

# INTELLIGENT MEDICINE



A GUIDE TO OPTIMIZING  
HEALTH AND PREVENTING  
ILLNESS FOR THE  
BABY-BOOMER GENERATION

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A FIRESIDE BOOK  
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*Medicine*. A major impetus to me in the broadcast arena has been my agent and dear friend, Mrs. Betty Fredericks, whose late husband, Dr. Carleton Fredericks, was the irreplaceable prototype of all health broadcasters to follow.

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## CHAPTER FOUR

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# Self and Nonself: The Immune System

- A young woman comes into my office with an assortment of vague symptoms, including a rash on her face and joint pains. She's on the verge of tears because her doctor has diagnosed lupus, a deadly disease that can attack crucial bodily organs, seemingly at random, and can lead to death.

- A hard-working, highly stressed 36-year-old television producer suffers colds that last two to three weeks. They occur with increasing frequency every couple of months, regularly turn into sinus infections, and now require spiraling doses of antibiotics to treat them. On top of this, he contracted a bad case of the flu, and three weeks later he still doesn't feel back to normal. In desperation he asks, "Doc, I can't understand what's happening to me. It's as if my immune system is collapsing. Do you think I should take the AIDS test?"

- A stockbroker tells me at her annual checkup that she feels weak and exhausted whenever she's at work — she feels as if she's "losing her edge." But on weekends she starts to recover, and by Sunday afternoon she feels fine. This has been happening ever since her company moved to new quarters in a prestigious new office building, raising the company's profile in the industry. She doesn't know whether there's something physically wrong with her or whether she's having a nervous breakdown or some kind of midlife crisis.

- A new patient comes in who has had a successful kidney transplant but is taking so much medication to prevent rejection of the organ that he has developed Kaposi's sarcoma, a rare type of opportunistic cancer that typically occurs in AIDS patients. And he has to take additional medication to prevent other infections like the form of pneumonia caused by *Pneumocystis carinii*. He's relieved that the transplant is working, but now he's plagued with new illnesses.

- I'm treating a cop — a detective who's worked his way up in the ranks — who is overwhelmed by anxieties from his job and by asthmatic attacks that seem to get worse when he's under pressure. This is starting to affect his self-confidence and his performance on the job.

What do all these people have in common? They are all suffering from imbalances of the immune system. And these represent only a few of the disorders that are generally accepted as immune related. Even heart disease seems to be mediated through an immune-system response, and there is evidence that the natural decline of immune function with age may be related to the increased rate of cancer in those over sixty.

Still, we've achieved some of the greatest of our medical advances by enhancing or modulating the immune system. We've used vaccination to completely eradicate smallpox and to protect children from illnesses like polio and diphtheria that plagued us only forty or fifty years ago. We've mounted a worldwide assault on infectious diseases in the developing world, drastically reducing mortality from childhood diseases in many countries. Thanks to modern antibiotics, we've successfully avoided scourges like the flu epidemic of 1918 that killed hundreds of thousands of Americans.

At the same time, though, we've seen the proliferation of new and deadly diseases, from Legionnaire's disease to AIDS. As populations move across porous national borders, and as air travel links every part of the globe, obscure microbes from Amazonian jungles or the African veldt can move out into the world arena. Many of them live in symbiosis with their animal hosts but can leap to humans, where they may turn deadly. AIDS, the hanta virus, the Ebola virus, and Creutzfeldt-Jakob (mad cow) disease all seem to have taken this path. Moreover, we are inundated with pollutants, preservatives, and new and strange foods from around the world that may be putting our immune system in a state of constant alert. Industrial pollutants, smog, and second-hand smoke challenge the immune system's ability to absorb and neutralize toxins. In the industrialized world, immune system imbalances are on the rise, from annoying allergies to deadly autoimmune diseases. Cancer rates are rising, too. At the same time, some of our most amazing medical miracles, like the replacement of vital organs, are thwarted by the primitive and powerful action of our immune systems.

For some forty years, we've been using antibiotics to help knock out bugs that our immune systems can't easily handle. Yet, our very success with antibiotics has led to new challenges to our health. Old scourges like tuberculosis, which we thought we had conquered, are back in new, virulent forms that are resistant to every drug we've used to combat them. And this is not an isolated case. Our overuse of antibiotics is shaping the evolution of bacteria and viruses around the world, so that more and more diseases are becoming resistant to the basic antibiotics. Baby boomers, the first generation raised from childhood on antibiotics, are at particular risk. We are forced to develop new and sophisticated drugs just to keep up, and these are increasingly expensive and often have dangerous side effects. We are now

looking at the possibility that the “age of antibiotics” may have been a temporary and short-lived respite from the scourge of infectious disease.

As a result, the notion of strengthening the immune system has almost superseded the belief in divine protection. People used to wear amulets to ward off evil spirits. Now they gulp down vitamins to strengthen the immune system — the shield against disease. While the immune system has been studied for a century, it has in the time of the baby boomer been propelled from an obscure niche of medicine to extraordinary prominence in both medicine and the popular imagination. Although few people really understand the workings of the immune system, recent advances have convinced baby boomers that it is now possible to enhance their natural defenses against infections, cancer, and other serious diseases as well as hasten their recovery from minor ailments. In many cases they are right.

The huge upsurge of interest in the immune system has inspired the creation of a “Body Wars” exhibit at Epcot Center. The exhibit is very well done and shows the components of the immune system, but it’s based on the typical martial imagery that people use to describe immune function. People talk about invaders, spies, skirmishes, defending armies of lymphocytes, and so on. This imagery makes sense in some ways, but we shouldn’t be limited by it. Some patients can use the martial imagery as part of guided imagery to help them fight disease, but the invader/army image has become a limiting stereotype.

Another stereotypical view is that we have to “build up our immunity” as if it were on a dimmer switch and we should just turn up the juice. What we really want to do is balance elements of the immune system. Autoimmune disease, for example, is immunity gone berserk. It’s really an excessive immune response — the flip side of weakened resistance. But an individual can have both an autoimmune disease and a weakened immune response to outside invaders. So we can’t just say your immunity is too high or too low. It makes more sense to think of the immune system as being properly balanced or out of balance and out of order.

The immune system mediates our response to infection and disease, but it also enables a healthy coexistence with the microbes and “foreign substances” of the world. The immune system does “defend” us — it’s a barrier, a shield to protect us from threatening parasites and microbes. But the immune system also enables the body to integrate materials and organisms from outside so it can simultaneously and selectively fend off some invaders while accommodating itself to harmless or useful agents. In fact, we live in synergy or at least peaceful coexistence with many bacteria, microbes, and even insects. We should be able to tolerate common creatures in the environment like dust mites and roaches without their sending our immune systems into a tizzy. People have lived with these creatures for thousands of years. We’ve evolved with them, and yet for people with allergies they can

be a real problem. Somehow their immune systems have failed to adapt to their presence.

The intestinal flora are a good example of immune adaptation. These are bacteria that live in the intestine, usually without harming us, sometimes even assisting with the digestion of food. We adapt to the bacteria of our geographical region and develop a kind of “nonaggression pact.” So a person living in Mexico City may be able to eat fruit from an outdoor stand and be fine, while a tourist from the United States can come down with diarrhea and illness caused by the local bacteria. And the Mexican citizen could come down with intestinal illness after eating vegetables from a New Jersey farmers’ market. The lymphatic tissue of the gut, which harbors cells of the immune system, becomes adjusted to the presence of local bacteria and tolerates them in a kind of symbiotic way, but it will mount a severe reaction against unfamiliar bacteria in a foreign environment. Antibiotics can distort this natural balance, wiping out the “friendly” bacteria, and leaving the gut open to colonization by strangers.

These examples suggest that our immune system balances or “harmonizes” our own physiology with outside influences. We shouldn’t view microbes and infection simply as the enemy but as a necessary source of information to prime the immune system. We might do well to look at the immune system as a way of processing information, distinguishing between self and nonself, rather than simply as a kind of Star Wars defense against external threats.

In this view, sickness becomes not the enemy but a natural process in the ebb and flow of optimal immunity — something like a boot camp for white blood cells. Efforts to vanquish disease by developing vaccines and using antibiotics at the slightest pretext may leave the immune system incompletely programmed and may result in the development of unforeseen consequences such as the bizarre autoimmune diseases that we are currently seeing.

## **From Cowpox to T Cells: How the Immune System Protects Us**

Though a clear understanding of the immune system has begun to emerge only in this century, people have been trying to harness its power for millenia. Molds containing the antibiotic tetracycline have been found in the preservatives used to embalm ancient Nubian mummies. In the Middle Ages, Chinese physicians tried to confer resistance by scratching the skin of their patients and applying smallpox scabs from other patients. (Unfortunately, their patients were as likely to contract the disease as to acquire resistance.) Two hundred years ago, in England, Dr. Edward Jenner discovered that he could safely confer resistance to smallpox by scratching the

skin and applying cowpox scabs from an infected animal. The cowpox did not infect humans but did confer immunity to smallpox. This was the first effective vaccination. By the early nineteenth century, smallpox vaccination was commonplace in Europe, though no one knew how it worked or how to extend the principle to other diseases. Finally, in the late nineteenth century, Dr. Louis Pasteur developed the germ theory of infection and demonstrated that killed cells from an infected animal could confer immunity upon another animal.

We now know that vaccination works through the so-called humoral aspect of immune response, through a release of antibodies into the bloodstream. When a bacterium or other foreign agent enters the body, it activates B cells, which originate in the bone marrow, to produce substances called gamma globulin antibodies, or immunoglobulins. These are specialized chemical compounds, each designed to attack and destroy one specific type of foreign microbe. Once the infection has been conquered, enough of the activated B cells remain to enable the body to quickly produce more antibodies, in case of reinfection. Vaccination works by introducing a small amount of material, called antigen, which induces the antibody response. For safety, and so as not to induce the infection we are trying to guard against, the antigen can be made up of killed microbes, or protein fragments, or even related nonthreatening microbes like cowpox. Once the B cells have been activated and the antibodies produced, they stand guard to quickly wipe out any microbes that bear the specific antigen, so that they can't get a foothold in the body and cause infection.

In the twentieth century, doctors and researchers have developed a wide range of vaccinations to guard against some of the most dangerous and life-threatening diseases, from diphtheria to polio. This has been one of the great triumphs of modern medicine, but researchers are still looking for new vaccines against everything from Lyme disease to AIDS.

But there's another whole side to the immune system, the so-called cell-mediated immunity. Late in the nineteenth century, Elie Metchnikoff, an eccentric Russian zoologist and a contemporary of Pasteur, began to explore this kind of immunity. Studying specialized digestive cells in the starfish, he observed them reaching out with amoeba-like extrusions to capture and absorb foreign particles. In a mental leap of sheer genius, Metchnikoff speculated that similar cells—he later called them phagocytes—might serve as biological defenders against intruders. In his later research at the Pasteur Institute, Metchnikoff established that phagocytes are among the white blood cells, or leukocytes, known to cluster at the site of wounds and infections and that they play a significant part in resisting bacterial infections. Phagocytes are omnivorous—they'll consume all kinds of foreign material, from smoke particles to bacteria to cancerous cells. The discovery of cell-based immunity did not lead immediately to any

new forms of therapy. However, it did prove a valuable diagnostic tool, since white blood cell counts can indicate whether an infection is present or how advanced it is.

The last twenty years or so have seen an explosion of knowledge about the immune system, much of it fueled by research into AIDS. We have identified different types of white blood cells: natural killer cells, the B cells that produce antibodies, and the specialized T cells that can target and kill specific microbes. (T cells are the ones infected by the HIV virus.) We've identified a group of chemical messengers called cytokines that different cells of the immune system use to communicate with each other and with other systems of the body. We've discovered subsets of T cells, "helper Ts" that react to a single specific foreign agent and start the immune reaction; "killer Ts" that directly attack infectious agents; and "suppressor Ts" that turn off the immune reaction when the infection has been conquered. We now know about factors such as sugar, or environmental toxins like mercury, that can inhibit the functioning of white blood cells, and other factors that can enhance them. And we've begun to learn about the intricate interplay between the immune system, the nervous system, and the endocrine system.

But for all this, we've become much too dependent on a single crutch — antibiotics — to do the work of the immune system. And this tool is becoming less and less effective. We can no longer simply look at the "invading" microbes, and come up with magic bullets to kill them. We have to look more closely at the body's own response to microbes and foreign organisms, and whether it offers them an inviting or difficult environment to grow in. This chapter will offer an approach to natural immune enhancement, based on our current knowledge. Let's take a look at how we can use this knowledge to maintain health and enhance our resistance to disease.

## Immunity Under Siege

Despite the advances of modern medicine, we are living in an age that presents staggering risks to our immune system. In the global village, microbes can spread from continent to continent and from community to community more easily than ever before in history. Our polluted industrial environment is filled with toxic chemicals that challenge the immune system. Many of us lead high-stress lifestyles, with inadequate nutrition, sleep, and exercise — all of which can debilitate the immune system. Even our social environment comes into play: there is evidence that living in a warm, close-knit, stable community and with the extended family can enhance immunity and provide natural "vaccination" against common diseases through early exposure in infancy. But whether we live in suburbs



or cities, too few of us enjoy this kind of stable, supportive community. The nuclear family shelters us from some early exposure to disease but can also leave gaps in our immunity. Our very pleasures can weaken us: the vast array of imported and foreign foods challenge our immune system's ability to adjust and become acclimated to them. And too many people challenge their immune systems directly with cigarette smoke, alcohol, and sugar. Our diets of processed, packaged foods lack essential nutrients that help the immune system do its work. Finally, we must all deal with the decline in immune function that is a natural consequence of aging. Baby boomers can't take for granted the robust immune response we may have enjoyed in youth.

As a result, diseases and syndromes of impaired immune function, almost unheard of before the 1940s, have been on the rise in industrialized nations, especially during the past thirty years. They are still exceedingly rare among indigenous peoples. R. K. Chandra, a nutritional researcher at the University of Nova Scotia, has used a beautiful illustration to describe what is happening to the immune system. He shows an open umbrella (the immune system), protecting us from the "rain" of environmental risks. And then he shows a tattered umbrella, full of holes caused by poor nutrition, lack of exercise, and self-inflicted damage to the immune system, with the threatening agents raining in. Whether we think of the immune system as an umbrella or a defensive army, it's crucial, for our health, to maintain and support it. Let's look at some of the specific risks we face and how to guard against them.

### *Aging: Best to Plan Ahead*

Just like other organs and body parts, the immune system weakens with age. The decline begins at about age thirty. The thymus, which produces T cells, is the size of a walnut in children, shrinks by puberty to the size of a pea, and nearly disappears by the age of fifty. By old age, we have only about one-fourth of the T cell activity of youth. We become more susceptible to bacteria and viruses, and it gets harder to fight them off. We become more vulnerable to the proliferation of cancer cells. Fortunately, the bone marrow can effectively produce B cells, which in turn produce antibodies, well into old age. However, the aging B cells make fewer antibodies. While some immune functions weaken, others can become overactive, leading to an increase in autoimmune reactions. The endocrine system seems to play a part in this.<sup>1</sup>

On top of the natural decline, many elderly people are at increased risk because of limited, inadequate diets that do not contain enough of the immune-supporting nutrients. Since our need for these nutrients grows with age, even the standard Recommended Dietary Allowance may be inadequate.

Some of us have an extra edge against disease, however, since the vigor of the immune system is partially inherited. There are people who just don't seem to get sick. One Japanese study found rare genetic markers — perhaps coding for resilience — in a group of people over the age of 100 — and the absence of other markers that are linked with disease.<sup>2</sup> Most of us, however, need to augment our natural immunity.

### *Pollution and Domestic Chemicals*

We are learning that chemicals, petroleum byproducts, and toxic heavy metals can suppress the immune response. Industrial byproducts and hazardous wastes are increasingly polluting our environment with these materials, but some may be present in ordinary household chemicals and products, such as cleaning fluid and paint thinner.

Heavy metals like cadmium, lead, and mercury are everywhere in the industrialized world, and all cause immune suppression in addition to their other toxic effects. Mercury is a special concern. Not only is it poisonous in itself, but studies have shown that mercury amalgam fillings in teeth may contribute to immune suppression and to the development of antibiotic resistance.

Other pollutants that affect the immune system include polycyclic aromatic hydrocarbons — the kinds of petroleum byproducts that were produced in massive quantities by the burning of the oil fields in Kuwait and that can also be released by ordinary household chemicals. In fact, tests of immune function are increasingly turning up responses to chemical pollution that mimic the patterns of other immune deficiency diseases, such as HIV infection and chronic fatigue syndrome. On top of this, too many Americans compound existing environmental risks by “self-pollution” through smoking, alcohol abuse, and drug abuse.

### *Malnutrition: Even for the Well-fed*

From Biblical times through the Middle Ages to the present day, famine has been followed by plague and pestilence. Immune systems weakened by malnutrition have always provided fertile ground for infection. Today, malnutrition is common in underdeveloped countries, but it exists in fractions of every national population. In the industrialized West, it's common among the poor and among hospitalized patients. Studies of illness around the world have identified deficiencies of vitamins and trace elements as the cause of immune weakness and even death by infections. Immunologist R. K. Chandra has pointed out that the pattern of infections in malnourished people mimics the patterns of immune deficiency disorders such as AIDS.<sup>3</sup> Working backward, scientists have found that tests of

immune response are very sensitive indicators of nutrient deficiencies. It seems that the cell-mediated immune response — along with the effectiveness of phagocytes, natural killer cells, and T cells — is most profoundly affected by malnutrition.

The word malnutrition makes us think of starving children in famine-ridden parts of the world. Yet, even well-fed American citizens can suffer from malnutrition. The past forty years have seen a steady decline in the basic nutritional content of the American diet. Processed foods have had important vitamins and minerals processed out of them. Vitamins may be added back into processed foods in such a haphazard way that they do more harm than good. An *excess* of some foods can also lead to immunosuppression. The most common example in affluent societies is an excess of fat in the diet, which can lead to increased respiratory infections and is associated with higher risks of multiple sclerosis and certain cancers.<sup>4</sup>

There is even some evidence that the progressive decline of immune function with age may be due in part to nutritional deficiencies. People older than sixty-five may eat less, and as lean body mass decreases with age, blood levels of many nutrients fall. Studies have shown that vitamin and mineral supplements can reverse or arrest the natural decline of immune function. Supplements have a clear effect in hastening healing and preventing bacterial infections after operations, and they can increase the effectiveness of flu vaccinations, which are intended to evoke an antibody response.<sup>5</sup> Good nutrition turns out to be one of the best ways of strengthening the immune response, and we will look at this in detail below.

Since the immune system will inevitably, if gradually, decline, we must plan to bolster it. We have to make an action plan for immune health. More and more people are watching their diets and jogging or working out to strengthen the cardiovascular system and guard against heart attacks. We have to take the same kind of proactive approach to supporting the immune system. Fortunately, we don't have to learn a whole new set of tricks, because the same good diet and exercise that supports the immune system will help give us a healthy heart. There are some immune-specific prevention measures, though, and we'll learn about them in this chapter.

## Nutrition and Immunity: Building the Base

A good diet is the best place to begin bolstering immunity. It's critical to create a good biochemical environment to support the complex cellular and subcellular processes of the immune system and to avoid dietary stressors that can weaken the immune response. Diet and nutrition can affect the immune system in myriad, complex ways. Fortunately, we can

boil down the most crucial factors into a list of nutrition dos and don'ts, and we can offer a list of dietary supplements that will provide additional support for immune function.

Curiously, surgeons are among the specialists who first became interested in nutrition to prevent disease. Infection is one of the major risks in surgery. In fact, wounds are among the simplest models of immune system activity. If you cut yourself, white blood cells migrate to the wound, both to fend off infection and to consume damaged cells. Surgeons have found that good diet and nutrient support before surgery can contribute greatly to easy recovery and avoidance of postsurgical infections.<sup>6</sup>

### *Nutrition Don'ts*

#### SUGAR: ON THE TABLE, IN THE BLOOD

One of the most immune-suppressive foods is sugar, or any food that induces high levels of blood sugar. A quick rise in blood sugar to higher than normal levels can paralyze our immune response. We can see this in diabetics, who are unable to process blood sugar normally and as a result are much more prone to infection. You can actually see this effect under a microscope. If you look at normal, living white blood cells, they move about vigorously across the microscope slide. It's a fascinating demonstration to take a drop of blood from someone who's just eaten a sugary, high-carbohydrate meal and put it under the microscope. In the presence of sugar, the white blood cells look round and puffy and move sluggishly. I've shown this phenomenon to some of my patients who are embarking on a new dietary program — it really makes them sit up and take notice!

Scientifically speaking, we say that high blood sugar inhibits neutrophil chemotaxis. Neutrophils are the most common type of white blood cells, and they are normally drawn by chemical messengers (the process called chemotaxis) to the site of wounds or injuries to "gobble up" the dead tissue. High blood sugar slows down this process, so that the fragments of dead tissue linger, ripe for infection. Sugar also inhibits vitamin C absorption, so that a given blood level of vitamin C has less of a protective effect against infection.

We have to watch more than the sugar levels in desserts and soft drinks. Foods that we might think of as healthy, such as fruit juice or trail mix, can increase blood sugar levels beyond the optimum level. In fact, the food doesn't have to contain refined sugar to have this effect. Any food that rapidly raises blood sugar, such as alcohol or simple carbohydrates, will produce the same effect. Eating a big plate of white spaghetti will rapidly raise the blood sugar. This is why complex carbohydrates, such as whole grains and beans, are better for you — they release their sugar content

much more slowly, so that blood sugar levels don't swing wildly up and down.

## CALORIES

Beyond sugar and high blood sugar, it appears that excessive caloric intake of any kind seems to impair immunity. We see this in studies of rats showing that lean, slightly underfed rats are less prone to infectious disease, malignancies, and autoimmune disease — and they actually live longer. Why this occurs is unclear, but it appears that excess food may burden the body's detoxification pathways and thereby tie up energy required for immune response. Alternatively, the toxins that build up when wastes are not easily eliminated may suppress immunity. We do see a similar effect in patients suffering from anorexia nervosa. Even though they severely undereat, they sometimes show a robust immune response.<sup>7</sup> It's as if there were an evolutionary advantage to boosting immune response in times of famine. However, extended undereating, with insufficient nutrition, will ultimately weaken immune response.

## FAT

The biggest source of excess calories in the American diet is fat, which may indirectly suppress immune response in other ways. Studies show that high blood cholesterol levels in animals are associated with increased susceptibility to infection. T cell response is weakened, and phagocytes seem to be less active in doing their job of consuming foreign particles and dead tissue. It's true that obese people suffer more than others from infections. In laboratory studies, animals show enhanced cellular immunity on a low-fat diet.

There is also evidence that a high level of dietary fat is related to reduced activity of natural killer (NK) cells.<sup>8</sup> These NK cells are the first line of defense against tumors and inhibit the spread of cancerous cells throughout the body. One study showed that lowering the amount of fat in the diet caused a significant increase in NK cell activity.<sup>9</sup> The implication is that high-fat diets may increase the risk of cancers, and there does appear to be some correlation with some types of cancer, including uterine cancer, prostate cancer, possibly breast cancer, and even certain skin cancers. It's theorized that the dietary fat may affect hormone secretion.

One type of fat does seem especially harmful: trans-saturated or hydrogenated artificial fats, normally found in margarine and vegetable shortening but rarely found in nature. Cell membranes are normally composed of fats, and these artificial "trans-fats" seem to damage immunity by filling up the cell membrane at the expense of natural fats and possibly by interfering with the ability of cells to communicate with one another. There is

evidence that the use of hydrogenated fats is related to an increased incidence of cancer, and we can certainly note a general increase in cancer that just happens to coincide with the introduction of these artificial fats earlier in the twentieth century.

Roy Wolford's book *The 120-Year-Old Diet* advocates reducing calories and under-eating to extend life. There does seem to be some logic to this. If obesity and high-fat diets reduce the immune response, the contrary should be true, and a low-calorie, low-fat, low-sugar diet should keep the immune system functioning at top form.

### *Nutrition Do's: The Basic Immune-supporting Diet*

This sets us up for the ideal immune-supporting diet: low-fat, low-cholesterol, and low-sugar, with plenty of complex carbohydrates like whole grains and beans. Sufficient protein is important, since protein deficiency can suppress immune function. Some nutritional studies have been done with cancer patients undergoing surgery who experience extreme immune suppression caused by the surgery, the blood transfusions, the anesthesia, and malnutrition caused by the cancer itself. It turns out that protein, RNA, and omega-3 fatty acids, as found in fish oil, are helpful in boosting their immune response.<sup>10</sup> Other studies with animal subjects have also shown that fish oil helps recovery from immune challenges.<sup>11</sup> It seems Grandma was on to something with her cod-liver-oil tonic!

The best immune-supporting diet is really our basic Salmon and Salad Diet outlined in chapter 16, which is good for cardiovascular health and general health as well as for the immune system. But we are learning that vitamin and nutritional supplements can play an important role in maintaining immune health, and can slow or even arrest the natural decline with age. In particular, studies have shown that supplementing diets with vitamins and minerals that exceed the Recommended Dietary Allowances improves measures of immune response and increases resistance to infectious disease.<sup>12</sup> The body especially demands nutrients that assist with the rapid protein synthesis of antibodies and the production of T and B cells. In one study, R. K. Chandra gave nutritional supplements to elderly people and found that they had half the number of colds, flus, and other infections, compared with a group that didn't receive the supplements, and recovered in half the time. Other studies have produced similar results.<sup>13</sup> Studies done at Tufts suggest that it's not a single nutrient but a synergistic or cumulative effect of several nutrients that makes the difference.<sup>14</sup> Let's take a look at some of the principal nutrients that help support the immune system.

- *Vitamin A and the carotenoids* are crucial nutrients for immune health. Vitamin A is required for lysozyme, an antibacterial enzyme found in tears,

sweat, and saliva. Vitamin A regulates and protects the surface of epithelial cells that line the body's digestive tract and other passages and surfaces, including the skin, cornea, mucous membranes, lungs, and bladder. In animal studies, vitamin A inhibits cancer growth by stimulating killer T cells to eradicate mutant, precancerous cells.

The carotenoids, including beta-carotene, are precursor nutrients, which are converted in the body to vitamin A as they are needed. By itself, beta-carotene enhances the cell-mediated side of the immune system, stimulating the production of T and B cells, macrophages, and natural killer cells. As an antioxidant, beta-carotene can also absorb the dangerous oxidized particles in the body called free radicals that can suppress the immune function by damaging the cell receptors that recognize foreign antigens.

Recent large-scale prevention trials performed with Finnish smokers and American physicians have disappointed proponents of the use of beta-carotene for cancer prevention. However, the tests used beta-carotene alone, which may explain the results. Critics of these studies point to the necessity of utilizing beta-carotene along with companion carotenoid nutrients, as well as other antioxidants, to achieve immune enhancement and protect against free radical damage. They also point to the rigorous task assigned to beta-carotene: that of preventing cancer in heavy smokers for the relatively short duration of the trials themselves—a few years, rather than the decades during which the subjects had been smoking. The truth is that all studies of beta-carotene *in foods* have shown it to have pronounced cancer-protective and immune-enhancing characteristics. This suggests that we need to unlock the potential of the carotenoids and other phytonutrients. New efforts are under way to reformulate supplements with broad-spectrum carotenoids and individual phytonutrients with daunting names like lycopene and zeaxanthine.

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**DOSAGE:** Mixed carotenoids, 5,000–20,000 I.U.; Vitamin A, 5,000 I.U. As little as 30–60 I.U. a day of vitamin A supplement has been shown to enhance immune response, though the RDA is 5,000. Some people don't easily convert beta-carotene to vitamin A, so it's important to have both in the diet or as supplements.

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- *The B vitamins* are essential cofactors in cell metabolism, and they may regulate the activity and rapid proliferation of the white blood cells of the immune system. Folic acid, pantothenic acid, pyridoxine, riboflavin, and vitamin B<sub>12</sub> all play an important role in sustaining immune function. Of all the B vitamins, pyridoxine, or vitamin B<sub>6</sub>, has the most profound effect

on the immune system. Low levels can globally suppress immunity, inhibiting both antibody production and cell-mediated immune response. Curiously, vitamin B<sub>6</sub> deficiency is one of the most common of all vitamin deficiencies, especially among the elderly, who typically have a reduced immune response. Studies have shown that supplements of just 15 milligrams a day can increase immune response. Most B-complex supplements contain 50 milligrams of vitamin B<sub>6</sub>.

- *Vitamin C* is probably best-known of the nutrients that affect immunity. A whole literature of studies shows the effect of vitamin C in increasing immune activity and reducing the incidence of infection. This includes Nobel prize winner Linus Pauling's 1976 study on vitamin C and the common cold. It's true there's plenty of resistance to the late Pauling's enthusiasm for vitamin C in the medical and scientific community, but his studies speak for themselves. And his aren't the only ones. One double-blind study by I. M. Baird showed that even the relatively small dose of 80 milligrams a day of vitamin C had a statistically significant effect in reducing the rate of infection by colds.

Another interesting study was of the incidence of respiratory infections in long-distance runners, people who run marathons and ultra-marathons. These runners tend to have a much higher incidence of colds and upper respiratory diseases following a race because of the physical stress on the lungs. The study found that runners given vitamin C supplements had half the incidence of post-race infections compared with runners who received a placebo.

We also know that vitamin C reduces infection and the symptoms of other viral infections, including mumps, herpes, measles, and flu. Like beta-carotene, vitamin C is a powerful antioxidant and may promote immunity in this way. Studies also suggest that vitamin C may work by boosting levels of interferon, which fights viral infections, and by activating the phagocytes and T cells that attack bacteria. There's a high concentration of vitamin C in phagocytes. Though colds are viral, vitamin C helps fight the secondary bacterial infections that can extend the course of a cold and make symptoms worse.<sup>15</sup> There's evidence that vitamin C can also promote antibody production. Large doses of vitamin C, as espoused by Linus Pauling, may help reverse the natural decline of immunity with age.

- *Vitamin E* is another antioxidant that has a documented effect on supporting immune cell activity and increasing resistance to infections. White blood cells have a higher concentration of vitamin E than do red blood cells, and vitamin E has been shown to increase activity of phagocytes and T cells. Vitamin E also suppresses the hormone called prostaglandin E<sub>2</sub>, which has been linked to age-related declines in immune response.<sup>16</sup>



Several studies have shown that even moderate supplementation of vitamin E can reduce the statistical rate of infections among healthy older people. In animal studies, high doses of vitamin E given to elderly animals have caused their immune response to equal that of younger individuals. So this is one more nutrient that may help in slowing the natural decline of immunity with aging. In fact, we could look at this from another point of view: the elderly simply have a greater need for certain nutrients, like vitamin E, just as children require a higher than normal intake of other nutrients.<sup>17</sup>

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**DOSAGE:** 200–400 milligrams daily. **Warning:** megadoses in the range of 1200 mg daily or higher may inhibit immune function, especially in the young.

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- *Zinc* is one of the most important nutrients for sustaining and boosting immune response. It's an ingredient in a hundred different enzymes, including one that works to assemble DNA strings during cell division. So it's essential for immune response, which is directly dependent on the rapid reproduction of T cells and other white blood cells. It promotes activity of the thymus gland, where many immune functions take place. Zinc can increase the activity of natural killer cells that attack tumorous and precancerous cells, and increases the production of antibodies in response to infections. It can speed up the healing of wounds, and there is even evidence that elemental zinc can directly kill viruses.<sup>18</sup>

There is a natural decline in zinc blood levels with aging, and several studies have shown that zinc supplements can correct and even reverse the immune suppression that occurs with aging. Older people often have a reduced response to vaccines because of the reduced antibody production associated with reduced levels of thymic hormone. There's evidence that zinc can restore thymic function as well, thereby restoring this aspect of immune function. It's interesting that zinc supplements produce a greater effect in the elderly than in the young.<sup>19</sup>

One of the most fascinating effects of zinc on immunity is its ability to shorten the duration and reduce the symptoms of the common cold. Studies have shown that elemental zinc, in lozenge form, directly attacks the rhinovirus that takes hold in the tissues of the throat and mouth.<sup>20</sup> If taken early enough, the zinc can halve the duration of a cold.

**DOSAGE:** For general supplementation, the USRDA of 15 milligrams a day should probably be doubled, but taking more than about 80 milligrams a day may actually suppress immune function.

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**DOSAGE FOR COLD SUPPRESSION:** 180-milligram lozenges of zinc gluconate (containing 20–23 milligrams of elemental zinc), up to 12 tablets a day until symptoms cease, or up to seven days.

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- *Selenium* is a trace metal in the environment, but a necessary dietary element. Its deficiency can cause liver disease, muscular disease, and even degenerative disease of the heart. Selenium is also an important nutrient for maintaining the health of the immune system, and it is an essential component of one type of antibody that fights bacterial infection.<sup>21</sup>

Selenium in concert with vitamin E has an antiinflammatory effect, and some studies suggest a role in preventing cancer growth. Indeed a recent study showed that doses of 200 micrograms of selenium daily halved the rates of prostate, breast, and colon cancer in human subjects. Selenium is also a component of an important antioxidant enzyme, glutathione peroxidase, which typically decreases in blood level with age. In a University of Helsinki study, an organic selenium supplement plus vitamin E was given to a group of retirement home residents, who then became less depressed, fatigued, and hostile; were more active; took more initiative; and had better appetites than residents in the control group, who did not receive the supplement. So here's another nutrient with the potential to arrest or reverse the natural decline in immunity with aging.

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**DOSAGE:** This is a trace element, so the optimum amount is hard to quantify. The suggested dosage is 50–400 *micrograms* daily. Doses in excess of 800 micrograms per day can be toxic.

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- *Other metals*, as nutrients, can also affect immune function. Deficiencies in copper, iron, and magnesium can cause immune suppression. An excess of copper or iron can *increase* susceptibility to infection. In response to infection, the body automatically removes iron from the blood serum and redistributes it to cellular storage sites in order to restrain bacterial growth. Magnesium is necessary for the robust production of antibodies,

and deficiencies are widespread. If you think you may have immune impairment, you might ask a nutritionally oriented doctor to check your blood levels of these minerals. Not everyone needs or can tolerate extra doses of these nutrients, so they need to be prescribed by a qualified nutritionist.

- *Nucleotides and nucleic acids* are the materials that make up RNA and DNA, the genetic programmers of cell division. A sufficient dietary source, usually from protein, is necessary to support the growth and rapid division of immune system cells. A diet without nucleotides causes decreased immune cell function and decreased resistance to infection.<sup>22</sup>

- *Fish oil*, which is rich in the omega-3 oils, has been shown to have a powerful immune-modulating effect. It's particularly helpful with autoimmune problems. The omega-3 oils in fish oil work by affecting the prostaglandin mechanism. The prostaglandins are a group of hormones, some of which enhance immune function, while others put the brakes on. Fish oil tends to put the brakes on immune reactions and can therefore help with the overactive immune response that causes autoimmune problems and allergies. It can also be used to help reduce the amount of debilitating immune-suppressive drugs that are required for people with organ transplants.

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**POSSIBLE DOSAGE:** 2–3 1,000-milligram capsules twice daily, as approved by a qualified nutritionist.

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## Exercise and Immunity: The Hidden Benefits

The effect of regular physical exercise — 30–40 minutes, three or four times a week — is just as powerful as the effect of good nutrition in supporting the immune response and slowing its decline with age.

It's true that moderate physical exercise temporarily suppresses some immune functions, including T cell activity and antibody production. But the effect does not linger, and over time a pattern of moderate exercise actually increases antibody response and resistance to tumor formation while increasing the white blood cell count, including levels of specialized immune cells like the natural killer cells and messenger hormones like interferon. The body adapts to moderate physical stress, if it's repeated over time, by increasing immune function. In one study, women who engaged in moderate physical exercise were found to actually have lower rates of cancer than those who did not exercise, possibly because of increased immune system vigilance against tumor cells and precancerous cells. The

## NUTRIENTS THAT CAN AFFECT THE IMMUNE SYSTEM

NUTRIENTS AND BEST FOOD SOURCES	EFFECTS
Omega-6 fats (corn, safflower, soybean oils)	Excess disrupts immune system; high levels may suppress rejection of transplanted organs but promote tumor growth
Omega-3 fats (fish oil, canola oil, flaxseed oil, purslane)	May inhibit spread of cancer cells; can increase the activity of white blood cells; dampens down autoimmune reactions
Nucleotides, including DNA and RNA (all plant and animal foods)	Can decrease risk of fungal and bacterial infections
Arginine (nuts)	Enhances immunity in malnutrition, cancer, etc.; speeds surgical recovery; may accelerate herpes growth
Zinc (meat, eggs, poultry, seafood)	Deficiency suppresses maturation of immunological cells; excess suppresses immune response
Iron (liver, red meats, leafy vegetables)	Early life deficiency can cripple immunity; high levels can foster infectious organisms
Selenium (seafood, whole-grain cereals, meat, egg yolk, chicken, milk, garlic)	Needed for the formation of antibodies and enzymes that participate in immunity; excess can impair immune response
Vitamin A (dark green and deep yellow vegetables and fruits) (good to obtain through beta-carotene, body makes its own, nontoxic amounts)	Deficiency increases risk of infection; excess is toxic
Vitamin B <sub>6</sub> (whole grains and greens)	Deficiency impairs cellular and hormone-regulated immunity
Folic acid (organ meats and greens)	Needed for cell division; deficiency impairs immunity; pregnant women, elderly, and inner-city children often deficient

top quarter of women who exercised had about one-sixteenth the incidence of cancer found in women in the sedentary bottom quarter.

It's also interesting that many of the longest-surviving AIDS patients are people who pursue a vigorous exercise program. Some of the benefits may be indirect: regular exercise can reduce the anxiety and depression associated with HIV infection, and it's known that depression directly suppresses immune response. The improved mood that comes with exercise can have a beneficial effect on interlocking hormonal, neurological, and immune functions. However it works, the benefits are real and have been demonstrated in several studies.<sup>23</sup>

The key to exercise benefits is moderation and regularity. Professional or

### HEALTHY LIFESTYLES BOOST IMMUNE RESPONSE



A recent Japanese study has shown that healthy habits have a direct effect on the blood levels of natural killer cells—the immune cells that are our first line of defense against tumors and metastasis, or the spread of cancer cells through the bloodstream to different parts of the body. It's already been observed that high dietary fat, stressful life events, and a sedentary lifestyle all lower NK cell activity. In the Japanese study, a questionnaire was used to rate sixty-two healthy male office workers on each of these health practice factors:

1. Cigarette smoking (not smoking)
2. Consuming alcohol (not every day)
3. Eating breakfast (every morning)
4. Hours of sleep (7–8)
5. Hours of work (less than 10)
6. Physical exercise (at least once a week)
7. Nutritional balance
8. Mental stress (keeping stress levels moderate)

A good health practice group and a poor health practice group was identified for each factor. The results? The good health factors all correlated with increased NK cell activity, with the factors related to smoking and exercise producing the most significant increase. The men with all good overall habits showed significantly higher NK cell activity compared with those in the poor habit group. The implication is that good health habits have a cumulative effect—the more you follow them, the better the results.<sup>24</sup>

amateur athletes who engage in strenuous exercise or train intensely over long periods of time do have some special risks. They are actually more susceptible to infection and colds, probably because of the immune-suppressive effect of the exercise. We can measure lower numbers of T cells and lower levels of antibodies after a strenuous training session, while other white blood cells remain at high levels. Strenuous exercise increases oxygen flow through muscles, which generates a higher level of oxidizing free radicals that can damage tissue and prevent immune cells from recognizing their targets. Inhaling large amounts of polluted, ozone-tainted air can also increase free radicals and oxidant levels in the blood, and strain the immune system. People who regularly exercise strenuously need higher levels of antioxidant nutrients, especially vitamins C and E.

Also at some risk are people who go on exercise binges, engaging in strenuous exercise for short periods and then stopping cold. This kind of short-term stress weakens the immune response without giving the body a chance to establish a balance. People who are accustomed to regular exercise and then stop may also experience some degree of immune suppression. Studies show that animals who aren't allowed to exercise freely can develop constricted blood vessels and symptoms resembling rheumatoid arthritis. A regular, moderate exercise program, with sufficient rest, and sufficient antioxidant nutrients, will provide the most effective long-term support to the immune system. A 30–40 minute exercise session three or four times a week — swimming, jogging, or a workout at the gym — will do the trick.<sup>25</sup>

## The Mind–Body Connection

Doctors have long known, and popular wisdom has held, that mental attitude has a lot to do with recovery from illness and maintaining health. A patient who has the will to live has a big advantage in recovering from serious illness. Norman Cousins has told the world about how he recovered from cancer by taking a daily dose of funny movies. We're now finding out just how intimately mood and mental attitude are related to health and how closely intertwined are the immune system, the nervous system, and the endocrine (hormonal) system on a deep biochemical level.

We've learned that certain hormonal neurotransmitters, which help convey electrical impulses in the brain and nervous system, are also crucial messengers between different cells of the immune system, and that immune reactions can directly stimulate hormonal and nervous system responses on a preconscious level. Immunologists have become fascinated with parallel functions of both the brain and the immune system: both can learn from outside stimuli, and both can make the important distinction between that which is "self" and that which is "nonself," the brain on the

macro level, and the immune system on the cellular and molecular level. And both can act instinctively, based on what they've "learned," to protect us. For a while now, some immunologists have been working in the field of *psychoneuroimmunology*. And some are beginning to look at the nervous system, the endocrine system, and the immune system as one complex, interactive field, the study of which is *psychoneuroimmunology*.

Fortunately, we don't have to practice pronouncing these jawbreakers to benefit from this branch of medicine. Let's take a look at some of the key discoveries and how we can use them to support immune health.

### *Stressed Out? Or Stressed Just Right?*

Stress has gotten a bad name over the past few years. In some ways we have become a nation of people with a stress phobia. Overstressed, stressed out, burned out—it's part of our daily vocabulary. I see patients who are really upset that they have stress in their lives. With some, the only thing they seem to be stressed about is stress itself. We tend to forget that Hans Selye, who first explored the deleterious effects of excessive stress, also noted the positive effects of a manageable amount of stress. Stressing the muscles causes them to strengthen; stressing the mind causes us to learn and adapt. We need a certain amount of physical stress to keep the body in optimum condition. And this goes for the immune system, too.

This said, drastically reducing stress can have very clear benefits for some people. I have had several patients who decided to quit the job, get out of the fast lane, and work full time on bolstering their immune systems. I'm very supportive of this. As a young student I used to observe a venerable Chinese herbal physician who was given to oracular, impressive pronouncements like "Ah, organs very weak, you must lie down, one month, no get up, no move, only go to bathroom and to table to eat." When people followed his advice, some would have fair to middling results, some would have trouble with spouses or jobs, and some would have very good results, because only this kind of drastic prescription would get them to slow down enough to get better. In fact, Chinese medicine is much more supportive of rest and rehabilitation. Chinese hospital stays are much more prolonged than in the West; they are more like an old-fashioned spa cure, with light activity that includes t'ai chi and housekeeping chores. Our medical system and our culture itself don't encourage this kind of approach to treating illness. But this doesn't mean that we can't deal with stress in creative ways, even if we can't take off a month from work to rest and let the immune system do its work. And Western medicine is making some very interesting discoveries about how stress affects the immune system.

Studies have shown that extreme, traumatic stress clearly depresses immune function. In one study, reduced T cell counts were found in men

who were suffering from profound grief because their wives were dying of cancer. Other studies have shown depressed immunity and increased rates of tumor growth in rats who were subjected to repeated shocks that they could not escape from. Stress that is profound and chronic is that which most weakens the immune system. Yet, studies of illness levels in people who have experienced stressful events — like death in the family, job loss, taking out a mortgage, or moving to another city — have come up with mixed results. Stressful events do correlate to weakened immunity and susceptibility to infection. But of people who experience the same kind of stress, some tend to get sick and some don't. It is probable that different people handle their stress differently, and this may affect their immune health.

Other studies have shown that certain kinds of stress can actually enhance immunity. Rats who are subjected to shocks that they can escape from have a heightened immune response. Medical students who are studying for exams usually don't get sick until *after* the exams, when the stressful period is over. This fits in with the notion that mild or manageable stress can actually be good for us.

### *Conditioning the Immune Response*

A fascinating discovery in the area of mind-body medicine is that the immune response can be a conditioned response, just as Pavlov conditioned his dogs to salivate at the sound of a bell. In a key experiment at the University of Rochester, psychologist Robert Ader gave rats saccharine water before they received an immune-suppressive injection, and he discovered that eventually the rats would have an immune-suppressive reaction to drinking the saccharine water alone, without the injection. The implications of this fact are enormous — it means that neural and psychological events can directly affect the cells of the immune system, and it implies that we may be able to use psychology or conditioning to enhance our immune response to diseases.

In fact, experiments have shown this to be true. Clinical studies at UCLA and elsewhere have shown that cancer patients who participate in support groups, where they talk over their feelings and the problems they're facing, experience a strengthening of some aspects of immune response, and overall have a better rate of recovery. At the University of Pittsburgh, psychologist Sandra Levy and her colleagues found that women with breast cancer whose personal relationships with husbands and physicians were supportive had improved immune cell activity. And psychologist James Pennebaker, found that students who merely kept journals in which they wrote about their feelings and any disturbing or traumatic events had measurably better immune functions.

Other researchers have looked at meditation, relaxation, guided imagery,



### IMMUNE HEALTH CHECK LIST



- |  |   |
|--|---|
| _____ Do I get some sort of regular exercise, 30–40 minutes, at least three times a week?                                | _____ Do I live near any industrial sites?  |
| _____ Do I eat a healthy low-fat, low-sugar diet?  | _____ Do I have a lot of mercury amalgam dental fillings?   |
| _____ Do I eat organic foods when possible?  | _____ Do I get the flu every winter or more than two or three colds a year?   |
| _____ Does my diet contain sufficient amounts of carotenoids, vitamins C and E, zinc, and selenium?                      | _____ Do I get repeated colds or flu attacks? Do they linger for weeks and weeks or require antibiotics to deal with secondary infections?                  |
| _____ Do I drink more than one or two alcoholic beverages a day, if a man, or more than two or three a week, if a woman? | _____ When I get the flu, do I run a real fever and have strong symptoms that run their course, or do I run only a low-grade fever with lingering symptoms? |
| _____ Do I smoke?  | _____ Have I had any chronic or persistent infections that don't ever clear up for good?  |
| _____ Do I have some effective means of dealing with normal or extraordinary stress in my life?                          | _____ Do I get frequent bladder or yeast infections?  |
| _____ Do I get sufficient sleep? An average of seven or eight hours a night?   | _____ Do any wounds I get heal quickly, or do they tend to heal slowly and get infected?  |
| _____ Am I subjected to any persistent environmental hazards or pollutants at work or at home?                           | _____ Do I often feel ill after eating certain foods?   |
| _____ Is my drinking water free of pollutants and excessive chlorine?  |   |

humor, and even hypnosis as ways of modulating immune response. Studies have confirmed the positive effects of these activities on immune response. To mention just one, residents of a geriatric nursing home who were taught relaxation techniques and guided imagery showed increased activity of immune cells and had better control over recurrent herpes infections.

## Acupuncture: A New Tool for Immune Support

One of the most fascinating areas of current research is the study of how acupuncture, the traditional medical treatment of China, can help modulate the immune system. Studies have shown that acupuncture treatment can assist in the treatment of diseases like chronic hepatitis infection, not just in reducing symptoms but in actually hastening the end of the infection and normalizing the body's immune response. How is this possible just from a needle stuck into the flesh? Well, it appears that acupuncture may work by stimulating specific portions of the autonomic nervous system, which in turn causes responses in the immune system. One study has even found that acupuncture stimulation can cause a significant rise in blood levels of interferon, one of the immune system's messenger hormones. The effect lasts for several days and is much safer than other methods of boosting interferon.<sup>26</sup> Interestingly, the acupuncture point used in this study has traditionally been used to treat symptoms and infections of the head and upper respiratory tract, including the common cold, headache, dentalgia, pharyngitis, rhinitis, and tonsillitis.

The point is that we now have a range of "new" tools, from meditation to guided imagery to support groups, that have a clear medical benefit for treating immune suppression, whether caused by stress, state of mind, or other reasons. Anyone who is concerned about maintaining immune health should seriously consider these.

## Trouble-Shooting: Testing and Diagnosis

The explosion in knowledge about the immune system has led to a search for tests that will indicate very specific problems with the complex range of cells and hormones that make it up. Let's take a look at our current tool kit for testing immune health.

### T CELLS AND T CELL RATIOS

The HIV epidemic has made T cells part of everyday language, since they are the primary target of the AIDS virus. It's the very low T cell count that