POWER FOODS

FOR THE BRAIN

AN EFFECTIVE 3-STEP PLAN TO PROTECT YOUR MIND AND STRENGTHEN YOUR MEMORY

NEW YORK TIMES BESTSELLING AUTHOR OF *21-DAY WEIGHT LOSS KICKSTART*

Neal D. Barnard, MD

WITH RECIPES BY CHRISTINE WALTERMYER AND JASON WYRICK

As Seen on Public Television

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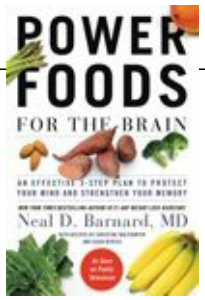

To Drs. David and Alexandra Jenkins,
who are lighting the way for others to follow.

A Note to the Reader

I hope this book provides you with new insights into important health issues and gives you tools to tackle them. Before we begin, let me mention two important points:

See your health-care provider. Memory problems are serious business. It is important to have an appropriate evaluation and care. I would also encourage you to speak with your provider before making any diet change. This is not because changing your diet is necessarily dangerous. Quite the opposite. Adjusting the menu is a good ide But people who are taking medications—for diabetes or high blood pressure, for example—very often need to adjust their medications when they improve their diets. Sometimes they are able to discontinue their drugs altogether. Do not do this on your own. Work with your health-care provider to reduce or discontinue medicines if and when the time is right.

Also, talk with your doctor before you jump into a new exercise routine. If you have been sedentary, have any serious health problems, have a great deal of weight to lose, or are over forty, have your provider check whether you are ready for exercise, and how rapidly to begin.

Get complete nutrition. The way of eating presented in this book is likely to improv your nutrition overall, in addition to the specific health benefits it may bring. Even so, you will want to ensure that you get complete nutrition. Please read the details in chapter 10. In particular, be sure to take a daily multiple vitamin or other reliable source of vitamin B_{12}, such as fortified cereals or fortified soy milk. Vitamin B_{12} is essential for healthy nerves and healthy blood.

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Introduction

> They were not very tidy and not very clean…. They smoked as they played and they ate and talked and pretended to hit each other. They turned their backs on the audience and shouted at them and laughed at private jokes.[1]

That was how Brian Epstein described the Beatles when he first saw them at a Liverpool club in 1961. In leather jackets and jeans, this ragtag foursome did not attract the interest of a single record company in Britain, or anyone else outside a short radius.

Yes, they were scruffy. But they had energy and magnetism, and plenty of drive and ambition. They couldn't read music, but they had an irresistible sound. Although Epstein had never managed a band before, he took them under his wing, determined to help them succeed. He dragged them to a London tailor and plunked down £40. Out with the leather jackets and jeans and in with proper suits. And no more "greaser" haircuts; it was time for a new hairstyle. No eating, smoking, or swearing onstage, and please learn to bow to the audience at the end of a set. He scheduled performances, arranged publicity, and made sure everyone got paid.

Within nine months, the Beatles had their first hit on the British pop charts, and within two years, they had conquered the world.

The reason I am telling you this is because inside your brain you have unruly needs, wants, drives, and ambitions, too. Your "early Beatles" reside deep in the center of your brain, in your hypothalamus. This nut-size organ is the locus of hunger, thirst, sex, and anger. And if there is one thing it needs, it is a manager.

By the time you were born, your hypothalamus was already signaling its demands. But all you could do about it was to wail and thrash your arms and legs.

Your "Brian Epstein" is in the outer layers of your brain, in your cerebral cortex. It takes your ragtag, scruffy self and all its wants, drives, and ambitions, and gets things organized. It helps the desperate hypothalamus to wait patiently when food is on the way. It solves your problems and guides you to get what you want more effectively than by simply stamping your feet. As the years go by, your manager matures, developing ever more sophisticated ways of getting what you need and like.

By August 27, 1967, eighteen Beatles songs had topped the charts, and they were at the peak of their popularity. But that was the day that everything changed. Brian Epstein was found dead in his apartment. He was just thirty-two. And for the Beatles, it was the beginning of the end. The group began to sputter. They had arguments, with no arbiter. Disagreements became chronic and bitter. Rudderless, they lost their musical cohesiveness, drifted apart, and eventually the most successful musical group of all time collapsed, each member going his own way.

Inside your brain, your own fateful August 27 is looming large. Just when your knowledge and experience are at their maximum and your family life and perhaps your financial security are finally established, that's exactly the moment that you are at risk of losing your manager. If that happens, you will find that you can't remember things or will have trouble reasoning things out. Sometimes things go downhill to the point where you are no longer able to control your disorganized, unruly, unmanaged inner self. The day the manager in your brain becomes nonfunctional is the day that life as you have known it comes to an end.

This is a book about keeping your manager alive and well. It is about memory and mental clarity, and keeping them intact lifelong.

What's Happening in My Brain?

It starts as an occasional lapse. You've forgotten a name or word—something you know perfectly well but just cannot put your finger on. Later on, it happens again, and you sta to wonder what's wrong. Maybe you're overtired or overstressed, and a good night's sleep will set everything to rights.

But maybe it is more than that. Memory problems affect a great many people. They are worrying, to say the least. Not being able to come up with a friend's name, losing your keys one too many times, losing track of facts and events, and, perhaps worst of al having others *notice* that you seem to be having trouble—none of this is good.

It may not be just memory. Sometimes you might feel that your thinking is just not as clear as it used to be. You'll be adding up your checkbook or reading a newspaper artic and you'll feel as if your brain is stuck in low gear.

And sometimes cognitive problems are very serious. One in five Americans between the ages of seventy-five and eighty-four develops Alzheimer's disease. Beyond age eighty-five, it hits almost half of us. Also frighteningly common are strokes, which can devastate our ability to speak, move, and think.

Of all the worries we may have about our future, the possibility of losing our mental abilities tops the list. We work hard, start our families, set aside some money, and finally have some time to relax and enjoy life. But if memory loss enters the scene, it steals everything we cherish.

Losing our memory and brainpower means stripping away our most critical capabilities. Little by little, we start to slip away from our families. Things we did together are erased. If the process drags on over years, as it often does, it can end up encumbering our families and eventually exhausting them physically, emotionally, and financially.

A poor memory is not just "a part of life" that you have to put up with. And it is certainly not an automatic part of growing older. Your calendar does not come equipped with an eraser.

Imagine having a sharp memory—and good concentration and alertness—day after day for as long as you live. Instead of apologizing for names that elude you, the words come easily, just as they always did. Instead of lapsing into memory problems in older age, your mind remains clear and strong.

For many years, my research team has been investigating the role of foods in health. We have helped people trim away weight and cut their cholesterol levels. We developed dietary method for managing diabetes that is more powerful than previous diets, sometimes making the disease essentially disappear. We have also developed programs for the workplace and for doctors' offices, designed to help people make diet changes to improve their health.

Just as we were doing our studies, other research teams were looking at the brain and

how specific nutritional factors could affect the risk of Alzheimer's disease, stroke, and other serious brain problems, as well as the surprising effects of foods on more day-to-day cognitive issues.

In Chicago, researchers from Rush University Medical Center have been tracking thousands of people, teasing apart what separates those who stay healthy and sharp throughout life from those who don't, finding that particular aspects of diet and lifestyle are key. Other researchers in the United States, Europe, and Asia have conducted detaile studies into specific nutrients that either protect or attack the brain. Meanwhile, new brai scanning techniques have allowed researchers to look into the brains of living human beings to understand brain function in ways that were impossible even a few years ago. Special tests have begun to show who is at risk for cognitive problems as the years go by.

Along the way, it has become clear that the diet changes my research team found to promote physical health and those that other researchers have found to be critical for brain health are remarkably similar. Specific foods and eating patterns have a powerful protective effect.

And there is more to it. It is possible to exercise the brain in simple ways that, over time, strengthen the connections between brain cells. And simple physical exercises actually allow you to counteract the brain shrinking that occurs in most people as they age.

It is urgent that people know about these findings, and that is why I've written this book and developed this program. The fact is, we know more than ever about how our memory works and about the causes of memory problems, whether they are minor lapses, "senior moments," or potentially devastating problems like Alzheimer's disease and stroke. And yet most people have no idea of any of this. While they may have a pretty clear idea about how to prevent lung cancer and how to reduce their risk of heart attack, most have absolutely no clue that it is possible to protect the brain.

There are simple, powerful steps that you can take, starting right now. This book will show you how to put this information to work and help preserve your memory and strengthen your brain.

Three Steps to Protect Your Brain

Taking advantage of what research has shown is not difficult. Here are three steps you can take that will shield your brain:

Step One: The first step is using power foods to give your brain the nutrition it needs We will select foods with three things in mind:

First, we'll shield you from toxins that are in everyday foods and water. They are surprisingly common, and it is critical to know where they are and how to avoid them.

Second, certain natural fats are essential for brain function, while others are harmful. We'll see which are which and where they are on your plate. The correct balance makes big difference in helping each brain cell work optimally.

Third, certain vitamins knock out free radicals and other compounds that could damage brain cells. We'll see which foods and supplements provide the nutrients you need.

Building a healthful menu is the most important thing you can do. After all, every minute of the day, your brain cells are bathing in the nutrients—or toxins—you've taken in through foods.

Step Two: Did you know you can exercise your brain? Simple mental exercises strengthen connections within your brain. They are surprisingly easy, fun, and powerful I'll help you develop a regimen for peak performance.

Physical exercises are powerful, too. Just as exercise strengthens your heart, it does th same for your brain. The effect of physical exercise is so dramatic that MRI scans can demonstrate a visible difference in brain structure in a relatively short period of time. You'll learn which exercises are most helpful to the brain and why.

Step Three: Now it's time to defeat the common physical threats to your memory an preserve and enhance your brain. There are two specific issues you'll want to address: sleep disruptions and certain medications and medical conditions.

Sleep is essential for integrating memories, and many cognitive problems can be trace to common sleep disruptions. We will see how to correct any problems so you can take advantage of the natural integrative power of sleep.

Common medications and medical conditions can derail your thought processes, sometimes to the point of being mistaken for Alzheimer's disease—until the cause is identified. I'll show you the surprising list of common culprits and what to do about them.

Whether you aim to simply boost your brainpower, eliminate daily lapses, or cut you risk of Alzheimer's disease and stroke, you will want to put each of these simple steps to work so you can be at your absolute best for the long haul. Implementing your brain-enhancing strategy will be easy with the advice I offer and the menu plans and delicious recipes I'll share.

Time for a Change

Millions of families are worried about what the future holds for them. During my trainin in neurology and psychiatry at the George Washington University School of Medicine i Washington, D.C., I had my first encounters with patients who felt that their minds and nervous systems were no longer their own. Some were succumbing to severe memory loss caused by Alzheimer's. Others had had strokes. And still others showed the progressive nerve symptoms caused by multiple sclerosis or other conditions. There was very little we could do to help them and nothing we knew of that could prevent these problems from arising.

Even today, most people—including many doctors—have yet to learn about the techniques you will read about here. And even though the medications that aim to slow the onslaught of memory problems are all but useless, few doctors and patients have learned about the new research on the power of nutrition. Most have no idea that their mealtime choices could make a difference.

This book changes that. The fact is, there is much we can do to prevent memory loss, not to mention maximize the everyday function of people who simply want to feel their best.

Simple choices can enhance and protect your brain, give you energy, improve your sleep, and boost your overall health. I will show you how.

Science Thrives on Controversy

Not long ago someone gave me a book on survival in wilderness settings. It helpfully pointed out that if you happened to wash up on some faraway island in the middle of nowhere, a wild Malay apple would be perfectly safe to eat, while the fruit of the *pangi* tree could kill you. If you found an ordinary strawberry, it would be delicious, but a look-alike *duchesnea* is poisonous. And it is important to be able to tell an edible Dryad saddle mushroom from a deadly panther cap. After a few pages I realized I had no idea how to handle any such situation and was grateful to have a grocery store across the street.

Nutrition can be confusing, and, as a result, different people interpret things in different ways. When it comes to research on food and the brain, scientists all have their own opinions. Some want to wait before suggesting any diet changes. They feel we need more research before we can make definitive statements.

Others, including me, feel that we do not have the luxury of waiting. If you are planning your dinner this evening, you are stacking the odds one way or the other. You need to go by the best information available. As you'll see, that information is powerful and is easy to put into action. At least it's easier than trying to identify the fruit of the *pangi* tree.

All the Side Effects Are Good Ones

As you put the findings of this book to work to protect your brain, you may notice not only that you feel mentally sharp. You may also find that your bathroom scale is becoming friendlier day by day. Your cholesterol and blood pressure may improve, and if you have diabetes, it may get better, too. If you have arthritis or other chronic aches and pains, you may notice that they are fading. That's the power of healthful eating.

My hope is that, instead of searching for words or worrying about your memory, you'll be searching for a tougher crossword puzzle, calling up old schoolmates whose names you remember well, and planning your next walking trip through the Rockies.

I hope you enjoy the very best of health and all the foods that will bring it to you.

CHAPTER 1

Sharpen Your Memory, Enhance Your Brain

In my previous books on health and nutrition, I have translated the research findings of my team and others into steps to help people conquer diabetes, cholesterol problems, chronic pain, and other health concerns. However, this book did not start with our research studies. It started with my own family.

My mother's father was a physician in a small Iowa town back when house calls and home births were everyday parts of a doctor's work. His diet, like that of the rest of the family, was typical Iowa fare, which is to say it was long on meat and potatoes and shor on green vegetables and fruits. Long before the advent of health insurance, patients did not always have money to pay for his services. So people often paid with a chicken or a cut of beef.

At around age sixty, he suffered his first heart attack. And not long after that, his behavior started to change. He became confused. Sometimes he set out for walks withou seeming to know where he was going. Cars had to stop as he wandered across busy streets. Once in a while, a motorist knew him and brought him back home. With time, things got worse. He became aggressive and was put into a hospital, where another hear attack eventually killed him.

We never knew if his problems were due to Alzheimer's disease, a series of strokes, o something else. His wife, my grandmother, lived longer, but her memory went, too. "By the time I get to the end of an article in the newspaper, I've forgotten the beginning," sh told me. Memory gaps here and there began to coalesce into ever-bigger caverns where she was unable to find her way. It was tragically downhill from there, as she fell into severe dementia.

Both of my father's parents suffered the same fate—a gradual decline into more and more severe cognitive problems to the point where they were essentially unresponsive to the world around them. They existed this way for years before finally dying.

Fast-forward. Not long after I got out of medical school, I became concerned about my mother. Her memory was fine at the time. It was her cholesterol that was a problem. She and my father lived in Fargo, North Dakota, where they and their five children took full advantage of a typical Midwestern diet, and the results showed up on her cholesterol test.

A diet change would have helped, but it was a tough sell for my dear, stubborn mom. It was not until her personal physician threatened to put her on cholesterol-lowering medication for the rest of her life that she decided to try some changes in the kitchen. And, to her credit, she eventually did throw out the cholesterol-laden meat, dairy

products, eggs, and greasy foods, adopting a vegan diet for seven weeks before going back to see her doctor. And her doctor could not believe the change. Her cholesterol had dropped nearly 80 points, which he thought *had* to be the result of some kind of mistake in the laboratory! But the effect was real, and my mother no longer needed medicines at all.

She continued on a healthy diet and lured my father into healthier eating habits, too. At family get-togethers, my mother and I prepared healthful foods and did our best to rebuff the contributions of family members who remained loyal to our not-so-healthful North Dakota traditions.

Sometime later, my parents moved into a retirement home. And there healthy diets were not the order of the day. The management felt that people in their "golden years" were not interested in healthful eating, and meaty, cheesy fare was on the menu at every meal. My parents soon drifted back into unhealthful diets, and she and my father dug in whatever foods were in front of them.

My mother's cholesterol skyrocketed again. As time went by she developed a severe blockage in one of the carotid arteries that lead to the brain. And she began to complain that her memory was going.

My father started to have memory problems, too. As they became more severe, he had a battery of medical tests, none of which showed any treatable cause. His dementia worsened, and eventually he became expressionless, nearly mute, and immobile.

Were my family's problems all genetic? Or did the blame go to their Midwestern diet or perhaps a lack of exercise? Were they missing out on the vital nutrients that protect the brain?

At that time, none of us had a clue about how to protect the brain. Even today, most people—including many doctors—have never learned about the nutritional steps or exercises that shore up brain function and cut the risk of memory loss. That is why I wrote this book.

Let me give you a quick overview of where we're headed.

Connections

Did you ever wonder how you remember a name, a face, a fact, or a song? Or how your brain holds on to all the coordinated movements it takes to ride a bicycle or drive a car so that it's all second nature? How do we remember the layout of our home or our neighborhood?

When your brain lays down a new memory trace, it does not create a new brain cell—a neuron—to stuff a fact into. Rather, it makes new connections—called *synapses*—between brain cells. Or it strengthens existing connections. So a rickety one-lane bridge that could accommodate a pedestrian or two becomes a two-lane bridge, a four-lane bridge, or an eight-lane thoroughfare.

Your brain is taking in your experiences, making sense of them, and then deciding what it needs to hold on to and what it can let go of. Important events and emotional moments stay, while today's weather forecast, a restaurant phone number, and movie showtimes get pitched into the recycling bin.

Sleep plays a vital role in the process. That is when your brain integrates memories—carefully filing them away so you can retrieve them later.

Unfortunately, our brain circuits are fragile. They are easily knocked off-kilter by a lack of certain nutrients, poor sleep, or a medication side effect. And sometimes synapses break. You might have trouble finding a name or a word that you know is in your memory banks somewhere, if only you could figure out where. And for some people, memory problems become serious.

Memory Lapses

What if your memory is sputtering and misfiring? What if you're having lapses more frequently than normal?

If that is happening to you, it is important to know that there is a surprising range of things that can derail your memory and cloud your thinking—problems that are often easy to identify and treat. Sometimes it is as simple as correcting your sleep habits. Many people are chronically sleep-deprived, often without realizing it, with noticeable effects on their memory function.

Other times it's a question of looking at medications you may be taking. As we will see in chapter 8, common medications can throw a wrench into your gray matter. Sometimes a medication causes no problem when used by itself but causes all manner of problems when prescribed in combination with other drugs.

There are many medical problems that affect the brain, too, from vitamin deficiencies to thyroid problems. So you'll want to have a medical evaluation, and I'll show you what you need to look out for so you can correct the problem.

Mild Cognitive Impairment

If memory problems continue and no cause can be spotted, your doctor would label the problem *mild cognitive impairment*. This term refers to a situation in which you are doin fine in other respects—you're able to socialize, take care of yourself, and enjoy life—bu your memory and thinking are not as sharp as they were. You might be a bit slower when it comes to paying bills or balancing your checkbook, and you might forget to pic up your dry cleaning. You may have trouble with names and words. You may also have trouble solving problems, planning ahead, or focusing your attention.

How can you tell whether mild cognitive impairment will turn into something more serious? The answer is, you can't at first. Only as time goes on does the picture become clearer.

Your doctor will want to track how you are doing over time. He or she is likely to give you some simple tests, such as asking you to memorize a name and address—John Smith, 103 Orchard Street, Springfield—and to recall it a few minutes later. Or he or sh might show you three common objects—a pen, a stapler, and a book, for example—and place them around the room, asking you to remember each object and its location later on. What your doctor is looking at is your ability to learn and hold on to new information, because that is an indicator of how likely it is that more serious problems li ahead.[1]

These quick tests sometimes are followed by more formal testing, which can be repeated as often as needed. Some researchers add special examinations to try to predict who might be headed for Alzheimer's disease. Drawing a sample of spinal fluid, they would look for two proteins, called *beta-amyloid 42* and *tau*.[2] A low level of beta-amyloid 42 suggests that beta-amyloid, which is linked to Alzheimer's disease, has been deposited in the brain. A high level of tau protein suggests that neurons have been damaged.

Using an MRI or other scanning methods, they can look for brain shrinkage (particularly in a part of the brain called the hippocampus), reduced brain activity, or signs that amyloid has been deposited in the brain.

If you have mild cognitive impairment, you'll want to use each of the steps in the following chapters to regain function if you can and to prevent further loss.

Frances and Mary Lou

Frances and her younger sister Mary Lou were born in Milwaukee, Wisconsin, and have lived there all their lives. They inherited a large grocery store from their parents and worked there throughout their careers, making a comfortable living.

Both reported that around the time they turned sixty, they felt less sharp than before. For Mary Lou, that meant memory problems, which worsened over time. She found that she would often draw a blank for names and sometimes could not remember the words for common objects. She also found that she was no longer the math wizard she had been as a youngster, and she was not as able to keep her attention focused. In part as a result of these problems, she retired from her job. As the years went by, she found these problems annoying, and her doctor labeled them mild cognitive impairment. However, the condition never deteriorated into Alzheimer's disease, and she still lives in the same house she has been in for the past four decades.

Frances's situation was different. She, too, noticed that it often took a bit longer to remember names, but she observed no other problems at all, and even her difficulty with names did not get any worse. She is now in her mid-eighties and still works in the same job in the family store.

Later on, we will look at what may have made the difference in these two women's experiences.

Alzheimer's Disease

Not everyone with mild cognitive impairment progresses to Alzheimer's disease, but many do. As we've seen, Alzheimer's is extremely common among older folks. But the fact is that we are now at a turning point in Alzheimer's disease research, with the emergence of what appear to be powerful tools for reducing the likelihood that you will develop it. Unfortunately, treatments for people who already have Alzheimer's are not a all what they should be, but research studies suggest an effective preventive strategy, which I'll lay out for you in the next several chapters.

When Alzheimer's disease takes hold, it attacks your brain's centers for learning, memory, reasoning, and language.[3] Here are the common symptoms:

- **Difficulty learning and remembering new things.** You might misplace personal belongings more frequently than normal. You might ask the same questions repeatedly, or get lost on what had been a familiar route.
- **Poor reasoning, judgment, or problem solving.** It becomes harder to make decisions, plan activities, handle routine finances, or take the usual steps to protect yourself (e.g., looking out for traffic before crossing a street).
- **Poor visuospatial abilities.** You might have trouble recognizing faces or using simple objects, or find it harder than it should be to do routine things like putting on your shoes or doing up buttons.
- **Losing language skills.** Words may elude you, and reading and writing can be mor difficult.
- **Personality changes.** You could become irritable, agitated, or eventually just apathetic.

Alzheimer's is different from mild cognitive impairment in that cognitive problems ar no longer just a nuisance; they are now interfering with your day-to-day activities. To reach the diagnosis, a doctor would look for at least two of the above symptoms. Typically these changes come on insidiously, unlike the more sudden cognitive problem caused by a stroke, trauma, or infection.

To separate Alzheimer's disease from other brain conditions, your doctor will do a physical exam and laboratory tests, and will also test your ability to learn and remember and can check your language skills. Sometimes doctors check cerebrospinal fluid, drawn via spinal tap, for *beta-amyloid 42* and *tau*. Special brain scans can spot amyloid deposi in the brain or shrinkage or reduced function in certain parts of the brain.[4]

But even with sophisticated testing, your doctor cannot be entirely sure of the diagnosis. If it looks like Alzheimer's, the diagnosis will be called "possible" or "probable." A definitive diagnosis relies on an examination of the brain itself.

A Look Inside the Brain

If you were to look within the brain of a person with Alzheimer's disease, you would no find normal, healthy brain tissue. Here and there between the brain cells are tiny deposits of beta-amyloid protein. Doctors refer to these deposits as *plaques.* They are microscopic, but they are not doing the brain any good. They are a sign of a disease process.

I should mention that "plaque" is a generic word that refers to any sort of unwanted deposit. So you could have plaque on your teeth, plaques clogging your arteries, or microscopic plaques in your brain. They have nothing in common, except that the same word is used in each case.

Scientists have teased these beta-amyloid plaques apart to see what is in them. After feverish research, we now have a good picture of what they are made of. What is actuall inside those plaques is surprising. As we'll see in the next chapter, we can put this finding to use, starting today, to work toward preventing the buildup of these plaques in the first place.

Aside from the beta-amyloid plaques that lie between the brain cells, there is also something wrong *inside* the brain cells themselves. They contain what look like tangled balls of yarn.

Normally your brain cells have microscopic tubes—which scientists call *microtubules* —that maintain the cell's structure and help it to transport various things from place to place within the cell. To stabilize these microtubules, your cells use *tau* proteins (*tau* is just the Greek letter that is the equivalent of our letter "T"). And it's those *tau* proteins that are balled up in what neurologists call *neurofibrillary tangles.*

In 1906, German physician Alois Alzheimer spotted these odd plaques and tangles in the brain of a patient who had died in her mid-fifties after suffering from memory loss and behavioral problems. Although Dr. Alzheimer dutifully reported the existence of plaques and tangles, he had no idea what had caused them, and for the past century, researchers have struggled to find out.

A person assaulted by Alzheimer's disease has also lost brain cells, along with many of the synapses between brain cells—the connections they need to communicate with each other.

So where is all this leading? Ultimately, many people with Alzheimer's disease die of pneumonia, often because the disease has affected their ability to swallow, and food particles end up in their lungs.

All of these problems are what we now aim to prevent.

Genetics of Alzheimer's Disease

Genes play a role in Alzheimer's disease. Chromosomes 21, 14, and 1 hold genes that produce proteins (called *beta-amyloid precursor protein*, *presenilin 1*, and *presenilin 2*) that are involved in making the beta-amyloid that ends up in plaques. Mutations in these genes cause aggressive forms of Alzheimer's disease that can strike when people are jus in their thirties, forties, or fifties.

Fortunately, these cases are rare. For the vast majority of people, the effect of genes is weaker.

The best-known genetic contributor is a gene called APOE. Located on chromosome 19, it holds the instructions for producing a protein called *apolipoprotein E* (which scientists abbreviate with small letters as *apoE*, to differentiate it from the gene). ApoE's job is to help carry fat and cholesterol from place to place. It also repairs brain cells and builds connections from one neuron to another.

Here is what counts: There are three different common versions (alleles) for the APO gene, called e2, e3, and e4. The e4 variant is the one that has raised concerns about Alzheimer's risk. Compared with people who got the e3 allele from both parents, those who inherit the e4 allele from one parent have about three times the risk of developing Alzheimer's disease. People who get the e4 allele from both parents have ten to fifteen times the risk.[5] [6]

What Genes Mean

Each of your genes is made of two *alleles*—one from your mother and one from your father. For example, your mother might have given you an allele for brown hair, while your father might have given you an allele for blond hair. Your genetic makeup—and, in this case, your hair color—depends on the combination of alleles that you received.

For Alzheimer's disease, the APOE gene is important. The three common alleles are:

- e2: Reduced risk of Alzheimer's disease but increased risk of rare cholesterol problems and cardiovascular disease
- e3: No increased Alzheimer's risk
- e4: Increased risk of Alzheimer's disease, especially if the allele came from both parents

People with the e2 allele have less Alzheimer's risk. But e2 has problems of its own, causing a higher risk of rare cholesterol problems and cardiovascular disease.

It is important to understand that genes work in many different ways. Certainly, some genes are dictators—the genes for hair or eye color, for example. If they call for you to have blond hair or brown eyes, that's it. Those dictatorial genes won't take no for an answer.

But the genes for Alzheimer's disease are more like committees. They don't give orders; they make suggestions. And research suggests that changes in diet and lifestyle—the steps you will read about shortly—can keep those genes from expressing themselves. Like dry seeds on the desert floor, they simply lie dormant. If you don't water them, they'll never sprout.