# Grain Brain: The Surprising Truth about Wheat, Carbs, and Sugar--Your Brain's Silent Killers, David Perlmutter

**Introduction**

Maintaining order rather than correcting disorder is the ultimate principle of wisdom. To cure disease after it has appeared is like digging a well when one feels thirsty, or forging weapons after the war has already begun. —HUANGDI NEIJING, 2ND CENTURY BC Location 20

I’m here to tell you that the fate of your brain is not in your genes. It’s not inevitable. Location 40

And if you’re someone who suffers from another type of brain disorder, such as chronic headaches, depression, epilepsy, or extreme moodiness, the culprit may not be encoded in your DNA. It’s in the food you eat. Location 41

Modern grains are silently destroying your brain. Location 44

Basically, I am calling what is arguably our most beloved dietary staple a terrorist group that bullies our most precious organ, the brain. Location 46

Or the fact that heart disease is our number one killer, trailed closely by cancer. Location 57

I believe that the shift in our diet that has occurred over the past century—from high-fat, low-carb to today’s low-fat, high-carb diet, fundamentally consisting of grains and other damaging carbohydrates—is the origin of many of our modern scourges linked to the brain, Location 67

For starters, diabetes and brain disease are this country’s costliest and most pernicious diseases, yet they are largely preventable and are uniquely tied together: Location 86

Having diabetes doubles your risk for Alzheimer’s disease. Location 87

Our genes determine not just how we process food but, more important, how we respond to the foods we eat. Location 94

With modern hybridization and gene-modifying technology, the 133 pounds of wheat that the average American consumes each year shares almost no genetic, structural, or chemical likeness to what hunter-gatherers might have stumbled upon. Location 97

Gluten is what I call a “silent germ.” It can inflict lasting damage without your knowing it. Location 103

***women who were put on statin drugs to lower their cholesterol had a nearly 48 percent increased risk of developing diabetes*** compared to those who weren’t given the drug. Location 110

This one example becomes even more critical when you consider that becoming diabetic doubles your risk for Alzheimer’s disease. Location 112

***(we’re talking no more than 60 grams of carbs a day—the amount in a serving of fruit)***. Location 159

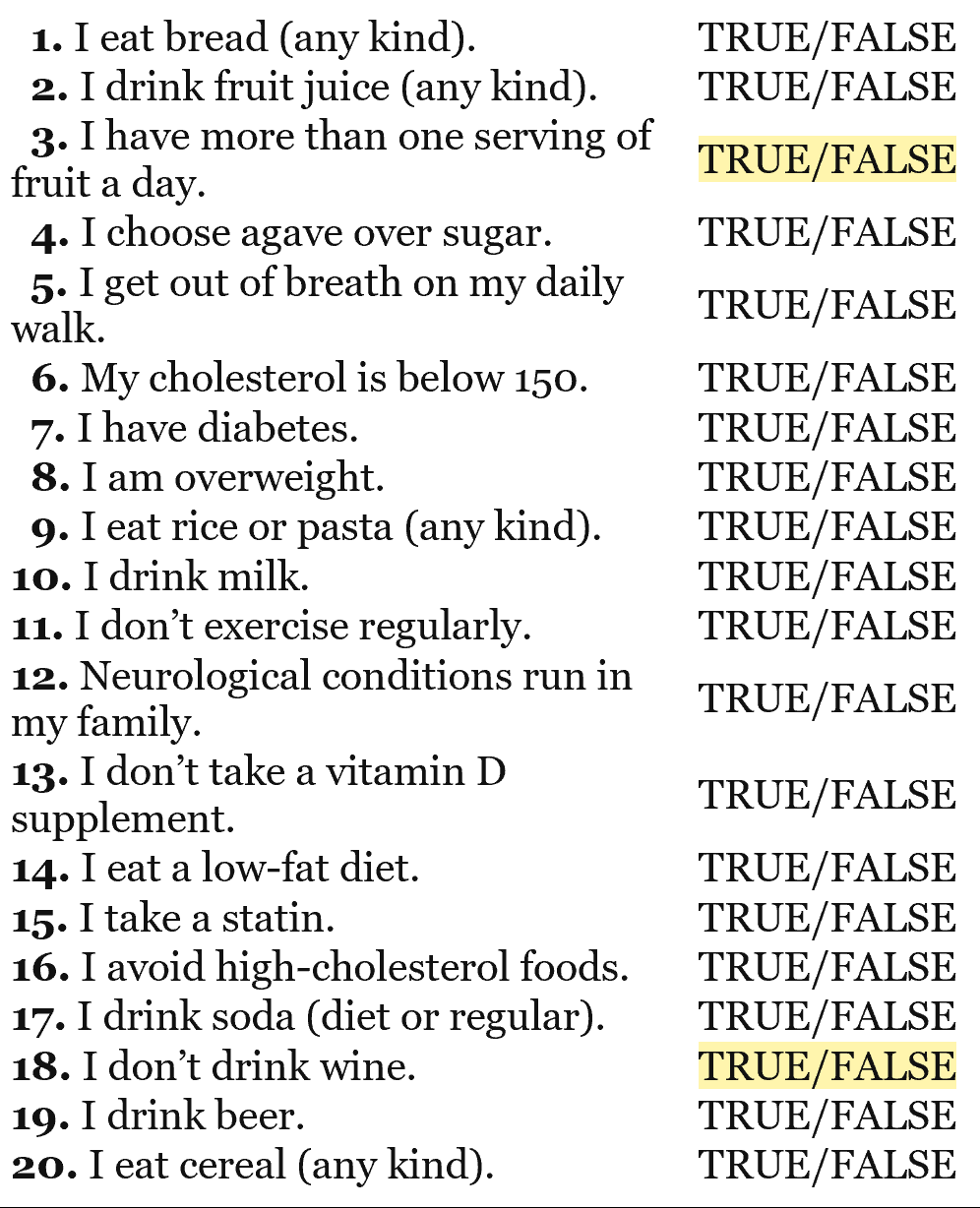
For additional support and ongoing updates, you can go to my website at www.DrPerlmutter.com. There, you’ll be able to access the latest studies, read my blog, and download materials that will help you tailor the information in this book to your personal preferences. Location 173

Self-Assessment What Are Your Risk Factors? Location 184

Brain dysfunction is really no different from heart dysfunction. It develops over time through our behaviors and habits. Location 188

The goal of the questionnaire below is to gauge your risk factors for current neurological problems, Location 194

* If you scored more than a ten, you’re putting yourself into the hazard zone for serious neurological ailments that can be prevented but cannot necessarily be cured once you are diagnosed. Location 214



* Get blood tests that monitor the following (check the book for acceptable levels):
  + Fasting blood glucose Location 222
  + Hemoglobin A1C Location 226
  + Fructosamine Location 229
  + Fasting insulin Location 231
  + Homocysteine Location 234
  + Vitamin D Location 236
  + C-reactive protein (CRP) Location 237
  + Cyrex array 3 Location 238
  + Cyrex array 4 (optional) Location 239

**PART I THE WHOLE GRAIN TRUTH Location 244**

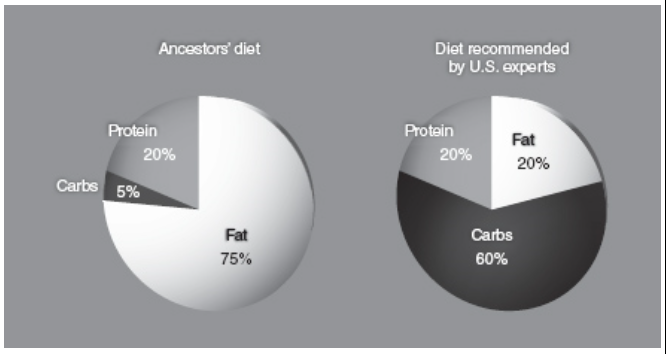
**CHAPTER 1 The Cornerstone of Brain Disease What You Don’t Know About Inflammation**

The chief function of the body is to carry the brain around. —THOMAS A. EDISON Location 258

we’ve gotten better at surviving the accidents and illnesses of childhood. We haven’t, unfortunately, gotten better at preventing and combatting illnesses that strike us when we’re older. Location 293

origin of brain disease is in many cases predominantly dietary. Location 307

In fact, take a look at the following graphic that depicts the main differences between our diet and that of our forebears. Location 316



The studies describing Alzheimer’s as a third type of diabetes began to emerge in 2005, Location 319

The body can manufacture glucose from fat or protein if necessary through a process called gluconeogenesis. But this requires more energy than the conversion of starches and sugar into glucose, which is a more straightforward reaction. Location 326

Normal, healthy cells have a high sensitivity to insulin. But when cells are constantly exposed to high levels of insulin as a result of a persistent intake of glucose Location 331

our cells adapt by reducing the number of receptors on their surfaces to respond to insulin. In other words, our cells desensitize themselves to insulin, causing insulin resistance, which allows the cells to ignore the insulin and fail to retrieve glucose from the blood. Location 334

This creates a cyclical problem that eventually culminates in type 2 diabetes. Location 336

insulin doesn’t just escort glucose into our cells. It’s also an anabolic hormone, meaning it stimulates growth, promotes fat formation and retention, and encourages inflammation. Location 341

insulin resistance, as it relates to Alzheimer’s disease, sparks the formation of those infamous plaques that are present in diseased brains. Location 359

New estimates indicate that Alzheimer’s will likely affect 100 million people by 2050, a crippling number for our health care system and one that will dwarf our obesity epidemic. Location 369

type 2 diabetes, which accounts for 90 to 95 percent of all diabetes cases in the United States, has tripled in the past forty years. Location 371

And in the next forty years, more than 115 million new cases of Alzheimer’s are expected globally, costing us more than one trillion dollars Location 373

gluten sensitivity represents one of the greatest and most under-recognized health threats to humanity, Location 386

As many as 40 percent of us can’t properly process gluten, and the remaining 60 percent could be in harm’s way. Location 392

the cornerstone of all degenerative conditions, including brain disorders, is inflammation. Location 399

gluten, and a high-carbohydrate diet for that matter, are among the most prominent stimulators of inflammatory pathways that reach the brain. Location 401

Study after study shows that high cholesterol reduces your risk for brain disease and increases longevity. By the same token, high levels of dietary fat (the good kind, no trans fats here) have been proven to be key to health and peak brain function. Location 411

people who had the highest cholesterol levels scored higher on cognitive tests than those with lower levels. Evidently, there is a protective factor when it comes to cholesterol and the brain. Location 429

For this reason, getting a fasting insulin test, which is done first thing in the morning before eating a meal, is critical. An elevated level of insulin in your blood at this time is a red flag—a sign that something isn’t metabolically right. Location 440

THE CRUEL IRONY: STATINS Location 522

* Ironically, cholesterol-lowering statins, which are among the most commonly prescribed drugs (e.g., Lipitor, Crestor, Zocor), are now being touted as a way to reduce overall levels of inflammation. Location 524
* But new research also reveals that statins may lessen brain function and increase risk for heart disease Location 525

The reason is simple: The brain needs cholesterol to thrive, a point I’ve already made but will repeat to make sure you don’t forget it. Location 526

* Cholesterol is a critical brain nutrient essential for the function of neurons, and it plays a fundamental role as a building block of the cell membrane. Location 527
* It acts as an antioxidant and a precursor to important brain-supporting elements like vitamin D, as well as the steroid-related hormones Location 528
* Most important, cholesterol is looked upon as an essential fuel for the neurons. Location 529
* Neurons themselves are unable to generate significant cholesterol; instead, they rely on delivery of cholesterol from the bloodstream via a specific carrier protein. Interestingly, this carrier protein, LDL, has been given the derogatory title of “bad cholesterol.” Location 530
* The fundamental role of LDL in the brain, again, is to capture life-giving cholesterol and transport it to the neuron, where it performs critically important functions. Location 532
* individuals with low cholesterol are at much greater risk for dementia and other neurological problems. Location 535
* coronary artery disease has more to do with oxidized LDL. Location 538
* And how does LDL become so damaged that it’s no longer able to deliver cholesterol to the brain? One of the most common ways is through physical modification by glucose. Location 539
* Sugar molecules attach themselves to LDL and change the molecule’s shape, rendering it less useful while increasing free radical production. Location 540

**CHAPTER 2 The Sticky Protein Gluten’s Role in Brain Inflammation (It’s Not Just About Your Belly)**

“gluten-free” products. In the past couple of years, the volume of gluten-free products sold has exploded; at last count, the industry clocked in at $6.3 billion in 2011 and continues to grow. Location 631

Gluten—which is Latin for “glue”—is a protein composite that acts as an adhesive material, holding flour together to make bread products, Location 640

Most Americans consume gluten through wheat, but gluten is found in a variety of grains including rye, barley, spelt, kamut, and bulgur. Location 645

Gluten is not a single molecule; it’s actually made up of two main groups of proteins, the glutenins and the gliadins. Location 649

there’s a huge difference between celiac disease and gluten sensitivity. My aim is to convey the idea that celiac disease, also known as sprue, is an extreme manifestation of gluten sensitivity. Celiac disease is what happens when an allergic reaction to gluten causes damage specifically to the small intestine. Location 653

Remember that when a body negatively reacts to food, it attempts to control the damage by sending out inflammatory messenger molecules to label the food particles as enemies. This leads the immune system to keep sending out inflammatory chemicals, killer cells among them, in a bid to wipe out the enemies. The process often damages our tissue, leaving the walls of our intestine compromised, a condition known as “leaky gut.” Once you have a leaky gut, you’re highly susceptible to additional food sensitivities in the future. Location 669

Gluten sensitivity in particular is caused by elevated levels of antibodies against the gliadin component of gluten. When the antibody combines with this protein (creating an anti-gliadin antibody), specific genes are turned on in a special type of immune cell in the body. Once these genes are activated, inflammatory cytokine chemicals collect and can attack the brain. Cytokines are highly antagonistic to the brain, damaging tissue and leaving the brain vulnerable to dysfunction and disease—especially Location 676

an estimated 99 percent of people whose immune systems react negatively to gluten don’t even know it. Location 690

Dr. Hadjivassiliou goes on to state that “gluten sensitivity can be primarily, and at times, exclusively, a neurological disease.” Location 690

on many occasions I’ve found patients whose brain changes were in fact not related to multiple sclerosis at all and were likely due to gluten sensitivity. And lucky for them, a gluten-free diet reversed their condition. Location 774

gluten sensitivity always affects the brain. Location 796

incidence of gluten sensitivity in Western populations may be as high as 30 percent. Location 798

Read 2009 article aptly titled “The Gluten Syndrome: A Neurological Disease”: Location 801

If you’re familiar with drugs like Celebrex, ibuprofen, or even aspirin, you’re already familiar with the COX-2 enzyme, which is responsible for inflammation and pain in the body. These drugs effectively block that enzyme’s actions, thus reducing inflammation. Location 826

High levels of another inflammatory molecule called TNF alpha have also been seen in celiac patients. Elevations of this cytokine are among the hallmarks of Alzheimer’s disease and virtually every other neurodegenerative condition. Location 828

Gluten sensitivity—with or without the presence of celiac—increases the production of inflammatory cytokines, and these inflammatory cytokines are pivotal players in neurodegenerative conditions. Location 829

Modern food manufacturing, including bioengineering and specifically hybridization, have allowed us to grow structurally-modified grains that contain gluten that’s less tolerable than the gluten that’s found in grains cultivated just a few decades ago. Location 842

We’ve known since the late 1970s that gluten breaks down in the stomach to become a mix of polypeptides that can cross the blood-brain barrier. Once they gain entry, they can then bind to the brain’s morphine receptor to produce a sensorial high. Location 847

But even casting the gluten factor aside, I should point out that one of the main reasons why consuming so many grains and carbs can be so harmful is that they raise blood sugar in ways other foods, such as meat, fish, poultry, and vegetables, do not. Location 869

Nine times out of ten, people pick the wrong food. No, it’s not the sugar (GI = 68), it’s not the candy bar (GI = 55), and it’s not the banana (GI = 54). ***It’s the whole-wheat bread at a whopping GI of 71, putting it on par with white bread*** (so much for thinking whole wheat is better than white). Location 886

The following grains and starches contain gluten:

* Barley
* Bulgur
* couscous
* farina graham flour
* kamut
* matzo
* rye
* semolina
* spelt
* triticale
* wheat
* wheat germ Location 930

The following grains and starches are gluten-free:

* amaranth
* arrowroot
* buckwheat
* corn
* millet
* potato
* quinoa
* rice
* sorghum
* soy
* tapioca
* teff Location 937

The following ingredients are often code for gluten:

* amino peptide complex
* Avena sativa
* brown rice syrup
* caramel color (frequently made from barley)
* cyclodextrin
* dextrin
* fermented grain extract
* Hordeum distichon
* Hordeum vulgare
* hydrolysate
* hydrolyzed malt extract
* hydrolyzed vegetable protein
* maltodextrin
* modified food starch
* natural flavoring
* phytosphingosine extract
* Secale cereale
* soy protein
* Triticum aestivum
* Triticum vulgare
* vegetable protein (HVP)
* yeast extract Location 986

**CHAPTER 3 Attention, Carboholics and Fat Phobics Surprising Truths About Your Brain’s Real Enemies and Lovers**

***I’m going to rescue you from a lifetime of trying to avoid eating fat and cholesterol and prove how these delicious ingredients preserve the highest functioning of your brain***. We’ve developed a taste for fat for good reason: It’s our brain’s secret love. Location 1032

Our bodies thrive when given “good fats,” and cholesterol is one of these. And Location 1039

***Interestingly, the human dietary requirement for carbohydrate is virtually zero;*** we can survive on a minimal amount of carbohydrate, which can be furnished by the liver as needed. Location 1040

Eating high-cholesterol foods has no impact on our actual cholesterol levels, and the alleged correlation between higher cholesterol and higher cardiac risk is an absolute fallacy. Location 1044

***Fat—not carbohydrate—is the preferred fuel of human metabolism*** and has been for all of human evolution. Location 1046

older people who fill their plates with carbohydrates have nearly four times the risk of developing mild cognitive impairment (MCI), generally considered a precursor to Alzheimer’s disease. Location 1063

This particular study found that those whose diets were highest in healthy fats were 42 percent less likely to experience cognitive impairment; people who had the highest intake of protein from healthy sources like chicken, meat, and fish enjoyed a reduced risk of 21 percent.2 Location 1065

***our hunter-gatherer ancestors consumed omega-6 and omega-3 fats in a ratio of roughly 1:1.5 Today we consume ten to twenty-five times more omega-6 fats than evolutionary norms***, Location 1089

* Oil Omega-6 Content/Omega-3 Content
* canola 20% 9%
* corn 54% 0%
* cottonseed 50% 0%
* ***fish 0% 100%***
* ***flaxseed 14% 57%***
* peanut 32% 0%
* safflower 75% 0%
* sesame 42% 0%
* soybean 51% 7%
* sunflower 65% 0%
* walnut 52% 10% Location 1093

***Seafood is a wonderful source of omega-3 fatty acids, and even wild meat like beef, lamb, venison, and buffalo contain this fab fat***. Location 1112

“High cholesterol is associated with better memory function.” Location 1118

***Parkinson’s disease is also strongly related to lower levels of cholesterol.*** Researchers in the Netherlands writing in the American Journal of Epidemiology published a report in 2006 demonstrating that “higher serum levels of total cholesterol were associated with a significantly decreased risk of Parkinson’s disease with evidence of a dose effect relation.” Location 1120

the journal Movement Disorders showed that people with the lowest LDL cholesterol (the so-called bad cholesterol) were at increased risk for Parkinson’s disease by approximately 350 percent! Location 1123

In addition to oxidation destroying the LDL’s function, sugar can also render it dysfunctional by binding to it and accelerating oxidation. Location 1130

A principal player in that risk of oxidation is higher levels of glucose; LDL is far more likely to become oxidized in the presence of sugar molecules that will bind to it and change its shape. Location 1133

***Nothing could be further from the truth than the myth that if we lower our cholesterol levels we might have a greater chance of living longer and healthier lives***. Location 1150

The truth is we thrive on saturated fats. In the words of Michael Gurr, PhD, author of Lipid Biochemistry: An Introduction, “Whatever causes coronary heart disease, it is not primarily a high intake of saturated fatty acids.”15 Location 1180

In 1900, the typical city dweller consumed about 2,900 calories per day, with 40 percent of these calories coming from equal parts saturated and unsaturated fat. Location 1200

By 1950 we had gone from eating about eighteen pounds of butter and a little under three pounds of vegetable oil each year to just over ten pounds of butter and more than ten pounds of vegetable oil. Location 1206

Read Dr. Donald W. Miller, cardiac surgeon and professor of surgery at the University of Washington, stated it perfectly in his 2010 essay entitled “Health Benefits of a Low-Carbohydrate, High-Saturated-Fat Diet”: Location 1232

“The sixty-year reign of the low-fat, high-carbohydrate diet will end. This will happen when the health-destroying effects of excess carbohydrates in the diet become more widely recognized and the health benefits of saturated fats are better appreciated.” Location 1234

So if eating saturated fat doesn’t cause heart disease, then what does? Location 1244

Neurotransmitters are your main mood and brain regulators, and when your blood sugar increases, there’s an immediate depletion of the neurotransmitters serotonin, epinephrine, norepinephrine, GABA, and dopamine. Location 1249

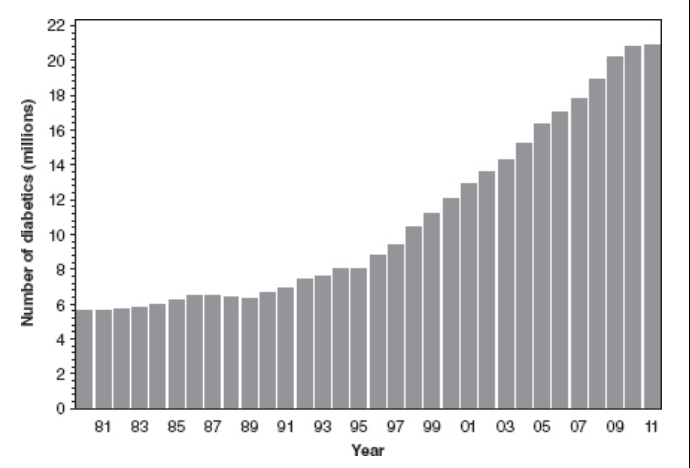
At the same time, B-complex vitamins, which are needed to make those neurotransmitters (and a few hundred other things), get used up. Magnesium levels also diminish, and this handicaps both your nervous system and liver. In addition, high blood sugar triggers a reaction called “glycation,” Location 1250

***glycation is the biological process whereby glucose, proteins, and certain fats become tangled together, causing tissues and cells to become stiff and inflexible, including those in the brain***. Location 1253

Aside from sweetened beverages, grain-based foods are responsible for the bulk of carbohydrate calories in the American diet. Location 1257

***it’s compelling to note that in 1994, when the American Diabetes Association recommended that Americans should consume 60 to 70 percent of their calories from carbohydrates, rates of diabetes exploded***. Location 1262

Take a look at the rapid upward slope from 1980 through 2011, during which the number of Americans diagnosed with diabetes more than tripled: Location 1265



In the body, dietary carbohydrates, including sugars and starches, are converted to glucose, which you know by now tells the pancreas to release insulin into the blood. Insulin shuffles glucose into cells and stores glucose as glycogen in the liver and muscles. It’s also the body’s chief fat-building catalyst, converting glucose to body fat when the liver and muscles have no more room for glycogen. Location 1287

***When your diet is continuously rich in carbohydrates, which in effect keep your insulin pumps on, you severely limit (if not completely halt) the breakdown of your body fat for fuel***. Location 1295

This is why many obese individuals cannot lose weight while continuing to eat carbs. Their insulin levels hold those fat stores hostage. Location 1298

***However, while the synthetic trans fats found in margarine and processed foods are poisonous, we know now that monounsaturated fats—such as the fat found in avocados, olives, and nuts—are healthy***. Location 1313

***But we need saturated fat, and our body has long been designed to handle the consumption of natural sources of it***—even in high amounts. Location 1318

***Few people understand that saturated fat plays a pivotal role in a lot of biochemical equations that keep us healthy. If you were breast-fed as a baby, then saturated fats were your staple, as they make up 54 percent of the fat in breast milk***. Location 1319

***Every cell in your body requires saturated fats; they comprise 50 percent of the cellular membrane***. Location 1320

***Heart muscle cells prefer a type of saturated fat for nourishment, and bones require saturated fats to assimilate calcium effectively***. Location 1325

For a complete list of where these good fats can be found (and where the bad fats lurk), see the sidebar “***The Oh-So-Many Omegas” in chapter 3***. Location 1331

***But contrary to what you might think, they are not two different kinds of cholesterol. HDL and LDL reflect two different containers for cholesterol and fats, each of which serves a different role in the body***. Location 1334

* As we’ve seen, science is only recently discovering that both fat and cholesterol are severely deficient in diseased brains and that high total cholesterol levels in late life are associated with increased longevity. ***The brain holds only 2 percent of the body’s mass but contains 25 percent of the total cholesterol***, which supports brain function and development. ***One-fifth of the brain by weight is cholesterol!*** Location 1339
* ***Cholesterol forms membranes surrounding cells, keeps cell membranes permeable, and maintains cellular “waterproofing” so different chemical reactions can take place inside and outside the cell. Location 1342***
* ***We’ve actually determined that the ability to grow new synapses in the brain depends on the availability of cholesterol, which latches cell membranes together so that signals can easily jump across the synapse. Location 1343***
* ***In essence, cholesterol acts as a facilitator for the brain to communicate and function properly. Location 1347***
* ***Moreover, cholesterol in the brain serves as a powerful antioxidant. Location 1347***
* ***The bile salts secreted by the gallbladder, which are needed for the digestion of fat and, therefore, the absorption of fat-soluble vitamins like A, D, and K, are made of cholesterol. Location 1355***
* ***Having a low cholesterol level in the body would therefore compromise a person’s ability to digest fat. Location 1356***
* ***In fact, cholesterol is regarded by the body as such an important collaborator that every cell has a way to make its own supply. Location 1357***

The brain uses fat exceptionally well; it is considered a brain “superfuel.” Location 1363

THE STATIN EPIDEMIC AND THE LINK TO BRAIN DYSFUNCTION Location 1368

* Our understanding of how cholesterol is critical for brain health has brought me and many others in my field to believe that statins—the blockbuster drugs prescribed to millions of Americans to lower cholesterol—may cause or exacerbate brain disorders and disease. Location 1369
* Read - Today he has written three books on the matter, the most famous of which is Lipitor, Thief of Memory. Location 1373
* American Medical Association and published in the Archives of Internal Medicine in January 2012 demonstrated an astounding ***48 percent increased risk of diabetes among women taking statin medications***. Location 1376
* ***If you deprive cholesterol from the brain, then you directly affect the machinery that triggers the release of neurotransmitters. Neurotransmitters affect the data-processing and memory functions***. Location 1392
* ***They not only reduce the amount of cholesterol contained in LDL particles, but also diminish the actual number of LDL particles. So in addition to depleting cholesterol, they limit the stash available to the brain of both fatty acids and antioxidants, which are also carried in the LDL particles. Location 1406***
* ***Proper brain functioning depends on all three of these substances Location 1408***
* ***The body makes vitamin D from cholesterol in the skin upon exposure to UV rays from the sun. Location 1417***
  + Vitamin D deficiency is not just about an increased risk for weak, soft bones and, at the extreme end, rickets; it’s associated with many conditions that heighten one’s risk for dementia, such as diabetes, depression, and cardiovascular disease. Location 1421
* Those who were taking statin drugs and had the lowest levels of low-density lipoprotein (LDL) were found to have the highest rates of mortality. Conversely, people with higher levels of cholesterol had a lower risk of death. Location 1433

HOW CARBS—NOT CHOLESTEROL—CAUSE HIGH CHOLESTEROL Location 1435

* If you can limit carb intake to a range that is absolutely necessary (the details of which are in chapter 10) and make up the difference with delicious fats and protein, you can literally reprogram your genes back to the factory setting you had at birth. This is the setting that affords you the ability to be a mentally sharp, fat-burning machine. Location 1436
* ***It’s important to understand that when you have a blood cholesterol test, the number that is represented is actually 75 to 80 percent derived from what your body manufactures and not necessarily what you’ve eaten. In fact, foods that are high in cholesterol actually decrease the body’s production of cholesterol***. Location 1438
* So what happens if you restrict your cholesterol intake, as so many people do today? The body sends out an alarm that indicates crisis (famine). Your liver senses this signal and begins to produce an enzyme called HMG-CoA reductase, which helps make up for the deficit by using carbohydrates in the diet to produce an excess supply of cholesterol. Location 1444
* As you eat excessive carbohydrates while lowering your cholesterol intake, you incite a steady and punishing overproduction of cholesterol in the body. Location 1447
* The idea that aggressively lowering cholesterol levels will somehow magically and dramatically reduce heart attack risk has now been fully and categorically refuted. Location 1454
* So when I see patients with cholesterol levels of, say, 240 mg/dl or higher, it’s almost a given that they will have received a prescription for a cholesterol-lowering medication from their general practitioners. This is wrong in thought and action. Location 1457
* ***The best lab report to refer to in determining one’s health status is hemoglobin A1C, not cholesterol levels. Location 1459***
* Today, the threshold is down to 180. Location 1464
* And what makes testosterone? Cholesterol. What are millions of Americans doing today? Lowering their cholesterol levels through diet and/or taking statins. Location 1483
* If you have coronary disease and low testosterone, you’re at much greater risk of dying. So again we are giving statin medications to lower cholesterol, which lowers testosterone… and lower testosterone increases the risk of dying. Is this crazy or what? Location 1493

**CHAPTER 4 Not a Fruitful Union This Is Your Brain on Sugar (Natural or Not)**

Read Gary Taubes, the author of Good Calories, Bad Calories,2 wrote an excellent piece for the New York Times titled “Is Sugar Toxic?” Location 1513

“isocaloric but not isometabolic” when he describes the difference between pure glucose, the simplest form of sugar, and table sugar, which is a combination of glucose and fructose. Location 1519

* When we eat 100 calories of glucose from a potato, for instance, our bodies metabolize it differently—and experience different effects—than if we were to eat 100 calories of sugar comprising half glucose and half fructose. Location 1521
* Your liver takes care of the fructose component of sugar. Glucose from other carbs and starches, on the other hand, is processed by every cell in the body. Location 1523
* So consuming both types of sugar (fructose and glucose) at the same time means your liver has to work harder than if you ate the same number of calories from glucose alone. Location 1524
* Drinking liquid sugar is not the same as eating, say, an equivalent dose of sugar in whole apples. Fructose, by the way, is the sweetest of all naturally occurring carbohydrates, which probably explains why we love it so much. Location 1526
* Consuming fructose is associated with impaired glucose tolerance, insulin resistance, high blood fats, and hypertension. Location 1531

***for the most part, you can have your fruit and eat it, too. The quantity of fructose in most whole fruit pales in comparison to the levels of fructose in processed foods.*** Location 1534

Meals that are higher in carbohydrate, and especially those that are higher in simple glucose, cause the pancreas to increase its insulin output in order to store the blood sugar in cells. Location 1553

***What about the carbs in a vegetable? Those carbs, especially the ones in leafy green vegetables such as broccoli and spinach, are tied up with indigestible fiber, so they take longer to break down. The fiber essentially slows down the process, causing a slower funneling of glucose into the bloodstream***. Plus, vegetables contain more water relative to their weight than starches, and this further dampens the blood sugar response. Location 1560

When we eat whole fruits, which obviously contain fruit sugar, the water and fiber will also “dilute” the blood sugar effect. If you take, for instance, a peach and a baked potato of equal weight, the potato will have a much bigger effect on blood sugar than the watery, fibrous peach. Location 1563

if we didn’t eat such high-carb diets, obesity would be a rare condition. Location 1583

if diabetes began before a person was sixty-five years old, the risk for mild cognitive impairment was increased by a whopping 220 percent. Location 1607

***The authors described a proposed mechanism to explain the connection between persistent high blood sugar and Alzheimer’s disease: “increased production of advanced glycation end products.***” Location 1609

* Glycation is the biochemical term for the bonding of sugar molecules to proteins, fats, and amino acids; Location 1654
* This process forms advanced glycation end products (commonly shortened, appropriately, to AGEs), which cause protein fibers to become misshapen and inflexible. Location 1658
* Glycation is an inevitable fact of life, just like inflammation and free radical production to some degree. Location 1665
* Clearly, the goal is to limit or slow down the glycation process. Location 1670
* The number one source of dietary calories in America comes from high-fructose corn syrup, which increases the rate of glycation by a factor of ten). Location 1673
* glycation of proteins is a normal part of our metabolism. But when it’s excessive, many problems arise. Location 1678
* the best way to keep AGEs from forming is to reduce the availability of sugar in the first place. Location 1682

***LDL—the so-called bad cholesterol—is an important carrier protein bringing vital cholesterol to brain cells.*** ***Only when it becomes oxidized does it wreak havoc on blood vessels. And we now understand that when LDL becomes glycated (it’s a protein, after all), this dramatically increases its oxidation***. Location 1687

When proteins are glycated, the amount of free radicals formed is increased fiftyfold; this leads to loss of cellular function and eventually cell death. Location 1689

you want to reduce oxidative stress and the action of free radicals harming your brain, you have to reduce the glycation of proteins. Which is to say, you have to diminish the availability of sugar. Location 1694

A1C is the protein found in the red blood cell that carries oxygen and binds to blood sugar, and this binding is increased when blood sugar is elevated. Location 1700

hemoglobin A1C doesn’t give a moment-to-moment indication of what the blood sugar is, it is extremely useful in that it shows what the “average” blood sugar has been over the previous ninety days. Location 1701

***hemoglobin is a powerful risk factor for diabetes, but it’s also been correlated with risk for stroke, coronary heart disease, and death from other illnesses. These correlations have been shown to be strongest with any measurement of hemoglobin A1C above 6.0 percent***. Location 1704

***comparing the degree of brain tissue loss in those individuals with the lowest hemoglobin A1C (4.4 to 5.2) to those having the highest hemoglobin A1C (5.9 to 9.0), the brain loss in those individuals with the highest hemoglobin A1C was almost doubled during a six-year period***. Location 1709

***ideal hemoglobin A1C would be in the 4.8 to 5.4 range***. Location 1712

carbohydrate ingestion, weight loss, and physical exercise will ultimately improve insulin sensitivity and lead to a reduction of hemoglobin A1C. Location 1713

why it’s so important to check not only your fasting blood sugar, but also your fasting insulin level. An elevated fasting insulin level is an indicator that your pancreas is trying hard to normalize your blood sugar. Location 1720

The average insulin level in the United States is about 8.8 micro international units per milliliter (µIU/mL) for adult men and 8.4 for women. Location 1729

***Patients who are being very careful about their carbohydrate intake might have insulin levels indicated on their lab report as less than 2.0***. Location 1731

Masses of body fat form complex, sophisticated hormonal organs that are anything but passive. You read that right: Fat is an organ. Location 1740

This is especially true of visceral fat—the fat wrapped around our internal, “visceral” organs such as the liver, kidneys, pancreas, heart, and intestines. Visceral fat has also gotten a lot of press lately: We know now that this type of fat is the most devastating to our health. Location 1742

It’s well documented that visceral fat is uniquely capable of triggering inflammatory pathways in the body as well as signaling molecules that disrupt the body’s normal course of hormonal actions. Location 1748

the larger a person’s waist-to-hip ratio (i.e., the bigger the belly), the smaller the brain’s memory center, the hippocampus. The hippocampus plays a critical role in memory, and its function is absolutely dependent upon its size. As your hippocampus shrinks, your memory declines. More striking still, the researchers found that the higher the waist-to-hip ratio, the higher the risk for small strokes in the brain, Location 1761

And those who were overweight—defined by having a body mass index between 25 and 30—looked eight years older than their leaner counterparts. Location 1771

the clinically obese people had 8 percent less brain tissue, while the overweight had 4 percent less brain tissue compared to normal-weight individuals. Location 1772

You can improve insulin sensitivity and reduce your risk of diabetes (not to mention all manner of brain diseases) simply by making lifestyle changes that melt that fat away. And if you add exercise to the dieting, you’ll stand to gain even bigger benefits. Location 1800

***All of the diets provided the same number of calories, but those on the low-carb, high-fat diet burned the most calories***. Location 1808

***the low-carb diet triggered the biggest improvement in insulin sensitivity—almost twice that of the low-fat diet. Triglycerides, a powerful cardiovascular risk marker, averaged 66 in the low-carb group and 107 in the low-fat group***. Location 1809

**CHAPTER 5 The Gift of Neurogenesis and Controlling Master Switches How to Change Your Genetic Destiny**

epigenetics, the study of particular sections of your DNA (called “marks”) that essentially tell your genes when and how strongly to express themselves. Location 1850

***Here’s what is most compelling: We can change the expression of more than 70 percent of the genes that have a direct bearing on our health and longevity.*** Location 1854

THE STORY OF NEUROGENESIS Location 1859

* We can grow new neurons throughout our entire lives. Location 1861
* scientists have determined that the heart muscle—an organ that we long thought was “fixed” since birth—does in fact experience cellular turnover as well. Location 1892
* When we’re twenty-five years old, about 1 percent of our heart muscle cells are replaced every year; but by the age of seventy-five, that rate has fallen to less than half a percent per year. Location 1893
* brain cells may die, but they most certainly can be regenerated. Location 1901
* Read Norman Doidge’s The Brain That Changes Itself: Location 1915
* Specifically, a gene located on chromosome 11 codes for the production of a protein called “brain-derived neurotrophic factor,” or BDNF. Location 1920
  + BDNF plays a key role in creating new neurons. But beyond its role in neurogenesis, BDNF protects existing neurons, ensuring their survivability while encouraging synapse formation, Location 1921
  + The gene that turns on BDNF is activated by a variety of lifestyle habits, including physical exercise, caloric restriction, following a ketogenic diet, and the addition of certain nutrients like curcumin and the omega-3 fat DHA. Location 1927

THIS IS YOUR (NEW) BRAIN ON EXERCISE Location 1931

* Physical exercise is one of the most potent ways of changing your genes; put simply, when you exercise, you literally exercise your genes. Location 1932
* Aerobic exercise in particular not only turns on genes linked to longevity, but also targets the BDNF gene, the brain’s “growth hormone.” Location 1933
* More specifically, aerobic exercise has been shown to increase BDNF, reverse memory decline in elderly humans, and actually increase growth of new brain cells in the brain’s memory center. Location 1934

CALORIC RESTRICTION Location 1940

* when animals are on a reduced-calorie diet (typically reduced by around 30 percent), their brain production of BDNF shoots up and they show dramatic improvements in memory and other cognitive functions. Location 1942
* It was shown that the incidence of Alzheimer’s disease among Nigerian immigrants living in the United States was increased compared to their relatives who remained in Nigeria. Location 1960
* The research clearly focused on the detrimental effects that a higher caloric consumption has on brain health. Location 1963
* ***the same pathway that turns on BDNF production can be activated by intermittent fasting*.** Location 1973
* lower caloric intake is associated with a decreased incidence of Alzheimer’s and Parkinson’s disease. Location 1979
* Consuming fewer calories decreases the generation of free radicals while at the same time enhancing energy production from the mitochondria, the tiny organelles in our cells that generate chemical energy in the form of ATP Location 1981
* Caloric restriction also has a dramatic effect on reducing apoptosis, the process by which cells undergo self-destruction. Location 1983
* In addition, caloric restriction triggers a decrease in inflammatory factors and an increase in neuroprotective factors, specifically BDNF. Location 1987

THE BENEFITS OF A KETOGENIC DIET Location 2000

* ***the same pathway can be activated by the consumption of special fats called ketones. By far the most important fat for brain energy utilization is beta-hydroxybutyrate (beta-HBA),*** Location 2001
* In one 2005 study, Parkinson’s patients actually had a notable improvement in symptoms that rivaled medications and even brain surgery after being on a ketogenic diet for just twenty-eight days. Location 2006
* consuming ketogenic fats (i.e., medium-chain triglycerides, or MCT oil) has been shown to impart significant improvement in cognitive function in Alzheimer’s patients. Location 2008
* A ketogenic diet has also been shown to reduce amyloid in the brain,25 and it increases glutathione, the body’s natural brain-protective antioxidant, in the hippocampus.26 What’s more, it stimulates the growth of mitochondria and thus increases metabolic efficiency. Location 2011
* At rest, 20 percent of our oxygen consumption is used by the brain, which only represents 2 percent of the human body. Location 2025
* we can define this mild ketosis as the normal state of human metabolism when we’re not eating the carbohydrates that didn’t exist in our diets for 99.9 percent of human history. As such, ketosis is arguably not just a natural condition but even a particularly healthful one.” Location 2028

CURCUMIN AND DHA Location 2036

* Although it is well known for its antioxidant, anti-inflammatory, anti-fungal, and antibacterial activities, its ability to increase BDNF in particular has attracted the interest of neuroscientists around the world, especially epidemiologists searching for clues to explain why the prevalence of dementia is markedly reduced in communities where turmeric is used in abundance. Location 2038

more than two-thirds of the dry weight of the human brain is fat, and of that fat, one quarter is DHA. Location 2042

DHA helps orchestrate the production, connectivity, and viability of brain cells while at the same time enhancing function. Location 2049

The researchers also found that consuming more than two servings of fish per week was associated with a 59 percent reduction in the occurrence of Alzheimer’s disease. Location 2061

I can’t tell you how many times I’ve “cured” ADHD just by recommending a DHA supplement. Location 2066

***How can we increase our DHA? Our bodies can manufacture small amounts of DHA, and we are able to synthesize it from a common dietary omega-3 fat, alpha-linolenic acid***. Location 2068

We need at least 200 to 300 milligrams daily, Location 2070

INTELLECTUAL STIMULATION BOLSTERS NEW NETWORKS Location 2072

Much in the way our muscles gain strength and functionality when physically challenged through exercise, the brain similarly rises to the challenges of intellectual stimulation. Location 2075

Our DNA can actually turn on the production of protective antioxidants in the presence of specific signals, and this internal antioxidant system is far more powerful than any nutritional supplement. Location 2088

Common antioxidants work by sacrificing themselves to become oxidized when faced with free radicals. Thus, one molecule of vitamin C is oxidized by one free radical. (This one-to-one chemistry is called a stoichiometric reaction by chemists.) Can you imagine how much vitamin C or other oral antioxidant it would take to neutralize the untold number of free radicals generated by the body on a daily basis? Location 2111

our cells have their own innate ability to generate antioxidant enzymes on demand. Location 2115

***New research has identified a variety of modifiable factors that can turn on the Nrf2 switch, activating genes that can produce powerful antioxidants and detoxification enzymes***. Location 2119

* Vanderbilt University’s Dr. Ling Gao has found that when the omega-3 fats EPA and DHA are oxidized, they significantly activate the Nrf2 pathway. Location 2120
* ***Glutathione is regarded as one of the most important detoxification agents in the human brain***. Location 2129
* glutathione has far-reaching roles in brain health. First, it serves as a major antioxidant in cellular physiology, Location 2131
* calorie restriction also has been demonstrated in a variety of laboratory models to induce Nrf2 activation. Location 2140
* Several natural compounds that turn on antioxidant and detoxification pathways through activation of the Nrf2 system have been identified. Among these are curcumin from turmeric, green tea extract, silymarin (milk thistle), bacopa extract, DHA, sulforaphane (contained in broccoli), and ashwagandha. Location 2143
* coffee is one of the most powerful Nrf2 activators in nature. Location 2147

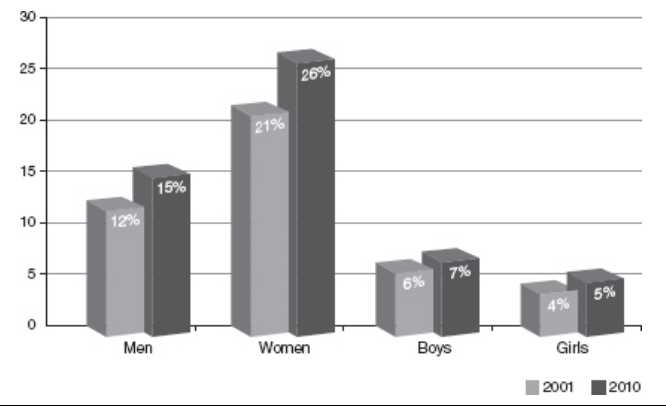
scientists have not identified a specific gene that causes Alzheimer’s disease. But one genetic risk factor that appears to increase one’s risk of developing the disease is associated with the apolipoprotein E (ApoE) gene on chromosome 19. It encodes the instructions for making a protein that helps transport cholesterol and other types of fat in the bloodstream. It comes in several different forms, or alleles. The three main forms are ApoE ε2, ApoE ε3, and ApoE ε4. Location 2160

The fate of your health—and peace of mind, as the next chapter shows—is largely in your hands. Location 2173

**CHAPTER 6 Brain Drain How Gluten Robs You and Your Children’s Peace of Mind**

Second, his face demonstrated classic “allergic shiners,” dark circles under the eyes that correlate with allergies. Location 2204

Percent of population using mental health medications 2001 vs. 2010 Location 2246



Eleven percent of Americans over age twelve take antidepressants, but the percentage skyrockets when you look at the number of women in their forties and fifties who have been prescribed antidepressants—***a whopping 23 percent***. Location 2247

***The good news is that we can reverse many of the symptoms of neurological, psychological, and behavioral disorders just by going gluten-free and adding supplements like DHA and probiotics to our diet***. Location 2261

Warning: Drugs used to treat ADHD have resulted in cases of permanent Tourette’s syndrome. Location 2276

When a baby passes through the birth canal naturally, billions of healthy bacteria wash over the child, thereby inoculating the newborn with appropriate probiotics whose pro-health effects remain for life. If a child is born via C-section, however, he or she misses out on this shower of sorts, and this sets the stage for bowel inflammation and, therefore, an increased risk of sensitivity to gluten and ADHD later in life. Location 2304

New research is also giving moms another reason to breast-feed, as babies who are regularly breast-fed when they are first introduced to foods containing gluten have been shown to cut their risk of developing celiac disease by 52 percent, Location 2308

Women on antidepressants were 45 percent more likely to experience strokes and had a 32 percent higher risk of death from all causes.20 Location 2354

depression runs much higher in people who have low cholesterol. Location 2368

And people who start taking cholesterol-lowering medication (i.e., statins) can become much more depressed. Location 2369

Read The Breakthrough Depression Solution, Location 2373

If you’ve got low cholesterol, you’ve got a much higher risk of developing depression. And the lower you go, the closer you are to harboring thoughts of suicide. Location 2388

Those who are bipolar are much more likely to attempt suicide if they have low cholesterol. Location 2391

How does depression relate to a damaged intestine? Once the lining of the gut is injured by celiac disease, it is ineffective at absorbing essential nutrients, many of which keep the brain healthy, such as zinc, tryptophan, and the B vitamins. What’s more, these nutrients are necessary ingredients in the production of neurological chemicals such as serotonin. Location 2406

***In fact, your intestinal brain makes more serotonin than the brain that rests in your skull.*** Location 2411

“Undiagnosed celiac disease can exacerbate symptoms of depression or may even be the underlying cause. Location 2420

we now have documented evidence that mothers who are sensitive to gluten give birth to children who are nearly 50 percent more likely to develop schizophrenia later in life. Location 2436

The team measured levels of IgG antibodies to milk and wheat in the blood samples to figure out that the “children born to mothers with abnormally high levels of antibodies to the wheat protein gluten were nearly 50 percent more likely to develop schizophrenia later in life than children born to mothers with normal levels of gluten antibodies.” Location 2445

By this point in the book you know that fat is a hugely powerful hormonal organ and system that can generate pro-inflammatory compounds. Location 2556

Fat cells secrete an enormous amount of cytokines that trigger inflammatory pathways. Location 2557 (**Cytokines** are cell signalling molecules that aid cell to cell communication in immune responses and stimulate the movement of cells towards sites of inflammation, infection and trauma. **Cytokines**exist in peptide, protein and glycoprotein (proteins with a sugar attached) forms.)

**PART II GRAIN BRAIN REHAB Location 2601**

**CHAPTER 7 Dietary Habits for an Optimal Brain Hello, Fasting, Fats, and Essential Supplements**

But even more important than our impressive volume of brain matter is the fact that, gram for gram, ***our brain consumes a disproportionately huge amount of energy. It represents 2.5 percent of our total body weight but consumes an incredible 22 percent of our body’s energy expenditure at rest***. Location 2616

THE POWER OF FASTING Location 2622

* One critical mechanism of the human body that I’ve already covered is its ability to convert fat into vital fuel during times of starvation. We can break down fat into specialized molecules called ketones, and one in particular that I’ve already mentioned—beta-hydroxybutyrate (beta-HBA)—is a superior fuel for the brain. Location 2622
* Unlike other mammals’, our brain can use an alternative source of calories during times of starvation. Location 2630
* Typically, our daily food consumption supplies our brain with glucose for fuel. In between meals, our brains are continually supplied with a steady stream of glucose that’s made by breaking down glycogen, mostly from the liver and muscles. Location 2630
* But glycogen stores can provide only so much glucose. Once our reserves are depleted, our metabolism shifts and we are able to create new molecules of glucose from amino acids taken from protein primarily found in muscle. Location 2632
* ***When food is no longer available, after about three days, the liver begins to use body fat to create those ketones. This is when beta-HBA serves as a highly efficient fuel source for the brain, allowing us to function cognitively for extended periods during food scarcity***. Location 2635
  + ***“Recent studies have shown that beta-hydroxybutyrate, the principal ketone, is not just a fuel, but a superfuel, more efficiently producing ATP energy than glucose.*** Location 2639
  + ***Dr. Cahill and other researchers have determined that beta-HBA, which is easily obtainable just by adding coconut oil to your diet, improves antioxidant function, increases the number of mitochondria, and stimulates the growth of new brain cells.*** Location 2641
* But intermittent fasting—a complete restriction of food for twenty-four to seventy-two hours at regular intervals throughout the year—is more manageable, Location 2646
* fasting provides the body with benefits that can accelerate and enhance weight loss, not to mention boost brain health. Location 2650
* ***Fasting not only turns on the genetic machinery for the production of BDNF, but also powers up the Nrf2 pathway, leading to enhanced detoxification, reduction of inflammation, and increased production of brain-protective antioxidants***. Location 2651
* ***Fasting causes the brain to shift away from using glucose as fuel to using ketones manufactured in the liver.*** Location 2652
* fasting enhances energy production and paves the way for better brain function and clarity. Location 2654
* fasting, which stimulates the brain to turn to fat for fuel in the form of ketones. A similar reaction takes place when you follow a diet low in carbohydrates and rich in healthy fats and proteins. Location 2661

What’s more, as we consume carbohydrates we stimulate an enzyme called lipoprotein lipase that tends to drive fat into the cell; the insulin secreted when we consume carbohydrates makes matters worse by triggering enzymes that lock fat tightly into our fat cells. Location 2665

when we burn fat as opposed to carbohydrate, we enter ketosis. Location 2667

***Being in a mild ketosis state is actually healthy. We are mildly ketotic when we first wake up in the morning, as our liver is mobilizing body fat to use as fuel***. Location 2669

***Both the heart and the brain run more efficiently on ketones than on blood sugar, by as much as 25 percent***. Location 2670

And, in fact, he published a case report of treating a glioblastoma patient using a ketogenic diet with impressive results. Location 2675

***A purely ketogenic diet is one that derives 80 to 90 percent of calories from fat, and the rest from carbohydrate and protein***. Location 2676

* You’ll limit your consumption of carbohydrates to just 30 to 40 grams a day during the four weeks, after which you can increase that amount to 60 grams. Location 2682
* Look for trace to small levels of ketosis in the neighborhood of 5 to 15; Location 2685

SEVEN BRAIN-BOOSTING SUPPLEMENTS Location 2688



“The high-carb diet I put you on twenty years ago gave you diabetes, high blood pressure, and heart disease. Oops.” Location 2690

(Refer to “Start Your Supplements” in chapter 10 for exact dosages and instructions on when to take each of these daily.) Location 2700

* DHA: As I mentioned earlier, docosahexaenoic acid (DHA) is a star in the supplement kingdom. DHA is an omega-3 fatty acid that represents more than 90 percent of the omega-3 fats in the brain. Location 2701
  + The richest source of DHA in nature is human breast milk. Location 2706

* Resveratrol: The magic behind the health benefits of drinking a glass of red wine a day has a lot to do with this natural compound found in grapes, which not only slows down the aging process, boosts blood flow to the brain, and promotes heart health, but also curbs fat cells by inhibiting their development. Location 2711
  + But for now we know that we could do our brains well with the addition of a modest dose every day. Location 2721
* Turmeric: Turmeric (Curcuma longa), a member of the ginger family, is the subject of intense scientific research, much of it evaluating the anti-inflammatory and antioxidant activities that stem from its active ingredient, curcumin. Location 2724
  + One of curcumin’s secret weapons is its ability to activate genes to produce a vast array of antioxidants that serve to protect our precious mitochondria. Location 2730

* Probiotics: Stunning new research in just the last few years has shown that eating foods rich in probiotics—live microorganisms that support our intestine’s resident bacteria—can influence brain behavior and help alleviate stress, anxiety, and depression. Location 2733
  + Ideally, get your probiotics through a supplement that offers a variety of strains (at least ten), including Lactobacillus acidophilus and bifidobacterium, and contains at least ten billion active bacteria per capsule. Location 2753

* Coconut oil: As I’ve already described, coconut oil can help prevent and treat neurodegenerative disease states. Location 2755
  + You can drink a teaspoon of it straight or use it when you prepare meals. Coconut oil is heat stable, so you can cook with it at high temperatures. Location 2756

* Alpha-lipoic acid: This fatty acid is found inside every cell in the body, where it’s needed to produce the energy for the body’s normal functions. Location 2758

* Vitamin D: It’s a misnomer to call vitamin D a “vitamin” because it’s actually a fat-soluble steroid hormone. Location 2762
  + vitamin D protects neurons from the damaging effects of free radicals and reduces inflammation. Let me state a few key findings:15 Location 2767
  + 25 percent risk reduction in cognitive decline in individuals with higher levels of vitamin D Location 2768
  + those with the highest intake of vitamin D had a 77 percent risk reduction for developing Alzheimer’s disease. Location 2771
  + low levels of vitamin D with risk for Parkinson’s and relapse in multiple sclerosis patients. Location 2774
  + Low vitamin D levels have long been shown in medical literature to contribute to depression and even chronic fatigue. Location 2777

**CHAPTER 8 Genetic Medicine Jog Your Genes to Build a Better Brain Location 2785**

The simple act of moving your body will do more for your brain than any riddle, math equation, mystery book, or even thinking itself. Location 2792

Exercise has numerous pro-health effects on the body—especially on the brain. It’s a powerful player in the world of epigenetics. Location 2793

Aerobic exercise not only turns on genes linked to longevity, but also targets the gene that codes for BDNF, the brain’s “growth hormone.” Location 2795

The latest science behind the magic of movement in protecting and preserving brain function is stunning. It boils down to five benefits:

1. controlling inflammation,
2. increasing insulin sensitivity,
3. influencing better blood sugar control,
4. expanding the size of the memory center, and, as I’ve already mentioned,
5. boosting levels of BDNF. Location 2846

The animals that exercised were the ones who had healthier brains and outperformed on the cognitive tests. Location 2859

We know that exercise spurs the generation of new brain cells. Location 2862

Change in size of the hippocampus over 1 year comparing aerobic exercisers to those doing stretching program Location 2868

We don’t get “smarter” just by making new brain cells. We have to be able to interconnect those cells into the existing neural network, otherwise they will roam around aimlessly and eventually die. One way to do this is to learn something new. Location 2873

but we do know that BDNF plays a role by strengthening cells and axons, fortifying the connections among neurons, and sparking neurogenesis. Location 2880

***that higher levels of BDNF are associated with a decrease in appetite***. Location 2882

elderly individuals engaged in regular physical exercise for a twenty-four-week period had an 1,800 percent improvement on measures of memory, language ability, attention, and other important cognitive functions compared to a control group. Location 2886

***The results of the study revealed that those individuals in the lowest 10 percent of daily physical activity had a 230 percent increased risk of developing Alzheimer’s disease compared to those in the highest 10 percent of physical activity***. Location 2912

**CHAPTER 9 Good Night, Brain Leverage Your Leptin to Rule Your Hormonal Kingdom**

In men, lack of sufficient sleep leads to elevated levels of ghrelin, a hormone that stimulates appetite. Location 2980

Shift workers, who are notorious for keeping irregular sleep patterns due to their job responsibilities, live with a higher risk for a host of potentially serious illnesses as a result. Indeed, they don’t call it the graveyard shift for nothing. Location 3002

* hormones: leptin. Because it essentially coordinates our body’s inflammatory responses and helps determine whether or not we crave carbs, no conversation about brain health can exclude this important hormone. And it’s powerfully impacted by sleep. Location 3008
  + this isn’t just your average hormone; like insulin, leptin is a major one that ultimately influences all other hormones and controls virtually all the functions of the hypothalamus in the brain. Location 3015
  + Leptin essentially controls mammalian metabolism. Location 3032
  + leptin actually controls the thyroid, which regulates the rate of metabolism. Location 3032
  + Leptin oversees all energy stores. Leptin decides whether to make us hungry and store more fat or to burn fat. Location 3033
  + Leptin orchestrates our inflammatory response and can even control sympathetic versus parasympathetic arousal in the nervous system. Location 3034
  + When your stomach is full, fat cells release leptin to tell your brain to stop eating. Location 3038
  + And what caused this leptin plunge? Sleep deprivation. Location 3041
  + Leptin is an inflammatory cytokine in addition to playing a big part in the body’s inflammatory processes. Location 3044
  + The more refined and processed the carbohydrate, the more out of whack healthy levels of leptin and insulin become. Location 3049

**PART III SAY GOOD-BYE TO GRAIN BRAIN Location 3085**

**CHAPTER 10 A New Way of Life The Four-Week Plan of Action**

Over the course of the next month, you will achieve four important goals:

1. Shift your body away from relying on carbs for fuel and add brain-boosting supplements to your daily regimen.

2. Incorporate a fitness routine into your schedule if you don’t already have one.

3. Work on getting restful, routine sleep seven days a week.

4. Establish a new rhythm and maintain healthy habits for life. Location 3124

Determine Your Baseline Prior to beginning the dietary program, have the following laboratory studies performed, if possible. I’ve included target healthy levels where appropriate. Test Ideal level

* + fasting blood glucose less than 95 milligrams per deciliter (mg/dL)
  + fasting insulin below 8 µIU/ml (ideally, below 3)
  + hemoglobin A1C 4.8 to 5.4 percent
  + fructosamine 188 to 223 µmol/L
  + homocysteine 8µmol/L or less
  + vitamin D 80 ng/mL
  + C-reactive protein 0.00 to 3.0 mg/L
  + gluten sensitivity test with Cyrex array 3 test Location 3135

Start Your Supplements Location 3166

* alpha-lipoic acid 600 mg daily
* coconut oil 1 tablespoon daily, taken straight or used in cooking
* DHA 1,000 mg daily (Note: It’s okay to buy DHA that comes in combination with EPA; opt for a fish oil supplement or choose DHA derived from marine algae.)
* probiotics 1 capsule taken on an empty stomach up to three times daily; look for a probiotic that contains at least ten billion active cultures from at least ten different strains, including Lactobacillus acidophilus and bifidobacterium
* resveratrol 100 mg twice daily
* turmeric 350 mg twice daily
* vitamin D3 5,000 IU daily Location 3175

***Watch out for foods marked (and marketed) “gluten-free.”*** Some of these foods are fine because they never contained gluten to begin with. But many are labeled as such because they have been processed—their gluten has been replaced by another ingredient such as;

* cornstarch
* cornmeal
* rice starch
* potato starch
* tapioca starch, all of which can be equally as offensive, raising blood sugar enormously. Location 3195

***Healthy fat: extra-virgin olive oil, sesame oil, coconut oil, grass-fed tallow and organic or pasture-fed butter, ghee, almond milk, avocados, coconuts, olives, nuts and nut butters, cheese (except for blue cheeses),*** Location 3201

Low-sugar fruit: avocado, bell peppers, cucumber, tomato, zucchini, squash, pumpkin, eggplant, lemons, limes Location 3207

Protein: whole eggs; wild fish (salmon, black cod, mahimahi, grouper, herring, trout, sardines); shellfish and mollusks (shrimp, crab, lobster, mussels, clams, oysters); grass-fed meat, fowl, poultry, and pork (beef, lamb, liver, bison, chicken, turkey, duck, ostrich, veal); wild game Location 3208

Vegetables: leafy greens and lettuces, collards, spinach, broccoli, kale, chard, cabbage, onions, mushrooms, cauliflower, Brussels sprouts, sauerkraut, artichoke, alfalfa sprouts, green beans, celery, bok choy, radishes, watercress, turnip, asparagus, garlic, leek, fennel, shallots, scallions, ginger, jicama, parsley, water chestnuts Location 3211

The following can be used in moderation Location 3213

* Carrots and parsnips.
* Cottage cheese, yogurt, and kefir: Use sparingly in recipes or as a topping.
* Cow’s milk and cream: Use sparingly in recipes, coffee, and tea.
* Legumes (beans, lentils, peas). Exception: you can have hummus (made from chickpeas). Location 3215
* Non-gluten grains: amaranth, buckwheat, rice (brown, white, wild), millet, quinoa, sorghum, teff. (A note about oats: although oats do not naturally contain gluten, they are frequently contaminated with gluten because they are processed at mills that also handle wheat; avoid them unless they come with a guarantee that they are gluten-free.) Location 3219
* (choose dark chocolate that’s at least 70 percent or more cocoa). Location 3223
* Whole sweet fruit: Berries are best; be extra cautious of sugary fruits such as apricots, mangos, melons, papaya, prunes, and pineapple. Location 3224
* Wine: one glass a day if you so choose, preferably red. Location 3225

***the belief that the cholesterol we eat converts directly into blood cholesterol is unequivocally false; Location 3229***

* dietary cholesterol actually reduces the body’s production of cholesterol, and more than 80 percent of the cholesterol in your blood that is measured on your cholesterol test is actually produced in your own liver. Location 3232

whole eggs contain all of the essential amino acids we need to survive, vitamins and minerals, plus antioxidants known to protect our eyes—all for the low-low price of just 70 calories each. Moreover, they contain ample supplies of choline, which is particularly important for aiding healthy brain function as well as pregnancy. Location 3242

* Optional Fast Ideally, start week 1 after you have fasted for one full day. Location 3248
  + I recommend that people fast at least four times a year; Location 3258

WEEK 1: FOCUS ON FOOD Location 3259

* It’s imperative to lower carb intake to just 30 to 40 grams a day for four weeks. After that, you can increase your carb intake to 60 grams a day. Location 3271
* eating pasta and bread again. What you’ll do is simply add more of the items listed in the “moderate” category, such as whole fruit, non-gluten grains, and legumes. Location 3272
* You can pretty much eat as many vegetables as you like with the exception of corn, potatoes, carrots, and parsnips. Location 3297

WEEK 2: FOCUS ON EXERCISE Location 3299

WEEK 3: FOCUS ON SLEEP Location 3326

1. Maintain regular sleep habits Location 3331

2. Identify and manage ingredients hostile to sleep Location 3335

3. Time your dinner appropriately Location 3344

4. Don’t eat erratically. Location 3347

5. Try a bedtime snack Location 3349

* Go for foods high in the amino acid tryptophan, which is a natural promoter of sleep. Location 3351
* Foods high in tryptophan include turkey, cottage cheese, chicken, eggs, and nuts (especially almonds). Location 3352

6. Beware of imposter stimulants Location 3354

7. Set the setting Location 3357

8. Use sleep aids prudently. The occasional sleep aid won’t kill you. But chronic use of them can become a problem. Location 3361

WEEK 4: PUT IT ALL TOGETHER Location 3369

* Eating Out Toward the end of week 4, work on the goal of being able to eat anywhere. Location 3424
* Baked fish with steamed vegetables is likely to be a safe bet Location 3429
* ask for a side salad with olive oil and vinegar). Location 3430
* ***Instead of regular flour or wheat, try coconut flour, nut meals like ground almonds, and ground flaxseed;*** Location 3436
* Many people have applied the famous 80/20 principle to diet—eat well 80 percent of the time and save that last 20 percent for splurges. Location 3445
* This is life, and accepting a certain give-and-take is okay. But see if you can stick to a 90/10 rule. For 90 percent of the time, eat within these guidelines and let the last 10 percent take care of itself, as it inevitably does in life. Location 3448

**CHAPTER 11 Eating Your Way to a Healthy Brain Meal Plans and Recipes**

What to Drink: Ideally, stick with purified water. Location 3480

Fruit: Choose whole fruit, and during the first four weeks, aim to save fruit for a snack or as a dessert. Location 3484

Olive Oil Rule: You are free to liberally use olive oil (extra-virgin and organic). Note that in many cases, you can substitute coconut oil for olive oil during the cooking process. For instance, pan-fry fish and sauté vegetables in coconut oil rather than olive oil or scramble eggs in coconut oil for breakfast. This will help you get your daily tablespoon of coconut oil as recommended in the supplement section. Location 3486

I travel with avocados and cans of sockeye salmon. Location 3496

When choosing canned fish, opt for sustainably caught, pole- or troll-caught fish. Also steer clear of any fish that is likely to be high in mercury. Location 3498

A great site to bookmark on your computer is the Monterey Bay Aquarium’s Seafood Watch program at http://www.montereybayaquarium.org/cr/seafoodwatch.aspx. Location 3499

What to Snack On: Location 3501

* A handful of raw nuts Location 3504
* A few squares of dark chocolate (anything above 70 percent cacao). Location 3505
* Chopped raw vegetables (e.g., bell peppers, broccoli, cucumber, green beans, radishes) dipped in hummus, guacamole, goat cheese, tapenade, or nut butter. Location 3506
* Cheese and wheat-free, low-carb crackers. Location 3507
* Slices of cold roasted turkey or chicken dipped in mustard. Location 3508
* Half an avocado drizzled with olive oil, salt, and pepper. Location 3509
* Two hard-boiled eggs. Location 3510
* Caprese salad: 1 sliced tomato topped with fresh sliced mozzarella cheese, drizzled olive oil, basil, salt, and pepper. Location 3511
* One piece or serving of whole, low-sugar fruit (e.g., grapefruit, orange, apple, berries, melon, pear, cherries, grapes, kiwi, plum, peach, nectarine). Location 3513

***See book for sample menu for a week***