# Experience Life's Guide to Functional Medicine

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## Functional Wellness

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# Experience Life's Guide to Functional Medicine

*All material is provided courtesy of Experience Life.*

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# Editor's Note for Each Article:

For more than 15 years, celebrated author and pioneering medical visionary Mark Hyman, MD, has been practicing and promoting a revolutionary healthcare concept known as functional medicine. It's a patient-centered (vs. disease-centered) approach that focuses on identifying and addressing the root causes of chronic health challenges as opposed to merely treating symptoms. Functional medicine also emphasizes incorporating nutrition and lifestyle solutions rather than relying exclusively on pharmaceutical and surgical interventions. Experience Life is proud to bring you this six-part series in which Dr. Hyman describes the emerging practice of functional medicine and explains how it can improve your well-being.

# About Mark Hyman, MD:

Mark Hyman, MD, is the medical director and founder of The UltraWellness Center in Lenox, Mass., and the former medical director at Canyon Ranch health resort. He has authored several best-selling books, including UltraMetabolism: The Simple Plan for Automatic Weight Loss (Scribner, 2006), UltraPrevention: The 6-Week Plan That Will Make You Healthy for Life (Scribner, 2003), and The UltraSimple Diet (Pocket Books, 2007). Dr. Hyman also is editor in chief of the peer-reviewed journal Alternative Therapies and a leading expert in functional medicine. For more information, see www.ultrawellness.com/blog.

# Note:

Part four of Dr. Hyman's series for Experience Life has not been included with the other five parts of this series of articles. "Functional Wellness, Part 4: Real Healthcare Reform" addresses the roles that the government, pharmaceutical companies and the food industry play in America's healthcare system. It is an excellent article regarding the economics of healthcare and the potential improvement that functional medicine presents. It can be read online at:

http://experiencelife.com/article/functional-wellness-part-4-real-healthcare-reform/

# Functional Wellness, Part 1: Genes and the Environment

**Learn how your genes interact with your habits, lifestyle and surroundings to create a healthy body – or an unhealthy one.**

EXPERIENCELIFE.COM

By Mark Hyman, MD (@markhymanmd) / June 2008

When patients ask me if they are doomed by their genetic report card — destined to suffer the same diseases as their forebears — I tell them the story of the Pima Indians.

For centuries, the Arizona band of Pima Indians was thin, fit and healthy. Since the 1950s, however, they have become one of the world's fattest populations. They have a staggeringly high 80 percent rate of diabetes and a life expectancy of just 46 years. In contrast, the band of Pima Indians who live in Mexico is still thin and fit, with no incidence of diabetes at all. These people are genetically identical to their cousins across the border, but the state of their health couldn't be more different.

So what gives? As it turns out, the Mexico Pimas have been living much the same healthy lifestyle as their ancestors, while the Arizona Pimas have fallen victim to what we call the "White Menace" — a diet replete with white flour, white sugar and white fat (think shortening or trans fat).

The upshot? Genes may load the metabolic gun, but when it comes to creating real damage, it's the environment that pulls the trigger.

Although your individual genes may make you more susceptible to some diseases, your DNA is not a fixed blueprint. Emerging research shows that your genes may be influenced by environmental factors such as diet (as in the case of the Pimas); stress; exercise; toxins in food, air and water; electromagnetic radiation; and trauma.

The great news is that by improving these environmental inputs, we can change the way our genes are activated and expressed. In other words, we may not be able to change our genotype (our actual genes), but we can change our phenotype (how our environment interacts with our genes to create who we are at this moment).

## Making Medicine 'Functional'

Many doctors cling to the myth of genetic determinism and, as a result, turn a blind eye to the environmental and lifestyle factors that underlie every disease. When a patient tells me, "It runs in my family," I ask, "*What* runs in your family? Heart disease? Insulin resistance? Certain lifestyle habits? Was yours a family that was stressed out, didn't exercise and ate pork rinds for breakfast?"

The question is: What *really* runs in the family — habits or genes — and what are you willing to do about it?

America's broken healthcare system is based on outdated ideas that don't address the roots of illness, a particularly dangerous situation given the country's current epidemic levels of chronic disease. At present, 109 million Americans (more than a third of the population) suffer from a chronic disease, such as diabetes, cancer, heart disease, and autoimmune disorders like rheumatoid arthritis and fibromyalgia.

Conventional medicine is good at naming diseases, blaming the name for the problem and then finding a drug that matches the name. I call this the "naming and blaming" game, and in my mind, it's a totally dysfunctional way of practicing medicine.

Given the number of people who are now suffering from chronic disease, it's clear to me and a growing number of medical professionals that naming and blaming just isn't good enough. We need to understand that diseases are not mysterious things that you catch or that just "show up" out of the blue, but are, instead, a product of how our environment interacts with our genes. The truth is, nearly all of the disease-related deaths in our society could be prevented.

I am part of a revolution in medicine that is helping to shift our scientific model of disease. This innovative healthcare approach is called functional medicine. It looks at the roots of illness — not just the symptoms — and works with the underlying biological forces that power our vitality (see “The 7 Keys to UltraWellness,” below).

So, for example, in the case of the Arizona Pima Indians, instead of simply treating the diabetes, functional medicine takes a broader look at the various nutrition and lifestyle factors that *give rise* to diabetes.

Take note: This is *not* alternative or integrative medicine, but rather a science-based, fundamental change in the way we think about health and disease.

Functional medicine provides a way of understanding all the influences on our biology, including those that are at the root of illness, and how our lifestyle and environment interact with our genes to create the balances or imbalances that are the real determinants of health or disease.

Functional medicine’s treatments are grounded in nutrition and lifestyle improvements that minimize imbalances and irritations while maximizing vitality. Most important, the treatments are patient-centered as opposed to disease-centered, meaning that not everyone with the same set of symptoms or same disease “name” will be treated the same way.

As the great William Osler, one of the founding fathers of modern medicine, said, “It is much more important to know what sort of a patient has a disease than to know what kind of a disease a patient has.” [For related perspectives on medicine and health, see “A New View of Health” in our April 2007 archives.]

## DNA Isn’t Destiny

Although a few traits — gender, race and hair color, for example — are controlled by a single gene and cannot be changed, most of our physical and biochemical characteristics are controlled by multiple genes. Our height and weight, metabolism, and most illnesses are affected by many different genes in concert with our environment.

The truth is, we all enjoy a tremendous opportunity to affect the expression of our genes — as well as our traits, tendencies and overall health — by improving both our physical environment and our cellular environment through more healthful diet and lifestyle choices.

There has been a great deal of excellent research that accentuates this point. In one Scandinavian study, for example, researchers assessed more than 44,000 pairs of identical twins to determine whether cancer was genetic. The result? Fewer than 10 percent of cancers could be traced to genetic predisposition; the rest were predominately environmental in origin, resulting from lifestyle choices such as diet and personal habits. (Only breast, prostate, stomach, lung and colon cancers showed a significant hereditary inclination.)

The same is true of other diseases. Let's say you were born with a genetic tendency for heart disease. Meanwhile, you smoke, don't exercise, eat poorly, gain weight and are under a lot of stress. Taken together, these factors strongly suggest that you are likely to develop heart disease at an early age. Yet, if you had the same genetic tendency for heart disease, but avoided smoking, exercised regularly, ate well, maintained your weight, and took steps to reduce and manage your stress, you would quite likely prevent heart disease from ever developing.

Or take the recent study in which Finnish researchers gave two groups of people with metabolic syndrome, or prediabetes, a slightly different diet. For 12 weeks, each group ate the same number of calories and the same amount of fat, protein, carbohydrates and fiber. The only difference? The first group had wheat, oat and potatoes as its carb source, and the second group had rye — which has very special properties because the body slowly absorbs it, and its phytonutrients help you lose weight and improve metabolism.

So what happened? The wheat, oat and potatoes diet activated 62 genes that increased inflammation and oxidative stress, worsened the blood-sugar balance, and generally amplified all the forces in the body that can lead to obesity, heart disease, cancer, diabetes and Alzheimer's disease.

It was a 100 percent effect: No good genes were turned on. The rye diet, on the other hand, activated 71 genes that*prevent* diabetes, lower cholesterol, reduce inflammation and improve blood-sugar control — a 100 percent *good* gene effect.

Just imagine: If there were a drug that could turn off all the disease-promoting genes and turn on all the health-promoting, anti-aging genes, it would be a blockbuster. But you don't see ads on television telling you to eat more whole-kernel rye bread!

## Don't Be Trigger-Happy

Most of our genes developed when we were eating a very different diet of whole, wild, fresh, real food and lived in a world without toxins like mercury and pesticides. In other words, our present-day genes were designed to thrive in a much more pristine world. Faced with present-day challenges — including a nutrient-deficient diet, a sedentary lifestyle and a profusion of environmental toxins — those same genes can become easily confused and disrupted.

Although much-ballyhooed genetic testing can be a helpful guide in understanding the origins and the risks of some chronic illnesses, we have to recognize that it is the *interplay* of many genes interacting with the environment and our daily choices that determines our health.

In reality, mutations in a single gene that we're powerless to change cause less than 1 percent of all diseases, and these are rare disorders like cystic fibrosis and Tay-Sachs. We also know that there is *no* single gene for Alzheimer's or depression or heart disease or cancer or autism. So we must give up the myth that our genes are entirely to blame. Instead, we must acknowledge that there are common variations in the symphony of our gene patterns that are integral to many chronic diseases — patterns that vary from person to person and are highly influenced by diet, toxins, allergens, infections and stress.

That's actually wonderful news, because it means we can work to correct the environmental inputs and, in so doing, relieve the burden of suffering from so many chronic diseases. In future articles in this series, I'll be offering lots of examples of how you can begin transforming your own health profile through better health habits and choices.

In the meantime, remember this: However your genetic gun might be loaded, you're under no obligation to pull the trigger by making unwise choices. Nor should you just wait around passively accepting the suppression of symptoms that passes for "treatment" of many of today's most common chronic health problems.

Instead, I suggest making sure your "safety" switch is on, starting now. See "Recipe for Health," below, for an overview of the choices that matter most. Then tune in to the rest of this series to learn more about how they work together — and why they matter so much in creating a health destiny you can feel good about.

## Recipe for Health

Environmental factors like toxins, allergens, infections, stress and poor diet interact with your genes to create nearly all illnesses. Your vulnerability to a particular illness depends on how your genes interact with specific triggers.

Want to bring out the best in your genes and remove the irritants that encourage them to misbehave? Start living clean and healthy, and put vitality-supporting priorities like these at the very top of your "must have" list.

- Whole, real, fresh foods
- Nutrients (vitamins, minerals, etc.)
- Oxygen
- Water
- Light
- Sleep
- Healthy life rhythms
- Deep relaxation and rest
- Connection, community, love
- Meaning and purpose

## The 7 Keys to UltraWellness

Simply put, when your core systems are out of balance, they make fertile ground for the roots of illness. When they are *in* balance, they become the keys to creating wellness and vitality:

1. **Environmental Inputs** (diet, lifestyle, toxins, stress and trauma)
2. **Inflammation and Immune Balance** (the hidden fire within)
3. **Hormone and Neurotransmitter Balance** (insulin, thyroid, adrenal balance, sex hormones and mood chemicals)
4. **Gut and Digestive Health** (digestion, absorption, assimilation, intestinal ecosystem and the gut-immune system)
5. **Detoxification Imbalances and Function** (getting rid of wastes and dealing with toxins)
6. **Creating Energy** (the source of life energy and metabolism — antioxidant balance)
7. **Mind-Body/Body-Mind Connection** (change your mind, change your body; change your body, change your mind)

# Functional Wellness, Part 2: Hormones and Inflammation

**Hormonal imbalances can lead to a host of serious health problems, including inflammation, high blood pressure, heart disease, obesity, cancer, dementia and more. Here's how to get your body back in balance.**

EXPERIENCELIFE.COM

By Mark Hyman, MD (@markhymanmd) / July-August 2008

Let me tell you about a patient of mine whose story may sound all too familiar to you. James was a 46-year-old Wall Street executive who came to me for a cardiac stress test. He was a hard-driving guy who was convinced he was dying of heart disease. Every afternoon, he would experience the sudden onset of sweating, a racing heart, anxiety and shortness of breath.

James also happened to be thick around the middle. After listening to his troubles, I said, "You don't eat breakfast, do you? And, you feel tired after eating, so that's why you skip food during the workday? And when you do feel sluggish, you go to the vending machine for a quick sugar fix, and in a few minutes you feel better, don't you?"

Shocked, he asked, "How did you know?" I explained that he was fighting with his genes and was insulin resistant. In other words, his hormones were severely out of balance. He couldn't control his metabolism of carbohydrates because he had too much insulin. Consequently, his blood sugar was out of whack, which led to all of his symptoms — and was also taking him down the slippery slope toward high blood pressure, heart disease, obesity, cancer, brain aging, dementia and more.

## Bodies Out of Balance

In fact, most Americans are living out of harmony with their natural biological rhythms, because the small molecules that help keep your body in balance have gone haywire.

These molecules — the hormone-messenger molecules of the endocrine system and the neurotransmitter-messenger molecules of the brain and nervous system — are involved in almost every function of the body, and they are critical to our well-being.

The hormone and neurotransmitter system is yet another one of the body's core systems we must address in order to prevent disease and power our vitality (see "The 7 Keys to UltraWellness," [previous page]). Understand how and why these systems get out of balance and you will begin to see why so many Americans walk around tired, depressed and overweight. And why no amount of pharmaceutical intervention is going to solve the problem.

All of our hormones and brain-messenger chemicals must work together in a finely orchestrated symphony to keep everything in balance. For example, the hypothalamus and pituitary glands in your brain are the command-and-control centers for all the endocrine (hormone) glands. They send signals to distant parts of the body to control everything from your stress response through your adrenal glands, your blood-sugar balance through your pancreas, your thyroid hormone via your thyroid gland, and your sexual function through your reproductive organs. They also control growth, sleep, mood and much more.

Neurotransmitters, meanwhile, send messages throughout the body to every cell, organ and tissue and help you do everything from moving your arm to feeling happy or sad. So it's not hard to see why having an appropriate supply of these chemicals is so essential to our well-being.

Indeed, when our hormones become imbalanced, the health consequences can be severe. There are three big epidemics of hormonal problems in America today: too much insulin (from sugar), too much cortisol and adrenaline (from stress), and not enough thyroid hormone. These all interconnect with and affect the other major category of hormones — our sex hormones.

Imbalances or disturbances in any one of these interconnected systems can influence the way our brains function and lead to everything from depression and dementia to anxiety and attention deficit hyperactivity disorder (ADHD). They also are linked to two other major epidemics we currently face: obesity and inflammation.

## Our Hunter-Gatherer Past

My patient James is hardly an unusual case. More than 100 million Americans suffer from insulin resistance. That number has grown to epidemic proportions for one simple reason: We have strayed from eating in harmony with our genes.

Historically, as a hunter-gatherer species, people ate the equivalent of only 20 teaspoons of sugar a year (exclusively from fruits, berries, tubers and the like). These days, each of us eats a whopping 158 *pounds* per year — or about 50 teaspoons a day! There's absolutely nothing in our genetic makeup that could have prepared our bodies to handle this kind of dramatic change, or many of the other similarly dramatic lifestyle changes to which we've been simultaneously exposed.

Think about it: Humans evolved in a world without grocery stores and fast-food restaurants. For virtually all of human history, our ancestors had to work to find food and had very limited access to refined foods or excess calories.

But with the appearance of 15,000 low-fat foods (a.k.a. high-sugar, high-calorie foods) on the market over the last 15 to 20 years, and our increasingly sedentary — and stressful — lifestyle, we have essentially abandoned the conditions for which our historically conditioned metabolisms are well suited. And in the process, we've created the perfect conditions for an epidemic of obesity, diabetes, heart disease and brain disorders.

Our bodies normally produce insulin in response to food in our stomach, particularly sugar. And, since our genetic structure evolved at a time when sugar was rarely consumed, our insulin response is designed to handle *vastly* lower levels of sugar than what we eat today.

Our bodies respond to our new diet of low-fat, highly processed and refined foods the only way they know how: They keep pumping out insulin — which, in excess, happens to function as a pro-inflammatory substance.

Eventually, we become resistant to all this excess insulin in our blood, just as we would become resistant to a drug. The body needs more and more of it to do the same job it once did with far less. So our insulin-production system spirals out of control, pumping ever more into our bodies, which become inflamed and metabolically imbalanced.

That's bad, but it gets worse: Remember, hormones are message carriers. And what is all this insulin saying to the rest of our body? It's rushing through our bloodstreams spreading the message that we are starving. The result: We start craving foods with high sugar content — the very same foods that caused the problem in the first place.

## This Is Your Body on Insulin

Perhaps the situation wouldn't be so bad if insulin metabolized only sugar. We once thought that was insulin's only role — to help sugar enter your cells to be metabolized, transforming the stored energy of the sun (in plant foods) and the oxygen we breathe into the energy we use every day to run our bodies.

But here is what too much insulin *really* does to your body, your brain and your health:

- **Insulin is a major switching station,** or control hormone, for many processes. It dictates how much fat the body will store.
- **As long as your insulin levels are high,** you will fight a losing battle with weight loss. It acts on your brain to increase appetite — specifically, an appetite for sugar and refined carbohydrates.
- **Insulin increases inflammation** and oxidative stress and ages your brain, leading to what is being called type 3 diabetes — also known as Alzheimer's.
- **Insulin increases LDL** ("bad") cholesterol, lowers HDL ("good") cholesterol, raises triglycerides and increases your blood pressure. Insulin resistance causes 50 percent of all reported cases of high blood pressure.
- **Insulin stimulates the growth of cancer cells.**
- **Insulin leads to mood and behavior disturbances** such as depression, panic attacks, anxiety, insomnia and ADHD.
- **Insulin makes your blood sticky** and more likely to clot, leading to heart attacks and strokes.
- **Insulin causes sex-hormone problems** and can lead to infertility, facial hair growth, acne and scalp hair loss in women; in men, it can cause low testosterone, breast growth and more.

## Rebalancing Act

The good news is that balancing blood sugar and correcting insulin resistance is well within our reach, and the effects are dramatic: Diseases ranging from depression to dementia can be stopped and even reversed if intervention occurs early enough.

While there are some new medications that can help, such as Glucophage, Avandia and Actos, they have side effects and are only a band-aid approach to chronic conditions unless used with a comprehensive nutritional, exercise and stress-management plan that balances your neuro-endocrine system by helping it work the way it was designed.

Here is what to do to rebalance insulin, both nutritionally and through your lifestyle:

- **Eat whole, real foods,** mostly from plant-based sources. Our bodies evolved and were designed to flourish on fruits, vegetables, beans, nuts, seeds, whole grains, and lean animal protein such as fish, chicken and eggs.
- **Remove toxic foods from your diet.** Toxic foods, such as trans fats, high-fructose corn syrup, and all processed foods with ingredients you don't easily recognize, interfere with your metabolism and create blood-sugar imbalances.
- **Eat organic.** Pesticides, antibiotics and hormones slow down your metabolism.
- **Avoid sugar and flour products.** They slow your metabolism and contribute to inflammation.
- **Eat early and try to eat protein with each meal.** Starting off the day with protein — nuts or nut butters, eggs, a protein shake, or even leftovers from the night before — jump-starts your metabolism and helps to avert overeating throughout the day.
- **Eat frequently.** Fueling your body regularly throughout the day speeds up your metabolism. Make it a priority to have three meals and a couple of snacks every day.
- **Finish eating at least two hours before bed.** If you fall asleep with food in your stomach, your body is more likely to store it, not burn it.
- **Sleep seven to eight hours a night.** A lack of sleep generates increased levels of ghrelin, the hunger hormone that triggers you to crave and eat more refined carbs and sugar.

- **Build and maintain muscle.** Your biggest metabolic engine is your muscle mass — basically, this is where your metabolism lives — so use it or lose it. Working with weights, exercise bands and resistance machines, and doing yoga all prevent your muscles from wasting away.
- **Exercise intelligently.** Try including interval training into your exercise program two or three days a week: Exercise at 90 to 95 percent of your peak heart rate for 30 to 60 seconds, then three to five minutes at 60 to 65 percent of your peak heart rate, alternating for a total of 30 minutes. Exercising at this intensity will trigger a metabolic effect that will cause you to burn more calories all day and while you sleep.
- **Deeply relax daily.** Stress hormones such as cortisol increase blood sugar, amplify appetite and cause weight gain around the middle, all of which promote insulin resistance. Find some time each day to sit quietly, breathe deeply or meditate.

Try this plan and see how it works for you. The goal is to make your metabolism more efficient — to make your cells more intelligent and cooperative, not resistant. As a result, you'll need much less insulin to accomplish the task of balancing your blood sugar. Best of all, once you correct your insulin levels, you may find that many related, inflammation-based health problems (see "The Fire Within," below) and hormonal imbalances subside.

Experience this, and you'll be experiencing functional medicine in action: It's really about harnessing the power you have to reset your metabolism and restore your body's natural balance simply by stopping the things that knock you off kilter. And by doing the simple things that empower you to thrive.

## Investigate Your Insulin

Could your insulin levels be out of whack? The more "yes" answers you provide to the questions below, the more likely it is that you have problems controlling your blood sugar. That means your body is pumping out dangerously high levels of insulin (and, potentially, suffering other hormonal and inflammatory problems as a result).

- Do you feel dramatic mood and energy swings?
- Do you crave sugar or salt?
- Are you overweight and putting on more and more belly fat?

- If you are a woman, do you have premenstrual syndrome, painful or heavy periods, and low sex drive?
- Are you depressed?
- Do you sleep poorly?
- Do you feel tired but wired?
- Do you rely on coffee in the morning and a few glasses of wine at night just to wake up and calm down every day?
- Do you have thinning hair or dry skin and feel sluggish in the mornings?

## The Fire Within - Where Hormones and Inflammation Intersect

One of the most insidious consequences of hormonal imbalances, and insulin resistance in particular, is inflammation, which is now thought to be at the root of all chronic illness we experience — from heart disease, obesity and diabetes to dementia, depression, cancer and even autism.

Inflammation and immune balance is yet another one of the body's core systems we must address to prevent disease and power our vitality (see "The 7 Keys to UltraWellness," below). We may feel healthy, but if this inflammation is raging inside of us, we're in trouble.

The real concern is not our acute inflammatory response to injury or infection, but the chronic smoldering inflammation that slowly destroys our organs, compromises our ability for optimal functioning and leads to rapid aging.

The real effects of statin drugs like Lipitor in reducing heart disease may have nothing to do with lowering cholesterol and everything to do with their unintended side effect of reducing inflammation. But is that the right approach to address the problem? No. This treatment approach is a classic example of what I call "downstream" medicine: Modern medicine tends to get caught up in treating the symptom — inflammation, in this case — without actually stopping to think: *What is actually triggering this inflammation? Where is it coming from?*

Common treatments such as anti-inflammatory drugs (ibuprofen or aspirin, for example), or steroids like prednisone, though often useful for acute problems, interfere

with the body's immune response and inevitably lead to serious side effects. In fact, as many people die from the side effects of taking excessive amounts of anti-inflammatory drugs like ibuprofen as die every year from asthma or leukemia. In other words, stopping the inappropriate use of these drugs would be the lifesaving equivalent of finding a cure for asthma or leukemia. Hard to believe, but true.

So, what is the "upstream" medical approach to inflammation? First, identify the triggers and causes of inflammation, such as sugar, processed foods, hidden food allergens, environmental allergens, toxins, stress, being sedentary and hidden infections. Then, remove as many as possible, and help the body's natural immune balance reset by providing the right conditions for it to thrive.

Taking a comprehensive approach to reducing inflammation at its source is one of the most important things we can do to support the core systems of the body, and I consider it a cornerstone to good health.

In fact, the future of medicine may no longer have specialties like cardiology or neurology or gastroenterology, but new specialists like "inflammologists" who focus on precisely these sorts of root causes of disease. In the meantime, it's up to you to keep a close eye on your own "fire within" — and to take the steps (like those described above) that will keep them from smoldering out of control.

*For more on inflammation, see "Fighting Inflammation" in the July/August 2004 archives.*

# Functional Wellness, Part 3: Digestive Health

**A well-functioning digestive system is the cornerstone of good health. Find out how the gut works, what makes it vulnerable – and what you can do to keep your own digestive tract in tiptop shape.**

EXPERIENCELIFE.COM

By Mark Hyman, MD (@markhymanmd) / September 2008

Digestive distress is hardly a topic for dinner-party conversation, but the truth is, it's surprisingly common. About one in three Americans suffers from gut problems of various sorts. Two of the top seven best-selling drugs in the United States are prescribed for gastrointestinal problems. And nearly half of all visits to internists are for "functional bowel disorders," such as reflux and irritable bowel syndrome.

Doctors use the word "functional" to describe problems related to function — situations where the bowel simply isn't working properly — as opposed to "structural" disorders, which are something we can see (e.g., blockages, punctures, malformations), and which therefore are often considered more "real." But functional gut disorders are equally real problems with very real causes — and sometimes dire consequences.

Considering how many people suffer from these problems, you would think our sophisticated medical system would have a clear understanding of the causes of irritable bowel syndrome, constipation, diarrhea, reflux, inflammatory bowel disease and other common digestive issues. You would think by now we'd have developed great treatments to fix these problems.

Unfortunately, our understanding of this highly sophisticated and integral part of our body is still quite primitive, despite the explosion of scientific research on what *Science* magazine has called “the inner tube of life.”

As it turns out, digestive problems aren’t *just* digestive problems. They can cause many other seemingly unrelated diseases, a fact that has escaped most people — including many doctors.

Over the last 15 years of practice and research, I have found the gut to be the source of inestimable suffering throughout the body. Yet, when you treat the digestive problem, the other symptoms often improve. These treatments promise relief from common “functional” gastrointestinal symptoms (and most allergic and autoimmune diseases, which originate in the gut), but they’ve also proven effective against illnesses ranging from depression and attention deficit hyperactivity disorder (ADHD) to dementia and Parkinson’s disease.

Sound crazy? Let me tell you about one of my patients. She was 57 and had suffered for eight years from severe, unrelenting eczema all over her body. She saw doctor after doctor for this red, oozing, scaly, itchy rash. They gave her salves, lotions, steroids and antibiotics. But they never addressed the underlying cause of her problem.

When she came to me, I learned she ate a high-sugar diet and suffered from frequent yeast infections. She also had a leaky gut, which is known in medical terms as “increased intestinal permeability” — in other words, the gut-wall barrier was not working. Plus, she had developed 24 immunoglobulin G (IgG) food allergies, and her stool lacked healthy bacteria and showed an overgrowth of yeast. She also had very high blood antibodies against yeast.

The answer? I treated her skin by treating her gut. I asked her to stop eating the foods to which she had reactions, told her to stop feeding the yeast by cutting out sugar and refined carbohydrates, and helped her kill the yeast in her gut with antifungal medications and herbs. Then I replenished the healthy bacteria and healing gut nutrients. The result? Her eczema disappeared — and it has never come back.

## How Your Gut Works

Many people think of their digestive systems as a series of tubes through which food is mechanically crushed and extruded. It's not as simple as that. Your gut's health determines which nutrients are absorbed and which toxins, allergens and microbes are repelled. As a result, it is directly linked to the health of your entire body.

Intestinal health could be defined as the optimal digestion, absorption and assimilation of food. But that is a big job that depends on many other factors.

First, the bugs in your gut function like a rainforest — a diverse and interdependent ecosystem. The 3 pounds of bacteria there include some 500 different species that act as a chemical factory — helping you digest your food, produce vitamins, regulate hormones, excrete toxins and produce healing compounds that keep your gut healthy.

But for you to be healthy, these bacteria must be in balance. Too many of the wrong bugs, like parasites, yeasts and bad bacteria — or not enough of the good bugs, like *lactobacillus* or *bifidobacteria* — can seriously damage your health. (For more on good bugs and bad, see "Good Bacteria Welcome" in the July/August 2007 archives.)

Second, the gut is delicate. Your entire immune system and the rest of your body are protected from the toxic environment in the gut by only a *one-cell-thick* layer — the epithelium — that covers a surface area the size of a tennis court! If that barrier is damaged, you will get sick and your immune system will become overactive, producing inflammation throughout the body.

And then there's your second brain. That's right, your second brain. Your gut literally contains its own nervous system. In fact, the "brain" in your gut contains more neurotransmitters than the brain in your head.

The intestinal nervous system is wired back to your brain, and messages travel between the two. When those messages are altered for any reason in any direction — from the brain to the gut or the gut to the brain — your health will suffer.

But wait, there's more: Your gut also has to dispose of all the toxins created as a byproduct of your metabolism. If things get backed up, your entire body can become overrun with toxins.

Finally, in the midst of all of this, your gut must break down all the food you eat, separate all the vitamins and minerals, and shuttle everything across the epithelium into your bloodstream for you to stay healthy.

## Enemies of a Healthy Gut

With such a delicate balance and so many ways for things to go wrong, it's no wonder that so many of us are sick. Even in a perfect world, our gut has a hard time keeping things balanced. In the challenging circumstances of real life, there's seemingly no end to the things that knock our digestive systems off balance. They include:

- **A standard American diet** (SAD) that is low in fiber, rich in sugar, low in nutrients, and high in additives and chemicals, changing the ecosystem of our guts
- **Overuse of medications,** such as anti-inflammatories, antibiotics, acid-blocking drugs (see "The Dangers of Acid-Blocking Drugs," below) and steroids, that disrupt the gut's ability to stay in balance and do its job
- **Chronic low-grade infections** or gut imbalances with bacterial or yeast overgrowth, parasites, or even more serious gut infections
- **Exposure to toxins,** such as mercury and mold, that damage normal gut function
- **Lack of adequate digestive enzyme function,** which can be caused by acid-blocking medications or zinc deficiency
- **Chronic stress,** which can alter the gut's nervous system, causing a leaky gut and changing the normal bacteria in the gut

By now you probably have a better sense of why those "functional" bowel disorders I mentioned earlier are so widespread — and why most conventional treatments fail to address the underlying problems. All in all, we live in dangerous digestive times.

## Fighting Food Allergies

As I noted before, it's a rare digestive problem that remains confined to the gut. One consequence of poor diet, stress, medications, infections or toxins damaging the balance of normal gut function is that our ability to tolerate food we normally eat is impaired — in other words, we become sensitive or allergic to certain foods.

All these factors can damage the delicate lining of the small intestine, which, in turn, will harm healthy bowel bacteria, creating injury and inflammation in that one-cell layer of gut lining.

When that happens, we develop a leaky gut. Because many of our digestive enzymes (the chemicals that break down our food) are located right on that delicate epithelial layer that is now damaged, we cannot digest our food properly. Suddenly, we have partially digested food particles from normally innocuous foods “leaking” into our circulation.

And, because about 60 percent of our immune system is located in the gut, beneath that one-cell layer, our bodies react by increasing our immune response and generating inflammation. Our immune system, normally used to seeing fully digested foods (like proteins broken down into amino acids, fats broken down into fatty acids and carbohydrates broken down into simple sugars), suddenly “sees” foreign (meaning partially digested) molecules.

So it does what it is designed to do: attack and defend! That is how we create antibodies and develop IgG allergies to common foods. This is what makes us sick and fat, toxic and inflamed, depressed and anxious.

## How to Heal Your Gut

So, how do you bring your gut back into balance? Here’s the plan I use with patients whose digestive distress has caused other health problems. See how it works for you.

1. Eat whole, unprocessed foods that contain plenty of fiber, like vegetables, beans, nuts, seeds and whole grains.
2. If you think you might have food sensitivities, try an elimination diet. Cut out gluten, dairy, yeast, corn, soy and eggs for a week or two and see how your gut feels and what happens to your other symptoms.
3. Immediately treat any infections or overgrowth of bugs, like parasites, small bowel bacteria or yeasts.
4. Take digestive enzymes with your food.
5. Take probiotic supplements, which contain healthy bacteria for your ecosystem.
6. Take supplements of omega-3 fats, which help cool gut inflammation.
7. Use gut-healing nutrients such as glutamine and zinc.

If you think you have “just” a digestive problem, think again. Having a healthy gut doesn’t simply get you relief from bloating, gas, heartburn or constipation: A healthy gut is central to your overall health, and it is connected to everything that happens in your body. Keeping your digestive system healthy is critical, because, ultimately, you are not only what you eat — you are what you absorb.

## The Dangers of Acid-Blocking Drugs

Are millions of us born with a genetic defect that makes us produce too much stomach acid? Do we need powerful, acid-blocking drugs to prevent heartburn and reflux?

Or, could something simply be out of balance? Consider this: At least 10 percent of Americans have episodes of heartburn every day, and 44 percent have symptoms at least once a month. Overall, reflux or gastroesophageal reflux disease (GERD, also known as heartburn) affects 25 to 35 percent of the U.S. population.

Fast on the heels of Lipitor and Plavix (drugs for cholesterol and heart disease), acid-blocking drugs are the fourth top-selling pharmaceutical in America’s $286 billion drug market. In fact, three of the drugs to treat reflux — Nexium, Protonix and Prevacid — are in the top 20 best-selling drugs, accounting for some $13 billion in sales annually.

When I was a medical student and these drugs first came on the market, the pharmaceutical representatives warned us how powerful they were. They told us not to prescribe them for any longer than six weeks and only for patients with documented ulcers.

Now, these drugs are given like candy to anyone who has had too many hot dogs at a ballgame. And one drug, Prilosec, whose patent expired, is now available without a prescription. I’ve even seen a commercial showing a family rushing to stop their father from eating a big sausage with fried onions and peppers — and he tells them not to worry because he took his acid-blocking pill!

So, why are these drugs so bad? Well, their supposedly “good” effect — shutting down stomach acid — is actually a bad effect. Stomach acid is necessary to digest food, to activate digestive enzymes in your small intestine, to prevent bacterial overgrowth in your small intestine, and to help you absorb important minerals like calcium and magnesium and vitamins like B12.

Research indicates that taking these drugs can prevent you from properly digesting your food, cause mineral and vitamin deficiencies, and lead to irritable bowel, depression, hip fractures, and more.

For example, studies show that people who take long-term acid-blocking medications can become deficient in vitamin B12, which can lead to depression, anemia, fatigue, nerve damage and even dementia, especially in the elderly.

Studies also show that taking these drugs can cause dangerous overgrowth of bad bacteria in the intestine, which can lead to life-threatening infections.

For many more people, low-grade overgrowth of bacteria in the small intestine leads to bloating, gas, abdominal pain and diarrhea — which, by the way, are many of the common “side effects” noted in the label warnings for these drugs.

The funny thing is, back in my medical school days, GERD was not even on the radar as a significant illness. Some people had heartburn, and then there were people with ulcers. For the most part, that was it.

The upshot? It’s my view that drug companies invent diseases to create markets for their products. It is absurd to think that humans can’t feel good and live with normally functioning digestive tracts without help from powerful drugs with dangerous side effects.

These drugs may occasionally be necessary for short-term use, but if we deal with the root causes of digestive imbalances (as the practice of functional medicine suggests), reflux and other acid-related conditions usually can be managed without medication.

## Your Gut - A Day at the Office

Wondering what the heck your gut does all day long? For starters, it ...

1. **Breaks Down Your Food:** Mechanically and chemically separates and digests food with the help of adequate stomach acid, digestive enzymes and bile.
2. **Ushers in the Good Stuff:** Absorbs (through a delicate one-cell-thick layer) just the right molecules — amino acids, fats, sugars, vitamins and minerals — to keep us properly nourished.

3. **Bounces the Bad Stuff:** While letting in the nutrients essential for life, it must prevent, block or neutralize nasty toxins, bugs and chemicals that flow through our “inner tube of life.”
4. **Makes Raw Materials:** Your gut bacteria produce vitamins and other health-giving molecules that nourish you and make up your gut ecosystem.
5. **Protects You:** Balances your gut immune system (called the GALT, or gut-associated lymphoid tissue), which comprises 60 percent of your immune system, thereby protecting you from illness and supporting your vitality.

# Functional Wellness, Part 5: The Body-Mind Connection

**Discover the truth about how your mind affects your body, how your body affects your brain, and what you can do to keep the whole brilliant system working to your advantage.**

EXPERIENCELIFE.COM

By Mark Hyman, MD (@markhymanmd) / November 2008

## Stress Eats Away at Your Health

One of my long-term patients came to see me after his wife died. He had suddenly developed heart failure. His heart just wouldn't pump efficiently. What had caused this? Well, his heart was flooded with grief molecules: hormones like adrenaline, noradrenaline, cortisol and more.

This is a phenomenon known as "broken heart" syndrome. In fact, the *New England Journal of Medicine* recently published a study about how grief or emotional trauma can cause heart failure — *literally, a broken heart!*

So rather than give my patient drugs for "heart failure," as I was taught in medical school, I suggested he receive healing touch, a form of energy and emotional healing. The result? He recovered dramatically. It was his body's response to touch, not a pharmaceutical medication, that healed his heart.

If you find this surprising or too hocus-pocus, you're not alone. Americans just aren't used to viewing things this way. After all, we all learned how to read and write in school,

but most of us never learned how to use our minds to help us with the most important survival skills — staying happy and healthy.

One of the biggest predictors of longevity is psychological resiliency — being able to roll with the punches life throws at you. In fact, your attitude, social network, community and spiritual beliefs are more important than cholesterol, blood sugar, blood pressure and any other risk factor in determining whether you will live a long and healthy life.

This concept isn't new. Recently, I was browsing through my old books and found one that I read in college called *Mind as Healer, Mind as Slayer*. It was written by Kenneth Pelletier, MD, a friend of mine who is a leader in the field of mind-body medicine and a clinical professor of medicine at the University of California, San Francisco, and the University of Arizona. The book was published in 1977, but its basic truths remain the same.

The book states that there is a dramatic and powerful connection between the mind and body and vice versa. The word "connection" is a bit of a misnomer, actually, because it is really just *one* bidirectional system.

As Hans Selye, MD, the man who coined the word "stress" and first mapped out its biological effects, said, "The modern physician should know as much about emotions and thoughts as about disease symptoms and drugs. This approach would appear to hold more promise of cure than anything medicine has given us to date."

It's true. The most powerful pharmacy in the world is right between your ears — and also in your gut, where a "second brain" happens to reside within your intestinal system. (For more on that, see the third article in this functional wellness series, "Digestive Health," available in the September 2008 archives.)

What I'll explain in this article is how the experiences we think of as happening "in our minds" very powerfully affect our bodies. The state of our bodies, in turn, powerfully affects our minds. Rather than being two separate systems, our mind and body are intertwined in subtle and sophisticated ways — ways we would all do well to understand.

## Stress Eats Away at Your Health

We've all heard of those Tibetan monks who can control their physiology — slow their metabolism, change their heart rate and brain waves, and adjust their body temperature at will — simply by meditating. Unfortunately, most of us are not trained to address the stressful psychic loads that are the burden of the 21st century. And they are killing us.

Just consider these facts:

- Some 95 percent of all illness is caused or worsened by stress.
- Low socioeconomic status is associated with poorer health outcomes and higher risk of death from all causes. This is not related to poorer health habits, but to feelings of powerlessness and loss of control.
- Internalized stress from feeling discriminated against is associated with high amounts of belly fat.
- Stress hormones damage the hippocampus — the memory center in the brain — causing memory loss and dementia.
- In a study of people who volunteered to have cold viruses injected into their noses, only people with a high level of perceived stress got colds.
- Women with metastatic breast cancer may survive twice as long if they are part of a support group.
- Belonging to a group — a religious group, a bowling club, a quilting group, for example — reduces risk of death from all causes and increases longevity regardless of other health habits.
- In a study of doctors, those who scored high on hostility questionnaires had an even higher risk of heart attacks than those who smoked, were overweight, had high blood pressure or didn't exercise.

## The Mind-Body Connection Goes Both Ways

So we know that a tendency toward negative thinking, commonly referred to as ANTs (automatic negative thoughts) — taking everything personally, for example, or holding rigid beliefs or attitudes — can activate the stress response and trigger illness. (See "Got ANTs in Your Head?" below.) But you don't just have to think bad thoughts to trigger this stress response. Your mind-and-brain function also is influenced by what happens in your body. Every other input into your world — an imbalance in any of the other six key systems (see "The 7 Keys to UltraWellness," below) in your body — can

trigger that same response. Unfortunately, conventional medicine mostly *ignores* these connections.

Let me share just one story here. A patient I saw recently was completely stressed out and anxious, had heart palpitations, and drank four martinis a night just to calm down. He also had severe muscle cramps and eye twitches, which are obvious signs of magnesium deficiency. Stress, alcohol, caffeine and sugar all deplete magnesium. He was in a vicious cycle.

What he needed wasn't the Valium or Prozac most doctors would prescribe. Instead, I addressed why he was magnesium deficient by helping him detoxify, treating the yeast overgrowth in his gut, cutting out alcohol and caffeine, and giving him enough of the relaxation mineral, magnesium, to calm his nervous system. That, in combination with tools for calming the mind and the body, helped him reset his nervous system.

## Ushering in Some Calm

But life is stressful, right? What can you really do about it? The answer is, a lot. *You can change your beliefs and attitudes and their effects on your mind and your body.* You may need to learn a few new skills — essential survival skills that you probably never learned in school or from your family. Most of us were never trained to calm ourselves, for example. (Unless, of course, we learned to do it with a big glass of chardonnay or hours of television.)

But the fact is, we cannot thrive without these skills — particularly in today's society, where a runaway stress response has become such a consistent part of our daily lives that most of us don't even realize we are in an almost perpetual state of alarm.

That is why each of us must find a way to push our pause button *on a daily basis*. This is key to long-term brain health. So what can you do for yourself?

Here's my 10-step plan:

1. **Find the biological causes** of problems in the mind. Your problem could be mercury toxicity, magnesium or B12 deficiency, a toxic gut chemical, or a gluten allergy that is affecting your brain. By changing your body, you can change your mind!
2. **Learn how to actively relax.** To engage the powerful forces of the mind on the body, you must do something. Crafts, hobbies, relaxing exercise and meditation all work. But you can't just sit there and watch television or drink a beer. (For more on how to actively relax, see "Take a Deep Breath, Activate Your Relaxation Response," below.)
3. **Practice being calm.** Try meditation, deep breathing, yoga, biofeedback, progressive muscle relaxation, taking a hot bath, making love, getting a massage, watching a sunset, and walking in the woods or on the beach.
4. **Exercise.** It's a powerful way to burn off stress chemicals and heal the mind, and it has been proven to be better than or equal to Prozac for treating depression.
5. **Clean up your diet.** Eliminate mind-robbing molecules like caffeine, alcohol and refined sugars. Eat regular meals to avoid the short-term stress of starvation on your body.
6. **Take a multivitamin** and other supplemental nutrients. Vitamin C, the B-complex vitamins such as B6 and B5 (pantothenic acid), zinc, and most important, magnesium (the relaxation mineral) all help balance the stress response.
7. **Use adaptogenic herbs.** Used with care, ginseng, Rhodiola rosea, Siberian ginseng, cordyceps and ashwagandha can help you adapt and be balanced in response to stress.
8. **Take a hot bath or a sauna.** It will help your body deeply relax and turn on the relaxation response.
9. **Examine your beliefs,** attitudes and responses to common situations. Consider reframing your point of view to reduce stress.
10. **Consciously build your network** of friends, family and community. They are your most powerful allies in achieving long-term health.

All of these things help, and for most of us, *some combination of all of them* is the best approach.

There is no magic bullet — no single drug, food or therapy — that will solve our chronic health issues or the epidemic of mood, behavior, attention and neurodegenerative disorders with which our culture is now faced.

Everything is connected. We are one holistic system, and we need to understand the ecology of our body.

This type of thinking is foreign to medicine and difficult for most of us to grasp. But grasp it, we must. By the year 2025, it is estimated that major depression will be the second leading cause of medical disability in America. A different type of thinking is necessary to solve this problem.

It starts with understanding and rebalancing the root systems on which our health, vitality, clear-headedness and happiness all depend. Give this advice a try and see how a healthier mind affects your body — and how a healthier body affects your mind!

## Take a Deep Breath

**Activate your stress response.**

*Take a deep breath into your belly, counting to five, pause for one second, then breathe out slowly to another count of five. Keep your belly soft. Put down the magazine and do this five times. Then keep reading.*

You have just activated the vagus nerve, which extends from your brain through your neck, into your chest and through your diaphragm. So, when you take a deep breath and relax and expand your diaphragm, your vagus nerve is stimulated, you instantly turn on the parasympathetic nervous system, your cortisol levels are reduced and your brain heals.

This whole experience is called the relaxation response. The opposite of the stress response, the relaxation response is necessary for your body to heal, repair and renew. There are *many* ways to activate the vagus nerve and turn on the relaxation response, but this simple breathing exercise is an easy one to incorporate into your daily life, anytime, anywhere.

## Got ANTS in Your Head?

Identifying and transforming our ANTs — or "automatic negative thoughts" — is essential if we want to achieve health and happiness. In his book, *Feeling Good: The New Mood Therapy* (HarperCollins, 1999), David Burns, MD, reviews 10 common ANTs — all of which have a real, physical impact on our biology. They are:

1. "All-or-nothing" thinking
2. Overgeneralization — if one bad thing happens, then everything is bad or doomed to go poorly
3. Negative mental filter — a tendency toward ingrained pessimism, the opposite of "rose-colored glasses"
4. Jumping to conclusions
5. Personalization — taking everything personally
6. Disqualifying the positive — ignoring or downplaying good things that happen
7. Magnification — making things worse than they are
8. Emotional reasoning — assuming your negative emotions reflect how things really are, e.g., "I feel guilty, so I must be a bad person."
9. "Should" statements
10. Labeling and mislabeling — making incorrect assumptions about things

# Functional Wellness, Part 6: Energy, Mitochondria and Toxicity

**Mighty mitochondria – those little factories inside our cells that generate energy – play a central role in our metabolism, our vitality and our well-being. Find out how to rev your cellular engines, rid them of the gunk and damage that slows them down, and start feeling your healthy best.**

EXPERIENCELIFE.COM

By Mark Hyman, MD (@markhymanmd) / December 2008

In the end, everything comes down to energy. I mean that quite literally: The ultimate loss of energy is death. And yet, most of us don't think about energy this way — in terms of life and death. We don't think much about where our energy comes from, why sometimes we have more or less of it, how it might affect our brains, or even how it might affect aging. But, in fact, everything we have explored in the other keys to well-being influences our health directly through energy. (See the preceding articles in this six-part series to the right.)

Imagine if you could find a way to tune up your metabolism, to increase your energy levels, to be able to think more clearly and to feel less achy. Imagine if you could prevent diabetes, heart disease, Parkinson's disease and dementia. Imagine if you could heal fibromyalgia and chronic fatigue syndrome. Imagine if you could get to the root of aging and delay the whole process.

I've got news for you: All that and much more is possible if you're willing to give yourself a metabolic makeover. You see, energy is something we lose with age. But it can also

be lost because of anything that triggers more free radicals and oxidative stress or damage to our mitochondria.

Mito-who? Let me explain. In 2006, Harvard researchers found that the red pigment in grapes called resveratrol could extend life in mice by protecting their mitochondria. These mice actually lived 15 percent longer than average, even while eating a bad diet. In fact, they even became fitter and lost weight.

So how could they eat poorly and not exercise, but become fitter *and* live longer? One word: mitochondria. It turns out that the resveratrol protected and improved the function of the mitochondria through its effects on special master aging genes.

## A Mitochondria Primer

Mitochondria are tiny factories that turn food and oxygen into energy. In each cell, there are hundreds to thousands of these little energy factories. They exist in greater numbers in active organs and tissues, like the muscles, heart and brain.

Simply put, the mitochondria are where metabolism happens. The role of your metabolism is to take the oxygen you breathe and the food you eat and process it to make energy, the fuel for life. Along the way, many things can go wrong that may impede your metabolism, make it run less efficiently or practically shut it down.

The problem? Mitochondria are very sensitive to damage. And when they aren't working properly, you suffer all the symptoms of low energy — fatigue, memory loss, pain, rapid aging and more. Fatigue is the most common symptom of poorly functioning mitochondria. In fact, the reason we poop out as we age is the constant insult and injury we give our mitochondria.

But this doesn't have to happen! Research shows that we can protect our mitochondria — and boost metabolism. Renowned scientist Bruce Ames, PhD, at the University of California, Berkeley, has spent the last decade discovering how we can give ourselves a metabolic tune-up. In a series of studies, he gave old, tired rats — who wouldn't get on the treadmill anymore and couldn't find the cheese in the maze or swim very far — two molecules that boost metabolism by making the mitochondria run better: alpha-lipoic acid and acetyl-L-carnitine.

In only a month, these rats began acting younger. They got up on the treadmill by themselves, swam long distances without tiring and could easily find the cheese in the maze, just like younger, healthier rats. How could that happen? The molecules used on the rats support a core part of our own biochemistry and thus affect our system as a whole, but they are not the only things needed to boost energy.

## Oxidative Stress and Disease

To tune up your own metabolism, the first order of business is to find the things that damage your mitochondria — things like toxins, infections, allergens and stress. But the biggest insult over time is eating too much high-calorie, low-nutrient food — in short, too many “empty calories.”

When food is burned or metabolized with oxygen in the mitochondria, your body produces waste in the form of free radicals, which create a chain reaction of rusting, or oxidation. Unless you have enough antioxidants in your diet or you make enough in your body, you can’t protect yourself from the damage to your mitochondria. So when you eat empty calories — such as sugar, flour and processed foods that don’t have the high antioxidant levels of fruits and vegetables — you produce too many free radicals that tip the balance and start a chain reaction of cellular and tissue damage that destroys your mitochondria and, thus, your life force.

In short, oxidative stress is a slow, progressive process of deterioration that contributes to practically every known disease. It is part of the inevitable entropy, or chaotic breakdown, that is the basic principle of life.

You are already familiar with this process. You can see it in the rust on your car, the brown color that appears on an apple when cut open and exposed to air, the rancid vegetable oil in your cupboard, and even the wrinkles forming on your skin. But it doesn’t stop there. What you may not realize is that your own tissues are rusting, your own fats are going rancid, and your brain is effectively melting as you go about your daily life. OK, so it’s happening gradually, but still — perhaps you’re beginning to see the life and death connection I referred to earlier?

Your body does have a built-in anti-rusting system and mitochondrial protection system — the redox system, a chemical process of reduction and oxidation — but it can

become overwhelmed by all the work you ask of it. As with all the systems in the body, big problems can arise when any one part of a system is thrown out of balance.

Reduction is the neutralization of damage from oxidation, or rusting. But oxidation is actually not all bad. In fact, your white blood cells kill bacteria and viruses by releasing hydrogen peroxide and other compounds we call free radicals. These are electrochemical molecules that are missing an electron, which makes them unstable and "lonely." They bump into neighboring molecules and steal an electron, making them, in turn, unstable.

But while oxidation sometimes works in your favor, it can also easily get out of hand and start damaging the very tissues it was designed to protect. Eating too many empty calories and not taking in enough phytonutrients and antioxidants from fresh fruits and vegetables actively encourages your free radicals to multiply and run amok. The more free radicals you make, the less energy you produce, because you damage the cells' ability to make energy in the mitochondria. This is why eating too many calories and not enough nutrients is at the heart of both obesity and a great deal of chronic illness.

## Making the Most of Your Mitochondria

The key to achieving optimal health and enjoying a vital, energetic old age is to get your redox system back into balance and protect your mitochondria. Does that mean taking supplemental antioxidants is the answer? Not necessarily.

Much research has been done on antioxidants and disease — and the results are mixed. One problem is that we are used to looking at things through a pharmaceutical-drug lens, where you study a single drug, a single effect and a measurable outcome: You give a pill for high blood pressure and watch for blood pressure to go down. But studying a single antioxidant that we isolate from food, like beta-carotene, is completely counter-physiologic, because the body simply doesn't process nutrients this way. It prefers to get its nutrients in whole-food form, where they come complete with all the necessary cofactors and complementary nutrients required for proper assimilation. And then there's the fact that some of the most powerful antioxidants around — such as the proanthocyanidins in grapes and berries — are not available in supplement form.

Here's another problem with relying on megadoses of supplemental antioxidants: By definition, antioxidants have the potential to becomes oxidants. That's because an

antioxidant works by giving up one electron to neutralize the free radical — and then, by definition, it *becomes* a free radical. It then needs to be neutralized by another antioxidant, moving down a chain until it is finally neutralized by the mother of all antioxidants, glutathione, which can be recycled and restored.

Ultimately, no magic pill will do for us what a whole-food diet and healthy lifestyle will, particularly given all the real-life insults affecting us — poor diet, stress, environmental toxins and sedentary lifestyle — all of which affect our mitochondria.

But if dosing up on bottled antioxidants isn't the answer to our mitochondrial woes, what is? See the next page for my suggestions — and the lessons I learned from personal experience.

## How to Heal Your Mitochondria

So now you know what can damage your mitochondria. Here's how to protect them and prevent rusting.

First, address the causes of mitochondrial damage:

1. **Minimize your intake of processed food,** junk food, sugar, empty calories, artificial sweeteners, artificial colors and other chemical food additives. Their toxic effects can damage your mitochondria and prevent them from producing energy properly.
2. **Detoxify.** Support your body in ridding itself of the environmental and internal toxic "sludge" it has accumulated over the years. (For detox tips, see "Day-to-Day Detox" in the May 2008 archives.)
3. **Address inflammation.** Chronic, smoldering inflammation slowly destroys our organs and our ability for optimal functioning, and leads to rapid aging. (For advice, see "Fighting Inflammation" in the July/August 2004 archives.)
4. **Balance your hormones.** By resetting your metabolism and improving the way your body handles sugar and insulin — a master hormone — you can make your cells more intelligent and cooperative, and less resistant to doing their jobs.

Then, boost and protect your mitochondria:

1. **Exercise.** In essence, exercising encourages your body to upgrade its energy factories. Interval training, for example, increases the efficiency and function of the mitochondria. (For more, see "The Fit Way to Weight Loss" in the January/February 2008 archives.)
2. **Eat food that's full of antioxidants** and phytonutrients. Get eight to 12 servings of fresh vegetables, fruits, beans, nuts, seeds and whole grains every day. (For more on this, see "Phyto Power" in the November 2007 archives.)
3. **Take mitochondria-protective** and energy-boosting nutrients. These include acetyl-L-carnitine, alpha-lipoic acid, coenzyme Q10, n-acetyl-cysteine, NADH, D-ribose, resveratrol and magnesium aspartate. While not a cure-all, these nutrients, taken in conjunction with a whole-food, plant-based diet, can provide metabolic support for those low on energy.
4. **Increase omega-3 fats** to help build your mitochondrial membranes. Coldwater fish, such as wild salmon, sardines and herring, are good sources of omega-3 fats, as are flaxseeds and omega-3 eggs. They all help strengthen the fragile cellular membranes that make your mitochondria work the way they're supposed to.

Even as we are learning how mitochondrial injury is one of the common pathways to so many illnesses, we are also learning how to protect and defend ourselves. Getting a metabolic tune-up is not only possible, it's also necessary for most of us to feel our best. Eating a colorful plant-based diet, reducing toxic exposures and getting adequate exercise are all key factors in protecting and restoring our energy metabolism to optimal function — and to enjoying the full, vibrant life force within our grasp.

## The Case of the Poisoned Doctor

Anything that is toxic is damaging to our mitochondria. I first learned this the hard way: I got very sick.

The first seeds of my chronic fatigue syndrome were sown in 1994, when I went to China to develop a medical center in Beijing. I had been to China a decade before, but since then, Beijing had changed from a city of 10 million wearing Mao jackets and riding bicycles to an even more crowded city filled with Audi limos, cell phones and business suits. The homes were heated by raw coal, sending a dark cloud over the city on the

brightest winter days, and people walked the streets with surgical masks to filter out the black air.

At the time, I was unaware that coal burning is the most significant source of mercury emissions. I knew nothing of mercury, nor was I aware of a genetic polymorphism I have that makes it hard for me to detoxify.

It turns out that about half our population has this same polymorphism and is missing a key gene — GSTM1 — necessary for detoxifying mercury and many other 21st-century poisons. Because I am one of them, the entire time I was in China —breathing the polluted air, drinking polluted water and eating a lot of fish — mercury and other toxins were accumulating in my system.

Of course, I didn't realize at the time that the mercury and my genes didn't mix, setting the stage for my developing chronic fatigue syndrome two years later when I was back home in the Berkshire Mountains of western Massachusetts. I was exhausted and miserable, and I'd somehow gone from being a confident doctor to being a confused and frustrated patient.

My response was to begin researching my own case much as a detective would — digging into leads and following up on clues. Eventually I realized I was suffering from one of those diseases that most conventional doctors have been slow to acknowledge or name, much less effectively treat: chronic fatigue syndrome (CFS).

But it still wasn't entirely clear to me how I could be suffering from so many seemingly unrelated symptoms while still failing to test positive for any diagnosable disease.

After a few years of searching for the cause of my illness, a colleague mentioned that many people with CFS are toxic. I took a urine test to see the total mercury load in my body, and what I discovered scared me.

"Normal" levels of mercury are less then 3 micrograms per liter (mcg/L). My level was almost 200 mcg/L. Anything over 50 mcg/L is considered "poisoning." And one of the effects of that poisoning was to radically reduce the ability of my mitochondria to generate energy.

So I set about the process of unpoisoning myself. First, I did a lot of research and learning. I consulted with dozens of experts and then began experimenting with a careful, deliberate detoxification process that included detoxifying foods, supplements, intravenous glutathione and vitamin C, metal chelators, and saunas.

I was eventually able to rid my body of mercury and heal my mitochondria. Meanwhile, I also worked on healing my gut by eliminating food allergens, and by using probiotics and enzymes.

This journey to health took me from learning about and addressing my body's nutritional biochemistry and cellular biology to a process of psychological and spiritual renewal. It allowed me to heal completely and gave me the basis from which I now help to heal others.

Struggling with and fully recovering from a chronic problem that is often considered incurable, I learned how to work with every system of the body — one of the hallmarks of functional medicine. (See "The 7 Keys to UltraWellness," below, for an overview of our bodies' core systems.)

Too often, patients are given diagnoses that are quick or superficial health assessments. But because I learned firsthand what it's like to suffer from what are called "nondiagnosable" conditions, I have become much more empathetic and thorough with my own patients.

As I look back on the entire experience, I realize that my poor health offered me an opportunity to learn how to cure both myself and others. It is my hope that the field of functional medicine will bring this sort of patient-centered healing to all those who long for the full return of their vitality, energy and resilience. — *Mark Hyman, MD*