

# Preface

FOOD HAS ALWAYS BEEN MAGICAL TO ME. FOOD NOURISHES, HEALS, COMFORTS, inspires, and brings us joy throughout our lives. There's nothing else that has this kind of power. Even after a lifetime of studying food and nutrition, I am still awed by the inherent magic of nature and the food that she gives us. Now a new era of food awareness is emerging; people are concerned as much about healthfulness and diversity of foods as they are about flavor. Healthier foods are now being served everywhere from high-end white-tablecloth restaurants to fast-food chains, from airport concessions to mall food courts. Convenience stores and mainstream grocery stores are also improving the quality of food they stock.

With the epidemic of obesity, diabetes, cancer, and other diet-related diseases exploding, not just in the United States but also worldwide, improvements in the quality of food we eat cannot happen soon enough. I believe that food is going to become a primary form of medicine, even as eating good food remains one of life's great pleasures. We will be able to tailor what we eat to our unique dietary requirements and health goals and still please our palates.

Through *The Magic of Food*, my goal is to stir your passion for healthful eating and inspire you to make the right choices for your well-being. I have packed *The Magic of Food* with sound, medically based information to lead you on a journey on which you will discover the remarkable ways in which food can have a magical, yet real, impact on your body, mind, and health.

One of the major concepts in *The Magic of Food* is “synergetics.” Simply put, synergetics is how different foods and dietary factors work together to achieve a positive effect greater than the sum of each individual factor. So, in this case  $1 + 1 + 1$  does not equal 3 but something much greater.

## The Magic of Food

- Explains the principles of the world’s healthiest diets and latest science of nutrition
- Clarifies the revolutionary application of the effects of food on genetic expression
- Explains why phytochemicals are the “vitamins” of the twenty-first century and reveals my seven favorite superfoods
- Details which foods to eat as well as which ones to avoid for your health and total well-being
- Offers advice on which supplements to take and how much of them when you can’t get all of your nutrition from food
- Includes recipes and a meal plan for the Synergetic Diet

*The Magic of Food* brings together the latest scientific information about how specific foods work together to make you healthier and still give you the satisfaction and delight that you expect from the food you eat.

In good health,

Michael T. Murray, ND  
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# 1

## You Are What You Eat

In the early 1900s, Henry Lindlahr, MD, helped lay the groundwork for what became known as naturopathic medicine—medicine that emphasizes prevention and treatment of disease and the promotion of optimal health using natural, nontoxic therapies, including diet. In 1940, Henry’s son, Victor Lindlahr, MD, followed in his father’s footsteps by publishing his groundbreaking book *You Are What You Eat*. He’s right.

If you think about it, food is our direct connection to nature. It interacts with our bodies in complex and seemingly magical ways. It plays a major role in the composition of the cells throughout our bodies and influences how we function, think, and even feel. That is pretty magical, right?

### Your Body Is Younger Than You Think

You may have heard or read that we replace every cell in our body every seven to ten years. That statement is true with a few exceptions, such as brain cells, so most of our body is under constant renewal and repair. Where does the body get the raw materials for this effort? From food. Scientists are discovering just how effective—seemingly magical—food is in making all of this happen. A healthful diet is one of the reasons we often act and feel younger than our numerical age would indicate.

If we are constantly making new cells and repairing or remodeling others, why do we age? It has to do with several factors but is largely related to a built-in biological clock that is triggered every time a cell replicates itself. As we age, the cumulative effects of cellular and DNA damage make it more difficult for a cell to repair and/or remodel itself. Fortunately, there are a lot of components in food that can slow down the process and perhaps even act as sort of a magic fountain of youth. It helps to have an understanding of how our genes work to see the effect of food on our bodies in general and on our health.

## Genetics, Epigenetics, and Nutrition

The Human Genome Project (HGP), an international research project, described, or sequenced, the chemical base pairs that make up the genetic code—the DNA—found in a body’s 23 pairs of chromosomes. The “genome” of any individual (except for identical twins) is unique. HGP has provided information about how genes work together, as well as the genetic causes of some diseases. Yet, along the way, scientists realized that genetics alone do not entirely determine our health status. Other factors, including primarily the food we eat, influence the expression of genes and whether we develop certain illnesses.

## Our DNA Is Not Necessarily Our Destiny

Our genes need specific instructions on what to do, how to do it, and when. It’s amazing that a human liver cell contains the same DNA as a brain cell, yet somehow it knows to replicate itself into a liver cell. If these instructions are not found in our DNA, where do they come from? Scientists have discovered an array of chemical markers and switches along the length of the double helix of DNA. Collectively these factors are referred to as the “epigenome.” Think of the DNA as a computer while the epigenome is the

software. The hardware is important. The software is what actually tells the DNA what to do.

It was originally thought that an individual's DNA and epigenome were firmly established during early fetal development. We now know that the epigenome can change in response to diet, environmental factors, lifestyle choices, and even the way we think. Damage to the epigenome can produce epimutations. But unlike damage to mutated or defective DNA, epimutations are reversible by various compounds found in food.

Food affects how genes are repaired and remodeled throughout your life. Certainly, there are other factors, such as environmental toxins, stress, and even habitual thoughts and attitude. But the answer lies in understanding how to avoid and/or combat harmful factors while making greater use of the beneficial compounds found in food.

## Good Nutrition Lowers the Risk of Genetic Disease Expression

In 2000, a landmark study done at Duke University explored the impact of nutrition and epigenetics. The researchers started with pairs of fat mice with yellow fur that carried the agouti gene, which made them fat and yellow and also dramatically increased their risk of developing cancer and diabetes. The goal was to see if that unfortunate genetic legacy could be changed.

Before the mice were conceived, a test group of mother mice was fed a diet rich in compounds collectively called methyl donors, which included vitamin B<sub>12</sub>, folic acid, and S-adenosylmethionine (SAME).

The baby mice were born brown and slender and, as they matured, did not succumb to cancer and diabetes. The nutritional intervention had completely erased the cancerous, diabetic genetic destiny of the agouti mice. Although the brown mice had the same genome as the yellow mice, the expression of the genome was significantly different because of nutritional factors. This is another instance of the magic of food and proof that genetic tendencies can be changed with dietary and nutritional approaches.

## Human Twin Studies

Some of the best demonstrations of how diet, lifestyle, and the environment affect genetic expression are based upon studies in identical twins, which result from a fertilized egg splitting into two identical embryos. At birth, their genome is identical, but as the twins age, the genomes change dramatically. By the time the twins are in their fifties, they may have only 3% of their genome in common. In other words, the identical twins are now only 3% identical in regards to their expression of DNA. Food and lifestyle are primarily responsible for these changes.

Personality, values, and behavior are more hardwired than once thought, whereas health and the risk of developing certain diseases are hugely variable. This is important to remember, because it shows that we have some control over our genetic destiny by enlisting the aid of healthful food and good nutrition.

## The Pima Indians

The Pima Indian population further illustrates the importance of how diet can affect the body. The Pima Indians of Arizona historically have the highest risk of type 2 diabetes and obesity of any Pima population in the world. Research shows that this is related to diet and lifestyle rather than genetic wiring. The Pimas of Mexico cultivate corn, beans, and potatoes as their main staples, plus a limited amount of seasonal vegetables and fruits such as zucchini, tomatoes, garlic, green peppers, peaches, and apples. The Pimas of Mexico also make heavy use of wild and medicinal plants in their diet and exercise much more. Because they have no electricity or running water in their homes, they have to walk long distances to bring in drinking water or wash their clothes. They use no modern household devices, so food preparation is as close to farm to table as you can get.

In contrast, the Pima Indians of Arizona are largely sedentary and follow the dietary practices of many other Americans. As a result, while roughly 22% of Arizona Pimas have type 2 diabetes and 70% are obese, type 2 diabetes is a rarity in the Mexican Pimas and only about 10% could be classified as obese. The average difference in body weight between the Arizona and Mexican Pimas is more than 60 pounds.

Other racial and ethnic groups besides Pima Indians that have a higher tendency for type 2 diabetes include other Native Americans, African Americans, Hispanic Americans, Asian Americans, Australian Aborigines, and Pacific Islanders. In all of these higher risk groups it's important to note that when they follow the traditional dietary and lifestyle practices of their original culture, the rate of diabetes and obesity is low. The diabetes and other health issues appear when people adopt the typical American high-carb, high-sugar diet and sedentary lifestyle.

## Diet Affects Epigenetic Factors in the Development of Alzheimer's Disease

Western dietary patterns—eating lots of sugar, carbohydrates, and the wrong type of fats—contribute to the development of chronic degenerative diseases. Let's take a look at just one disease—Alzheimer's. Many people have had someone close to them develop this degenerative brain disorder with its progressive deterioration of memory and cognition. In the United States, it is now estimated to affect about 20% of individuals between 75 and 84 and 42% of people older than age 85. These numbers are striking when compared to data from the 1960s, when the incidence was only 2% in people over the age of 85. The tremendous increase in AD in people over 85 years of age is often referred to as the “Alzheimer's epidemic.”

There are actually two types of Alzheimer's—early onset (EOAD) and late onset (LOAD). EOAD occurs in people 30 to 60 years of age. It is rare, as it represents less than 5% of all people who have AD, and it has a strong genetic component. Most Alzheimer's cases are the late onset form, which develops after 60 years of age. LOAD also has a strong genetic link, but dietary, environmental, and lifestyle factors greatly influence a person's risk of developing the disease.

The primary brain lesions of Alzheimer's disease are the result of deposits of a substance known as beta-amyloid. Although the immune cells in the brain normally remove beta-amyloid and plaque, research has shown that susceptible individuals have a chronic and excessive inflammatory reaction to amyloid proteins in the brain, which can promote Alzheimer's disease.

The tremendous increase in late onset Alzheimer's parallels the rise in type 2 diabetes, a condition that is primarily the result of dietary and lifestyle factors. Specifically, too much sugar, too much of the unhealthy fats, and not enough of the good fats lead to a dampening of the effects of the hormone insulin. When cells throughout the body become resistant to insulin, glucose (blood sugar) cannot enter the cells. As a result, it can oxidize and damage external cell structures, or it can also act like superglue in attaching to receptor sites on cells that monitor body function, much as a thermostat monitors and controls room temperature. If your temperature gauge was stuck at 60°F and the heat was set at 70°F, the thermostat would keep the furnace running no matter how hot it got because the temperature gauge would be telling it that it is only 60°F. When blood sugar levels are too high, they block vital feedback to cells about what is going on, which leads to disruption of proper cellular and body function. That explains why poorly controlled diabetes has so many serious consequences.

Since late onset Alzheimer's is so closely linked to insulin resistance, some researchers have referred to it as diabetes of the brain and even "type 3 diabetes." Individuals with type 2 diabetes have a 1.5- to 4-fold risk of developing LOAD as well as dementia caused by damage to the blood vessels of the brain. Insulin resistance in the brain is associated with poor uptake of glucose by brain cells, causing oxidative damage and localized inflammation that lead to beta-amyloid formation. Hence measures to improve blood sugar control and improve insulin sensitivity appear to be important steps in the prevention of LOAD.

- In regard to the genetics of late onset Alzheimer's, the breakdown of the process to clear beta-amyloid from the brain first involves amyloid binding to apolipoprotein E (ApoE); if beta-amyloid is unbound to ApoE, or "free," it begins to build up and form toxic clusters. There are three forms of ApoE coded for by the APOE gene:
- ApoE2, which is associated with decreased risk of developing LOAD.
- ApoE3, which is the most common form and is not known to affect LOAD risk.

- ApoE4, which is associated with an up to twelve times increased risk of developing LOAD.

So a person's risk of developing late onset Alzheimer's for many years is likely the result of his or her genetic expression of ApoE. People who had ApoE4 were at risk; others were not. But with the huge increase in LOAD development, it is clear that other factors are now the biggest contributors in determining the clearance of beta-amyloid from the brain.

The results of a recent study indicate that diet can influence clearing beta-amyloid. The study involved twenty-seven cognitively normal participants and twenty with mild cognitive impairment suggestive of late onset Alzheimer's. The participants were randomly assigned to one of two diets that were identical in total calories:

- High-fat, high-carbohydrate diet: This diet provided 45% energy from total fat (25% from saturated fat), 35% to 40% from carbohydrates, and 15% to 20% from protein. A typical meal for these participants might have included cheeseburgers, soda, and fries. The diet also had a high glycemic index, meaning that it contained a lot of foods that quickly raised blood sugar levels, such as soft drinks, breads, cereals, and pasta.
- Low-fat, low-glycemic diet: Participants in this group ate food with a low glycemic index and low in fat. This diet consisted of 25% energy from fat (less than 7% from saturated fat), 55% to 60% from carbohydrates, and 15% to 20% from protein. A typical meal in this group was fish, brown rice, and steamed vegetables.

At baseline, the researchers found that those with mild cognitive impairment had a greater fraction of their beta-amyloid in the free state than did the participants with normal mental function. Those carrying the genetic risk factor ApoE4 had an even higher level of free beta-amyloid.

At the end of the study, in people with ApoE2 and ApoE3, the high-fat, high-glycemic diet further increased free beta-amyloid levels, while the low-fat, low-glycemic diet produced significant decreases in free beta-amyloid

levels. But the different diets had little impact on free beta-amyloid in individuals with ApoE4.

The study also showed that lower insulin levels were associated with higher levels of free beta-amyloid. Insulin is critical for proper brain function for many reasons. When insulin resistance occurs, as in obesity and type 2 diabetes, higher levels of insulin in the blood result in impaired transport of insulin into the brain. Therefore, low levels of insulin in the cerebrospinal fluid reflect systemic insulin resistance.

In the normal brain, insulin plays an important role in maintaining synapses and memory. So with the lower brain insulin levels noted in this study and others, it seems appropriate that LOAD is often referred to as “type 3 diabetes.”

These results mean that in individuals who have a low risk of developing late onset Alzheimer’s because of their ApoE type, a high-fat, high-glycemic diet produces the same sort of changes in beta-amyloid seen in those with the ApoE4 genetic predisposition to LOAD. In other words, dietary habits can nullify the protection that a person’s genetic code can provide. On the flip side, the dietary changes used in this study were not enough to reduce the genetic predisposition toward LOAD in high-risk subjects. Yet that does not mean the disease is inevitable, just that additional dietary and supplement strategies are necessary to address this predisposition.

## How Food Interacts with Our Genes

New research reveals ways in which foods seem to interact magically with our genes and epigenetics.

One discovery is that plant foods contain small fragments of RNA (ribonucleic acid), which are now known to modify genetic behavior. One form of RNA is called messenger RNA, or mRNA (which is basically more “software”), because it instructs various cells to assemble a specific protein or perform some other vital task. Another type of RNA found in plants is composed of small fragments called microRNAs (miRNAs), which play a huge role in how cells grow and die and how cell functions are balanced in their input and output of energy.

Chinese scientists used Japanese honeysuckle (*Lonicera japonica*), a remedy for colds and influenza in traditional Chinese medicine, to show how its miRNA can help in viral infections. The study showed that, when mice drank honeysuckle tea, the miRNA traveled via the bloodstream to the lungs, where it directly targeted the influenza A virus. This group of viruses is the culprit behind the Spanish flu, swine flu, and avian flu epidemics. So here we have an herb with a historical use for symptoms related to what we now know are caused by viruses, showing significant activity against these viruses in a newly discovered mechanism. Before this model existed, all that was known was that the herb exerted some sort of magical effect against viral infections.

Additional studies have shown that concentrated plant miRNAs are successful in reducing the number of tumors in animals with colon cancer.

## We Are Biochemically Unique

In the late 1970s, when I began discovering the importance of nutrition in human health, one of my heroes was Roger Williams, who was responsible for discovering many B vitamins, including pantothenic acid and folic acid.

One of the most important concepts that Dr. Williams introduced was the idea of “biochemical individuality.” Each of us has unique biochemical traits that determine who we are and how we interact with the world around us. Biochemical individuality is what makes all of us unique in the interaction between our genes and our environment. It also plays a big role in determining how healthy we are and what ailments we are likely to experience.

What determines our biochemical individuality is a family of perhaps one hundred enzymes within our cells known as the cytochrome P450 enzymes. These enzymes play a critical role in processing food components as well as detoxifying drugs, cancer-causing compounds, and hormones. Generally, each enzyme is designed to metabolize certain types of chemicals, but there is also a lot of functional overlap. This “backup system” ensures that your liver is usually able to detoxify your body efficiently.

Nutrigenomics may clarify the effects of dietary practices. Differences in these enzymes may explain why some people can smoke without developing

lung cancer and why certain individuals are more susceptible to the harmful effects of pesticides and other toxic chemicals.

Research on the effects of coffee consumption on heart disease has been a mixed bag: one study finds no correlation between coffee consumption and heart disease, while another shows a correlation with heart attack risk, yet another shows elevated cholesterol for those drinking more than four cups, and still another shows no correlation when paper filters are used.

Let's take a look at a study examining the association between heart attack rates and caffeine consumption. Unlike other studies, this one also measured the activity of the liver enzyme that detoxifies caffeine. Researchers divided the group according to whether they possessed a form of this enzyme that metabolized caffeine quickly or slowly. Those with the rapid caffeine breakdown decreased their risk of a heart attack by drinking coffee, while slow caffeine metabolizers dramatically increased their risk. Drinking four cups a day of coffee was associated with a 17% decreased risk in fast metabolizers and a 260% increased risk in slow metabolizers.

Many drugs, hormones, and dietary factors also influence this enzyme system. For example, the enzyme system is inhibited by oral contraceptives and enhanced by vegetables in the cabbage family. In addition, there is convincing evidence that regular coffee consumption decreases the risk of developing Parkinson's disease, Alzheimer's disease, and type 2 diabetes.

In the future, nutrigenomics will enable us to use food prescriptions to influence gene expression so as to promote health based upon our individual biochemical makeup. Many mechanisms of health-promoting components of food are now being uncovered. I will explain how you can take advantage of this new knowledge so that the food you eat will dramatically improve your health. It is an exciting dawn of an emerging era with so much that can be applied today to start helping you.