From Our Food

Linoleic acid (the most common "omega-6" fatty acid) is required for nervous system development and many other body functions. Though it is deficient in cow's milk products, it is abundantly supplied in human breast milk and widely found in plant-derived foods. However, the availability of the crucially important alpha-linolenic acid (the most common "omega-3" fatty acid) is a more complicated matter. We use this fatty acid to make regulating substances which serve us in many ways:

- limit inflammation and the inflammatory response.
- tone down allergic reactions.
- reduce auto-immune disease activity.
- reduce heart rate and blood pressure.
- slow the progression of degenerative diseases.

Cholesterol, saturated fats and hydrogenated fats, all of which we don't need in our food, and lineolic acid, which we do need, share a major problem: in large amounts, they all decrease our body's ability to process the alpha-linolenic acid we depend on so heavily. It is obvious that we can minimize these first three fats in our diet by removing meat, fish, poultry, eggs, dairy products, margarine, shortening and foods using hydrogenated ("trans") fats as an ingredient. We must also learn to balance out the omega-3 and omega-6 fatty acids.

Most plant-derived fats consumed in the U.S. are refined oils almost totally devoid of omega-3 fatty acids but with plentiful omega-6 content: corn, safflower, peanut, sesame, sunflower and cottonseed oils. Olive oil, palm oil and high-oleic sunflower or safflower oils have only modest omega-6 fats but still around zero omega-3 fats, so they contribute to exactly the same problem: our omega-3 fatty acid needs are sabotaged by an overwhelming glut of omega-6 fatty acids from refined oils.

What about using plant-based fat sources besides refined oils? Avocadoes and pumpkin seeds don't seem to worsen the omega-6 : omega-3 balance. However, how is this affected when we are eating all-natural peanut butter, peanuts, almonds, cashews, filberts, pecans, pistachios, tahini, sesame seeds, and sunflower seeds? Though these are nutritious foods, we are thereby again adding omega-6 fats accompanied by approximately zero omega-3s. The problem still grows.

Canola oil is a refined oil but is relatively high in omega-3 fats. It comes from rapeseed, most older varieties of which contained anti-nutritive factors and were not used as human food. Today most canola oil is from genetically modified rapeseed and poses possible hazards not fully understood. However, some canola oil is produced from organically grown rapeseed.

The single most important task-to-remember for vegetarians and vegans is probably: try to get enough omega-3 fatty acids and avoid excess omega-6's. However, with a diet of natural, unrefined foods dominated by a very wide variety of vegetables, fruits, whole grains and beans, this would probably be easy! Here is the four-part explanation:

(1)-VEGETABLES: Though only about 1 to 15 percent of their calories are fat calories, their fats have a greater percentage coming from omega-3 fatty acids than do the fats of any other foods! So, let's eat as many vegetables as we can! (Also... fruits will do nothing to disturb the fatty acid balance, so we may eat them as we wish.)

(2)-WHOLE GRAINS: The fats in whole grains such as wheat and oats are reasonably balanced between omega-6's and omega-3's, but those in corn are badly imbalanced. If we eat a wide assortment of whole grains not dominated by corn, the overall effect should be positive.

(3)-BEANS, PEAS, OTHER LEGUMES: The fats in legumes such as soybeans and chickpeas are reasonably balanced between omega-6's and omega-3's, but those in peanuts are badly imbalanced (and in large supply). If we eat a wide assortment of legumes including only modest amounts of peanuts, the overall effect should be positive.

(4)-CONCENTRATED SOURCES OF OMEGA-3 FATTY ACIDS: It is extremely desirable to add some of these:

- flax seeds (their oil is the most abundant source; they are suitable to be ground up, then immediately put into refrigerator/freezer, as their oil is the most perishable oil known)
- spirulina, other algae (the sources from which fish get their sizable supply of "next-stage" omega-3 fats; available as powdered supplements)
- alaria or wakame sea vegetable (from Canada/Maine or Japan, respectively)
- hemp or chia seeds (hemp is a new market product, chia a Mexican commodity)
- walnuts (only favorable source among common nuts; choose based on freshness)

To meet omega-3 needs comfortably, we should try to observe the above four guidelines while steadily reducing or eliminating animal-derived foods, margarine, shortening, foods using hydrogenated ("trans") fats as an ingredient, and refined oils.

Vitamins

With two exceptions, all known vitamins are amply provided by plant foods. The accompanying chart illustrates this for most vitamins. We should explain two families of vegetables mentioned in the chart:

(1) DARK GREEN LEAFY VEGETABLES: examples include kale, collard greens, bok-choi, spinach, very dark lettuces, leeks, scallions, parsley, watercress, arugula, escarole, chickory greens, dill, fennel/anise, basil, cilantro, chives, mint, chard, beet greens, turnip greens, mizuna, mustard greens, dandelion, garlic scapes (greens), broccoli rabe.

(2) CABBAGE FAMILY: examples include kale, collard greens, bok-choi (yes, some are in both!), broccoli, broccoli rabe, cauliflower, green cabbage, red cabbage, savoy cabbage, nappa / Chinese cabbage, brussels sprouts, kohlrabi, rutabagas, turnips, turnip greens, mizuna, mustard greens, and the sprouts of broccoli, cabbage, rutabaga or turnip seeds.

Vitamin A - Dark green leafy vegetables; deep-yellow fleshed root vegetables (e.g. carrots, sweet potatoes), squashes (e.g. butternut) and fruits (e.g. apricots, peaches, cantaloupes); red peppers; broccoli

B vitamins - Dark green leafy vegetables, sprouts and nutritional yeast are good sources of a broad spectrum of B vitamins. Specific vitamins follow.

• **thiamin** - Beans and peas, peanuts, sunflower and sesame seeds, whole grains, some nuts, laver sea vegetable, asparagus, okra, Jerusalem artichokes, cabbage-family vegetables, garlic, potatoes

· **riboflavin** - Mushrooms, almonds, whole grains, sea vegetables, beans and peas, okra, asparagus, cashews, avocado, broccoli, sweet potatoes, bok-choi, bananas, peanuts

• **niacin** - Peanuts, sea vegetables, mushrooms, seeds, beans and peas, potatoes, almonds, whole grains, asparagus, sweet corn, avocado, dried apricots, dates, cashews, prunes

• **pyridoxine (B6)** - Sea vegetables, legumes, walnuts, peanuts, bananas, potatoes, sweet potatoes, figs, avocado, whole grains, cauliflower, cabbage, beets, watermelon, tomatoes, raisins, prunes, okra, oranges

• **pantothenic acid & biotin** - Beans, peanuts, oats and other whole grains, cauliflower, pecans, walnuts, almonds, mushrooms, avocado, sweet potatoes

• **folic acid** - Beans and legumes, whole grains, asparagus, avocado, brussels sprouts and other cabbage-family vegetables, mushrooms, almonds, walnuts, pecans, beets, parsnips, tomatoes, peanuts, sunflower and sesame seeds, okra, onions, sweet potatoes, some fruits

Vitamin C - Dark green leafy vegetables, sweet peppers, broccoli and other cabbage-family vegetables, sprouts, citrus fruits, tomatoes, berries, tropical fruits, asparagus, okra, fresh beans and peas

Vitamin E - Dark green leafy vegetables; sprouts other than alfalfa; sweet potatoes; pumpkin and sunflower seeds; mango; whole soybean products such as tempeh; cabbage-family vegetables; asparagus; whole grains; avocado; walnuts, sea vegetables; peanuts; pecans; almonds; parsnips; tomatoes

Vitamin K - Dark green leafy vegetables, cabbage-family vegetables, legumes, asparagus, some sea vegetables.

There are many more plant-derived sources of these vitamins than those listed above.

Two vitamins merit extra attention. The first, vitamin D, is actually a family of hormones. It is vital to calcium metabolism and a deficiency can lead to rickets in children. The source of vitamin D intended by nature is sunlight's action on the skin. Because this fat-soluble vitamin is stored in the body, reasonable time spent in the sunshine during the warm months should provide enough to last the winter. Dark-skinned children and those who live in far northern latitudes or in cloudy or smoggy areas should be sure to use reliable dietary sources of vitamin D. Though the vitamin D added to cow's milk is well publicized, there is no need to use this product. Vitamin D-2, or "ergocalciferol", is commercially produced from plant sources and added to many vegetarian foods and supplements. Vegetarians should avoid vitamin D-3, or "cholecalciferol" (also a common ingredient or supplement), normally derived from animal body parts. Nutritionists recommend that we do not take in more than the Recommended Daily Allowance of 5 mcg (10 after age 50) due to toxicity risks. We should be aware that many foods fortified with vitamin D have been found to contain (in error) amounts greater than those stated on their labels.

The second, vitamin B12, is essential for the nervous system, for energy metabolism, for the health of our DNA and red blood cells, and for cell division throughout the body. In recent years, it has been clarified that it (along with folic acid and vitamin B6) is also crucial to holding down our levels of amino acid homocysteine by assisting conversion to other sulfur-containing amino acids. Excess homocysteine in the blood is likely to cause oxidative damage in cells and blood vessels, increasing risk of coronary artery diseases and some kinds of cancer.

Attention to this vitamin is necessary for all people, regardless of the kind of diet they choose to eat. Though it is required in microscopic amounts, the consequences of its deficiency may be extremely serious. Nervous system symptoms of deficiency may remain hidden for years. Erroneous information about sources of the vitamin is widespread and often falsely reassuring.

Vitamin B12 is made by bacteria in the soil. Humans' greatest historical source for B12 was the same as that relied on by other land animals: soil particle contamination clinging to the outside of every foodstuff in nature. Changes of industrialized life make it impractical or undesirable to eat large amounts of unwashed, unpeeled plant-origin foods each day, so we now lack our easiest means for getting this vitamin.

Tempeh, sea vegetables, mushrooms and sprouts had been publicized as practical B12 providers, but later research has shown them not to be reliable sources.

It is clear that each of us should take supplemental forms of the vitamin. Active B12, generally labeled as cyanocobalamin, is produced commercially via bacterial fermentation, and not taken from animal tissue. It is available alone in pills, as part of multi-vitamin preparations, and as an added ingredient in many packaged vegetarian foods. The solo pill form is regarded as most reliable in terms of potency; the megadoses of other vitamins which may be present in a multivitamin can interfere with absorption or usage of B12. A once or twice weekly dosage would seem adequate for nearly all people without current deficiency or digestive disorders to maintain their vitamin B12 levels long-term. However, anyone with possible doubts about past B12 history is strongly urged to take supplements daily for a transition period of at least a few years.

Minerals

Minerals help in the body's acid-base balance, aid in the maintenance of osmotic pressure, assist in blood clotting, provide a medium for nerve transmission and muscle contraction, and much more. They are generally plentiful in a varied vegetarian diet of natural foods.

Well Supplied, Without Worry About Absorption Rates

Whole grains, beans, nuts and seeds, all important mineral sources, contain something called phytate phosphorus which partly reduces the percentage we absorb of certain “alkaline” minerals from our food. Calcium, iron, magnesium and zinc are among these minerals. This lowering of absorption is not a serious issue, as exemplified by tests involving calcium. Research studies have found the calcium absorption percent for various whole wheat and soy products at least comparable to that for cow's milk. Also, sprouting or fermenting any of these items enhances its absorbability of these minerals. Thus when we use soy or multi-grain tempeh, sourdough whole grain breads, brown rice amasake, yogurt from soy or nuts, or sprouted beans/peas/grains, we’re digesting an even greater share of these minerals than we would have by eating the original ingredients. Overall, whole grains, beans, nuts and seeds do make a significant contribution to our mineral needs, especially if we choose a wide variety of them. .

The only other foods documented as showing a much lower absorption rate for these alkaline minerals are the "excess oxalate" ones. Those few commonly used in the U.S.are spinach, chard, beet greens, rhubarb, unhulled sesame seeds, beets, parsley and a few weeds. These are still nutritious foods, but we simply don’t digest as much of their mineral content as we’d expect. We should let them be modest parts of our diet, not the dominant foods, not relying upon them as major mineral sources. Spinach and parsley shouldn’t be the only salad greens we ever use!

We will examine individually some minerals of special interest.

· **Calcium** provides the mineral matrix for teeth and bones, and it plays a role in blood clotting, nervous system activity, muscle relaxation and enzyme activity. It is important to the health of the heart, and seems to help control the risk of certain types of cancer.

Calcium is an essential mineral we all must ensure that we get from our diet, but someone eating a wide variety of natural plant-based foods generally has no need to take calcium supplements. The richest calcium sources on the planet are dark leafy greens (they're also what cows use), but many vegetables, fruits, legumes, whole grains and unprocessed nuts/seeds make a significant contribution to our calcium supply. Seeking diversity of whole plant-derived foods is more beneficial than is eating a narrow-range or junk-based diet after we've identified one calcium "powerhouse" food. At least 11 vegetables commonly used in the U.S. contain more calcium per calorie than do any (even the "skim") cow's milk products; these are bok-choi, turnip greens, watercress, mustard greens, collard greens, kale, chicory greens, dandelion, escarole, dark lettuces and fennel/anise. Twenty seven common vegetables, plus carob, oranges, tangerines, papayas, currants, figs and several seaweeds, have a greater calcium-to-protein ratio than does any dairy food... important to note because the amount of protein eaten is one of the main factors causing the body to need more calcium. Kale, turnip greens, broccoli and related vegetables have even demonstrated a higher calcium absorption percentage than has cow's milk.

Physical inactivity and consuming excess protein (especially from animal-derived sources) can drastically increase the body's daily calcium excretion in the urine. These are major risk factors for osteoporosis. Some of the factors helpful to bone health are: limiting use of sodium salt; getting adequate sunlight or supplementing vitamin D (D2, ergocalciferol) if sun-deprived; keeping magnesium and phosphorus intake in reasonable proportions to that of calcium; and avoiding tobacco, excess caffeine, steroid drugs, aluminum contamination, and excess alcohol. A woman's estrogen drop at menopause does cause the body to excrete more calcium than before, so she needs to pay more attention to this mineral. However, dozens of research studies from the 1920's right up through the present have shown this: the increase in daily calcium loss caused by eating a high-protein rather than low-protein diet is greater than the change in calcium loss caused by any of the other factors just mentioned. Only immobilization of the body would have as negative an impact (weight-bearing exercise provides an extremely positive effect!)

Human milk, designed by nature to meet the needs of a child during its most rapid growth period, has only 75 mg of calcium per cup, compared to 265-275 mg/cup in cow's milk. This suggests that, in spite of the recent intense media focus on calcium, human needs may actually be less than we've believed, for people who don't burden themselves with the osteoporosis risk factors discussed above. We do know that the intestine absorbs calcium more efficiently from low-calcium diets than from high calcium diets. Indeed, comparative studies of populations throughout the world have consistently found: countries who consume more calcium (they use more cow's milk products and animal-origin foods as well) have much higher rates of bone fractures and other osteoporosis indicators than do countries who consume less calcium (they use less cow's milk products and animal-origin foods as well). Thus, the United States, Canada, western Europe, Australia and New Zealand show the greatest occurrence of osteoporosis problems in the world.

These results are compatible with the findings of various clinical studies which fail to demonstrate a protective effect for dairy products against osteoporosis. One example: the famous Nurses Health Study, with over 75,000 subjects, conducted by Harvard.

• **Iron** is the central element in the hemoglobin molecules which carry oxygen through our blood. It also plays a part in our muscle cells' energy systems, in our immune system, and in some brain and nervous system functioning. It is well publicized that meat does contain iron, but also true that cow's milk products are quite deficient in it. Dairy products have been further incriminated in scientific research as the cause of hypochromic microcytic anemia in infants... an iron deficiency anemia arising through intestinal bleeding. Because of this and because of the extensive scientific evidence linking dairy products to infant insulin-dependent diabetes, the American Academy of Pediatrics recommended that unmodified cow's milk not be given to infants under one year of age.

The 25 or 30 foods showing the greatest iron content per calorie would all be fresh vegetables, except that a few sea vegetables like dulse, kombu kelp or alaria/wakame would be included. Dark green leafy vegetables, other than the higher-oxalate spinach, chard, beet greens and parsley, should be seen as the finest sources among common foods. Iron absorption is increased when foods high in vitamin C are used simultaneously, but in the case of most fresh vegetables and fruits, each food is already a useful source of both these nutrients anyway. Eating a wide variety of vegetables, fruits, whole grains and legumes, with optional addition of nut/seed foods, offers easy opportunities to meet normal iron needs.

Our bodies handle absorption of “heme” iron, as found in animal-origin foods, and of “non-heme” iron, as found in plant-origin foods, differently... and viva la difference! Our bodies seem to be safeguarding us this way. Overall, heme iron’s absorption rate seems a bit higher than that of non-heme iron, but it is fairly constant, unvarying. In contrast, we tend to absorb a much higher percent of non-heme iron when iron is scarce, and a much lower percent when it’s’ plentiful. When consuming iron from plant sources, we thus protect ourselves from possible iron overdose. In large amounts, iron can act as an “oxidizing agent” and cause “free radical” damage in our cells and blood vessels. Thereby risks of illnesss like cancer and coronary heart disease would be much greater. When we eat iron from animal products, we lack the safety measure of turning down the absorption rate in times of excess.

• **Zinc** is a part of over 80 enzymes, does teamwork with many vitamins, is involved with protein, fat and carbohydrate metabolism, and plays a key role in our immune and reproductive systems. Deficiency, likely seen in conjunction with other conditions such as alcoholism or rheumatoid arthritis, may cause retarded growth and wound healing, nervous disorders, and impairment of the senses of taste and smell.

People relying mainly on refined foods, such as white flour, white rice, concentrated fats and sweeteners, may have difficulty meeting requirements for zinc. However, the amount of zinc per calorie found in vegetables, whole grains, legumes and nut/seed foods varies surprisingly little. Simply emphasizing a wide variety of whole, natural plant-derived foods and avoiding “empty calorie” foods should serve zinc needs well. When zinc deficiencies have been found in studies throughout the world, they have occurred with people unable to get enough or sufficiently varied food, or people who lost large amounts of minerals due to sweat dehydration, parasites or unusual illness. Dark green leafy vegetables, other than the higher-oxalate spinach, chard, beet greens and parsley, are, as expected, very useful common sources, along with sprouts made from beans. Pumpkin seeds, sunflower seeds and nutritional yeast are often publicized as helpful “supplemental” foods for zinc, but along these lines the most impressive example would be sea vegetables such as dulse, kombu kelp or alaria/wakame.

• **Iodine** is crucial to our energy metabolism via its role in thyroid gland functioning. Our iodine needs are small but must be supplied by what we eat. More so than with other minerals, iodine has its content in foods varying widely according to production conditions. Traditionally, foods grown farthest from oceans have been most likely to be iodine deficient. Recent generations in the U.S. have looked toward the table salt condiment (whether “iodized” or “sea” salt) as providing some assurance that enough iodine was being consumed. Drastic overuse of table salt in the U.S. has increased risk of high blood pressure and osteoporosis, and it is desirable to cut back somewhat on this sodium use. An additional iodine source would be sea vegetables such as dulse, kombu kelp or alaria/wakame. Very modest use of any of these would provide plenty of iodine.

We should be reassured: though eating most cabbage-family vegetables or legumes in very large amounts will lower the rate at which food iodine reaches the thyroid gland, this is of no concern when there is a reliable iodine source in the diet.

Antioxidants and Other Phytochemicals

Extensive scientific research over the last 20 years has shown that many more substances found in plant-derived foods are actually highly beneficial to human health. These naturally occurring chemicals, present in microscopic amounts, and not classified as vitamin or mineral, are known as "phytochemicals". Many of them have shown the effect of
lowering blood cholesterol levels. Many of them act as "antioxidants" in our bodies, particularly protecting us from damage in our cell membranes, just as do the vitamins A, C and E. This means that they help prevent destructive oxidizing chemicals like free radicals from attacking us where we are most vulnerable. Their work helps to resist cancer development, and to slow down the progress of aging and of degenerative diseases.

Thousands of health-promoting phytochemicals have been discovered, mainly in fresh vegetables and fruits, and "new" ones emerge every month. This chart shows many for which some research has demonstrated cancer-fighting properties. We should explain two families of vegetables mentioned in the chart:

(1) CELERY FAMILY: examples include celery, carrots, parsley, dill, parsnips, fennel/anise, cilantro, celeriac, caraway.

(2) ONION FAMILY: examples include garlic, red/white/yellow onions, scallions, leeks, chives, shallots, garlic scapes (greens).

PHYTOCHEMICALS LINKED TO CANCER-PREVENTIVE EFFECTS	USUAL FOOD PIGMENT	FOODS GENERALLY RECOGNIZED AS SIGNIFICANT SOURCES
lutein and100's of miscella. carotenoids	orange/yellow	dark greens + same foods as for plant vitamin A
anthocyanins (polyphenolic flavonoids)	blue/purple	blueberries, other berries, grapes, plums
indole-3-carbinol, other indoles		cabbage-family
sulphoraphane	blue/purple	cabbage-family
other glucosinilates and aromatic isothiocyanates	blue/purple	cabbage-family
coumarins		celery-family, citrus
rutin and flavone flavonoids		celery-family, citrus, olives, buckwheat, asparagus, rose hips, some other fruits
d-limonene and limonoid monoterpenes		citrus
d-carvone and other monoterpenes		citrus, onion-family, ginger, dill, mint, caraway
diphenolic lignans		flaxseed, whole grains, legumes, other seeds
allylic sulfides		garlic and onion-family
thiosulfinates		garlic and onion-family
triterpenes		garlic and onion-family, licorice root, legumes
quercetin and flavonol flavonoids		grapes, olives, cranberries, greens, buckwheat
proanthocyanidin flavonoids	blue/purple/red	grapes, cranberries, blueberries, apples, rhubarb, barley, rose hips, legumes, sorghum
chlorophyllin	green	green peas
tannins, catechins, other polyphenols		legumes, c. sinensis green tea, grapes, carob
lectins		legumes
Bowman-Birk protease inhibitor		soybeans, lima beans, peanuts, other legumes
genistein, daidzein, diphenolic isoflavones		soybeans, other legumes, licorice root
lycopene carotenoids	red, purple-red	tomatoes, red cabbage, watermelon, red grapefruit, guava, some berries and other fruits
phenolic acids and phenolic curcurmin		turmeric, ginger, raspberries, grapes, cherries, strawberries, other fruits, garlic, onion-family, legumes, whole grains, nuts, vegetables, cumin

Fiber

A lack of what Grandma called roughage has been linked with ills ranging from constipation to colon cancer to varicose veins to heart and artery disease. "Fiber" refers to many kinds of non-digestible non-calorie-supplying carbohydrate. It is what prolongs and gradualizes digestion/absorption of starches in whole grains, legumes and starchy vegetables... thereby allowing them to have a stabilizing influence on blood sugar levels and a "sustained energy" effect. Farther down the tract: just as increased fat content of one's diet slows down passage of digested food through the colon, increased fiber speeds it up. Thus it reduces absorption of any toxins or cancer-causing agents there may be, and it reduces re-absorption of a woman's estrogen, helping to control one risk factor for breast cancer. Fiber is absent in animal-origin foods.

Attempting to make up for the lack of fiber in the typical meats-and-sweets meals, many people have tried to aid their elimination by supplementing their diets with products famous for high-fiber content. Usually these have not been fresh foods, but dry foods, e.g. dried prunes and the various processed "bran" items made from wheat and oats. If these foods are eaten in their dried form, not well rehydrated, their fiber probably won't work its expected wonders on intestinal movement. It will probably cause some dehydrating effect and discomfort. Fiber demands a watery intestinal environment. Take note that vegetables and fruits contain all the fiber we'd ever want, plus abundant water built in from the start. Also note: if we're interested in wheat bran or oat bran, why not eat whole wheat or whole oatmeal (or any other whole grains or legumes), which give us the benefit of all the vitamins, minerals and other nutrients which were scooped out to produce the bran? Fiber is easily and deliciously available from all plant-origin whole foods.

Putting it all together

It's easy to meet all our nutritional requirements on a plant-based diet. The Physicians Committee for Responsible Medicine has proposed the following "New Four Food Groups" to help us plan our daily menu for optimum health and nutrition:

Vegetables · Fruits · Whole grains · Legumes

Fresh vegetables and fruits are nature's most magnificent sources of phytochemicals, antioxidants and cancer-preventive factors. Whole grains and legumes are the greatest storehouses of complex carbohydrates, our bodies' optimum fuel. All four groups provide us generously with fiber, which is unavailable in animal-origin foods, plus vitamins and minerals. Using these four groups will offer us an inviting adventure of diversity and flavor while reducing our risks of numerous degenerative diseases.

Primary Author: Bob LeRoy, R.D., M.S., Ed.M (Nutrition Advisor since 1990, North American Vegetarian Society), bob1040@juno.com

Produced by the North American Vegetarian Society, a non-profit, educational organization serving vegetarians and the public since 1974.

Contact information: PO Box 72, Dolgeville NY 13329
(518) 568-7970
navs@telenet.net
www.navs-online.org