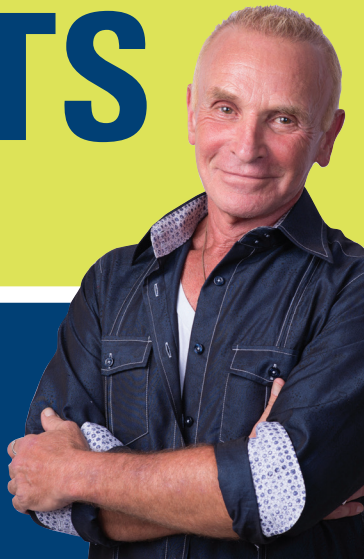
WHAT YOU NEED TO KNOW NOW

# The Uncensored Truth about VITAMIN & MINERAL SUPPLEMENTS



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# Introduction

When my publisher first came to me with the idea of an updated and expanded version of *The 150 Healthiest Foods on Earth* for a 10th anniversary edition, one of the first ideas I had was to add an appendix about vitamins and minerals. After all, vitamins and minerals are mentioned so frequently in the book. It might be good to have a single place to look them up quickly and get a short synopsis of what they actually do and why it's a good thing when they're in foods.

Good idea, right?

I thought so, too. That is, until I had to decide which ones to include and which ones to leave out.

Deciding on vitamins was relatively easy. There are only thirteen of them. They're all found in foods, and every one of them is also available as a supplement and has multiple uses and effects. So, including all thirteen—the four fat-soluble ones (A, D, E, and K) and the nine water-soluble ones (the eight B vitamins and vitamin C)—was a no-brainer.

With minerals . . . not so much.

Minerals in the diet are divided into two groups—the macrominerals and the trace minerals. Macrominerals are needed in relatively large quantities, while trace minerals (also known as microminerals) are needed in much smaller amounts. But all are essential. There are seven macrominerals (calcium, magnesium, sodium, chloride, sulfur, and phosphorus) and nine trace minerals (iron, zinc, iodine, selenium, copper, manganese, fluoride, chromium, and molybdenum).

But there are also other minerals that are turning out to be pretty important—even though minimum amounts haven't been established. Boron, for example, is important for bone health. Cobalt is needed for the synthesis of vitamin B12. Vanadium may be useful for helping to regulate blood sugar.

Conversely, there are minerals in the nine trace minerals and seven macrominerals that almost no one is deficient in and that almost no one ever takes as a separate supplement (for example, chloride and phosphorus). Should those be included, I wondered?

And what about nutraceuticals such as coenzyme Q10? Or alpha-lipoic acid? Or herbs such as saw palmetto, astragalus, or ginseng? Probiotics? Resveratrol? Curcumin? Or, for goodness sake, what about omega-3s? They are not a vitamin, a mineral, a botanical, or an herb. They're a class of fatty acid that's absolutely essential for human health!

And then there's *nicotinamide riboside*, a special form of B3 that just might be the most important nutritional supplement discovery in the past decade.

All of these—and many more—have a place in natural medicine, not to mention preventive care and general health, at least for certain people at certain times.

But, if I included them all, we're talking a second book—not an appendix.

So, I comprised. This guide covers all the thirteen vitamins, the seven macrominerals, and the nine trace minerals. And, because I just couldn't resist, I also included seven "superstar" nutrients—omega-3, curcumin, resveratrol, probiotics, coenzyme Q10, alpha-lipoic acid, and the aforementioned nicotinamide riboside, which is sold under the brand name of Niagen®. I think these are so important, I just couldn't leave them out even though they didn't fit neatly into the predetermined categories. In the case when a nutrient is almost never taken as a supplement and for which deficiencies are almost unknown, I simply tell you what it is and why we're not spending a lot of time on it.

I hope this basic guide will help you answer some basic questions like, "what does vitamin A do anyway, and why should I care?" If it accomplishes nothing other than that, it will have achieved its modest purpose.

# The Thirteen Vitamins

## 1. VITAMIN A

Vitamin A is one of a select group of vitamins and minerals that are known to be powerful antioxidants. (This group also includes C, E, and the mineral selenium.) Antioxidants prevent or reverse damage to cells and DNA caused by nasty little molecules called "free radicals." In fact, there's a famous theory called the "Free Radical Theory of Aging" that holds that free radicals are at the heart of why we age, basically causing "rusting from within."

Vitamin A is more than just a powerful antioxidant. It also has the power to boost immunity, and it is a great weapon against infections and colds. Not for nothing does vitamin A have the reputation as the ultimate "infection fighter."

Vitamin A is one of the few vitamins that have the potential for toxicity, but at ridiculously high and unrealistic doses. Toxicity has occurred in Arctic explorers who ate polar bear liver, which is extremely high in vitamin A. Not exactly a situation you need to worry about.

Vitamin A—like vitamins E, K, and the whole family of carotenoids (including beta-carotene, lutein and zeaxanthin)—are all fat soluble, meaning they are far better absorbed when consumed with some fat. Vitamin A is an absolutely essential part of the diet, and deficiencies can cause serious health problems.

**FUN FACT**

For years, I've been using micellized (liquid form) vitamin A in high doses at the first sign of a cold or infection. It's a powerful booster of immune system function. I generally take 50,000 IUs for three days straight, along with zinc (50–100 mg a day while sick), extra vitamin C, and the herbs astragalus, Echinacea, and oil of oregano. It works 95 percent of the time, and variations of this protocol are used by many integrative and functional medicine practitioners.

## 2. THIAMINE (VITAMIN B1)

Vitamin $B_1$ (also known as thiamine) is one of the eight B vitamins sometimes collectively known as B-complex. All B vitamins help you turn your food into energy, but they each have specific (if overlapping) functions.

Many people may remember *beriberi* from high school biology textbooks. Beriberi is a nutritional deficiency disease caused by inadequate intake of vitamin $B_1$. (The word beriberi is Sinhalese, and it means literally "I can't I can't," a reflection of the absolutely debilitating effect the disease produces on every aspect of human functioning.)

Though we don't see much beriberi these days—certainly not in the United States—that doesn't mean everyone's getting optimal amounts of $B_1$. Like all eight B vitamins, thiamine is water soluble, so it doesn't stay in the body very long after ingesting. That means it's important to get a continual supply of it from your diet. Many life situations also increase your need for this important vitamin—for example pregnancy, lactation, high carb diets, exercise, or even drinking alcohol.

Cooking, baking, pasteurization—any kind of heating destroys a substantial amount of the $B_1$ in foods. Though junk foods often are made with "fortified" flours, the amount of thiamine they fortify with doesn't amount to anything worth mentioning. What's more, because it's usually flours that are

fortified, the heat from the baking knocks out most of the small amount of $B_1$ they used to fortify the flour in the first place. "Fortified" foods are rarely your best choice for *any* vitamin. The only reason they need to be fortified in the first place is because without fortification they'd be nutritionally empty foods—and usually high-glycemic to boot!

Low thiamine status has been found in patients with heart failure and diabetes, and there's some suggestion from animal studies that thiamine deficiency might play a role in Alzheimer's. Thiamine helps the body manufacture *hydrochloric acid*, which is absolutely critical to digestion and to the absorption of nutrients.

## 3. RIBOFLAVIN (VITAMIN B2)

Unlike superstar vitamins like vitamin D—which consistently garners attention in the nutrition press—you don't hear much about vitamin B2. That's because it's best known as a supporting player. But don't make the mistake of underestimating its importance. Vitamin B2 goes about its business quietly, helping with things like metabolizing food, helping to convert vitamin B6 to its active form, helping to create hemoglobin in the blood, and acting as an antioxidant. It's also needed to make one of the body's most important endogenous antioxidants—glutathione.

While riboflavin deficiency on its own is rather rare in the developed world, suboptimal levels can affect pathways in the metabolism of vitamin B6, niacin, iron, and folate, and deficiency has been linked to preeclampsia in pregnant women. Cracks at the corner of the mouth can sometimes be caused by vitamin B2 deficiency as well.

As is true of many vitamins, not having a deficiency disease doesn't guarantee you're getting optimal levels. Though most people in the US consume the minimum recommended amount of riboflavin, according to the NIH, 6 percent don't; groups who are especially susceptible to deficiency include vegans, vegetarian athletes, and pregnant/lactating women and their infants.

### FUN FACT

Many people who start taking vitamins—particularly B-complex—often notice that their urine seems bright yellow. That's riboflavin, which produces yellow fluorescent substances. And it's perfectly harmless.

## 4. NIACIN (VITAMIN B3)

Vitamin B3 is one of a select group of vitamins—along with C, D, B12, and thiamine—that actually has a deficiency disease associated with it. In the case of niacin, the disease is pellagra, a disease whose symptoms are often called the "Four Ds": dementia, diarrhea, dermatitis, and death!

We don't see much pellagra anywhere in the Western world, but it's pretty clear that you'd be in deep trouble if you didn't get enough niacin. Luckily, getting enough niacin to prevent pellagra is pretty easy to do.

Figuring out which form of niacin to use—well, that's a different story. (More on that in a moment.)

Niacin—also known as vitamin B3 or nicotinic acid—plays a role in numerous metabolic pathways, but it really garnered a lot of attention in the 1950s when researchers discovered its lipid-improving abilities. Niacin can:

- lower low-density lipoproteins (LDL)
- lower triglycerides
- improve high density lipoproteins (HDL)
- increase the ratio of large/small particle LDL

That last one is especially important, for reasons outlined in my book with cardiologist Stephen Sinatra,

*The Great Cholesterol Myth*. We now know that LDL isn't a single molecule and actually comes in several "flavors" or subtypes. LDL-A is a large fluffy molecule that is virtually harmless (unless it becomes damaged by oxidation). LDL-B, on the other hand, is a nasty little bugger—a hard, small, dense molecule that can definitely contribute to atherosclerosis.

In other words, your LDL number itself isn't so important. It's what *subtype* you have that can make the difference. Pattern A—where most of your LDL is of the fluffy type—is good. Pattern B—where most of your LDL is the hard, dense type—is not.

Niacin can shift the ratio so you have *more* LDL-A and *less* LDL-B. And that's much more important than just reducing overall LDL. Niacin is also one of the only nutrients found to lower a really nasty molecule called Lp(a), high amounts of which can significantly raise the risk of heart attacks. Cardiologist Stephen Sinatra, M.D., calls Lp(a) "*one of the most devastating risk factors for heart disease and one of the hardest to treat*." The pharmaceutical industry hasn't come up with anything to lower Lp(a), but niacin does the job just fine.

Niacin comes in a number of "flavors," but all niacin is not created equal. One type of niacin called *niacinamide* is widely used in multivitamins and B-complex formulas. It has plenty of benefits, like preventing pellagra! But if you're taking it to lower cholesterol, forget about it. The niacinamide form of niacin has exactly zero effect on cholesterol.

The most common form of niacin—*nicotinic acid*—kicks in immediately and is quite effective for cholesterol lowering, but watch out. It creates that miserable flushing that conventional niacin is known for. It's horrible, and more than 40 percent of the population (including yours truly) can't tolerate it. My friend, naturopathic physician Nikki Arguinzoni-Gil, N.D., recommends taking a baby aspirin thirty minutes before taking niacin (nicotinic acid) to reduce or eliminate the flush.

Then there's "no-flush" niacin, otherwise known as *inositol hexanicotinate*. There's only one problem with using it to lower cholesterol it: it doesn't work.

Sorry.

There's also time-release niacin, which puts a lot of strain on your liver. A particular form of time-release niacin called *wax-matrix niacin* does *not* tax the liver, and *is* effective for cholesterol lowering, but it can be hard to find. (Google wax-matrix niacin if you want to try it.)

There's a third type of niacin called *nicotinamide riboside* (NR) that is so interesting and creating so much of a buzz in the anti-aging community that I've given it its own entry in this book, in the section called "7 Superstar Nutrients that are Not Vitamins or Minerals." Because nicotinamide riboside *is* a form of vitamin B3, it's technically a vitamin. I included it in the Superstar Nutrients section anyway to distinguish it from other forms of B3. Nicotinamide riboside is sold under the brand name Niagen®.

As with other vitamins, the amount needed to prevent a horrible deficiency is not necessarily the same as the optimal amount. Niacin helps convert the food you eat into energy. Niacin also helps your body make both sex hormones and stress hormones, and it's been shown to suppress inflammation. Population studies have shown that people who get more niacin in their diet have less risk of Alzheimer's.

## 5. PANTOTHENIC ACID (VITAMIN B5)

You probably wouldn't hear much about vitamin B5 except for the fact that it's gotten a reputation as the "stress vitamin," or, more accurately, the "*anti*-stress" vitamin. That's because vitamin B5 is vitally important to your adrenals, which produce important hormones such as cortisol and adrenaline, also known as "stress

hormones." Being under stress eats up vitamin B5, which is why many integrative practitioners suggest supplementing with B5 for those under a lot of stress.

Vitamin B5, also known as pantothenic acid, is an essential nutrient. Pantothenic comes from the Greek word *pantos*, which means everywhere. That's because this vitamin is found all over the place, in both plant and animal foods. Pantothenic acid deficiency in humans is almost unheard of, but when scientists experimentally create deficiency in order to study it, they find headache, fatigue, insomnia, intestinal disturbances, and impaired antibody production.

These symptoms might be because of the coenzyme A connection. You see, you need coenzyme A to metabolize protein, carbs, and fat, and vitamin B5 is needed to create coenzyme A. That means you basically need vitamin B5 to metabolize your food. Best sources of the vitamin are organ meats such as liver and kidney, egg yolks, avocados, cashew nuts, and peanuts. Two of the richest sources of pantothenic acid are royal jelly and brewer's yeast.

## 6. VITAMIN B6

Vitamin B6 was a topic that used to get Robert Atkins, M.D.—of Atkins Diet fame—piping mad. He felt it was an outstanding example of how divorced the dietary policy makers at the Food and Drug Administration (FDA) were from what the latest research was saying.

Half tongue-in-cheek, he called vitamin B6 "the most essential B vitamin," and thought the government recommendations for daily intake were laughably small. He believed that the average person was "alarmingly deficient" in this important nutrient.

He may have been right. Vitamin B6 is involved in more than 100 metabolic operations. Along with folic acid and vitamin B12, it's one of a trio of B vitamins that can bring down blood levels of *homocysteine*, an inflammatory compound in the blood that increases the risk of stroke and heart disease. But B6 may help the heart in other ways, apart from its ability to lower homocysteine. One study found that low B6 levels were an independent risk factor for coronary artery disease.

B6 has a particular role in women's health. It helps convert *estradiol*—one of the three forms of estrogen—into *estriol*, which is the least carcinogenic of the estrogens. Many women who have an overgrowth of the *Candida albicans* yeast don't metabolize B6 properly—their bodies can't convert it into the active form (pyridoxal-5-phosphate). Pregnancy depletes B6, and so do birth control pills.

And because B6 is needed to convert tryptophan into serotonin, it's very important for mood. Most functional medicine practitioners I know that treat depression with nutritional supplements almost always include B6 in their recommendations.

## 7. BIOTIN (VITAMIN B7)

Biotin—a member of the B-vitamin family—has a reputation as being the "go-to" nutrient for thinning, listless, and dry hair. One reason for that is that a lot of research shows symptoms of biotin deficiency include dry thinning hair and hair loss. That does not mean that biotin deficiency is the only cause—or even the main cause—of dry thinning hair or hair loss, but it certainly explains why people would want to eliminate that possibility.

Biotin plays a key role in the health of the skin, cells, and the digestive tract. Most people don't need biotin supplements because we get enough from our food. Not only that but biotin is actually recyclable by the human body.

There are, however, two situations where biotin supplements might be useful. One is in the case of brittle hair and nails. In one study, patients taking biotin supplements had improved nail hardness and firmness, and in another study, they had a significant decrease in nail splitting and brittleness.

The other case where super-high doses of biotin might be useful is in the management of blood sugar.

**FUN FACT**

Biotin once had the nickname "Vitamin H" which came from the German words for hair (*haar*) and skin (*haut*).

Research on this is promising, and if managing blood sugar is important to you, you might want to discuss adding high-dose biotin to your supplement regimen with your integrative practitioner.

## 8. FOLIC ACID (VITAMIN B9)

Probably the single most important thing to know about folic acid is that it can prevent birth defects such as spina bifida, the most common permanently disabling neural tube defect in the United States.

It's also one of a trio of B vitamins—the others being B12 and B6—that can lower homocysteine, a nasty little inflammatory compound that increases the risk of heart disease and stroke.

Many people don't really understand the difference between folate and folic acid, but it's actually rather simple. Folate is found in food, mainly green, leafy veggies. Folic acid is a synthetic compound used in dietary supplements and in food fortification. Folate deficiency has been reported to be the most common vitamin deficiency in the United States. Not only that, pregnancy actually doubles the need for dietary folate.

Folic acid supplementation and fortification have significantly reduced birth defects from spina bifida, and that's a great thing. But folic acid supplementation has a dark side. While high folate status seems to *reduce* the risk for cancer, too *much* folic acid supplementation can increase it. In addition, excess folic acid consumption can mask a vitamin B12 deficiency.

The body takes the folates you get from food and turns them into the active, usable form of folate known as 5-methyltetrahydrofolate (5-MTHF). This active form of folate is metabolized in the small intestine, and everything is right with the world. But folic *acid* is processed in the liver, which doesn't always do a great job of metabolizing it. That can leave you with a large amount of "unmetabolized" folic acid floating around your bloodstream, and that excess unmetabolized folic acid that may be the link to an increased cancer risk.

You can actually get supplements of folate in its already-metabolized, active form of 5-methyltetrahydrofolate (also abbreviated as 5-MTHF), and this is what everyone in functional medicine recommends. Many people have a mutation in the gene responsible for producing the enzyme that converts folate into its active form. When you have a mutation of this gene—called the MTHFR gene—your body has trouble converting folate, and this can lead to a host of health problems down the line. (MTHFR gene mutation has become such a "thing" that there are now entire websites devoted to it.) Bottom line is to always supplement with the active, 5-MTHF form of folate (5-methyltetrahydrofolate). Some high-end manufacturers even use the active, 5-MTHF form of folate in their multivitamins. Those are the ones you should look for.

You should definitely supplement if you're pregnant or trying to get pregnant. It's critical to have enough folate (or folic acid) in your system in the first weeks of pregnancy in order to prevent spina bifida and other neural tube defects. Experts recommend at least 400–800 mcg of folic acid supplementation for anyone of pregnancy age because many women don't discover they're pregnant till they're a few weeks in. At that level of supplementation, there should be no problems. If it's possible for you to find supplements that use the 5-methyltetrahydrofolate form of folate, you'll be even better off.

## 9. VITAMIN B12

If I had to pick just one word for you to remember about vitamin B12 it would be this one: memory.

In the last ten years or so, it's become increasingly clear that B12 deficiency in elder adults is linked with dementia, and cognitive impairment in general. While B12 may not reverse dementia, it may play a role in protecting you from it. That makes it all the more important that you get enough.

Most people don't, and here's why. Number one, vitamin B12 requires a supply of something called *intrinsic factor*, which is a compound you make in your stomach that latches on to the B12 in your food and coaxes it into the bloodstream. Problem is, we make less and less intrinsic factor as we get older. (This is why so many people are fond of vitamin B12 injections or vitamin B12 sublingual supplements, both of which get into the bloodstream without the need for intrinsic factor.)

Then there's the vegetarian factor, the fact that many people are eating less meat. This has led to an endless debate on whether or not plant sources of B12 are just as good as animal sources. (They're not.)

A deficiency of vitamin B12 is known as pernicious anemia, (different from iron-deficiency anemia), but just because you don't have a B12 deficiency doesn't mean you have enough of this critical vitamin. B12 is one of three B vitamins (the others are B6 and folic acid) that together bring down blood levels of *homocysteine*, an inflammatory molecule that's a risk factor for strokes and heart attacks. Vitamin B12 is involved in mental function, sleep disorders, blood pressure, the immune system, energy, and much more.

The signs and symptoms of vitamin B12 deficiency include weakness, fatigue, neurological disorders, and possible links with Alzheimer's and heart disease.

Much like folate, it's extremely important that you get the right kind of vitamin B12, the active kind usable by the body. It's known as *methylcobalamin*, and it's the only B12 supplement you should take. (Personally, I take methylcobalamin injections a few times a month.)

In short, B12 is really important and many people aren't getting enough of it. Best sources are animal products, but many people—especially vegetarians—should be supplementing as well.

## 10. VITAMIN C

Vitamin C is like the "chicken soup" of vitamins—there's almost nothing it isn't good for!

It's a powerful antioxidant, meaning that it helps fight ongoing cellular damage from rogue molecules called free radicals. This type of damage—which we can see on our skin when we get too much unprotected sun—is called oxidative damage, and it happens everywhere in the body, not just on the skin. There's oxidative damage to our cholesterol, our arteries, our lungs, our brain—just about every tissue or system can be affected by oxidative damage. And the more we understand how oxidative damage and inflammation are involved in heart disease, the more we understand how important vitamin C is for heart health.

Vitamin C boosts our natural defenses. It's very important for the immune system.

The immune cells have a high concentration of vitamin C and that vitamin C gets used up quickly once an infection sets in, which may be one reason why it's a good idea to supplement with vitamin C when you start getting sick. And no, unfortunately, research hasn't supported the notion that vitamin C prevents common colds, but there's pretty good evidence that it reduces their severity and duration.

Vitamin C is also vital for the production of collagen, the most abundant protein in the body and the main structural protein in the skin. And many studies have found an inverse relationship between dietary vitamin C intake and cancer.

Researcher Mark Moyad, M.D., M.P.H., of the University of Michigan was involved in a research project, published in *Seminars in Preventive and Alternative Medicine*, that looked at more than 100 studies over the course of ten years. In an interview in WebMD, he said, "The more we study vitamin C, the better our understanding of how diverse it is in protecting our health, from cardiovascular, cancer, stroke, eye health (and) immunity to living longer."

## 11. VITAMIN D

If nutrients were on the cover of *US Weekly*, vitamin D would be a superstar. Let me explain.

We've known about the role of vitamin D in bone strength for some time. Now, new research is showing the importance of vitamin D in preventing cancer. Sex hormones are made from the stuff. Populations that don't get much sunlight (and are low in vitamin D) are at greater risk for multiple sclerosis. And research has shown that physical performance—especially in older folks—is significantly affected by their vitamin D status.

Several studies have shown that women who have adequate vitamin D levels lose more weight than those who don't. Vitamin D may reduce the formation of new fat cells in the body, and may suppress fat accumulation. Vitamin D supplements might even help some people lose weight. The effects are small but significant, and add to the accumulating evidence that optimal levels of vitamin D are critically important for health. Meanwhile, more than 25 percent of the population—and I'm being *wildly* conservative—is vitamin D deficient.

There is a massive amount of research showing that low levels of vitamin D increase the risk for any number of diseases you don't want to have. Even the generally conservative WebMD points out that low levels of vitamin D have been associated with increased risk of death from cardiovascular disease, cognitive impairment in older adults, severe asthma in children, and cancer. MedicineNet also points out that it may play a role in prevention and treatment of type l and type 2 diabetes, hypertension, glucose intolerance, and multiple sclerosis.

**FUN FACT**

English are called "limeys" because of vitamin C. In the 1600s and 1700s hundreds of sailors were dying at sea from a then-unknown disease (which turned out to be scurvy). On one of these trips, a curious passenger named Dr. Roger Lind performed a nutritional experiment on the sailors—he gave them citrus fruits and found that they felt better almost immediately. This ultimately led to the discovery of vitamin C, the substance in citrus that made the sailors feel immediately better. The British Royal Navy then made it a practice to supply lemon juice to all sailors, but ultimately switched to lime juice, leaving the British Navy with the nickname "limeys."

What's more, low vitamin D levels affect a person's mood, ability to lose weight, physical performance, immune system function, and even their chances of dying. A 2008 study found that low levels of vitamin D increased the risk for death from any cause—called the mortality risk—by a whopping 26 percent compared to those who had "optimal" levels in their blood.

Sadly, there's not much vitamin D in food except for foods that are "fortified" with it, and food manufacturers tend to use an inferior form of vitamin D called *ergocalciferol* (vitamin D2). What's even more ridiculous is that manufacturers frequently fortify nonfat dairy foods (skim milk, nonfat yogurt) even though vitamin D is a fat-soluble nutrient—how much you absorb without fat is anyone's guess.

It's my strong opinion that most people would benefit from supplementation with vitamin D, but it needs to be in the D3 form (*cholecalciferol*), which is the form all high-end supplements use. Speak to your health practitioner about the best dose to use, and ask to be checked for vitamin D levels at your next blood test. The test you want is called a 25(OH)-D test, and it's inexpensive and important. Aim for around 50 ng/ml, which is the number the vitamin D council considers the ideal level to aim for, though levels up to and including 80 ng/ml are absolutely safe.

## 12. VITAMIN E

Vitamin E is not a single, homogenous substance; it actually contains eight slightly different forms. Four of these "flavors" of vitamin E are classified as *tocopherols* (alpha, beta, gamma, and delta) and four of them are classified as *tocotrienols* (also alpha, beta, gamma, and delta). This is important, because many studies of vitamin E supplementation used only one form of vitamin E—alpha tocopherol—which may not even be the most important form. Not only that, but many studies that showed disappointing results used an inferior, artificial form of vitamin E (dl-alpha-tocopherol) which, in my opinion, is so inferior it shouldn't even be sold as a supplement.

The important thing to know about vitamin E is that it is a powerful antioxidant. There's some clinical research showing that even synthetic vitamin E at very high doses may slow cognitive function decline in patients with moderately severe Alzheimer's disease. And in patients with mild to moderate Alzheimer's, high-dose vitamin E has been shown to slow functional decline, translating to a delay in disease progression of about six months.

There's also some research showing that taking vitamin E orally reduces symptoms of anxiety, craving, and depression in patients with PMS.

But unless you've been specifically advised to supplement with large doses of vitamin E, I don't advise it. It's pretty difficult to get a decent amount of vitamin E from food, but a high-quality multiple should provide about 400 IUs which should be fine for most people. To get the most effective blend of the different forms of E, look for "mixed tocopherols," or "high gamma" tocopherols. Best food sources for vitamin E in general are nuts and seeds.

Tocotrienols are sold as a supplement separately because they have a pretty impressive resume on their own, even apart from their tocopherol cousins. There's a fair amount of research showing that they help fight cancer, and they also seem to protect against and minimize stroke-related brain damage in animal research. One good food source of tocotrienols is Malaysian red palm oil.

## 13. VITAMIN K

Vitamin K is finally getting the attention—and the respect—it so richly deserves. It's comprised of two structurally related (but very different acting) compounds, vitamin K1 and vitamin K2. Vitamin K1 is primarily found in green leafy plants such as lettuce and spinach. Vitamin K2 is primarily synthesized by bacteria in the colon.

The most important thing that vitamin K1 does is help the body with clotting. That's why doctors tell you to "avoid" green leafy vegetables when you're on Coumadin, a popular drug which is frequently given to thin the blood of patients who are prone to blood clots. The advice to take Coumadin and avoid green leafy vegetables may be well past its expiration date at this point, but that discussion is beyond the scope of this book.

Vitamin K2, on the other hand, does a whole bunch of other things having nothing to do with clotting. For one thing, it's vitally important for strong healthy bones. Why? Because vitamin K is necessary to make a bone-related protein called *osteocalcin*. Without vitamin K, osteocalcin doesn't work very well, and

without osteocalcin minerals like calcium can't bind to bone.

So, in a metaphorical sense, vitamin K kind of acts like a traffic cop, making sure calcium winds up where it belongs—in the bones (and teeth). And that brings us to the second, very important role of vitamin K2 in heart health.

See, keeping calcium in the bones where it belongs is only one side of the coin. The other side is keeping calcium *out* of the arteries, where it most definitely does *not* belong! That's why vitamin K2 is gaining such a strong reputation as a heart-healthy nutrient—which it is!

Vitamin K2 is found in fermented foods, such as sauerkraut, natto, and some cheeses (many of which most people don't eat). The situation is made worse by the fact that antibiotics wipe out so many of the bacteria that normally produce vitamin K2 in the colon. Because I don't think most people get enough K (especially K2), I usually recommend supplementing. Vitamin K2 comes in two forms—MK4 and MK7. Both are good, but the MK7 is longer acting. Remember to take vitamin K with a meal containing some fat, because it is a fat-soluble vitamin.

# The 7 Macrominerals

## 1. MAGNESIUM

There are two basic things I want you to know about magnesium. Number one, it's needed for more than 300 metabolic operations. Number two, almost no one gets enough of it.

Magnesium plays a crucial role in carbohydrate metabolism. It also plays a critical role in the secretion and action of insulin, thereby helping to control blood sugar. One study found that most prediabetics had inadequate magnesium intake, and that those with the highest magnesium intake reduced their risk for metabolic problems by an impressive 71 percent. The researchers concluded that "magnesium intake may be particularly beneficial in offsetting risk of developing diabetes among those at high risk."

Magnesium is equally important for cardiovascular health—low cellular levels of magnesium cause destruction of heart tissue. In animal studies, magnesium has been shown to prevent this process from happening, protecting heart tissue from destruction.

Stress has an interesting relationship with magnesium, and both have an interesting relationship with cardiovascular disease. Too much stress depletes magnesium which can lead to hypertension, coronary artery constriction, arrhythmias, and heart attack. What's more, having low magnesium levels is seen by the body as a stressor, which depletes even *more* magnesium—and the whole vicious cycle continues.

Many functions that are essential to life depend on adequate magnesium levels. But almost three out of every four Americans fail to get the recommended intake of magnesium per day. According to a study published in the *Journal of the American College of Nutrition*, 68 percent of Americans consume less than the recommended daily allowance of this critical mineral. What's more, the study found that individuals with intakes below the recommended dietary allowance (RDA) are more likely to have elevated levels of C-reactive protein (CRP), an important measure of inflammation. And inflammation is a promoter of every degenerative disease we know of, including (but not limited to) cardiovascular disease.

There are a lot of different forms of magnesium supplements, and not all are created equal. The big

difference between magnesium supplements isn't so much the magnesium, but what it's bonded to. Magnesium by itself is a very small molecule, but it can't just be alone by itself, it has to be bonded to another compound so that it's stable. Magnesium *oxide*, for example, is bonded to oxygen, but is the least well-absorbed of the magnesium supplements (though fine for some situations). Magnesium *citrate* is bonded to *citric acid* which makes for better absorbed magnesium. (The right dose of magnesium citrate, by the way, is the perfect natural cure for constipation.) Magnesium *glycinate* is magnesium bonded to the amino acid glycine, which has relaxing properties of its own. Magnesium *taurate*—harder to find—is particularly good for the heart because it is magnesium bound to taurine, an amino acid with particular cardiovascular benefits. And for those who don't like to take pills, magnesium (magnesium citrate) comes in a great drinkable form by Natural Vitality called Natural Calm. (I find this drinkable form—especially with a pinch of Himalayan sea salt—to be terrific for muscle cramps.)

Finally, you can absorb magnesium quite well through the skin, which is why people used to (and still do) take Epsom salts baths. For my money, the upgraded version of an Epsom salts bath is a bath in Natural Calm Bath, another over-the-counter product made by Natural Vitality, and a great way to both distress and stock up on your stores of magnesium at the same time.

Vegetables, nuts, and seeds are your best food sources for magnesium. That said, I believe most people would benefit from a magnesium supplement. It's one of a small group of key supplements—along with vitamin D and fish oil—that I recommend for almost everyone.

## 2. SODIUM

Sodium is one of the most important electrolytes in the body. Electrolytes like sodium (and chloride—see section 3 carry electrical charges, and they are essential to balancing fluids inside and outside the cell. Too much sodium (particularly for those who are genetically 'salt sensitive') can lead to hypertension. On the other hand, sodium deficiency symptoms can range from irritating to fatal, with a pronounced effect on the nervous system. The term "the Goldilocks effect" was ready-made for sodium—the perfect amount is not too much, not too little, but "just right."

Sodium isn't just found in salt—good food sources include apples, egg yolks, and bananas. Be aware that most of the sodium in our diet—especially the excess sodium many consume unwittingly—does *not* come from the salt shaker. It comes from processed foods. (If you really want to be shocked sometime, take a look at how much sodium is in a typical can of canned soup. Don't look if you're squeamish.)

It's rare that someone would have to supplement with sodium. Occasionally, endurance athletes—who may lose massive amounts of electrolytes in the course of a four-hour event—may need to take in more salt, but that's an exceptional case and almost always done under the supervision of a health professional or coach. The average person gets more than enough sodium in his or her diet.

## 3. CHLORIDE

Chloride is one of the main electrolytes in the body, which basically means that when dissolved in fluid (like water) it produces charged particles called ions. (Any substance that produces ions when it's dissolved in water is an electrolyte.)

Because it carries an electrical charge, it's essential to keeping the balance between fluids inside the cell (intracellular) and outside the cell (extracellular). The right balance between fluids in and out of the cell is critical for regulating muscles, nerves, hydration, blood pH, and blood pressure. Most of us get all the chloride we need from our diet or from plain old salt, which

is a combination of the electrolyte sodium and the electrolyte chloride.

Another function of chloride is that when it combines with hydrogen in the stomach it creates *hydrochloric acid* which is one of the most important substances you need for digestion. Without hydrochloric acid you're kind of screwed. You can't break down proteins, and you can't form something called *intrinsic factor* which is necessary for the absorption of vitamin B12 (see section on vitamin B12).

Chloride is almost never taken as a supplement, and deficiency is rare. However, when it does occur—which, let me repeat, is rare—it may result in a life-threatening condition known as *alkalosis*. Alkalosis can also happen if you lose an excessive amount of sodium. For example, excessively heavy sweating during a marathon with an excessive loss of sodium can cause this. Again, a situation so rare that it's not a consideration for 99.99 percent of the population.

It's almost never necessary to supplement with chloride.

## 4. POTASSIUM

There are three things to know about potassium:

1) It's vitally important for heart health.
2) It has a symbiotic relationship with sodium.
3) The regulations regarding potassium supplements are batshit crazy.

Virtually every observational study has shown that people who eat plant-based diets have lower blood pressure and generally lower risk of heart disease. The problem is the definition of "plant-based." Talk to fanatic vegan advocates like Dr. Neal Barnard and the conclusion is clear: vegetarian diets are "healthier."

I'm not so sure. (At least, about the "vegetarian diets are healthier" part.)

This isn't the place to debate veganism or vegetarianism, but the fact is that people who eat lots of fruits and vegetables *do* get lots of potassium, regardless of whether they're vegetarians or Paleo. That's because fruits, vegetables, and nuts are where potassium live. I happen to believe that everyone—regardless of their dietary preferences—can use more vegetables in their diet, and potassium is one of the many reasons.

Potassium is one of the macrominerals in the body. It is also an electrolyte, which basically means that when dissolved in fluid—like water—it produces charged particles called *ions*. (Any substance that produces ions when it's dissolved in water is an electrolyte.)

Potassium and sodium have an interesting relationship. Sodium draws fluid (water) *out* of the cells, while potassium draws fluid into the cells. Just as omega-6 and omega-3 need to be consumed in a balanced ratio, so do potassium and sodium. Our Paleolithic ancestors got a lot more potassium and a lot less sodium, while our modern diet offers the exact opposite ratio. Potassium actually modulates the modern dietary excesses of sodium, and there are many who feel that those who worry about "too much sodium" in the diet should really be worried about "too little potassium." In fact, multiple studies demonstrate a link between the *ratio* of sodium-to-potassium intake on the one hand, and hypertension and cardiovascular disease on the other. In fact, this ratio is a more powerful predictor of outcomes than the intake of either sodium *or* potassium separately!

The bottom line is you need potassium. *Lots* of it. The Food and Nutrition Board—not known for being wildly radical—recommends that we get 4,700 mg a day of the stuff (5,100 mg for women who are breastfeeding). Top potassium foods include spinach, sweet potatoes, bananas, lima beans, avocados, pistachio and pine nuts, and—believe it or not—mushrooms. One cup (156 g) of cooked sliced mushrooms gives you about 400 mg.

Don't count on supplements to make up the difference if you're not eating enough potassium-rich foods. The U.S. government regulatory agencies—in their infinite wisdom—have decided that potassium supplements have to be limited to 99 mg. The thinking was that overdosing on potassium can have some pretty negative effects, but most people need to be worrying about too *little* potassium, not too much. High potassium readings in your blood are a matter for your doctor, and can be potentially life threatening. However, you should know that some high potassium blood levels are artifacts of the testing procedure. If you leave blood around a bit too long, potassium levels will test higher. That's not *always* the reason for a high potassium reading, but it often is.

## 5. CALCIUM

The thing about calcium is that you're constantly losing it.

You lose it through shed skin. You lose it through hair and nails. You lose it through sweat and excreta. So, nature figured out a solution to the problem, at least for land-living vertebrates: create an internal reserve of the stuff, so you always have it around. Think of it as kind of like a savings account, only instead of keeping money in it, you keep calcium in it. And that savings account is called bone.

Now bone has a lot of other functions *besides* acting as a storage facility for calcium, so the calcium reserve has to become a lot bigger than it would have to be just to provide enough calcium for basic cellular functions. That's why the main functions of calcium—like acting as a messenger within the cell or helping with hormone secretion—aren't threatened when you don't take in enough calcium through your diet. You only use about 1 percent of the calcium in your body for those functions—the other 99 percent of calcium in your body is stored in the bones and teeth.

The calcium reserves in your bone can be accessed by the body—just like your bank account can be accessed through an ATM—in a process known as "bone remodeling," a kind of dance of withdrawal and deposit, known respectively as *resorption* and *absorption*. When the amount of calcium you take in each day is less than the amount you need to offset what you lose, well then, bone reserves are depleted, there's a decrease in mass, and a reduction in strength. Keep this up and the bones become thinner, and eventually, osteoporosis can set in.

And honestly, osteoporosis isn't the problem—fractures are.

During the growth years, calcium intake is all about building a big reserve at the same time as you're building strong bones. That's why calcium intake is so important during the teen years. In the adult years, calcium intake serves to offset the daily loses of calcium and to reduce the amount of bone modeling to the minimum needed to maintain structural integrity. That's the basis of using calcium to prevent osteoporosis.

And that's why doctors have been telling us to get anywhere from 1000–1500 mg of calcium a day through food and supplements, although the exact amount changes with age, sex, and the year of the recommendation.

But there's a problem. Recent studies are showing that calcium supplements actually don't prevent fractures. In one review, the authors wrote that "evidence that calcium supplements prevent fractures is weak and inconsistent."

Worse, one study even showed that men taking calcium supplements may be increasing their risk of dying from cardiovascular disease by as much as 20 percent. In that same study, calcium supplements were *not*, for some reason, tied to an increased risk of dying for women.

This is not the place to go into the intricacies of the relationship between estrogen and calcium, hormone replacement, and bone loss, or even the conflicting and disturbing studies that suggest a relationship between calcium supplements and heart disease. These are complicated issues well beyond the scope of this guide, but you should definitely be aware of them. (For further reading, I suggest the "Calcuim Supplements"article by Chris Kresser, LAc (See References), one of the smartest clinicians I know and certainly one of the best sources for fair and balanced information.)

Here's my opinion.

Throwing calcium supplements at the problem of fractures and osteoporosis is not the solution for a number of reasons.

First, we know that there are many societies in which osteoporosis and fracture rates are far lower than ours yet their calcium intake is significantly less. And many of those societies don't consume dairy at all.

Two, calcium does not "work alone." It's a team player. For best results—meaning going into your bone reserves—it needs to be taken with a variety of other nutrients, especially magnesium (a 1:1 is best), vitamin D, boron, manganese, and . . . this is key . . . vitamin K.

See, one place you most definitely do *not* want calcium to wind up in is the arteries (think: *calcification of the arteries*). And vitamin K, particularly vitamin K2, is vitally important to make sure that calcium actually winds up strengthening the bones instead of blocking up your arteries.

Vitamin K comes in two flavors, though many doctors do not know this. K1 is the one that's easy to get. It's in all the green leafy vegetables, including lettuce, and it's needed for proper clotting. But K2 is found only in certain select foods (like natto, which almost no one eats). It's much harder to get adequate vitamin K2 from your diet than it is to get K1.

I can't prove this, but I believe that the vast majority of people studied in the research showing a slight—but disturbing—increase in heart disease risk were not taking balanced bone formulas containing calcium and magnesium in the right ratio and forms, coupled with adequate vitamin D, supporting nutrients, and sufficient K2.

Nevertheless, I'm not a huge fan of calcium supplements except for teenagers (especially girls) and people in their twenties. That's the time you're still making deposits into your calcium "bank," and a good, well-balanced and high-quality bone supplement makes a lot of sense.

When it comes to vitamins, minerals, and nutraceuticals, you will almost never hear me utter the standard dietitian talking point, "You can get all you need from food" because I believe that is patently false—most of the time. But when it comes to calcium, I have to agree. Get your calcium from food

And don't fall for the dairy industry propaganda that you need milk for calcium, even though they spend millions of dollars every year on marketing and lobbying efforts to get you to believe that.

Sardines, green leafy vegetables, kale, yogurt, kefir, cheese, and nuts are all rich sources, and they come without added steroids, antibiotics, hormones, high levels of pro-inflammatory omega-6.

## 6. PHOSPHORUS

Peek through a random sample of books on nutrition supplements and you may be surprised by how few times you see phosphorus mentioned. That's because just about everyone gets enough phosphorus in their diet so it's very rarely taken as a supplement. Nonetheless, it's the second most abundant mineral in the body right behind calcium. And it shares with calcium an affinity for bones and teeth—85 percent of the phosphorus in the body is found there, not surprisingly because phosphorus is essential for building strong bones and teeth. It also helps filter waste in the kidneys, plays an important role in cell growth and

cell repair, and helps us to synthesize, absorb, and use vitamins and minerals from the food we eat.

Good sources of phosphorus include sunflower seeds, raw milk, white beans, mung beans, almonds, brown rice, potatoes, broccoli, and eggs. Other good sources include high-protein foods such as tuna, turkey breast, and grass-fed beef.

Don't confuse phosphorus—a nutrient which the body needs and which helps build strong bones—with *phosphoric acid*. Phosphoric acid is in sodas, especially colas. And it's bad news. It actually works *against* the absorption of calcium and magnesium by your body.

And speaking of calcium, nutritionists recommend a balance of calcium and phosphorus in the diet, but the typical Western diet contains 2 to 4 times more phosphorus than calcium. Carbonated beverages can have as much as 500 mg of phosphorus (phosphoric acid) in one serving. And when there's more phosphorus in the body than there is calcium, the body will use the calcium stored in the bones to bind to it, and that's exactly what you don't want.

Because of the imbalance in the typical American diet—too much heavy, processed meats and not enough calcium-rich vegetables, seeds, and nuts—having too much phosphorus (especially relative to calcium) is probably a bigger danger than not having enough. Several studies suggest that higher intakes of phosphorus are associated with an increased risk of cardiovascular diseases. That said, phosphorus deficiency isn't unheard of. It appears that older women are most likely to experience it, 10 to 15 percent of whom have intakes of less than 70 percent of the recommended daily allowance. This may be in part because other elements of the diet interfere with phosphorus absorption. For example, phytates often found in grains compete for the same absorption site as phosphorus, and certain forms of calcium supplements (calcium citrate and calcium carbonate) can also interfere with phosphorus absorption from food.

## 7. SULFUR

If you've ever taken a soak in a hot spring, the one thing you noticed—besides the deep sense of relaxation you felt almost immediately—was the smell. It stinks. As in New Jersey Turnpike, rotten egg stink. That's because the same compound that makes hot springs so terrific also makes them smell disgusting, and that compound is sulfur.

Sulfur is a mineral, naturally occurring in hot springs and volcanic craters. The awful smell is caused by sulfur dioxide gas escaping into the air, but that same sulfur does wonders for arthritis and muscle pain. And bathing in a sulfur-rich pool of water does wonders for you—between the heat, the minerals in the water, and the sulfur, it's got a trifecta of benefits.

If you're not fortunate enough to have a hot spring near you, you can still get sulfur through your diet and through the judicious use of supplements. Athletes frequently take a supplement called methylsulfonylmethane (MSM) precisely because of its high sulfur content which many swear helps with all kinds of athletic injuries and pain.

Sulfur in the diet primarily comes from protein, specifically two sulfur-containing amino acids (methionine and cysteine). But sulfur-rich foods abound—most of the cruciferous vegetables (*Brassica* family) such as broccoli, kale, collard greens, cabbage, and cauliflower are good sources, as are whole eggs.

Some highly respected researchers—Stephanie Seneff, Ph.D. from MIT comes to mind—believe that sulfur deficiency is quite common, partly due to the depletion of minerals in our soils. Joe Mercola, DO believes that sulfur deficiency may be a contributing factor in health problems ranging from heart disease to chronic fatigue, and many researchers have questioned whether we get enough in our diet.

It's been noted that Iceland has remarkably low rates of all the awful Western diseases of lifestyle like depression, obesity, diabetes, and heart disease. While I

know of no study that confirms this, it's been suggested that one reason might be the eruptions of their volcanoes which can enrich the soil with sulfur. The sulfur would presumably benefit the plants that grow there (and the animals that graze there), and—moving up the food chain—would benefit the humans who eat those plants and animals. I can't prove this, but it sure sounds plausible. We used to believe Icelanders were protected from so many of these Western diseases of lifestyle because of the fish they ate, but Icelanders who move from Iceland to Canada and continue to eat fish do *not* enjoy the same decreased rate of depression and heart disease.

# 7 Superstar Nutrients that Are Not Vitamins or Minerals

## 1. OMEGA-3

Omega-3s are a type of fat that do so many wonderful things entire books have been written about their health benefits. Former Harvard professor of medicine Andrew Stoll calls them "the wellness molecule." Low levels of omega-3 are associated with just about every condition you can name, from behavioral problems in children to heart disease to suicide.

Research has shown that the dietary balance between the two essential fatty acids—omega-6 and omega-3—is a critical metric for human health. Omega-6 (found mostly in vegetable oils) is pro-inflammatory. Omega-3 (found in fish and flax and a few other foods) is anti-inflammatory. You need both, but they need to be consumed in the right ratio, ideally about 1:1. We currently consume as much as twenty (!) times more (inflammatory) omega-6 than we do omega-3.

There are three different omega-3 fatty acids. One of them—alpha-linolenic acid (ALA) is found mostly in plant foods such as flaxseeds, flaxseed oil, chia seeds, and hemp seeds. The other two—eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)—are found mainly in cold water fish. Omega-3 is considered an "essential" fatty acid because the body can't make it on its own—it has to be provided by the diet.

EPA and DHA are the most researched of the omega-3 fats, and they have been found to do all kinds of wonderful things from lowering inflammation to lowering blood pressure and triglycerides. ALA has a number of excellent properties as well, though most health professionals don't regard it as equal in power to EPA and DHA.

Technically, the body can take dietary ALA and "convert" it into EPA and DHA but in most people, the conversion is highly inefficient and can be as low as 1 percent. Whether you're making EPA and DHA in your body from ALA, or getting it directly from the food you eat, most people just don't wind up with optimal amounts of EPA and DHA (which is why fish oil supplements are so popular).

All three omega-3s are important. Research demonstrates that EPA is particularly important for the heart, while DHA is particularly important for the brain. Meanwhile, research has shown that higher intakes of ALA is associated with reduced risk for cardiovascular disease, a preventive effect on colon tumor development, and a reduced risk of breast cancer.

Despite some research showing the benefits of ALA (which is found in plant oils like flaxseed, and chia seed oil), fish oil is one of three or four supplements I recommend for just about everyone. The already formed EPA and DHA are ready and able to be used immediately. Also worth noting is that if

you're a vegetarian and depending on ALA to provide all your omega-3, take more of it than you think you should, because so little will wind up as EPA and DHA. Remember too, that the rest of your diet influences how well you convert that ALA into EPA and DHA. A high intake of vegetable oils is one of the things that sabotages conversion.

## 2. PROBIOTICS

I strongly suspect that anything I (or anybody else) says about probiotics right now will be obsolete in ten years, or perhaps even less. That's because the research on probiotics is exploding. One of the reasons for that is the intense interest among research scientists and nutritionists on something called the *microbiome*, which is the name researchers give to the huge collection of (nonhuman) microbes that inhabit the body, living on the skin and (mostly) in the gut.

We now know that gut ecology—the collection of bacteria, viruses, and other microbes that number in the trillions and inhabit our gut and live on our skin—have an enormous influence on health in ways that were never suspected ten years ago. The condition of the microbiome has now been shown to be associated with many conditions from schizophrenia to depression to obesity, and this is only the beginning. The vast majority of health experts practicing functional medicine (or naturopathic medicine) now believe—as I do—that the health of the gut should be one of the main focuses of all health and healing programs.

Probiotics are basically the "good guys" in the gut ecology. We want to keep them in the majority, and keep the "bad guys"—like *Candida albicans*—in a decided minority. Probiotics are found naturally in all real fermented foods like yogurt, kefir, kimchi, and real sauerkraut. And they have been shown to have significant health benefits—such as boosting immunity.

The problem is that there are tons of species of probiotics and research telling us what specific strains are beneficial for what specific conditions is in its infancy. The most common probiotics belong to groups known as *Lactobacillus* and *Bifidobacterium*, each of which contains many subtypes (an example being *Lactobacillus acidopholus*).

### TAKE IT FROM A PROFESSIONAL

Choosing probiotic supplements can be daunting. Between the various strains of microbes, the *number* of microbes (often listed as CFU—colony-forming units) and the *form* of the supplement (blister pack? refrigerated powder? pills?) it can be very confusing indeed.

My fast cheat sheet for consumers is simply this: Find a product endorsed by David Perlmutter, M.D., or by Tieraona Low Dog, M.D. You absolutely can't go wrong.

Most of the health professionals I work with and respect all recommend probiotic supplements, but there is a lot of discussion about which strains are best. Remember that different strains may have different effects on different conditions (and on different individuals). That said, integrative neurologist David Perlmutter, M.D., author of *Grain Brain*, and one of the top experts in the country on the gut-brain connection—recommends paying particular attention to these five species:

1. *Lactobaccilis plantarum*
2. *Lactobaccilus acidophilus*
3. *Lactobaccilus brevis*
4. *Bifidobacterium lactis*
5. *Bifidobacterium longum*

This doesn't mean these are the only five strains that matter—you can certainly make a case for others

strains such as *B. bifidum*. The take-away point is that probiotics are one of the most important supplements you can take, and even though we're not 100 percent sure what strains will turn out to be best for what situations, probiotics should still be on your top ten list of daily supplements. It certainly is on mine.

## 3. COENZYME Q10

Coenzyme Q10 isn't a vitamin. It's a vitamin-like substance that actually belongs to a family called *ubiquinones* (from ubiquitous), and it's made in every cell. Among the many important things it does, CoQ10 helps create energy from fuel (food) in the human body, just as a spark plug creates energy from fuel (gasoline) in a car.

And just as a gasoline engine can't work without spark plugs, the human body can't work without CoQ10. It's an essential component of the *mitochondria*, tiny structures in the cell which act as command central for the production of cellular energy. Not coincidentally, the heart is one of the two organs where the most CoQ10 is concentrated (the other being the liver). The heart never sleeps, never takes a vacation, and beats more than one hundred thousand times a day. This makes the heart one of the most metabolically active tissues in the body, so it's very dependent on the energy-generating power of CoQ10.

A CoQ10 deficiency affects your heart as profoundly as a calcium deficiency would affect your bones. We create less and less of it as we age (no surprise there), which makes it all the more important to supplement with CoQ10 as we get older. And forget about getting meaningful doses from food. The only foods that have any CoQ10 to speak of are things we rarely eat—organ meats like heart and liver. CoQ10 is also easily destroyed by heat and overcooking.

CoQ10 has been approved in Japan as a prescription drug for congestive heart failure since 1974. In the United States, the benefits of CoQ10 for the heart have been well known since at least the mid-1980s. CoQ10 is also a powerful antioxidant.

One of the big problems with statin drugs (cholesterol-lowering medications) is that they profoundly lower CoQ10. This is ironic because cholesterol drugs are supposed to help protect against heart disease and one of their actions is to deplete stores of one of the most important heart nutrients! Cardiologist Stephen Sinatra and I think CoQ10 supplementation is an absolute must for anyone on a statin (at least 100 mg daily or more), and 60–100 mg isn't a bad idea for everyone over forty, even if you're not on a statin.

There's a big controversy in the supplement industry over the best form of CoQ10 to use. For decades, the only form researchers had available was the ubiquin*one* form. In recent years, a more absorbable form called ubiqui*nol* has gotten a lot of press. Some doctors feel ubiquinol is slightly better absorbed, and Dr. Andrew Weil thinks it has more antioxidant activity. It also tends to be more expensive. There is also a *really* expensive (and effective) CoQ10 supplement on the market called Mito-Q (available online and on Amazon). Mito-Q comes from Australia, and most of the doctors who know about this stuff think that Mito-Q gets into the cells much more effectively than regular CoQ10 does. I personally like Mito-Q a lot. If money were no object, it's definitely the brand of CoQ10 I'd use—but the cost is considerable and may be too expensive for most people.

## 4. RESVERATROL

Resveratrol is one of the big success stories of the natural supplement industry. Here's the story in a nutshell.

Everyone wants to extend life—or, at least, what's called life (*health span*) span, the number of years during which you're still healthy and functioning (hopefully till you die!) Ever since the days of

Ponce de Leon, people have been searching for the elusive "fountain of youth." One technique that seems to work to extend lifespan is calorie restriction. This has been known ever since the 1930s.

The problem is that calorie restriction is a pain in the ass to do and is only for the most obsessive (or dedicated) people willing to forgo a lot of pleasure and willing to do a whole lot of counting. They even have Calorie Restriction Society International whose members, one suspects, are not a jovial lot.

So, starving yourself isn't a popular strategy, even if it does extend lifespan (which it does in every species studied so far, including monkeys.) But why does calorie restriction work to extend lifespan in the first place?

It's because restricting calories appears to turn on "turn on" longevity genes known as the *sirtuin* genes, which are considered to be major influencers of how long we live. "The sirtuin genes are the holy grail of medicine and nutrition," says my good friend Mark Houston, M.D. "These genes turn on or turn off different metabolic pathways that are designed to promote longevity and health."

So, wouldn't it be terrific if we could discover a compound that turned on those same genes and wouldn't require us to starve ourselves for the rest of our lives?

Well, we did. Or at least a Harvard-based scientist named David Sinclair did, and the substance's name is *resveratrol*. It's found primarily in the skin of dark grapes (and the wine made from them), and is one of the primary reasons for the health benefits observed among red wine drinkers.

Resveratrol "turns on" those SIRT (longevity) genes, apparently just as well as calorie restriction does. But we now know it does so much more. Resveratrol has been shown in studies to inhibit the growth of several cancer cell lines and tumors. It's a powerful antioxidant *and* anti-inflammatory. It ramps up detoxification enzymes in the liver (making it easier for your body to get rid of carcinogens) and protects the heart. It also protects neurons (brain cells). Recent research has even shown that it may reduce insulin resistance, a key factor in metabolic syndrome and type 2 diabetes. Animal studies show that it slows the accumulation of fat.

In 2010, researchers and scientists held a resveratrol conference in Denmark. Almost 3,700 published studies were analyzed and the findings were profound. Experts identified twelve mechanisms of action by which resveratrol may act to combat the diseases of aging and to protect the body against the five leading causes of death among Americans. Among the mechanisms cited:

- Resveratrol lowers inflammation.
- Resveratrol is a powerful antioxidant.
- Resveratrol can prevent damage to DNA.
- Resveratrol can stimulate bone formation.
- Resveratrol can lower the incidence of hypertension.
- Resveratrol is neuroprotective.

Still, the conference researchers felt that the evidence wasn't yet sufficiently strong to justify recommending resveratrol supplements. (Of course, these are people who, having the cautious temperament of scientists, are reluctant to recommend water for putting out fires because there aren't enough double-blind studies on it.) No matter, a few short years later, results from the first clinical trials on resveratrol became public, and researchers now argue that based on the new, even stronger research, the recommendations for resveratrol should be updated.

In 2005, researchers set out to review what they called the "strong anti-inflammatory" activity of resveratrol and the plausible mechanisms of those effects. They proposed that resveratrol "downregulates"

the inflammatory response by specifically blocking the release of pro-inflammatory chemicals in the body.

But all resveratrol supplements aren't created equal. Look at the small print on the label, and pay attention to the stuff known as *trans*-resveratrol. Trans-resveratrol is the active ingredient in resveratrol—it's what does all the good stuff. So, don't be fooled by a label that just says "500 mg of resveratrol." You need to look at the fine print and see how *much* of that 500 mg is actually *trans*.

For example, if the label reads "100mg of resveratrol *standardized to 10 percent trans*," it means only 10 percent of the total 100 mg is trans (10 mg, not very much). Ideally, you want 250–500 mg of pure trans-resveratrol daily. I'm a big fan of Resveratrol by Reserveage because there is no confusion about the amount of the active ingredient. Their 250-mg cap gives you a full 250 mg of trans in the capsule, not 25 mg, as you'd get if it was "standardized to 10 percent trans." Another fine company that does this is Life Extension. For either company, if it says 250 mg—or 300 mg or 500 mg—on the label, it means that's the amount of *trans* resveratrol you'll be getting in each serving.

## 5. CURCUMIN

If for some unfathomable reason I lost my mind and decided to join the cast of *Survivor*, and they allowed me to take just a handful of supplements with me for the season, one of them would definitely be curcumin.

Curcumin has anticancer activity, it supports liver health and it's a powerful antioxidant. But the one property of curcumin that stands out is its enormous power as an anti-inflammatory.

Curcumin is the general name for a group of active ingredients called *curcuminoids*, found in the spice (*turmeric*) that gives curry its yellow color. In India, where 94 percent of the turmeric in the world originates, curcumin is used to relieve arthritis. It's good for muscle pains as well as joint inflammation.

It's also important for the brain. It's been found to prevent the death of neurons (brain cells), reduce oxidative damage, and decrease the formation of inflammatory factors in the brain. And it reduces, or even, amazingly, reverses, the formation of amyloid plaques, a key player in the development of Alzheimer's. No less an authority than David Perlmutter, M.D., lists it (turmeric) as one of the seven most important brain supplements.

It's also terrific for pain. You can think of curcumin as a kind of natural NSAID (nonsteroidal anti-inflammatory drug, such as ibuprofen). In that sense, it works much like omega-3 fatty acids from fish and flaxseed and that may be part of the reason they are protective against Alzheimer's. Just for the record, the rate of Alzheimer's in the United States is nearly four times that of India, where turmeric is always on the menu.

As of this writing (September 2017), a search of the National Institute of Medicine database (PubMed.com) for the terms "curcumin and cancer" yields more than 4,000 studies. Many show that curcumin has the effect of either reducing the number or size of

### FUN FACT

Years ago, I was one of only two English-speaking presenters asked to speak at the first anti-aging medical conference in Sao Paulo, Brazil. The other American speaker was Tom O'Bryan, D.C., who went on to fame as an expert on gluten-related conditions and is the best-selling author of *The Autoimmune Fix*. O'Bryan's topic was curcumin. He argued that it was as close to a "super-supplement" as anything we've ever seen.

tumors. It is also very liver-protective and is frequently recommended in nutritional protocols for Hepatitis C.

For those who want even more of the science on curcumin and don't mind wading through some heavy-duty research, a good place to start is the white paper on curcumin published by the Linus Pauling Institute at Oregon State.

The downside of curcumin supplementation is that curcumin in general isn't well-absorbed. You only get a small amount of curcuminoids from turmeric, and curcumin supplements vary in how effective they are. Two brands I like are Terry Naturally and Life Extension. Terry Naturally has been making high-end curcumin products for decades using a particularly good form of curcumin known as BCM-95; Life Extension, another excellent and reliable supplement manufacturer, also uses BCM-95 curcumin in their curcumin products. You can't go wrong with either one.

## 6. ALPHA-LIPOIC ACID*

**(*also known as lipoic acid, or R-lipoic acid)**

Alpha-lipoic acid is a remarkable substance with myriad uses and a particular quality that makes it unique among antioxidants: it functions in both water and fat. This "all-access" pass allows it to do its magic act everywhere in the body. This organic compound—found in every cell in the body—is one of the most powerful antioxidants on the planet. It's also able to revitalize and refurbish two other antioxidants: water-soluble vitamin C and fat-soluble vitamin E. When you take alpha-lipoic acid as a supplement, you're really getting triple value for your supplement dollar. Lester Packer, Ph.D., professor and senior researcher at the University of California for more than forty years, and author of *The Antioxidant Miracle*, calls alpha-lipoic acid "probably the most potent naturally occurring antioxidant known to man."

Not only that, but alpha-lipoic acid is able to pass through the blood-brain barrier, which is like a firewall for the brain, allowing only select (nontoxic) molecules to pass. The blood-brain barrier is critical to protecting the brain against toxins, but one of the "side effects" of its awesome filtering ability is that it sometimes filters out some good stuff in the process (like potent antioxidant nutrients). Alpha-lipoic acid makes it through the blood-brain barrier just fine.

Alpha-lipoic acid as a brain nutrient first gained attention through the work of one of the most respected researchers in the country, Bruce Ames, Ph.D., professor of Biochemistry and Molecular Biology Emeritus at University of California. Ames performed a series of experiments in which he gave old rats a combination of acetyl-L-carnitine and alpha-lipoic acid. The results on aging were remarkable.

"With these two supplements together, these old rats got up and did the Macarena," said Ames. "The brain looks better, they are full of energy—everything we looked at looks more like a young animal."

There is also research suggesting that alpha-lipoic acid may have a role in the treatment of Alzheimer's.

Alpha-lipoic acid's benefit to the brain (and aging) may well come because of its incredible power as an antioxidant. Antioxidants, as you may know, help quench nasty destructive little molecules known as *free radicals* (a.k.a. *oxygen free radicals*). "If your brain is being devoured by free radicals," says David Perlmutter, M.D., integrative neurologist and best-selling author of *Grain Brain*, "you will not be able to think clearly, stay focused, or retrieve information when you need it." Perlmutter also points out that alpha-lipoic acid is one of the few antioxidants that can significantly boost *glutathione*, arguably the body's most important antioxidant and one that is nearly impossible to get from the diet or supplements because it is poorly absorbed. When it comes to glutathione, alpha-lipoic acid supplements help you to "roll your own."

Alpha-lipoic acid has also been helpful for diabetics, as it increases insulin sensitivity and offers relief from symptoms of diabetic neuropathy. It also

**NOTE WELL**

The natural form of alpha-lipoic acid—the only version that actually exists in nature—is R-lipoic acid. Most regular, garden variety alpha-lipoic acid supplements—even the very best ones—are created by chemical synthesis.

has liver-protective activity, and is frequently used in protocols for Hepatitis C.

R-lipoic acid supplements appear to be somewhat better absorbed but are more expensive; however, "regular" alpha-lipoic acid has been used in hundreds of studies successfully. You really can't go wrong with either type of supplement.

## 7. NIAGEN®

Niagen® (TruNiagen®) is the brand name for a particular form of vitamin B3 known as *nicotinamide riboside* (see vitamin B3, page 4). Since it's technically a form of vitamin B3 you might well ask why it's included in the section called "7 Superstar Nutrients that are *not* Vitamins or Minerals." The answer is that its activity is so special that it really deserves a stand-alone entry in this book. Mentioning it as merely one form of vitamin B3 in the Vitamins section of this book would not do justice to its unique activity in the body, so I fudged the category and decided to include it here.

For the sake of this entry, let's just refer to *nicotinamide riboside* by its proprietary brand name (Niagen®), even though, going forward, you can expect to find it as an ingredient in many vitamin formulas under its proper name, *nicotinamide riboside*.

Now that we've got that out of the way, what the heck is so special about Niagen®?

Glad you asked.

One of the biggest challenges in educating the public about Niagen® is explaining what it does without delving into biochemistry, a subject which can be reliably counted on to make everyone's eyes glaze over. But just because it's a little hard to explain doesn't mean it's not incredibly important—it is. Real scientists don't like to use the term "anti-aging," but the fact is that Niagen® might just be one of the most important "anti-aging" supplements ever discovered.

Here's why, and I promise to make it really simple.

1. **All aging basically starts at the cellular level—way before you can see its effects**. When you look in the mirror and see wrinkling skin or when you feel yourself slowing down from lack of energy, you can be sure your cells were falling apart way before you were.
2. **The cell is an incredibly complicated structure with many parts, all of which have specific duties to perform**—burn fat, get rid of toxins, create energy, etc. You can think of the cell as a car factory with a whole bunch of machines, each creating parts or circuits or structures which are essential to the production of the car itself.
3. **Every single one of those cellular operations requires a substance called NAD.** NAD is what's known as a "coenzyme"—it's like the spark plug in your engine, the pilot light on your stove or the kindling you use for your fireplace. Without that spark plug, no cellular operations can take place.
4. **In a cruel twist of fate, we make less NAD as we get older.** Less NAD means less cellular operations get done. The cells go on a "budget" and use what precious NAD is left for the most essential operations. The cells begin their journey towards senescence—a fancy word for biological aging. Trying to run your cells at peak levels of performance without enough NAD would be like trying to water a garden

with a hose that has a kink. The water dribbles out and the plants barely get wet. When there's not enough NAD around, cellular activity dribbles. And slows. And the cells ultimately die.

5. **Niagen stimulates NAD production.** And that's really all you need to know. Without NAD, you are, quite simply, screwed—or at least, the 40 trillion or so cells that make up your body are.

Scientists have been trying to figure out a way to increase NAD in the cells for ages, because, as stated above, when you start making less NAD your cells lose their ability to do everything we need them to do. None of the other forms of B3 can boost NAD as much as Niagen®. Other compounds that are marketed as NAD promoters—namely NADH and NMN—just aren't as effective. Two other forms of B3—nicotinamide and niacin—are also not effective *plus* they have side effects.

Niagen®, which was found in milk in 2004 by biochemist Charles Brenner, PhD (then at Dartmouth College) is the most effective NAD booster compound ever found. It's been available for people since 2013 and its been tested and shown to be orally active and safe.

Remember, all aging starts at the cellular level, so anything that can keep the cells running—with a steady supply of the stuff they need to run efficiently (NAD)—is of enormous interest to people who are concerned about healthy aging and robust energy.

Because Niagen® does exactly that, I consider it one of the true breakthrough discoveries in the field of anti-aging nutraceuticals.

Worth knowing: As the word gets out about this nutraceutical, expect to see a lot of marketing and hype from different companies trying to get in on the Niagen® bandwagon. The brand of Niagen® that's manufactured by the patent holders and endorsed by the discoverer—the aforementioned Dr. Charles Brenner—is TruNiagen®, available online. I personally take it every single day, and that's the brand I recommend.

# In Summary

Obviously there are hundreds of other supplements and nutraceuticals not covered in this basic manual. Many are really important—but I had to draw the line somewhere. Otherwise, this would be a book more like Alan Gaby's 1326-page encyclopedic masterpiece, *Nutritional Medicine*, or even the more modest 797-page *Encyclopedia of Dietary Supplements* put out by the National Institutes of Health. (Both these volumes sell for more than $300 each, by the way.)

But I hope this short, irreverent look at what vitamins, minerals, and a few superstar supplements actually do will serve as a basic guide to the world of nutritional supplements. Remember, we didn't even touch on herbal or botanical medicine. Most health practitioners who are oriented to functional medicine will often prescribe a mix of vitamins, herbs, amino acids, essential oils, and other natural remedies which, taken together, can go a long way toward getting—and keeping—you healthy.

If you have a medical condition, I strongly recommend seeking out a medical doctor or a licensed naturopathic physician who has been trained in the use of nutraceuticals, and who knows how to use them as either primary treatments or adjunct treatments. All medical doctors who are trained in functional medicine know how to do this, and so do licensed naturopathic physicians. Naturopathic physicians are currently licensed in eighteen states. Don't confuse a licensed naturopathic physician—who went to medical school and passed rigorous state exams—with the many people claiming to be "naturopaths" who have a certificate from an online university. If you're looking for a physician trained in functional medicine, there's no better place to start than the Institute of Functional Medicine website—their "find a practitioner" section will help you locate a specialist near you.

And, as you can imagine, I'm often asked, "Do we really *need* nutritional supplements?"

My answer is no. But then again we also don't "need" indoor plumbing. But why in the world would we want to live without it?

Nutritional supplements are just a high-tech way to deliver optimal levels of the nutrients our bodies (and minds) need to thrive. Now that we have them—why on earth wouldn't we use them?

On a personal note, I have been taking nutritional supplements for more than thirty-two years, and I take *a lot* of them. Like thirty a day, usually more. I've been taking these things—or some combination of these things—for more than thirty years, just like I've been exercising, replacing hormones, meditating, playing with my dogs, and nourishing my relationships. Do I know which of those activities is "responsible" for how good I feel? Nope, nor do I really care. For me, it's a formula that works, it ain't broke, and I'm not fixing it.

Enjoy the journey!

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# About the Author

Jonny Bowden, Ph.D., CNS, also known as "The Nutrition Myth Buster"™ is a nationally known board-certified nutritionist and expert on diet and weight loss. He has been interviewed on television more than one hundred times—including appearances on the Dr. Oz Show, Fox News, CNN, MSNBC, ABC, NBC, and CBS—and has written (or been interviewed for) articles in the *New York Times*, *Forbes*, the *Daily Beast*, the *Huffington Post*, *Vanity Fair* online, *Men's Heath*, *O* (the Oprah Magazine), *People*, *Prevention*, and dozens of other print and online publications.

Dr. Jonny is the best-selling author of fifteen books, including *The 150 Healthiest Foods on Earth*, *Living Low Carb* (now in its fourth edition) and the controversial number-one Amazon best-seller, *The Great Cholesterol Myth* (co-authored with cardiologist Stephen Sinatra, M.D.). His recent book, *Smart Fat*, was co-authored with PBS star Steven Masley, M.D. He has lectured to standing-room-only audiences all over the world, including at Beijing University in China, after which he was elected to honorary membership in the DeTao Masters Academy, an international group of 125 thought leaders headquartered in Shanghai.

Dr. Jonny is a columnist for *Clean Eating* magazine, *Better Nutrition*, *Amazing Wellness*, and *Whole Foods* online, and has served on the scientific advisory board for multiple companies in the natural products industry. He was featured in the Australian Broadcasting Network's television documentary *Heart of the Matter*, and is a much in-demand speaker who's presented at both academic conferences and consumer events all over the world, including Paleo f(x), Bulletproof Conference, American Academy for Anti-Aging Medicine (A4M), Vitamin Shoppe Conference, Low-Carb USA, and the American College of Nutrition.

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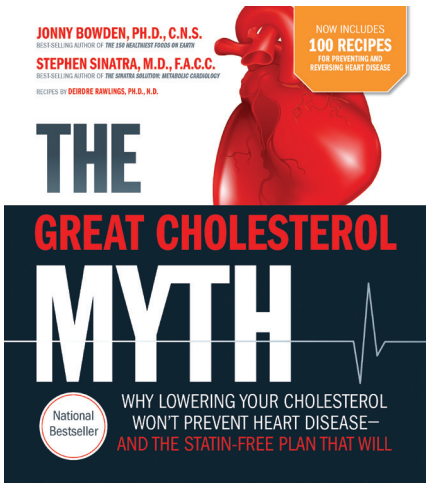


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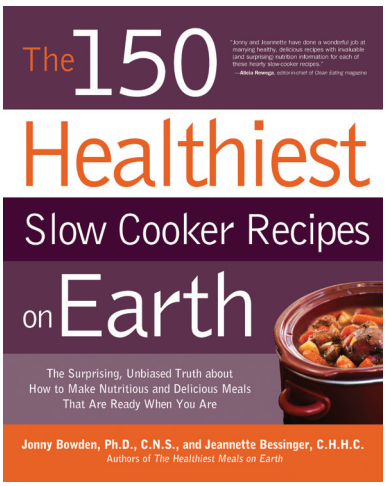


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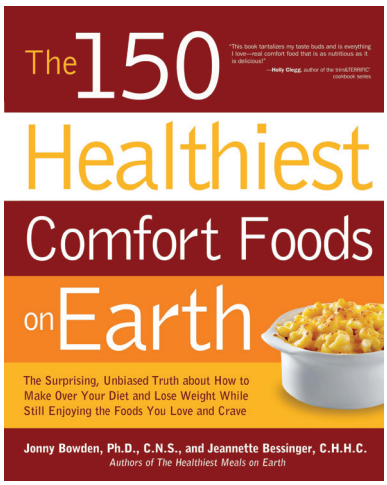


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