Bruce W. Perry

HEALTHY BY DISCOVERY

Fitness for Geeks

Real Science, Great Nutrition, and Good Health

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Fitness for Geeks

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Bruce W. Perry is a software engineer and journalist, and has written two books on software, published by O'Reilly Media. He participated in hundreds of road races and multisport events, and has since moved on to recreational alpine hiking, skiing, and resistance training.

"One need not be a geek to enjoy and benefit from the information gleaned from Bruce Perry's informative and entertaining *Fitness for Geeks*. Perry adroitly scripts each chapter to stand on its own, but I enjoyed it from cover to cover and was surprised at how much I learned."

—Jack Fultz, 1976 Boston Marathon Winner

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Fitness for Geeks

by Bruce W. Perry

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To my lovely wife, Stacy

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Preface

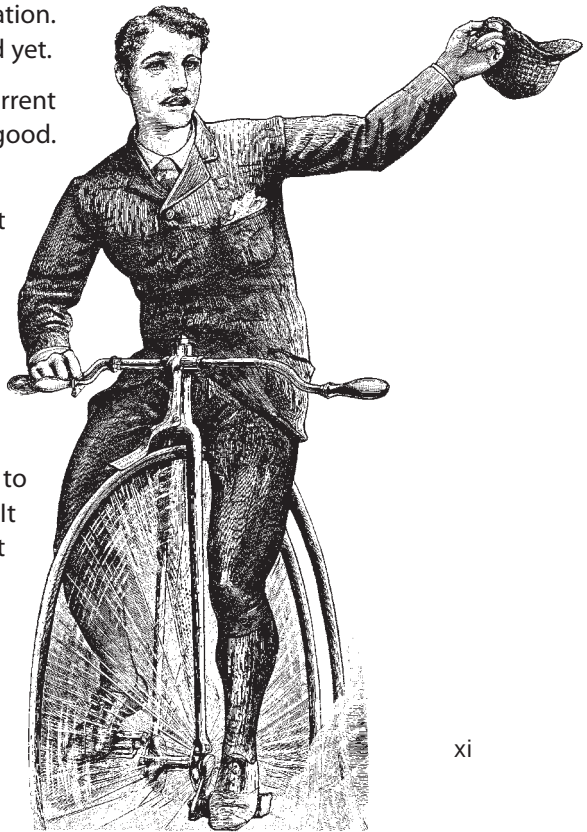
How can we define health? Ever tried to take a stab at it? I attempt to define "fitness" and "geek" here because they appear in the title. But it seems *health* is a mélange of a lot of things—genes, lifestyle, a feeling of being safe and in charge—not all of which we can put a finger on.

We tend to grope around in defining good nutrition and health. We can be too reductionist in our view of who's healthy or whether *we* are healthy, claiming that "nutrition is 90 percent of health," or that we have achieved some perfect biomarker like total cholesterol after six tests at the doctor's office, so therefore we must be healthy. Or maybe we find out our telomeres are resilient and hanging in there, or we take a long survey on the Web, and the results pat us on the back and suggest we'll live to be one hundred. Many of these things seem like feel-good, almost delusional exercises. So much about health is mysterious, yet to be discovered, and may never be discovered. I like that aspect of it, because it leads to more experimentation. Maybe your own ideas about how to stay healthy haven't been refuted yet.

This doesn't mean that you can't aim for health, particularly if your current strategy has you waking up in the morning most days feeling pretty good. That's where my "fitness" and "geek" definitions come in.

This is a book about fitness and nutrition for the independent of spirit and irrepressibly curious. The reason I have cleaved "nutrition" off from the general rubric of fitness is that, even though eating well (and the book will try to define *that* too) is part of being fit, we usually think of "fitness" as being an aspect of physical culture.

Fitness implies an underlying assumption of physical health. The *Oxford American Dictionary* defines fitness as "the condition of being physically fit and healthy." This book will discuss fitness in respect to becoming a physically stronger person and aging as well as we can. It will not advocate achieving a level of fitness, say, for a particular sport that undermines health in the process, which can actually be pretty common among all our popular extreme sports.



Mea culpa: I've done a few things in my life that some might consider extreme—like a five-hour–plus triathlon and a little mountaineering, mostly guided—but I would not claim that I was pursuing fitness during these adventures (I *was* fashioning unforgettable memories, and sometimes raising money for charity), and therein lies the difference. Since a good part of this book is about the latest and greatest gear that people are using for *self tracking*, speaking of extreme, I must pay homage here to the wonderful GoPro HD Hero helmet cams, which are tracking devices in their own right and have captured simply amazing outdoor videos for YouTube, such as that of a skier in the Alps being buried and dug out of an avalanche, and another skier launching off a cliff, unfurling a parachute, then watching an avalanche crash off the cliff behind him. Now *that's* personal tracking.

METs Anyone?

I will attempt to define fitness in terms of energy output—this book mentions *metabolic equivalent of task*, or MET, a number of times. This is a simple numerical index of the energy a person outputs during the day. So, fitness is the ability to not only have the requisite energy to get through your daily tasks, but to be intermittently capable of a high-intensity energy effort: a higher than typical MET, like lifting a heavy weight, jumping high, or running fast, relative to your age and circumstances.

We might even aspire to a more brass-tacks definition of fitness, which also comes from *Oxford-American*: the biological angle, "an organism's ability to survive and reproduce in a particular environment." You want to aspire to a level of fitness that allows you to thrive in your environment and be reasonably free of serious chronic illness. In this book's discussions of food, exercise, sleep, rest, meditation, hormesis, and other issues, I hope upon hope that readers can mine a few nuggets of information that help them "survive…in a particular environment."

The Food Angle

I like Boston Marathon winner Jack Fultz's "see food" diet—"see food and eat it" (see Chapter 7 for an interview with him)—for its simplicity. Eating in the modern world is anything but simple these days. The act of eating has been completely medicalized, and has become sociopolitically militant to boot. The vegans are hurling pies (nondairy, of course) at the meat eaters, the vegetarians are aiming online flames at the omnivores, and the raw foodists are, well, refusing to cook anything.

As you'll see in the chapter synopsis coming up, I'll provide a lot of detailed nutrition information, but it all comes down to "eat real food." Avoid processed junk and things we haven't eaten for millions of years (OK, coffee might be one exception). Yes, especially in Chapter 1, I spend a fair amount of time with the ancestral-health meme, or paradigm, that has worked its way through Western culture and among science and nutrition circles during the last few years.

The Mashed-up Ancient Angle

Humans spent hundreds of thousands of years moving around a lot outside, sleeping fairly long hours by the solar clock, and eating lots of plants and animal foods—and we carry largely the same software code inside ourselves today (human genes) as humans did back then. The closest approximations to an ancient person now are contemporary hunter-gatherers like the Maasai or the Hadzabe in East Africa, and they tend not to get our diseases.

Maybe a good part of fitness is simply getting back to our roots—not corrupting our own internal software by immobilizing ourselves in chairs, in cars, or in front of screens, moving around under the sun (making vitamin D), taking the time to sleep, and eating real food. Maybe.

Ironically enough, this is also a book about the latest technology—apps and gear that uses Global Positioning Systems, 3D accelerometers, and data connections to your own web dashboards to track personal propulsion (in running shoes and ski boots, etc.), eating, rest, and sleep. So it's a high-tech/ancient roots mashup. I certainly hope the mashup appeals and people don't find it cognitively dissonant.

Annals of Experimentation

OK, now that we kind of know what fitness is, what's a *geek*?

A geek is someone who spends a huge amount of time analyzing the fine points of whatever interests her, ad infinitum, to a level that no one around her can possibly understand.

The typical image of a geek in popular culture is the Spielbergian hero with Coke-bottle glasses who gets picked on at school, then becomes the town hero when he hacks the computers at the nearby nuclear plant that's having a meltdown. I tend to go for a broader definition, however. A geek is someone who spends a huge amount of time analyzing the fine points of whatever interests her, ad infinitum, to a level that no one around her can possibly understand. Her family members and friends are all flabbergasted and scratch their heads, until finally, with a shrug of their shoulders and a murmur of "fanatic…," they return to quotidian concerns.

When a geek focuses on fitness, that interest often manifests itself as self-experimentation. Geeks are inveterate, fearless experimenters. They want to plunge into demonstrations and proofs of conventional truths and, to this

end, subject their bodies to experiments that make others squeamish, like long fasts, "hormetic" cold-river swims, guzzling pans full of leftover beet juice and admiring the red color of their pee afterward, or sometimes just going out to a beach or mountain and sprinting like wild people.

They absolutely do not automatically accept the bland marching orders of some officially anointed expert, whether it be the company dietician, a health-network M.D. they've never seen before, or the acronym-denoted bureaucracy that is determined to lecture them about how to eat and exercise.

The several people I've interviewed in the book—including two NFL pro football players, a mountaineering guide, a national expert on vitamin C, a scientist who tests the effects of fasting on mice and tumors, an MIT scientist who studies our mTOR growth pathway, and a former Israeli soldier who studied the Spartans, Greeks, and Macedonians and made up a "warrior diet"—don't necessarily fit any kind of cultural cross-section, but I think they're all fitness geeks in their own right.

I know I've always been a fitness geek. I've kept a little text log of sleep, workouts, morning heart rate, and body composition since way before the Internet became popular. I've also been educated in English and American literature and software engineering, and have spent a fair amount of time as a software programming geek. I have found many parallels between software design and fitness geekdom, such as the whole concept of antipatterns, or learning how to do something by studying how *not* to do it first. These parallels are sprinkled throughout the book—as is a little code here and there, but you don't have to be *that* kind of geek to enjoy the reading.

The "Measure First" Mantra

The final point I'll make about fitness geeks is that measuring, whether it be with the Fitbit, Zeo, Endomondo, their own software, or a simple text file, is a big part of a fitness geek's obsession (healthy obsession, I'd say). The other day, we got a mailing from the electric utility describing our home's energy usage and comparing it to that of our neighbors. We're usually right in the middle, leaning toward the most efficient and not the most gluttonous, but this time we had used way too much energy. I handed my 15-year-old daughter the graph of our energy usage and the local comparisons—"Here, you might find this interesting."

Lo and behold, I started to find yellow sticky notes all over the house, at outlets and on appliances, containing tips on how we can reduce our electricity use. Cool! The old cliché is, "What gets measured gets managed." The same is true with measuring health and fitness—the biofeedback makes a *big* difference.

How to Use This Book

This is a book that you can read from cover to cover, but you don't have to approach it linearly. You can bop in and out of it—"Hey, today I'm going to read something about macronutrients or fasting." Each chapter definitely stands on its own, so happy sampling.

This isn't a book that prescribes exactly how to eat and exercise. "If you do A, B, C, and D, you will be healthy—trust me." So many of those books come and go. I admire the determination and temerity of their authors to find the one pathway to Elysium. This book is, however, chock-full of ideas—mostly not mine originally, but certainly tested by me—of ways that you can tinker with your lifestyle and body and move into a different, healthy direction. I do appeal to some general paradigms, though, which I've mentioned—to eat real food, move around a lot, sleep copiously (things you've heard of before)—and I look at a lot of different tools that geeks have invented to help you measure and share your progress.

In terms of pursuing personal, optimal health, it's not selfish—let's shake that monkey off our backs. It's the fit person who has the energy and availability to be charitable, help others, and give more of herself.

I suppose the pursuit of optimal fitness for yourself is a lofty goal, and it's the path you take to get there that provides all the fun, stimulation, and gratification. In terms of pursuing personal, optimal health, it's not selfish—let's shake that monkey off our backs. It's the fit person who has the energy and availability to be charitable, help others, and give more of herself.

Chapter 1: *Fitness and the Human Codebase: Reboot Your Operating System*

> Too many of us are living in chairs (including the front seat of your Honda Civic or Ford Explorer), eating processed fake stuff on the run, and eschewing sleep for cable TV and social media. Isn't our internal software designed for something—Monty Python enter here—completely different? Isn't there a way we can live in the modern digital world and still feel physically vibrant? We look at cultivating respect for and seeking the wisdom of the ancients, as well as the evidence for rebooting our installed code and thus reacquainting ourselves with real food, sleep, and the great outdoors.

Chapter 2: *Fitness Apps and Tools*

> There's a lot of gear now that's designed to promote fitness, as well as for just plain time-wasting fun. *Self-tracking* is a bona fide movement among humans. Want to track your exercise (even weightlifting), analyze your chow, and view your sleep graphs for the week? There are apps and widgets for that, and more. We look at stuff like the Fitbit, Endomondo, Fitocracy, Alpine Replay, Garmin Connect, Google Earth mashups, and nutritiondata.com, among others (Zeo is covered in Chapter 9).

Chapter 3: *Macronutrients*

This is the first of two heavyweight chapters on nutrition before we turn to the "kicking up your heels" part of existence later in the book. We explore everything you always wanted to know about carbs, fats, and proteins, and then some stuff you probably didn't, like Rabbit Starvation Syndrome (the joy of living on seal fat) and the effect of fructose on your liver.

Chapter 4: *Micronutrients*

This chapter looks at everything you always wanted to know about vitamins, minerals, and phytochemicals, including some stuff that might have slipped past the school nurse during those vitamin lectures, such as "antinutrients" and what spinach might be doing to your mineral absorption, and the sorrows of vitamin deficiencies (and how easy it is to avoid them).

Chapter 5: *Food Hacks: Finding and Choosing Food*

Shouldn't you just see food and eat it? Yeah, I suppose if you were wandering through a dystopian-blasted landscape with Terminators in pursuit, but these days we can be a little more nuanced about choosing food. As in, do your wandering through weekly farmer's markets, find out what a CSA is, and get to know your local farmer (get to know him *really* well). This chapter also offers with some ideas for dealing with food shortages, price increases, and food deserts.

Chapter 6: *Food Timing: When to Eat, When to Fast*

This chapter also has a nutritional bend, but from a different angle—*not* eating for intermittent periods and the health benefits of fasting. We talk to a scientist that studies the metabolic effects of fasts, and we discuss numerous variations of fasting protocols and some of the stuff that happens with your body during fasting. We also interview the inventor of the "warrior diet," which can involve eating for only four hours per day. Hey, the Spartans did it.

Chapter 7: *The Other World: A.K.A. Outside*

This chapter looks at the absolute joy and necessity of being outside (we're programmed for it), from the point of view of walking, sprinting, hiking, body-weight exercises, running, and skiing. You learn how to do Tabata sprints, a pull-up, and your own resistance-exercise regimen on a remote beach. We talk to a former Boston Marathon winner and a mountaineer. We bring in some of our favorite tools: Endomondo, Google Earth, and Alpine Replay. And hey, I'll bet you never knew what *friluftsliv* was!

Chapter 8: *Hello Gym! Navigating the Fitness Facility*

You decide you gotta join the gym and get strong. Now what? We give you a rundown on the basics of resistance exercise in the gym (yeah, we figure you get the most bang for your buck by aiming to add and retain lean mass). The chapter talks about sets, reps, volume, and "repetition max," then it jumps into descriptions of about 15 different techniques, including photos and links. We talk to two NFL pro football players about the not-so-casual aspects of getting strong enough to withstand a profession as modern gladiator.

Chapter 9: *Randomizing Fitness and the Importance of R & R*

Ever written a `random( )` method or function in your code? Did you know that randomizing fitness, as in letting an algorithm choose a random exercise for you, might be good for you? We propose a couple of ways that you could do that (the CrossFit world has a "workout of the day" tradition), including the gainfitness.com tool. We also discuss an online tool for determining if an athlete is rested and ready to go, called RestWise. Last, but not least, is the all-important topic of sleep—and this is where you get a look at a nice piece of gear for the power sleepers of the analytic set: the Zeo Sleep Manager.

Chapter 10: *Code Maintenance: Human Fueling and Supplements*

Once you start going crazy on bumping up your outdoor and indoor activities, you have to start paying even more attention to nutrition. You suddenly start eating to get stronger and/or faster, not just because you're hungry. This chapter discusses some of the nuances, such as eating more of everything to add muscle, the magic hour after exercise for chowing, as well as a few supplements you might consider based on the science literature. We interview an MIT scientist about the mTOR pathway, which is the core biochemical sequence, buried just about everywhere in your body, that controls growth of both good (muscle) and bad (tumor) stuff. That's right, it's anabolic.

Chapter 11: *Lifestyle Hacks for Fitness*

There are so many different *potential* ways that you can hack fitness (and at least delight in the experimentation, even if they don't really work). This chapter discusses a few of them that probably do work, many falling under the rubric of hormesis, or good stress. Try cold-water swims, saunas, a nice glass of vintage grape (but not three), plus high-intensity exercise (also hormesis). "The world breaks everyone," Hemingway wrote in *A Farewell To Arms*, "and afterward many are strong at the broken places."

Acknowledgments

I always wanted to write a whole book about fitness, even before I became a geek (wait, I guess I always was a geek, they just didn't have a word for it yet—*curious dork*?). I absolutely never would have published this book, however, without the help of numerous other people.

I'll start with my family. My parents, Anne and Robert Perry, brought me up in Concord, Massachusetts (back then a land of rebels, geeks, writers, and readers), and constantly made sure that either I had a book in front of me or I was running around playing outside. No matter how hard he'd worked that day, my dad always took me outside to throw baseballs at him (note the suggestion of inaccuracy). Thereby a "fitness geek" was born. I'm grateful for everything they have done for me.

Stacy LeBaron, my wife, constantly lends her encouragement, not to mention indefatigable assistance, along with our two dear, fit children, Rachel (black belt in martial arts) and Scott (slick downhill skier in Vermont). It's tough to carve out time to write a book, and these guys are constantly covering for me so I can escape to the Vermont woods to write, not to mention inspiring new ideas with their feedback.

I'm grateful to all the busy scientists, researchers, professors, athletes, inventors, and all-around fitness geeks who took the time out of busy schedules to answer my questions, after I had "cold emailed" them out of the blue. This would have been a far lesser book without their input.

I thank my editor Brian Sawyer, who shepherded the book along from the beginning, as well as the rest of the O'Reilly team and Bob Watson, Lindsay Peterson, and Meghan Johnson, the tech reviewers, whose feedback and perspicacious efforts have made this a better book.

I'd also like to acknowledge you, the reader, and your pursuit of health for health's sake, which ends up benefitting everyone, not just yourself. Keep experimenting!

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Fitness and the Human Codebase: Reboot Your Operating System

1

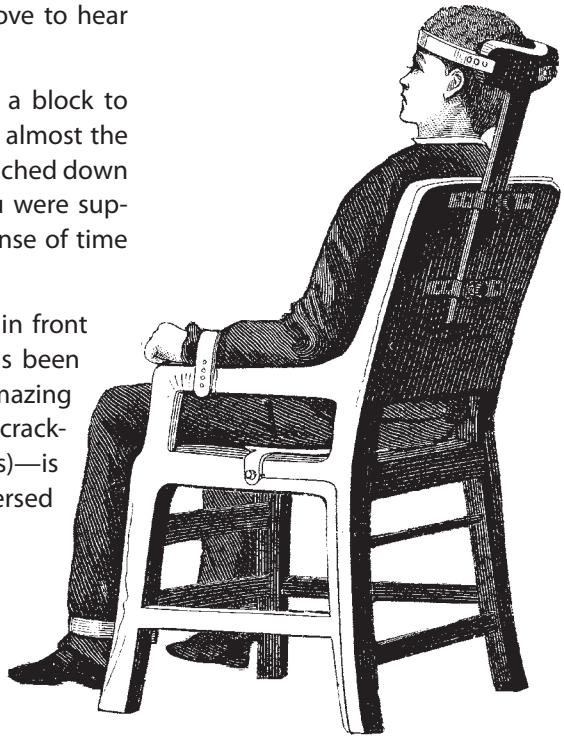
You get up in the morning with the shades yanked down, after having collapsed under the covers at some indeterminate time past midnight (which followed several robotic hours of Facebook typing). Luckily, you'd set the coffee maker on a timer, so a quart of strong joe waits on the kitchen counter. Twelve ounces of that washes down a toasted bagel smeared with extra margarine and jelly, as you're out the door on the way to a 45-minute car commute.

It's just the beginning of a marathon bout of sitting.

The Cubicle Blues

Sound familiar? When you get to work it's an elevator ride off to the cubicle, where you refill the to-go coffee mug with joe that already tastes old, and someone's left an open box of donuts in convenient proximity. You write code until you're cross-eyed, interspersed with two meetings where you sit on your behind listening to two marketing/admin guys who love to hear themselves pontificate.

At lunchtime, you take the elevator downstairs and walk half a block to Subway, where you buy a "healthy" tuna n' cheese sub, which is almost the size of the baseball bat you used in Little League. Half of it is munched down before you get back to your cubicle and that C++ module you were supposed to finish by 5:30, which rolls around with an amazing sense of time squashed into a smaller space than you ever needed it to be.



A few times during the day, you join the crowd congregating in front of the vending machines (to which an entire work enclave has been devoted). The temptation to push a couple of buttons on this amazing invention and get *something*—chips (many varieties), a Pop-Tart, crackers and tuna salad (yup, they have those in vending machines)—is overwhelming. The lively sounds of conversation are interspersed with the ripping noise of little bags being opened.

Movement, We Hardly Knew Ye

You wanted to exercise, but… it's back to the car commute and "dinner" (consisting of a Diet Pepsi and the rest of the sub while driving), when it dawns on you that you could not tell someone whether you actually walked in or physically sensed any sunlight that day. You get home, slump down onto a couch in the familiar sitting position, and, well, you feel like the bloody indefinable thing your big old cat, Hooch, who now eyes you with an inscrutable neutrality, dragged home that day.

Ditto the next day.

Free-Falling

What's wrong with this picture? Okay, so the implications of this narrative are pretty obvious. Hope I didn't lay it on too thick. You probably spent most of the day as a "chair liver."

… a bunch of scientists, fitness experts, philosophers, economists, anthropologists, medical doctors, and overall outside-the-box thinkers, have come up with the sensible hypothesis that we are designed according to our ancestors, who lived in a different way than the latter narrative.

The food you ate was "bad for you" (or simply not particularly good), and you didn't take any opportunities to move your limbs around, beyond pumping your fist in the air during an online glimpse of *ESPN SportsCenter*. You failed to stand up or walk for a reasonable period of time. The sun, bestowing life on earth, has become a stranger.

It's not your fault, you argue silently, with at least a little credibility. The work/commute schedule is crazy. You're lucky enough to have *any* job that pays pretty well.

Homing In on a Design Pattern

The messages your body undoubtedly sends you, however, roughly translated as *I feel like crap*, probably indicate that you're not really designed to live this way. In fact, a bunch of scientists, fitness experts, philosophers, economists, anthropologists, medical doctors, and overall outside-the-box thinkers have come up with the sensible hypothesis that we are *designed* for our ancestors' way of living, which was very different from the latter narrative.

We were not born to be chair livers, eating factory fare and keeping sleep hours like a vampire (unless we're in college, that is). Chapters 3, 4, 7, 8, and 9 will fill in just about all you need to know about eating right, kicking up your heels, and getting some rest. We need to find another design pattern.

DESIGN PATTERNS FOR CODE AND FITNESS

Men and women who write code for a living usually know something about design patterns. Design patterns are reusable strategies for solving common problems or tasks. The programming world borrowed this concept of design patterns from architecture—you have design strategies for buildings that always work, so why not reuse them instead of reinventing the wheel?

An example of a design pattern in object-oriented programming (OOP) is the Object Factory. OOP is a way of designing software based on the real world. If you have a website, and people join it as members, you might code a "Member" object so that you can separate that unit of `Member` code and have it only deal with aspects of memberships.

But you constantly need to create new `Members` in your code, because your website is so popular. So, the Object Factory is a piece of code whose sole purpose is to create new distinct `Members`. Every time your code needs to create a new `Member` (and store it in a database), it calls the Object Factory's `getNewMember( )` method or operation. Problem solved.

Your fitness can also be based on a common design pattern—get sunlight, movement, natural food, sleep, affection, love—which we derive from our very deep past. Much of our behavior can spin off this "human design pattern."

Preinstalled Software

I tend to agree with the meme, or paradigm, that has made its way about the Web and even among the scientific journals (call it "paleo," ancestral health, the return to Eden, or whatever you want to) that we were born to move around in sunlight, eat real food, and sleep much more than our friends want us to (you know, the ones who are knocking on the door right now and trying to get you to go to that party).

As a geek, think of our situation this way. We're all born with preinstalled software, our human codebase. The genome. You know, the curlicues of DNA in our chromosomes inside the nuclei of most cells: all that ATGC code that defines what we are biologically. It is kind of cool, almost mesmerizing, how Mother Nature seems to have her own software language. Perhaps we've subconsciously invented computer programs that have the look and feel of our own internal code.

> *See this page at 23andMe for a nice refresher or primer on genes and genetics: www.23andme.com/gen101/genes/.*

It took hundreds of thousands of years to write this software. The evolutionary process is very slow, meaning we haven't changed very much in thousands of years. We're all separated by tiny changes in our genes, such as the fact that some people can't digest lactose that well and others eat asparagus and sense a different smell in their pee (really).

> *"The spontaneous mutation rate for nuclear DNA is estimated at 0.5% per million years. Therefore, over the past 10,000 years there has been time for very little change in our genes, perhaps 0.005%," comments Artemis P. Simopoulos, M.D., of The Center for Genetics, Nutrition and Health, Washington, DC, USA, in a journal article from 2008.*[1]

The Pre–Convenience Store Era

Our ancestors, with basically our genome, ate dead meat (as in, scavenged), wild meat that they hunted, stuff that grew, tree nuts, whatever lake or sea foods they could grab, and gobs of raw honey produced by swarms of bees made docile by the smoky fires lit beneath their nests.

Some of the time, as the weather was changing crazily around them (sound familiar?), they couldn't find any food, for days—for weeks.

Whatever, essentially, our earliest forebears could eat to remain alive, they *did* eat. It all had to be hunted and wild; they didn't have bodegas or convenience stores back then. They had to move *to* the food (no pizza deliveries or fancy caterers), and often had to chase and subdue it, if not fend off other predators who sought to reclaim their carcasses. They were outside a good chunk of the time during daylight hours.

We're so close to these ancient forebears biochemically that molecular biologists have hypothesized a link from each of us to an ultimate Mom, a primordial Eve (see the sidebar, "The Ultimate Super Mom").

Imagine that you're standing next to your grandmother in a long line. She is standing next to her mother, and then your grandmother's grandmother is the next Mom in line after that, and the string of people extends for "10,000 grandmothers," as the author Brian Fagan puts it in his book *Cro-Magnon: How the Ice Age Gave Birth to the First Modern Humans*. The 10,000th grandmother might be the ultimate Mom that all humans are related to.

THE ULTIMATE SUPER MOM: MITOCHONDRIAL OR AFRICAN EVE

Our genetic ancestors are tens of thousands of years old, and we still carry their primeval DNA in our genome. For example, genetic scientists have created deep "family trees" that are designed to trace every person in the world down the line through all the mothers and grandmas to the same woman, a kind of "super Mom" who lived roughly 150,000 years ago in East Africa.

She's called "Mitochondrial Eve" because the mitochondrial DNA (mtDNA) is where the genetic connection between ourselves and a grandmother who theoretically existed 10,000 generations ago resides.

The mitochondria are organelles within most cells, little engines that generate much of our cellular energy. They are the places, other than the cell nuclei (where most DNA is located), that also contain our genetic blueprint. A major difference between the gene copy in the mitochondria and the copy in the nucleus of a cell is that mitochondrial DNA is inherited only from the mother—it isn't mingled together with the father's DNA.

This allows scientists to focus their analysis of genes from mother to mother as far back as they can.

The work of these molecular biologists and other scientists is a reflection of how tightly interrelated we are as humans, as well as of how close our own genes are to those of prehistoric people. "The African Eve is a fictional person, a product of molecular biology, which has used mitochondrial DNA to show that all of us, wherever we live, are ultimately of African descent," writes Brian Fagan in *Cro-Magnon: How the Ice Age Gave Birth to the First Modern Humans*.

Ancestors

The human genome goes back at least as far as about 2.5 million years, when the Lower Paleolithic era began (otherwise known as the early *Stone Age*). Actually you could trace our genes back quite a bit further, but for the sake of brevity we'll start with an upright ancestor that used tools 2.5 million years in the past called *homo habilis*.

He was followed by *homo erectus*, who trekked around his wild habitat (and often booked out of there as fast as he could) around one million years ago, and *homo sapiens* about half a million years ago. The most advanced and successful ancestor who wandered out of our original African habitat and established herself in Europe was *Cro-Magnon*, who thrived in that region beginning about 50,000 years ago. We're quite similar, anatomically and genetically, to these guys and gals.[2]

> *Few would disagree that a modern hunter-gatherer, or even a Cro-Magnon, is living or lived closer to our built-in design than most of us cubicle cronies!*

Five Seconds to Midnight

The typical way to express the idea of us carrying the preinstalled software of those prehistoric guys and gals is that if those millions of years of human evolution could be compressed into a 24-hour clock, the last 10,000 years since the Agricultural Revolution would take place beginning at about five minutes to midnight.

The last 200 years of the Industrial Revolution began to take place at about five seconds to midnight. And the Digital Age… well, you get the metaphor. It's been an eye blink, and evolution is not fast enough to redesign us for endless couch surfing!

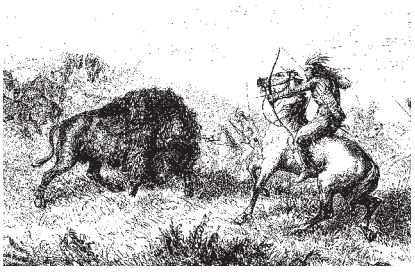
Designed to Get Our Butts Kicked

It's safe to say that the hunter-gatherers and us moderns are pretty similar in our genetic programming.

"Shallow" genetic changes that can dig in their heels faster are taking place all the time, according to Gregory Cochran and Henry Harpending's book *The 10,000 Year Explosion: How Civilization Accelerated Human Evolution*. These are variations on our genome; see the sidebar "Night of the Mampires: How Genes Can Affect the Way We Handle Food."

About 99 percent of our genetic history, however, has been spent interacting with our environment more like a Maasai tribeswoman, a Plains Indian, or a modern lady getting her butt kicked during an Outward Bound course, rather than the characters depicted in the TV show *Men of a Certain Age*.

The last two hundred years of the Industrial Revolution began to take place at about five seconds to midnight. And the Digital Age, well… you get the metaphor. It's been an eye blink, and evolution is not fast enough to redesign us for endless couch surfing!



This has something to do with those eighteenth- to nineteenth-century Plains Indians being the buffest bad-asses in the world during their time.[3] They were hunters who acted like hunter-gatherers and killed, ate, made stuff out of, and revered the American bison.

Here's another evolution-related example, partly from Chapter 4 on micronutrients. We can't biosynthesize or make our own vitamin C or vitamin E, as plants can (although we *can* biosynthesize vitamin D, from the sun). We therefore evolved to get vital micronutrients like vitamins *from those photosynthesizing plants*, as well as farther up the food chain, from the animals that munched the veggies. It's part of our design; we eat plants and animals because, in turn, we need the C and E vitamins to keep our internal machinery going.

To reach the plants and animals, guess what, we had to be moving around in a cyclical pattern of hunt-gather-rest, then do-it-again. We are bipedal people, ambulatory by nature. Whether or not at any moment we could have been ripped asunder and devoured by wild beasts or stomped to death by the underestimated prehistoric bison (you can't really sugarcoat that Paleolithic life, pun intended), this scenario still represents the diet and locomotive patterns that our ancestors, and we ourselves, were and have evolved for.

NIGHT OF THE MAMPIRES: HOW GENES CAN AFFECT THE WAY WE HANDLE FOOD

Although people most likely have not developed complex genetic adaptations to a diet dominated by sugar, wheat flour, and vegetable oils, we do display code differences in our ability to handle some foods.

Many of us are *mampires*: we can consume and digest the milk from other animals.

Lactase is an enzyme that is necessary for digesting milk. According to the book *The 10,000 Year Explosion: How Civilization Accelerated Human Evolution*:

> *The most dramatic examples are mutations that allow adults to digest lactose, the main sugar in milk. Hunter-gatherers, and mammals in general, stop making lactase (the enzyme that digests lactose) in childhood… But after the domestication of cattle, milk was available and potentially valuable to people of all ages, if only they could digest it. A mutation that caused continued production of lactase originated some 8,000 years ago and has spread widely among Europeans, reaching frequencies of over 95 percent in Denmark and Sweden.*[4]

Humans also differ in their tolerance for salt in the diet, according to the book:

> *There is a gene whose ancestral form helps people to conserve salt. Since humans spent most of their history in hot climates, this variant was generally useful. A high frequency of this ancestral allele among African Americans probably plays a role in their increased risk of high blood pressure today. In tropical Africa, in fact, almost everyone has the ancestral version of the gene. In Eurasia, a null variant (one that does nothing at all) becomes more and more common as one moves north.*[5]

So the genetic difference helps people to conserve salt in their bodies in hot climates, but it becomes a liability when you eat a lot of salt in processed foods.

Finally, the book points to evidence that some people are metabolically protected against certain blood-sugar problems:

"Researchers in Iceland have found that new variants of a gene regulating blood sugar protect against diabetes."[6] The upshot is that we're not exact replicas of hunter-gatherers; we're just very close to them.

The Cranky Anthropologist

Is it possible to live in a way that completely undermines your own software configuration? Are we corrupting our own code? Well, yeah, I guess that's where I'm leading, based on the aforementioned hypothesis of our closeness in design to our ancient forebears. Scientists call it *evolutionary discordance*.

The anthropologist Jared Diamond fumed in a famous essay from more than 20 years ago that the move to agriculture 10,000 years ago was "the worst mistake in the history of the human race" (*Discovery Magazine*, May 1987) and "a catastrophe from which we have never recovered."

Diamond emphasized the rigid class-based systems and "gross social and sexual inequalities, the disease and despotism" that agricultural systems have bred, but there were other physical and health-related downsides as well, which persist in a different nature all the way up to modern times.

> *Don't get the wrong impression from my knocks against the Ag Revolution—I love farms, particularly of the small and local variety. I just returned from one, with a juicy bag of salad materials, Macintosh apples, and blueberries. The point of this passage is that the transition from hunter-gatherer to the diet of agriculturalists had bad health consequences that are relevant today (i.e., we're still bedeviled by a high-quantity, low-nutrition diet).*

See the sidebar "A Tale of Hoe" for what the effect of the agricultural transition was on height and health in general.

A TALE OF HOE: PROTEIN AND THUS HEIGHT "TANKED"

"[Agriculture] vastly increased food production, but the nutritional quality of the food was worse than it had been among hunter-gatherers," according to *The 10,000 Year Explosion: How Civilization Accelerated Human Evolution*.[7]

"Hunter-gatherers would rarely have suffered vitamin-deficiency diseases such as beriberi, pellagra, rickets, or scurvy, but farmers sometimes did… it looks as if the carbohydrate fraction of their diet almost tripled, while the amount of protein tanked."[8]

Height crashed in response to this "quantity not quality diet," as did the robustness of the skeletons that paleoanthropologists have studied. The average Cro-Magnon male was between 5' 9" (176 centimeters) and 5' 10"; they were built athletically to boot.

"You can see the mismatch between the genes and the environment in the skeletal evidence. Humans who adopted agriculture shrank: Average height dropped by almost five inches."[9]

Hey, the Stone Age Was a Nasty Time

The oft-stated disclaimer is that all this hunter-gatherer talk is baloney: human longevity has never been greater than it is now, and even inside bustling, youth-oriented places like Manhattan, you can find many centenarians. In contrast, the lives of our Paleolithic ancestors were "nasty, brutish, and short," maybe averaging a third or less the length of one of those centenarians'.

A big problem with that argument, as a number of essayists have pointed out, is the concept of using an "average lifespan" to describe the health of a population of people.

As Jeff Leach pointed out in an October 2010 letter titled "Paleo Longevity Redux" in *Public Health Nutrition*:

> *The first problem with this thinking is the "average life span" math is misleading and tells us very little about the health and longevity of an individual, but rather gives us an average age of death for a given group or population. For example, a couple that lived to the ages of 76 and 71, but had one child that died at birth and another at age two ([76+ 71 + 0 + 2] / 4), would produce an average life span of 37.25. Using this methodology it is easy to see how one would come to the conclusion that this group was not very healthy.*

Along the same lines, the author of *The Black Swan*, Taleb Nassim, pointed out in an essay called "Why I Walk":

> *The argument often heard about primitive people living on average less than 30 years ignores distribution around such average—life expectancy needs to be analyzed conditionally. Plenty died early, from injuries, many lived very long—and healthy—lives. This is exactly the very same elementary "fooled by randomness" mistake, relying on the notion of "average" in the presence of variance, that makes people underestimate the risks in the stock market.*

Undoubtedly, some of those ancient lives were "nasty, brutish, and short," and inherently violent, without antibiotics, modern medicine in general, and a local police department.

In a way, the claims about brief Paleolithic lives are a red herring: the few remaining modern hunter-gatherers tend to go through their lives with only rare occurrences of the contemporary "diseases of Western civilization."

Jeff Leach concludes his essay:

> *The self-confidence that comforts us today as we review the average life span of our ancestors is misguided and tenuous when viewed through the captivating haze of modern medicine that literally props most of us up into our golden years. I doubt our ancestors would call this living. While we may live longer than our ancestors, we are in fact dying slower.*

The Modern Diet—It's Lame!

Note the "mismatch between genes and the environment" point in the "Tale of Hoe" sidebar. Things are at least as bad now in modern society as they were during the dawn of the agricultural age (at least those early farmers spent a lot of time outside doing hard-scrabble chores in sunlit gardens).

The World Health Organization estimates that lifestyle-oriented diseases will cost the global economy $30 trillion over the next 20 years (that includes smoking and alcohol abuse, as well as chowing down sugary and salt-laden snack foods).[10]

Couldn't we do a better job of embracing a new design pattern, one based on our own inherited operating systems?

What's going on here—why do we have such a massive health crisis? Don't our experts have an incredibly deep and nuanced knowledge about how health and the body function? We've sequenced the human genome. We're even working on "nutrigenomics," or specifically tailoring nutrition and supplements to a person's genes.

I guess health isn't *exclusively* about science, medical practices, or conventional public-health recommendations, or we'd be able to apply that knowledge about how to stay healthy with greater success than we do. Couldn't we do a better job of embracing a new design pattern, one based on our own inherited operating systems?

Evolutionary Discordance: It's SAD

In a 2005 article in the *American Journal of Clinical Nutrition*, the medical doctor Boyd Eaton and his colleagues pointed out how lame the diet many of us depend on—which is commonly lampooned as the Standard American Diet (SAD)—is:[11]

> *Although dairy products, cereals, refined sugars, refined vegetable oils, and alcohol make up 72.1% of the total daily energy consumed by all people in the United States, these types of foods would have contributed little or none of the energy in the typical preagricultural hominin diet.*

In a word, ouch!

Boyd Eaton also pointed out in a recent speech that "50 percent of our ancestor's diet was fruits and vegetables; now for Americans it's 13 percent, which represents a huge [decline]" in antioxidant intake (see the sidebar in Chapter 4 on those all-important antioxidants). "The skin of the fruit contains most of the antioxidants, and the smaller wilder fruits contain more antioxidants," given that you have to eat more fruit skin with the smaller, wilder varieties to fill up on fruit servings.

Taking this point to heart, I ate a lot of apples off an apple tree in Vermont this summer and early fall. The apples were smaller; I thus ate more skin and presumably antioxidants compared with larger, sweeter, store-bought apples. The apples were tarter off the tree, perhaps containing less fructose (you should watch the fructose load in your diet—see Chapter 3 on macronutrients). And hey, I had to jump and climb to get the apples, which had to be more active than cruisin' the checkout aisles!

Don't Crash Your Own Software

"As a result of the introduction of habitual physical inactivity into the pattern of daily living, the risks of at least 35 chronic health conditions have increased…"

Eaton and his colleagues have hypothesized, along with other researchers, that the "diseases of civilization," like cancer, heart disease, diabetes, and depression, could be caused by this evolutionary discordance in food intake.

In addition, some studies have pointed to the lack of physical exercise as more evidence that we are badly out of sync with our built-in codebase.

"Recent cultural changes have engineered physical activity out of the daily lives of humans," pointed out Manu Chakravarthy and Frank W. Booth in the *Journal of Applied Physiology* in 2004:[12]

> *As a result of the introduction of habitual physical inactivity into the pattern of daily living, the risks of at least 35 chronic health conditions have increased…we will speculate that the feast-famine cycling and physical activity-rest cycling that were related to food procurement for [hunter-gatherers] selected genes for an oscillating enzymatic regulation of food-storage and usage.*

If physical activity is part of our design, why did we engineer it out of our lives? One answer is the pervasiveness of technology, which it turns out controls us, rather than the other way around. Screen life requires immobility in front of screens. In addition, we no longer have to "go get" vitamins to stay alive—they're within an arm's reach on the shelf or easily acquired without even leaving a sitting position in the car (although convenience foods often lack those very vitamins). Modern food is ubiquitous.

Ironically, our own built-in "man-page" (the software instructions for the Unix operating system) carries the imprint of our earliest low-tech ancestors, and provides many clues for maintaining fitness.

A Useful Template

Of course, most of us cannot dash out the back door and give the hunter-gatherer life the old college try.

Nor can I advocate that we all sprint out into the woods with scary face masks and beat drums, throw spears at shadows, and howl at the moon (although, now that I mention it, what a blast *that* would be). We *can* initiate a kind of mashup of modern and ancient life, though. Our preloaded software represents a useful template with which we can assess our own daily choices. We know what we're designed for; we read this book!

We've discussed nutrition a bit up to now; the rest of the book launches into the savory subjects of food, fitness, and exercise in quite a bit of detail. The movement angle of fitness is obviously very important, but to what degree?

Chair Men of the Bored

Will Ferrell leans back in the movie *Wedding Crashers* and memorably cries out, "Hey Ma—the meatloaf—we want it now—the meatloaf!" He crystallizes an evolving biological tribe we could call *Homo barcalounger*.

We've become a species of sitters, as eloquently put by a doctor in a recent online issue of the *Brooklyn Eagle*: [13]

> *We move from the chair in the car to the chair in front of the computer in the office; then we go home in the chair in the car to the chair in front of a copious dinner to the chair in front of the TV. The next day the cycle repeats itself. We sit too much.*

Believe it or not, scientists have coined a term for this trend: *chair living*. It has been a part of cubicle life for us geeks since the early epochs of the digital age, but many of us, along with others of the deskbound variety, have since altered our workstations to combine standing with computer work (check out the stand-up workstation called the GeekDesk at *www.geekdesk.com*).

Chair living apparently takes sedentary living to a new level.

If you're like me, you probably think of sitting as an activity that is as common as, well, standing, and that might be bad for you if you did it for 25 years in a row. It's *much* worse than that, apparently.

As James Levine, an M.D. at the Mayo Clinic in Minnesota, wrote in a November 10, 2010, journal article, "a growing body of evidence suggests that chair-living is lethal… linked to cardiovascular disease, metabolic [problems], excess weight, and shorter life span."[14]

You can read that article and weep, then, consequently, leap out of your chair. Levine goes on:

> *The human evolved over several million years to be bipedal and ambulatory. This time frame is consistent with the genetic and epigenetic design of the human physique and organ systems. Neuro-behaviorists would argue that the human brain and behavior evolved in concert. The human evolved to competitively flourish while upright with respect to providing food (agriculture and hunting), shelter (home building), and tool design (e.g., flint knives). The human evolved to feed, shelter, and invent while ambulatory. The human, simply put, was not designed to sit all day.*

The Amazin' MET

The bottom line is that you want to push up your MET for the day, because it's what we're designed for.

A very useful measure of how much we are moving throughout the day is the metabolic equivalent of task (MET), or just metabolic equivalent. It's a simple way to quantify our energy output, and it starkly underlines the differences between sitting and real movement. The MET is designed to represent the amount of energy in the form of heat we're generating, using a numeric multiple. For example, reclining in a chair is 1 MET; sleeping is 0.8.[15]

This scale moves all the way up through walking about a mile per hour on the flat (1.9), actively raking leaves (2.9), light biking or golf (5.0), to running 12-minute miles (8.5), to running faster than nine miles an hour (9.5).

We're going to be returning to METs throughout this book, particularly in the tools and exercise chapters. For example, Chapter 2 discusses a nifty little gadget called the Fitbit that you can use to measure your average MET for a day.

The bottom line is that you want to push up your MET for the day, because it's what we're designed for. We seem to be evolved for a steady oscillation of physical activity throughout the day, along with short bursts of intense, almost scary effort (yeah, exercise can be hormesis!—see Chapter 11).

> *Olden-days hunter-gatherers almost certainly had a higher average MET than our contemporaries.*

Force Quit—Reboot

By now it should be obvious that we are built to eat Mother Nature's food, such as wild (or wild-like) meat or fish, and multicolored plants that come from organic farms and leap from the pages of *Mother Earth* magazine. We're supposed to boogie down, and we're not designed for self-imposed muscular paralysis. You might even think that this chapter belabors these points, which would amount to a harangue if not for the fact that most of these negative trends are instantly reversible.

I won't include much in this chapter about the specifics of fitness-oriented exercise and training, because so much of the book (see Chapters 2, 7, and 8) is crammed with various techniques for sprinting, resistance training, trekking (with or without weighted vests), and more for capturing all of your exercise data on a web page for various forms of analysis.

This chapter will conclude on an upward swing with the flip side of the "daily grind" we began with. It includes a couple of adjustments that bring it much closer to our installed software base—and our own pursuit of optimal fitness.

And Now for Something Completely Different

Try this: you wake up without an alarm sometime soon after sunrise, with plenty of time to spare to make it to work.

It was a good sleep; you went to bed just after nine o'clock after having a snack consisting of coconut milk blended with blueberries and a little whey powder. You're already savvy about getting enough REM sleep, but now you aim to bump up your deep sleep, or restorative NREM. You might even check out the wave chart your Zeo produced.

The first thing you do is pour a cup of black tea or coffee and go outside to this pool of sunlight you've noticed out your window.

You bask and reflect in it for a minute, perhaps followed by a few Tai Chi moves, push-ups on the lawn, or pull-ups on the jungle gym across the street from your apartment. You sip a bit more coffee and return to your living space to get ready for the commute.

Technically speaking, as you gazed up into the sky and basked in that sun, the light rays touched your retinas and were transduced by the hypothalamus and pineal gland in your brain, which has now helped set your circadian rhythms for the day.

Mindfulness

The sun you got wasn't much, not like spending the morning on the beach in the British Virgin Islands (gotta do that someday…), but it had the effect of lightening your mood, clearing your head, and kick-starting the day. You've sent the message to your body and your brain, "It's morning and I'm well rested and ready to go." (See Chapter 9 for more info on the health importance of sleep and rest.)

Every other day you stop at an intervening fitness facility to lift a few weights or do a 300-yard swim interspersed with a handful of 25-yard sprints—nothing too much, but today you're biking to the train station, where they've thoughtfully included a place to lock your rig.

The train ride into the center of the city (Boston, New York, San Francisco, Seattle, Portland, Vancouver, Montreal; Zurich, Frankfurt, Copenhagen, London, Sydney, Wellington, Tokyo, Osaka, Kyoto…) takes 35 minutes, and you stand for most of it, just because it feels better.

Geek Gear

You kind of want to rack up more activity points on this web-connected, motion-sensitive, stair-counting altitude calculator you've clipped onto your belt (yeah, it's called a Fitbit), although gear isn't strictly necessary this morning. It's just fun, in a geeky kind of obsessive way. You like quantifying and logging your exercise. This act itself seems motivating. The web charts your gear generates later are actually quite impressive. They can show your oscillating movement throughout the day, and pinpoint the days when you need more.

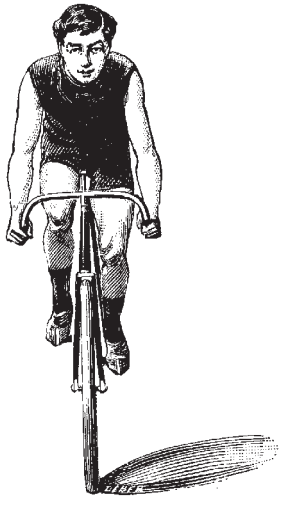
Gathering data is not useless when you act upon it.

The tool for adding up your daily motion mileage works with an odd "tail wagging the dog" effect; you seem to move more when you're wearing it. Further, you never really knew that ordinary movement could equate to that much mileage during the day. More than six miles sometimes, even though your walks were broken up into several smallish ones.

Plodding along on a treadmill just isn't necessary anymore. You love looking at the stats at the end of the day. Just keep moving, you say to yourself. Seek the sun.

Hard-Boiled Eggs to Go

It's morning and I'm well-rested and ready to go.



Breakfast today was two hard-boiled eggs (eggs bought the previous weekend at a farmer's market), a piece of Swiss cheese, a bite of salmon left over from last night, and two plums plus an avocado (also purchased at the market). Yesterday, you fasted through breakfast, and that felt fine. Actually, the bit of coffee plus "intermittent fast" kept you pretty perky throughout the morning. (See Chapter 6 for more on intermittent fasting.)

You've got a little plastic bag in your backpack containing the rest of the salmon, a mixture of almonds and walnuts, an apple, and a square of 85% high-cacao chocolate. In a pinch, there's a good salad place near work. It only took a couple of weeks not to miss that bagel anymore, and especially all that crappy margarine (you go for really yellow butter now)—the sluggishness and lack of satiety it seemed to leave you with, and the way it seemed to take half the morning to digest it and the donut and scone you piled on top of it.

Hopping off the train, you walk about 30 minutes the rest of the way to work, on the sunny side of the street, even though you could have dipped into the subway or hopped on a bus.