PART I

# The Nutrition-Gene Connection

# 1

# Your Genes Depend on Good Nutrition

*Nurture is reversible; nature is not.*
—Matt Ridley

Almost every week scientists announce the discovery of new genes that may influence our long-term risk of disease. The headlines and news stories tell us about genes that cause heart disease, Alzheimer's disease, breast cancer, prostate cancer, arthritis, diabetes, obesity, depression, schizophrenia, osteoporosis, and dozens of other diseases. As if we didn't already have enough to worry about, we now have to be concerned with whether we might be carrying any number of genetic time bombs.

We hear also that gene research may eventually lay the groundwork for new types of medical treatments. But until that time comes—and it will be years away at best—it's easy to feel victimized by our heredity. After all, we have been told for decades that our genes predetermine our health risks—genetic fatalism, so to speak—and that we can't do anything to change the genes our parents gave us.

Or can we?

The premise of *Feed Your Genes Right* corrects much of what you have previously heard. Your genes, of course, are the biological programs

that govern much of how your body functions or, as the case may be, *mal*functions and causes disease. But to the surprise of many scientists, recent research has revealed that your genes are not rigid, unchanging determinants of your health. Rather, you can improve your genetic heritage and the way your genes function. Quite simply, you can offset disease-causing genetic defects and age-related genetic damage with certain eating habits, nutritional supplements, and other lifestyle improvements.

As incredible as this may sound, the ability to modify the behavior of your genes forms a key concept in nutrigenomics, the scientific field that looks at how genes and nutrition interact. A large body of research clearly shows that the normal functioning of your genes depends on a good diet and a healthy lifestyle. By applying this research, you can foster healthier genes, slow your aging process (that is, feel and even look younger), and lower your risk of virtually every disease. *Feed Your Genes Right* explains exactly how you can do this, with easy-to-follow advice.

## Is Nutrition All That Important?

People often seem surprised to hear that all of the foods they eat (not just fats and carbohydrates) affect their physical health, aging process, stress responses, and appearance. The truth is that the nutrients you consume are literally the building blocks—the bricks and mortar—of your body. Good nutrition provides a solid foundation for health. In contrast, poor eating habits make for a shaky foundation at best.

The importance of nutrition in health is hardly a new idea. More than two thousand years ago, Hippocrates, the father of Western medicine, wrote that food was our best medicine. Today many people understand that some foods, such as fish and vegetables, are healthy and reduce the risk of heart disease and cancer, whereas sugary soft drinks, doughnuts, and candy bars are unhealthy because they set the stage for obesity and diabetes.

What has changed since Hippocrates' time is our comprehension of the exact details and the full extent of how nutrition affects our health. Until relatively recently, researchers had a fairly general understanding of how some nutrients, such as vitamins and minerals, affect health. Scientists have now gained a new and profound knowledge of the specific ways that foods and individual nutrients affect the activity of genes and, consequently, the health of the entire body.

With this growing understanding of how nutrients and genes inter-

act, it is now possible to determine whether you might need extra amounts of certain vitamins and minerals to stay healthy. Knowledge is power, of course, and you can use this knowledge to overcome genetic weaknesses and to reduce, slow, and sometimes reverse age-related genetic damage. The payoff? You can greatly improve your health, regardless of the genes you were born with. In a very real sense, you do not have to rationalize that a particular health problem "runs in my family," because you do not have to let the health problem run in *you.*

## Your Genes Are Flexible, Not Fixed

Our genes consist of a microscopic double strand coil of deoxyribonucleic acid, better known simply as DNA. How are genes and DNA different? DNA is the equivalent of a biological dictionary. Genes use DNA to form an entire set of instructions guiding the behavior of each and every cell in our bodies.

This genetic program functions like the instructions written in a computer's operating system, or the underlying program that runs your computer. Our genetic program governs the entire organization and operation of our bodies, ensuring that nearly all people are born with arms, legs, lungs, a heart, and other organs. We often look like our parents because they were the source of our genes, passing along genetic programs that determined our hair, eye, and skin color.

However, your genes do far more than program your appearance. They orchestrate the creation of everything in your body, including fifty thousand proteins and tens of thousands of other biochemicals. Although many of your physical features (such as eye color) are fixed, the genes in charge of your day-to-day biochemical processes are not. Contrary to what many people have believed, genes are not destiny. Your genes provide tremendous flexibility in your long-term health, and you can use that flexibility to your advantage.

Your genes are always responding, in good or bad ways, to what you eat; to your emotions, your stresses, and your experiences; and to the nutritional microenvironment within each of your body's cells. If you maintain a particularly healthy genetic environment, your genes will function normally and you will age relatively slowly and be more resistant to chronic, degenerative diseases. If you maintain a less-than-healthy genetic environment, such as by smoking or eating large amounts of unhealthy foods, you will age faster and be more susceptible to disease.

## The Promise of *Feed Your Genes Right*

By now you should realize that you do not have to live with health problems that make you feel less than your best and increase your risk of premature aging and disease. You also may be curious about the specific recommendations for feeding your genes right and improving your health.

As you read *Feed Your Genes Right*, you will discover how

- some inherited genes may be predisposing you to a variety of diseases that doctors commonly miss;
- age-related damage to your genes increases your risk of serious diseases, such as heart disease, Alzheimer's disease, and cancer, as well as saps your energy levels;
- nutritional deficiencies create biochemical bottlenecks, preventing genes from fulfilling their normal and intended functions;
- foods rich in sugars and refined carbohydrates boost levels of insulin, a hormone that alters gene activity and increases your risk of obesity, diabetes, heart disease, and cancer; and
- certain cooking habits can damage your DNA and accelerate the aging of your body.

But as the title suggests, *Feed Your Genes Right* is not just about what can go wrong with your genes and health. Instead this book emphasizes what you can do to protect your DNA and offset both inherited genetic weaknesses and age-related genetic damage. Most of this book explains how

- healthy, nutrient-dense foods, such as fish and vegetables, provide optimal nourishment for your genes and turn off many disease-promoting genes;
- some foods, such as kiwifruit, blueberries, and raspberries, actually help prevent and repair DNA damage;
- B vitamins help your body make and repair DNA and regulate the behavior of your genes, something that becomes especially important after age thirty;
- antioxidants, such as vitamins E and C, protect DNA from thousands of dangerous molecules each day;
- selenium, an essential nutrient, turns on genes that fight cancer cells; and

- vitamin-like nutrients, such as coenzyme Q10 and carnitine, counteract DNA-damaging molecules and boost your energy levels.

The take-home message of this book is really very simple: you can slow down your body's aging process, reduce your risk of chronic and catastrophic diseases, maintain high energy levels, stay sexually active, preserve a more youthful appearance, and remain mentally sharp as you reach middle and old age. You can do this by providing your genes with the best nutritional environment for their normal—and even optimal—functioning.

The key to accomplishing all of this, simple as it might sound, is eating nutritious foods, taking certain vitamins and other types of supplements, engaging in moderate physical activity, and limiting the harmful negative stresses in life. I've succeeded in doing these things myself, and I have known people in their seventies and eighties who look and feel decades younger than they really are by doing the same.

## The Feed Your Genes Right Quiz: Assessing Your Health and Risk of Disease

Your risk of disease is influenced by a variety of factors, including the genes you inherit from your parents and how your genes are shaped by the dietary and environmental factors unique to your life. This quiz assesses some of the risk factors affecting the health and function of your genes. Simply circle yes or no, depending on whether the statement applies to you.

### Your Inherited Risk Factors

| | | |
|---|---|---|
| I am more than forty years old. | Yes | No |
| My father died of a heart attack before the age of fifty. | Yes | No |
| My mother died of breast or cervical cancer before the age of forty. | Yes | No |
| Some serious diseases, such as arthritis, cancer, diabetes, heart disease, obesity, or others, seem to run in my family. | Yes | No |
| I was born with a recognized birth defect, such as a cleft lip or a cleft palate, or I have been diagnosed with a genetic condition. | Yes | No |

*Explanation*: Yes answers point to a risk of disease related to either inheritance or age-related genetic damage.

## Your Current Health Status

| | | |
|---|---|---|
| I am a little overweight. | Yes | No |
| I am considerably overweight and so is (was) at least one of my parents. | Yes | No |
| My energy levels are not as high as I would like, and I often feel too tired to do the things I would like to do. | Yes | No |
| I have been diagnosed with glucose intolerance, insulin resistance, Syndrome X, or diabetes. | Yes | No |
| I have been diagnosed with some type of cardiovascular disease or cancer. | Yes | No |
| I regularly take two or more different medications for conditions my doctor has diagnosed. | Yes | No |
| The older I get, the more forgetful I seem to become. | Yes | No |

*Explanation*: Yes answers indicate that your genetics, cell function, and metabolism have been compromised, most likely because of dietary or lifestyle habits. The more yes answers, the more seriously your genes and health have already been compromised.

## Your Stress Levels

| | | |
|---|---|---|
| I am under a lot of stress at home, at work, or while commuting. | Yes | No |
| I have a lot of resentment or anger about things that are not the way they should be in my life. | Yes | No |
| I have not been in a long-term relationship for at least several years, or I am in a relationship that I do not find enjoyable and satisfying. | Yes | No |
| I tend to have a lot of "down" days or often feel depressed. | Yes | No |

*Explanation*: Yes answers reflect a high level of stress, which can lead to an imbalance in brain chemistry and altered gene function in brain cells.

## Your Dietary and Exercise Habits

| | | |
|---|---|---|
| I usually skip breakfast, or I just have something like coffee and a doughnut. | Yes | No |
| I do not like eating vegetables, and I do not eat them regularly. | Yes | No |
| I eat a lot of my meals in fast-food restaurants. | Yes | No |
| I make most of my meals at home by heating something from a box in the microwave oven. | Yes | No |
| I smoke cigarettes. | Yes | No |

I drink spirits (hard liquor) or beer every day. Yes No

I am too busy or too tired to exercise regularly. Yes No

*Explanation*: Yes answers indicate that you are not providing a sound nutritional or lifestyle environment for your genes. Even if you are currently free of disease, you are experiencing accelerated genetic damage, which will set the stage for serious chronic disease.

### To Finish the Quiz

Add up your yes answers. If you did not circle any yes answers at all, you are in great shape, have good eating habits, and have good family genetics. If you circled just a few yes answers, you may be thinking that it's nearly impossible to achieve a perfect score—and that this quiz is stacked against you. But it is not. Rather the quiz is designed to show how many heredity, dietary, and lifestyle factors can work against you and the health of your genes. Every person inherits some types of genetic weaknesses and acquires additional genetic damage each and every day of his or her life.

## The Failure of Gene Therapy

You might be wondering whether it would be easier to wait for medicine to develop high-tech gene therapies to correct any genetic weaknesses you have or might develop as you age. The problem with that line of thinking is that you may be dead before such research produces any benefits for the majority of people.

The reason is that a lot of gene research has been misguided by wishful thinking and oversold to investors and the general public. For example, reports of a "breast-cancer gene," a "heart-disease gene," or an "obesity gene" suggest that a single faulty gene causes each of these diseases. If this were the case, it might be relatively easy to develop gene therapies. But the "one gene, one disease" view is overly simplistic. Only about 10 percent of women with breast cancer have one of the so-called breast-cancer genes. The truth is that only a very small number of people have "smoking gun" genes that predispose them to obesity, diabetes, heart disease, Alzheimer's disease, or other disorders.

Although you don't read about it very often, genetic research has clearly shown that degenerative diseases are actually "polygenic." That is, most diseases involve hundreds and sometimes thousands of genes that go awry. Up to 5,000 malfunctioning genes set the stage for

cardiovascular disease, almost 300 wayward genes are involved in asthma, and 140 faulty genes contribute to the problem of failing memory. And with the complex interplay of 30,000 genes and 3 billion units of DNA, it may very well be impossible ever to design truly effective multigene therapies to treat common diseases.

Another problem is that despite billions of dollars of research, gene therapies have so far been an abysmal failure. In most instances they have simply failed to work, and sometimes patients have developed cancer or died from mysterious causes. For example, many researchers have used genetically modified viruses to deliver disease-treating DNA. In some human experiments, these viruses missed their target and instead attached to the wrong gene, causing leukemia. The consequences of manipulating genes are often unpredictable, largely because of their inherent complexity.

The massive research effort to identify genes and turn gene therapy into a marketable product has for the most part ignored how genes—just like the rest of your body—depend on proper nourishment. Many scientists have been forced to accept the fact that thirty thousand genes cannot by themselves account for the phenomenal complexity of the human body. It is now becoming clear that vitamins and other nutrients directly and indirectly serve as cofactors in gene activity, strongly influencing how genes function.

Granted, foods and nutritional supplements are low-tech and considerably less glitzy than the latest much-touted medical discovery. They may even strike some people as being like quaint folk remedies. But the science behind nutrition and genetics is solid, and nutrition has the advantage of helping without causing harm. The most sensible approach is actually a generic one: for the majority of people, it is to eat foods and take supplements that enhance normal gene function and reduce gene damage throughout the body.

In the next chapter, we will look at some of the ways that DNA becomes damaged, as well as at DNA's ability to repair itself.