

introduction

GO AHEAD AND MULTIPLY the number $8,388,628 \times 2$ in your head. Can you do it in a few seconds? There is a young man who can double that number *24 times* in the space of a few seconds. He gets it right every time. There is a boy who can tell you the exact time of day at any moment, even in his sleep. There is a girl who can correctly determine the exact dimensions of an object 20 feet away. There is a child who at age 6 drew such lifelike and powerful pictures, she got her own show at a gallery on Madison Avenue. Yet none of these children could be taught to tie their shoes. Indeed, none of them have an IQ greater than 50.

The brain is an amazing thing.

Your brain may not be nearly so odd, but it is no less extraordinary. Easily the most sophisticated information-transfer system on Earth, your brain is fully capable of taking little black squiggles on this piece of bleached wood and deriving meaning from them. To accomplish this miracle, your brain sends jolts of electricity crackling through hundreds of miles of wires composed of brain cells so small that thousands of them could fit into the period at the end of this sentence. You accomplish all of

this in less time than it takes you to blink. Indeed, you have just done it. What's equally incredible, given our intimate association with it, is this: Most of us have no idea how our brain works.

This has strange consequences. We try to talk on our cell phones and drive at the same time, even though it is literally impossible for our brains to multitask when it comes to paying attention. We have created high-stress office environments, even though a stressed brain is significantly less productive. Our schools are designed so that most real learning has to occur at home. This would be funny, if it weren't so harmful.

Blame it on the fact that brain scientists rarely have a conversation with teachers and business professionals, education majors and accountants, superintendents and CEOs. Unless you have the *Journal of Neuroscience* sitting on your coffee table, you're out of the loop.

This book is meant to get you into the loop.

12 brain rules

My goal is to introduce you to 12 things we know about how the brain works. I call these Brain Rules. For each rule, I present the science and then offer ideas for investigating how the rule might apply to our daily lives, especially at work and school. The brain is complex, and I am taking only slivers of information from each subject—non-comprehensive but accessible.

The companion documentary film and interactive tutorials at www.brainrulesbook.com are an integral part of the project. You might use the film as an introduction, and then jump between a chapter in the book and the Web site. A sampling of the ideas you'll encounter:

- For starters, we are not used to sitting at a desk for eight hours a day. From an evolutionary perspective, our brains developed while working out, walking as many as 12 miles a day. The brain still craves the experience, especially in sedentary populations like our own. That's why exercise boosts brain power (Brain Rule #2) in such populations. Exercisers outperform couch potatoes in long-term memory, reasoning, attention, problem-solving tasks, and more. I am convinced that

integrating exercise into our eight hours at work or school would only be normal.

- As you no doubt have noticed if you've ever sat through a typical PowerPoint presentation, people don't pay attention to boring things (Brain Rule #4). You've got seconds to grab someone's attention, and only 10 minutes to keep it. At 9 minutes and 59 seconds, something must be done quickly—something emotional and relevant. Also, the brain needs a break. That's why I use stories in this book to make many of my points.

- Ever feel tired around 3 o'clock in the afternoon? That's because your brain really wants to take a nap. You might be more productive if you did: In one study, a 26-minute nap improved NASA pilots' performance by 34 percent. Even so, the brain isn't resting while it sleeps. It is surprisingly active. And whether you get enough rest affects your mental agility the next day. Sleep well, think well (Brain Rule #7).

- We'll meet a man who can read two pages at the same time, one with each eye, and remember everything in the pages forever. Most of us do more forgetting than remembering, of course, and that's why we must repeat to remember (Brain Rule #5). When you understand the brain's rules for memory, you'll see why I want to destroy the notion of homework.

- We'll find out why the terrible twos only look like active rebellion but are actually a child's powerful urge to explore. Babies may not have a lot of knowledge about the world, but they know a whole lot about how to get it. We are all natural explorers (Brain Rule #12), and this never leaves us, despite the artificial environments we've built for ourselves.

no prescriptions

The ideas ending the chapters of this book are not a prescription. They are a call for real-world research. The reason springs from what I do for a living. My research expertise is the molecular basis of psychiatric disorders, but my real interest is in trying to understand the fascinating distance between a gene and a behavior. I have been a private consultant

for most of my professional life, a hired gun for research projects in need of a developmental molecular biologist with such specialization. I have had the privilege of watching countless research efforts involving chromosomes and mental function.

On such journeys, I occasionally would run across articles and books that made startling claims based on “recent advances” in brain science about how to change the way we teach people and do business. And I would panic, wondering if the authors were reading some literature totally off my radar screen. I speak several dialects of brain science, and I knew nothing from those worlds capable of dictating best practices for education and business. In truth, if we ever fully understood how the human brain knew how to pick up a glass of water, it would represent a major achievement.

There was no need to panic. You can responsibly train a skeptical eye on any claim that brain research can without equivocation tell us how to become better teachers, parents, business leaders, or students. This book is a call for research simply because we don’t know enough to be prescriptive. It is an attempt to vaccinate against mythologies like the “Mozart effect,” left brain/right brain personalities, and getting your babies into Harvard by making them listen to language tapes while they are still in the womb.

back to the jungle

What we know about the brain comes from biologists who study brain tissues, experimental psychologists who study behavior, and cognitive neuroscientists who study how the first relates to the second. Evolutionary biologists have gotten into the act as well. Though we know precious little about how the brain works, our evolutionary history tells us this: The brain appears to be designed to solve problems related to surviving in an unstable outdoor environment, and to do so in nearly constant motion. I call this the brain’s performance envelope.

Each subject in this book—evolution, exercise, wiring, attention, memory, sleep, stress, sense, vision, gender, and exploration—relates

to this performance envelope. Motion translates to exercise. Environmental instability led to the extremely flexible way our brains are wired, allowing us to solve problems through exploration. Learning from our mistakes so we could survive in the great outdoors meant paying attention to certain things at the expense of others, and it meant creating memories in a particular way. Though we have been stuffing them into classrooms and cubicles for decades, our brains actually were built to survive in jungles and grasslands.

I am a nice guy, but I am a grumpy scientist. For a study to appear in this book, it has to pass what some at The Boeing Company (for which I have done some consulting) call the MGF: the Medina Grump Factor. That means the supporting research for each of my points must first be published in a peer-reviewed journal and then successfully be replicated. Many of the studies have been replicated dozens of times. (To stay as reader-friendly as possible, the extensive references are not embedded in this text but are at www.brainrulesbook.com.)

What do these studies show, viewed as a whole? Mostly this:

If you wanted to create an education environment that was directly opposed to what the brain was good at doing, you probably would design something like a classroom. If you wanted to create a business environment that was directly opposed to what the brain was good at doing, you probably would design something like a cubicle. And if you wanted to change things, you might have to tear down both and start over.

In many ways, starting over is what this book is all about.