ELEVATE YOUR GAME, AVOID BURNOUT, AND THRIVE WITH THE NEW SCIENCE OF SUCCESS

PEAK PERFORMANCE

BRAD STULBERG | STEVE MAGNESS

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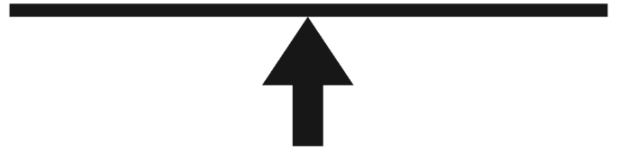

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RODALE

We inspire health, healing, happiness, and love in the world.
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FOREWORD

Is Healthy, Sustainable Peak Performance Possible?

In the summer of 2003, a precocious 18-year-old sat nervously on a grass field flanked by eight lanes of a warmup track, awaiting the final call to the starting line. This wasn't your ordinary high school track meet, or even a state championship; this was the Prefontaine Classic, the crown jewel of track-and-field. A few days earlier, the same 18-year-old was sitting in his physics class thinking about his high school crush, Amanda. Now, he was sitting amidst the best runners in the world, wondering how he'd measure up in the sport's preeminent event—the mile.

As he watched stars such as Olympic medalist Bernard Lagat execute their intricate prerace rituals, he tried to distract himself by playing his Game Boy; he stuck out like a sore thumb. A few long minutes later, when the athletes were summoned from the warmup area to the starting line, he was forced to leave the comfort of the video game *Super Mario Bros.* In a futile attempt to stay calm while entering the packed Hayward Field, located on the campus of the University of Oregon—a running mecca if there ever was one—he kept repeating the mantra, "Don't look up, don't look up." The top of his head, not his face, was broadcast across the country, live on NBC. Before he could process that he was lining up next to Kevin Sullivan, who had placed fifth at the previous Olympics, his name was suddenly belted out over the loud speaker. Any illusion of calm was shattered. A wave of anxiety coursed through his body. Whatever little food

was in his stomach rose into his chest. "Shit. Here we go," he thought, as the starter raised his gun. "Just don't puke."

Four minutes and 1 second later, it was all over. In that short time, he had become the sixth fastest high school miler in the history of the United States, the then-fastest high school miler in the country, and the fifth fastest junior in the world. He had gone toe-to-toe with collegiate superstar Alan Webb, who had a 3:53 mile to his credit and who would eventually set the American record of 3:46. He finished within arm's reach of Olympian Michael Stember and passed the then–US mile champion Seneca Lassiter, who promptly dropped out of the race after the high school kid left him in the dust on the final lap. In other words, he had officially become a teenage prodigy.

Even so, the disappointment that came with finishing just shy of the sport's magical 4-minute mile was evident. When the official results were announced, the NBC broadcast showed a wiry, completely depleted kid, hands covering his face. As the initial flood of emotion wore off, however, he couldn't help but revel in a bit of hard-earned contentedness. He thought to himself, "I'm 18 years old and running in the biggest professional meet in the country; breaking 4 minutes will soon be an afterthought."

NBC's color commentators were cooing over the performance of the high school kid. "You got to say something about a kid who can stay that disciplined," they remarked. If only they knew.

Reaching this level of performance demanded more than just talent and hard work. Ask those who knew him and a single descriptor invariably came to mind: obsessive. It was the only word that fit. Friends and family repeated this word so often that it could have easily been dismissed as trite and cliché. Except it wasn't.

His days were a monotonous pursuit of excellence. Wake up at 6 a.m., head out the door for a 9-mile run, go to school, lift weights, and then run

another 9 miles at 6 p.m. In order to avoid injury and illness, he adhered to a rigid diet and religiously went to bed hours before his peers. His life was an exercise in willpower and self-control.

He insisted on sticking to his training plan always, even if that meant running 100 miles during a week-long cruise vacation—circling the 160-meter track on the top deck until not fatigue but dizziness stopped him. He ran through tropical storms, summer heat advisories, and family emergencies. No natural or human disaster could prevent him from getting a workout in. One more example of his obsession manifested itself in his love life, or lack thereof. Apologies are long overdue for the unfortunate girlfriend with whom he cut things off simply because his racing had gone south during their courtship, even though she, of course, had nothing to do with it. His obsession surfaced every weekend when he regularly chose his 10 p.m. bedtime over parties and opportunities to meet girls. In other words, he was far from your average high school boy, but then again, average high school boys don't run 4-minute miles. He had the rage to master: an unending, unrelenting resolve to do everything he could to reach his goals. And it was paying off.

He was one of the fastest documented 18-year-olds on the planet and one of the fastest high school runners in the history of the sport. He received recruiting letters from nearly every university in the country, ranging from athletic powerhouses like Oregon to bastions of academic prowess like Harvard. His dreams were filled with Olympic rings, medals, and thoughts of conquering the world. And they were all realistic.

A FEW YEARS LATER, across the country in Washington, DC, a young man was preparing for his first day at a new job. He hurried out the door after his usual morning hygiene routine—brush teeth, shave, shower, get dressed, and go—a routine he'd condensed into 12 minutes. His morning routine hadn't always been such a sprint. But after 2 years of working at the elite consulting firm McKinsey & Company, he'd applied to his own life

the uncanny efficiency that he'd helped Fortune 500 companies achieve. No waste. No downtime. Completely streamlined. The sole pitfall of his uber-efficient mornings was that it caused him to sweat, which was only exacerbated by a tight-fitting suit and the thick humidity of summer in Washington, DC.

A single thought dominated the first 10 minutes of his walk to work: stop sweating. He wasn't accustomed to the suit, which was a step up in dress code required by the new job. He'd have to alter his morning routine: either build in more time or lower the water temperature in the shower. Maybe both. He was good at this kind of analytical thinking. In the months prior, he built a model that projected the economic impact of United States health care reform, a sweeping and messy legislation that would shake up multiple industries. His model had made its way around the Beltway, and experts, most of whom were twice his age, agreed it was pretty damn good. It undoubtedly helped him land his new gig.

When he turned onto Pennsylvania Avenue, however, his thoughts shifted away from which variable of his morning routine he'd alter first. "Holy shit," he thought, "this is awesome," as he arrived at number 1600, the White House. There, he'd be working for the prestigious National Economic Council, helping to advise the president of the United States on health care.

Like most exceptional performers, this young professional's journey to the White House was rooted in a combination of good DNA and hard work. He scored highly on an early childhood IQ test, but not off the charts: His verbal intelligence was exceptional, but his mathematical ability and spatial skills were quite ordinary, if that. He worked his ass off in school, regularly choosing to immerse himself in philosophy, economics, and psychology rather than in booze and parties. Though he was good enough to play small-school collegiate football, he instead chose to attend the University of Michigan and focus singularly on academics.

His scholarly success attracted recruiters from the prestigious consulting

firm McKinsey & Company. At McKinsey, he quickly earned a reputation as a top performer. In whatever time remained at the end of his 70-plus-hour workweeks, he practiced his presentation skills and read the *Wall Street Journal*, the *Harvard Business Review*, and countless economics books. His friends often joked that he was "anti-fun." No doubt he was grinding, but he was enjoying it, too.

His performance at McKinsey soared on an upward trajectory, and he got staffed on increasingly high-profile projects: It wasn't long before he was counseling the CEOs of multibillion-dollar companies. That's when, in the winter of 2010, he was asked to build the previously mentioned model that would forecast the effects of United States health care reform, a herculean task. Imagine being confronted with 50 variables, all of which interact with one another and none of which is certain, and then being asked: "Tell us what is going to happen, and do it on this spreadsheet."

He dug in and worked harder than ever before. If he wasn't losing sleep because he was working, he was losing sleep because he was anxious that he wasn't working. His hands and feet constantly felt cold. Doctors told him it was stress, though they couldn't be certain; his visits were all conducted via phone—there was no way he had time for an actual appointment during normal business hours.

But he got the work done, and the model worked. It was effective and elegant. Insurance companies and hospitals all over the country used it. As a matter of fact, it worked so well that the White House called and asked if he would help them implement the law. He'd be a few reports away from the president. His friends who once joked he was "anti-fun" now joked that he might run the country one day. In this fast-paced world of high-stakes problem solving, he was a rising star. He was a few months shy of his 24th birthday.

By now you may be wondering: Who are these people, and how can I emulate their success? But that's not the story we're here to tell.

The high school running phenom never ran a step faster than he did

that summer day at the Prefontaine Classic. And the young-gun consultant didn't go on to run for office or make partner at an esteemed firm. As a matter of fact, he left the White House and hasn't received a promotion since. Both runner and consultant shined extremely bright, only to see their performance plateau, their health suffer, and their satisfaction wane.

These stories aren't unique. They happen everywhere and can happen to anyone. Including us. We, the authors of this book, are the runner (Steve) and the consultant (Brad).

We met a couple years after we had both burnt out, and as we shared our stories over a few beers, we realized they were quite similar. At the time, we were both beginning our second lives: Steve as a performance scientist and budding coach of endurance athletes, and Brad as an emerging writer. Both of us were embarking on new journeys, and we couldn't help but wonder: Could we reach the highest levels of performance without repeating our previous failings?

What started out as a two-person support group morphed into a close friendship founded upon a shared interest in the science of performance. We became curious: Is healthy, sustainable peak performance possible? If so, how? What's the secret? What, if any, are the principles underlying great performance? How can people like us—which is to say, just about anyone—adopt them?

Consumed by these questions, we did what any scientist and journalist would do. We scoured the literature and spoke with countless great performers across various capabilities and domains—from mathematicians to scientists to artists to athletes—in search of answers. And like so many other reckless ideas conceived over a few glasses of alcohol, this book was born.

Is healthy, sustainable peak performance possible? If so, how? What's the secret? What, if any, are the principles underlying great performance? How can people like us—which is to say, just about anyone—adopt them?

We can't guarantee that reading this book will set you on a

path to winning Olympic gold, painting the next masterpiece, or breaking ground in mathematical theory. Genetics play an unfortunately undeniable role in all of those things. What we can guarantee, however, is that reading this book will help you nurture your nature so that you can maximize your potential in a healthy and sustainable way.

INTRODUCTION

Great Expectations

Let's start with a simple question. Have you ever felt pressure to perform? If you answered no, perhaps you've hacked some meditative, Zen-like trance. Or maybe you just don't care much about, well, anything. In either case, this book probably isn't for you. But if you answered yes, then you can consider yourself to be like just about everyone else on the planet. So read on!

Whether in school, the office, the artist's studio, or the arena, at some point most of us have experienced a desire to take our game to the next level. And that's a good thing. The process of setting a goal on the outer boundaries of what we think is possible, and then systematically pursuing it, is one of the most fulfilling parts about being human. It's also a good thing that we want to take our game to the next level because, more than ever, we have no other choice.

The majority of this book is focused on showing you *how* to improve your performance. But first, let's set the stage by briefly exploring *why* doing so is more imperative than ever.

The process of setting a goal on the outer boundaries of what we think is possible, and then systematically pursuing it, is one of the most fulfilling parts about being human.

UNPRECEDENTED PRESSURE

The bar for human performance is at an all-time high. New athletic records are being set weekly. College admissions requirements are at

The bar for human performance is at an all-time high.

unprecedented levels. Cutthroat competition is common in nearly every corner of the global economy. In his book *The Coming Jobs War*, Jim Clifton writes that we are on the precipice of "an all-out global war for good jobs." It would be one thing if a disgruntled employee was saying this on a ranting blog. Clifton, however, is anything but that. He is the chairman and CEO of Gallup, the global research firm that has an international reputation for its rigorous and scientific approach to polling. Clifton goes on to explain that recent polling at Gallup unequivocally shows that global competition has led to a shortage of "good jobs for good people." As a result, he writes, "An increasing number of people in the world are miserable, hopeless, suffering, and becoming dangerously unhappy."

Clifton paints a scary picture; unfortunately, he's right. Data shows the use of antidepressants by Americans has risen by 400 percent in the past decade and anxiety is at an all-time high. Though these conditions may have genetic roots, they are most likely also triggered by the environment we live in, the one that Clifton describes.

To grasp how we arrived at such an environment, we need look no further than the electronic devices we grasp most of the day. By placing the entire world within a few taps and swipes, digital technology opens up access to talent in a big way. Both the number of people available to do a given job and the places where a given job can be done have increased dramatically. Dan Schawbel, a human resource expert and author of the *New York Times* bestseller *Promote Yourself,* puts it this way: "This isn't the workplace of 10 years ago. There's a lot of pressure. And it's competitive in the sense that anyone in the world could take your job for less money, so you have to work harder." And in the workplace of 10 years from now, it won't just be other people we need to compete against but also a superhuman species that never tires and requires little self-care.

COMPETING AGAINST THE MACHINES

The use of computers, robots, and other sources of artificial intelligence is increasingly exerting pressure on human performance. This often happens in such subtle ways that we don't even notice. For example, by using ever more sophisticated technology to eliminate the need for physical space, inventory, and a salesforce, companies like Amazon can drive down their operating costs. This allows them to sell just about anything we might want at hugely discounted prices. But there is a dark side to such online megastores: the vast number of jobs they make obsolete. Indeed, the rise of Amazon marked the fall and eventual bankruptcy of some of their competition, notably the iconic brick-and-mortar bookstore Borders. At its peak, Borders employed about 35,000 people. That's a lot of lost jobs. The scariest part of this story is that, today, Amazon sells far more than books, and the company is starting to explore how it can deliver almost everything not with humans but with mechanical drones. Still happy with your Prime membership?

The use of computers, robots, and other sources of artificial intelligence is increasingly exerting pressure on human performance.

It's not just retail and sales jobs that machines are crowding out. Zeynep Tufekci, PhD, a professor at the University of North Carolina who studies the social impacts of technology, writes, "The machines are getting smarter, and they're coming for more and more jobs." Over the past decade, machines have learned how to process regular spoken language, recognize human faces and read their expressions, classify personality types, and even carry out conversations.

Tufekci isn't alone in her concern about technology's escalating impact on humans. Some of the world's brightest minds agree. Physicist Stephen Hawking, serial inventor Elon Musk, Google's director of research Peter Norvig, and others cosigned an open letter calling for researchers to take special care in developing new artificial intelligence. Hawking told the BBC, "The primitive forms of artificial intelligence we already have proved

very useful. But I think the development of full artificial intelligence could spell the end of the human race."

This book isn't about doomsday scenarios in which we find ourselves at war with machines. But in more ways than one, we are already waging that war. And in order to keep up with the machines, we will need to up our game. It's inevitable.

COMPETING AGAINST EACH OTHER

In 1954, when Sir Roger Bannister became the first ever person to run a mile in under 4 minutes, many thought it represented the outer limits of human performance. Shortly after crossing the tape, Bannister remarked, "Doctors and scientists said that breaking the 4-minute barrier was impossible, that one would die in the attempt. Thus, when I got up from the track after collapsing at the finish line, I figured I was dead."

Today, more than 20 Americans break the 4-minute barrier *every year.* When athletes in other countries, including running powerhouses such as Kenya and Ethiopia, are taken into account, experts speculate hundreds of people run sub-4 miles annually. Heck, some runners even do *training intervals* at this pace. Nuts is the new normal. Just look at the current mile record—3 minutes and 43 seconds—set by Hicham El Guerrouj in 1999. Sir Roger wouldn't even have been on the same straightaway when El Guerrouj was crossing the finish line.

In nearly all sports in which we compete against a clock, what were world records a half century ago are now regularly surpassed by high schoolers. Team sports, too, have become increasingly competitive over time. In 1947, the average height of a professional basketball player was about 6 feet 4 inches. Today, that number has grown to 6 feet 7 inches. It's not just genet-

In nearly all sports in which we compete against a clock, what were world records a half century ago are now regularly surpassed by high schoolers.

ically determined physical traits like height that have increased but also skills. If you watch game tape from the 1950s, you'll notice that even the point guards—the players who specialize in ball handling—dribbled almost exclusively with their dominant hand. Today, nearly every player on the court appears to be ambidextrous.

Why and how did this happen? Much like in the traditional economy, in the economy of sports the emergence of a global talent pool has increased the number of people "in the game" with ideal genetics for a specific sport as well as the number of people willing to dedicate themselves to achieving greatness. Layer on enhanced and more scientific training, nutrition, and recovery methods, and it becomes easier to comprehend the 16 seconds separating El Guerrouj and Bannister.*

Increased pressure to perform is ubiquitous across domains. This is a movement with no end in sight, and if Stephen Hawking is right, we may only be experiencing the beginnings of it. It should come as no surprise, then, that people are going to great lengths in search of an edge.

GOING TO GREAT LENGTHS

Have you ever walked into a GNC, Vitamin Shoppe, or any other supplement vendor? If you have, and if you're anything like us, you've probably wondered: Who buys all these pills, powders, and shakes? Judging by the numbers, the answer is, well, just about everyone. Although only a tiny minority of the developed world's population has mineral or vitamin deficiencies that stand to benefit from supplementation, annual revenue in the global supplement industry regularly exceeds $100 billion.

Even more remarkable are the outlandish claims made by many of the

* We'd be remiss not to mention doping, or the illegal use of performance enhancing drugs. Unfortunately, doping has played an undeniable role in far too many record performances, something we explore in much more detail in this book. Still, the general uptick in performance across all of athletics is far too great to be attributed solely to doping.

manufacturers of top-selling supplements and related products. Take, for instance, a product called neuro Bliss—a drink that promises to reduce stress and enhance brain and body function. It sells for over $2 a bottle. While the company's website says, "In a fast-paced world, neuro drinks help to level the playing field," we've yet to see any science that backs up this claim. Yet neuro Bliss continues to be a popular-selling drink. People are desperate for an edge—any edge—even if there is no science to suggest that such an "edge" exists. Unfortunately, this kind of desperation is often the first step down a dangerous path into the world of exploiting controlled substances for performance enhancement.

It was exam time at a major university and a student whom we'll call Sara couldn't help but notice a trend that was making her a bit more nervous than usual. More and more of her peers, students she'd be measured against, were taking Adderall. Intended to treat attention deficit hyperactivity disorder (ADHD), or the clinical inability to pay attention and focus, Adderall combines the stimulants levoamphetamine and dextroamphetamine, yielding what in essence is a tempered version of the street drug speed.

Although many experts believe the naturally occurring rate of ADHD is somewhere in the neighborhood of 5 to 6 percent of the population, data from the Centers for Disease Control and Prevention (CDC) show that the diagnosis is being made at twofold rates, or in about 11 percent of American youth. But from Sara's perspective, just about everyone on campus was using Adderall, regardless of whether they had an ADHD diagnosis or a prescription for the drug.

Why might this be the case? According to WebMD, which is a likely source for college students who are looking for a layman's description of a drug, Adderall "increases the ability to pay attention, concentrate, stay focused, and stop fidgeting." Never mind side effects that include loss of appetite, stomach pain, nausea, headache, insomnia, and hallucinations. These students, who had no sign of ADHD, were using Adderall like a

steroid for the brain to get a psychological edge. This student drug abuse is much like athletes who abuse steroids in sports, where drugs initially intended to treat medical conditions are used illicitly by healthy individuals to gain a physical edge. Some researchers estimate that 30 percent of students turn to stimulants like Adderall for nonmedical reasons. Not surprisingly, Adderall misuse is most common during periods of high stress, for instance during exams. Countless students report that the drug reduces fatigue while it increases reading comprehension, interest, cognition, and memory.

For a recent investigative report, CNN asked student-users about their experiences with Adderall. The answers sound like an infomercial:

- "The fact that it's illegal doesn't really cross my mind. It's not something that I get nervous about because it's so widespread and simple."
- "I just feel very alive and awake and ready for challenges that come my way."
- "I'm on page 15 of my paper in just a few hours . . . and I'm very confident in it."

No wonder Sara is feeling a bit under the gun. "I won't use [it] because I think it's cheating, but it's rampant—just rampant," she says.

It'd be bad enough if the illicit use of drugs in search of an edge were confined to academic settings, but it seems this trend is becoming increasingly pervasive in the professional workplace as well. Kimberly Dennis, MD, is the medical director for a substance-abuse center outside of Chicago. She says she's observed a dramatic uptick in the use of drugs like Adderall in professionals ages 25 to 45, who, just like students, are looking to gain even the slightest advantage.

One such worker, Elizabeth, told the *New York Times*, "It is necessary—necessary for survival of the best and smartest and highest-achieving people." During the process of founding an innovative health technology

company, Elizabeth sensed that working hard simply wasn't enough. She felt she had to put in more time, and sleep was getting in the way. So she turned to Adderall. "Friends of mine, people in finance and on Wall Street, are traders and had to start at five in the morning and be on top of their games—most of them were taking Adderall. You can't be the sluggish one . . . it's like this at most companies I know with driven young people—there's a certain expectation of performance."

Anjan Chatterjee, MD, chief of neurology at Pennsylvania Hospital and author of *The Aesthetic Brain*, sees the use of workplace productivity drugs as the "probable future." Americans will continue to work longer hours and take fewer vacations. "Why not add drugs to energize, focus, and limit that annoying waste of time—sleep?"

Though it may seem like a dire one, Chatterjee's prediction is not unique. Another expert who agrees with him is Erik Parens, a behavioral scientist at the ethics think tank The Hastings Center. He says that the epidemic of stimulant use in America is simply a symptom of modern life: on your game 24/7, tethered to your email, needing to perform better today than you did yesterday. But that doesn't mean this lifestyle, nor the stimulant use required to support it, is a good thing. As we'll soon learn, drugs or no drugs, performing in this nonstop manner without sufficient rest is suboptimal at best and dangerous at worse. A culture that pushes people to break the law and cheat just to stay in the game, let alone get ahead, is not a good one—nor is it sustainable.

A culture that pushes people to break the law and cheat just to stay in the game, let alone get ahead, is not a good one.

When Chatterjee and other experts talk about workplace doping, they often draw analogies to sports—intensely competitive, high-stakes, win-at-all-costs environments where even the most marginal advantage can produce huge gains. Unfortunately, if the workplace is truly moving in the same direction as sports, that's very bad news for everyone.

BIGGER, FASTER, STRONGER—BUT AT WHAT COST?

Home run records, Tour de France yellow jerseys, and Olympic medals represent feats of superhuman performance. Unfortunately, many of these performances have proven to be just that: superhuman. They are illusions aided by pharmacological resources and medical sophistication that rivals what you'd find at the best hospitals. Although less than 2 percent of dopers are caught, research suggests that up to 40 percent of elite athletes use banned substances to enhance their performance. More than a quarter of the athletes we watch on TV could be competing dirty.

While it's easy to think the problem is limited to the upper echelons of sport, that couldn't be further from the truth. Doping is alive and well in collegiate, high school, and amateur athletics. A 2013 survey conducted by the Partnership for Drug-Free Kids showed that 11 percent of high schoolers used synthetic human growth hormone (HGH) at least once in the prior year. Let that sink in. Eleven percent of teenagers are injecting a chemical rendition of the body's most powerful hormone straight into their developing bodies. Perhaps the only thing more disconcerting is that these high schoolers might be drawing inspiration from their parents.

It's unfortunate but true. Competitive weekend warriors—middle-age amateur men and women trying to win their age group in running, cycling, and triathlon races—have increasingly been caught using performance enhancing drugs. The problem is so large that the governing bodies of these sports are implementing drug testing programs even for those who aren't racing for a paycheck. David Epstein, a well-respected investigative reporter who covers doping, dug deep into the world of performance enhancing drug (PED) use among weekend warriors. What he found isn't pretty: He says that some $120 billion are attributed to "anti-aging," much of which is the peddling of steroids to middle-age men. This market is only destined to grow as baby boomers, with their disposable incomes and desire to stay young and competitive, grow older. Epstein sums up the situation in the report's title: "Everyone's Juicing."

The consequences of this performance-at-any-cost culture cannot be overstated. Unbelievable performances, the type that once lifted individuals to stardom, are now literally unbelievable. Whenever anyone does something great, be it on campus, at the workplace, or on the playing field, we are forced to question their integrity. As Michael Joyner, MD, an expert on human performance at the Mayo Clinic, says, "We live in a world where all exceptional performances are suspect." However sad this state of affairs may be on a cultural level, it's perhaps even worse on an individual one. This is especially the case for those who, like the student Sara, choose to compete clean and not to sacrifice their health and morality. As a result, people like Sara are forced to raise their game to an illusory bar. Far too often, the outcome is a bad one.

Unbelievable performances, the type that once lifted individuals to stardom, are now literally unbelievable.

BURNOUT

A 2014 survey of over 2,500 companies in 90 countries worldwide found that a pressing challenge for most modern employers is "the overwhelmed employee." Workers, perhaps fearful that they must always be "on" because someone else will be, check their cell phones almost 150 times per day. And when they swipe to the right on their devices, what they find is an utterly overwhelming amount of information. One study found that more than half of white-collar workers believe they've reached a breaking point: They simply can't handle any more information, and they report feeling demoralized as a result.

Even so, regardless of how futile our efforts might be, we feel compelled to keep up. This urge is especially common among Americans. Only a third of American workers say they take a proper lunch break (i.e., leave their desks). The other 66 percent opt to eat while working, or not at all. It's not just lunch that Americans are working through, but dinner, nights, and weekends, too. In an aptly titled paper, "Americans Work Too

Long (And Too Often at Strange Times)," economists Daniel Hamermesh and Elena Stancanelli found that 27 percent of Americans regularly work between 10 p.m. and 6 a.m., and 29 percent of Americans do at least some work on the weekends.

It would be one thing if we were making up for our workaholic tendencies by taking elongated breaks to recharge and rejuvenate. But that's not the case. On average, American workers leave 5 vacation days unused at the end of each and every year. When you add all of this up, as Gallup did in 2014, you find that the typical American workweek is 47 hours, not 40. In other words, American workers are grinding away for almost an entire extra day each and every week. Against this backdrop, it's by no means shocking that 53 percent of American workers report feeling burnt out.

American workers are grinding away for almost an entire extra day each and every week.

Nonstop, frenetic work won't just leave us feeling completely depleted; it's also bad for our health. One extreme case is that of 21-year-old Moritz Erhardt, an intern at Bank of America Merrill Lynch who, after working 72 hours straight, was found dead in his shower. According to an autopsy, he died of an epileptic seizure that might have been triggered by fatigue. Shortly after Erhardt's tragic death, Goldman Sachs, another preeminent investment house, put a restriction on the number of hours interns could work in a day: 17.

Less extreme than Erhardt's awful story, but far more common, are cases where unsustainable workloads and constant tension contribute to anxiety, depression, insomnia, obesity, infertility, blood disorders, cardiovascular disease, and a host of other biophysical consequences that are detrimental to both our quality and quantity of life. The irony is that burnout isn't just common in the corporate world but also in fields that exist to educate people on health and to help them achieve it. Studies have found that over 57 percent of medical residents and up to 46 percent of bona fide physicians meet the criteria for burnout. Other research shows that over 30 percent of teachers suffer from burnout as well.

The seemingly imprisoned 9-to-5 worker might envy the flexibility and freedom of an artist or writer, but it turns out flexibility and freedom are not the cure-alls to burnout that we imagine them to be. Nearly every artist has struggled with creative burnout at some point in their career. Burnout is common in artists because their passion serves as both a gift and a curse. A gift, because, as Plato remarked in the 4th century BCE, passion is "the channel by which we receive the greatest blessings," fueling original, imaginative, and inspired work. But left unchecked, passion can drive artists to work themselves into the ground.

Obsession, perfectionism, hypersensitivity, the need for control, and high expectations are common traits in great artists, and they are all linked to creative burnout. Add to this the pressure of making a living as an artist, harsh criticisms, social comparison, and the solitary nature of creative work, and it becomes easier to understand why so many artists suffer from burnout, or worse. Research shows that people who work in creative fields are especially susceptible to anxiety, depression, alcoholism, and suicide.

Another pursuit in which passion and pressure commonly collide is athletics, where burnout is one of the main reasons why everyone—from kids to weekend warriors to professional athletes—quits playing sports. So frequently do athletes push themselves too hard without taking a break that there is even a medical term for it: overtraining syndrome. In overtraining syndrome, the central nervous system is thrown out of whack, yielding a cascade of negative biological effects. Ultimately, overtraining syndrome results in deep fatigue, illness, injury, and performance decline. It's the body's way of saying "I'm done—absolutely no more." A forced shutdown of sorts.

Overtraining syndrome sounds like something to avoid at all costs, especially if you make a living with your body. Yet over 60 percent of elite runners say they've been overtrained at some point in their careers. Somewhat surprisingly, it's not just elite athletes who succumb to the temptation to do more when their bodies are tell-

Thirty to 40 percent of high school and amateur athletes have suffered from overtraining at least once in their sporting careers.

ing them to do less: Thirty to 40 percent of high school and amateur athletes have suffered from overtraining at least once in their sporting careers.

By now it should be clear that pressure to perform comes from all directions. As a result, more and more people are working themselves beyond the point of diminishing returns. Some are even turning to performance enhancing drugs, risking their health and reputation while breaking ethical and legal codes. Is this really the new requirement for success in today's society? There's got to be a better way.

It turns out, there is. The rest of this book is dedicated to exploring it.

A BETTER WAY

Over the past few years, we've had the privilege of delving deep into the practices of top performers across a wide range of capabilities and domains. We've studied, interviewed, observed, and in some cases worked with individuals who are not only at the top of their game, but who are also at the top of *the* game. In doing so, we couldn't help but notice striking similarities in how these great performers approach their work. It turns out that whether someone is trying to qualify for the Olympics, break ground in mathematical theory, or craft an artistic masterpiece, many of the principles underlying healthy, sustainable success are the same.

It turns out that whether someone is trying to qualify for the Olympics, break ground in mathematical theory, or craft an artistic masterpiece, many of the principles underlying healthy, sustainable success are the same.

These principles—each time-tested, safe, ethical, and legal—have been used by great performers for centuries. Only now, however, is fascinating new science revealing why and how these performance principles work. This understanding makes them accessible to everyone. The rest of this book is dedicated to examining these principles inside and out, merging

story with science to leave you, the reader, with concrete, evidence-based, and practical takeaways to help you improve your game.

Our journey into understanding the science and art of performance requires us to make links between traditionally siloed domains. It is through these overlooked connections that powerful performance insights emerge. In the words of Eric Weiner, author and innovation expert, breakthroughs occur when "people realize the arbitrary nature of their own [field] and open their minds to, in effect, the possibility of possibility. Once you realize there is another way of doing X, or thinking about Y, then all sorts of new channels open up to you." With that in mind, throughout this book we'll uncover what an artist can learn from an athlete, what an intellectual can learn from an artist, and what an athlete can learn from an intellectual.

We'll show you how strengthening your ability to solve complex cognitive problems is similar to strengthening your ability to lift weights—that the world's best thinkers and the world's best powerlifters follow the same processes to elicit growth. We'll investigate the influence of routine and environment, and explain how and why the pregame warmups of all-star athletes, artists, and public speakers are so alike and so effective. We'll even discuss fashion, and use science to explain why the geniuses of yesterday, such as Albert Einstein, and the geniuses of today, such as Mark Zuckerberg, don't care much about it. We'll explore why after they achieve breakthroughs—be it painting a masterpiece, penning an award-winning novel, or setting a world record in sport—so many great performers often thank and attribute their success to forces beyond themselves: be it family, God, or some other transcendent power.

If we've done our job well, by the time you finish reading this book, you'll thoroughly understand:

- The scientific cycle behind growth and development
- How to prime for peak performance and daily productivity
- The power of purpose as a performance enhancer

Far more important, though, you'll be able to use these concepts in your own pursuits, whatever those pursuits may be. To help you in doing so, throughout the book you'll find brief sections titled "Performance Practices." These sections are meant to hammer home key points and help you reflect on how you can apply them to your own life.

SECTION 1

THE GROWTH EQUATION

1

THE SECRET TO SUSTAINABLE SUCCESS

Think for a moment about what it takes to make muscles, such as your biceps, stronger. If you try lifting weights that are too heavy, you probably won't make it past one repetition. And even if you do, you're liable to hurt yourself along the way. Lift too light a weight, on the other hand, and you won't see much, if any, result; your biceps simply won't grow. You've got to find the Goldilocks weight: an amount you can barely manage, that will leave you exhausted and fatigued—but not injured—by the time you've finished your workout. Yet discovering such an ideal weight is only half the battle. If you lift every day, multiple times a day, without much rest in between, you're almost certainly going to burn out.

Stress + rest = growth. This equation holds true regardless of what you are trying to grow.

But if you hardly ever make it to the gym and fail to regularly push your limits, you're not going to get much stronger, either. The key to strengthening your biceps—and, as we'll learn, any muscle, be it physical, cognitive, or emotional—is balancing the right amount of stress with the right amount of rest. Stress + rest = growth. This equation holds true regardless of what it is that you are trying to grow.

PERIODIZATION

In the world of exercise science, this cycle of stress and rest is often referred to as periodization. Stress—and by this we don't mean fighting with your partner or your boss, but rather, some sort of stimulus, such as lifting a heavy weight—challenges the body, in some cases pushing it close to failure. This process is usually followed by a slight dip in function; just think about how useless your arms are after a hard weight-lifting session. But if after the stressful period you give your body time to rest and recover, it adapts and becomes stronger, allowing you to push a little harder in the future. Over time, the cycle looks like this:

1. Isolate the muscle or capability you want to grow
2. Stress it
3. Rest and recover, allowing for adaptation to occur
4. Repeat—this time stressing the muscle or capability a bit more than you did the last time

World-class athletes are masters at this cycle. On a micro level, their training alternates between hard days (e.g., intervals until the brink of muscle failure and total exhaustion) and easy days (e.g., jogging at a pedestrian pace). The best athletes also prioritize recovery, time on the couch and in bed, just as much as they prioritize time on the track or in the gym. On a more macro level, great athletes often follow a hard month of training with an easy week. They intentionally design their seasons to include only a few

peak events that are followed by periods of physical and psychological restoration. The days, weeks, months, years, and entire careers of master athletes represent a continual ebb and flow between stress and rest. Those who can't figure out the right balance either get hurt or burn out (too much stress, not enough rest) or become complacent and plateau (not enough stress, too much rest). Those who can figure out the right balance, however, become life-long champions.

SUSTAINABLE PERFORMANCE

When Deena Kastor graduated from the University of Arkansas in 1996, she was a good collegiate runner who had never quite pulled off a major victory. She received multiple All-American awards and stood atop many podiums, but the collegiate national championship was always just a touch—a few seconds, to be precise—out of reach. This didn't deter Kastor from going all-in on running. Upon graduation, she connected with the legendary coach Joe Vigil and followed him to the oxygen-deprived air of Alamosa, Colorado, and ultimately to Mammoth Lakes, California. There, training at 9,000 feet above sea level, Kastor went to work on reaching a level far beyond what her collegiate success could have predicted.

Glimpse into Kastor's training diary during her prime and one word comes to mind: extraordinary. A 24-mile-long run at 7,000 feet altitude; mile repeats at speeds that for most people would be equivalent to an all-out 100-yard dash; and her favorite, 4 by 2 miles at a lung-searing 5-minute-mile pace, all on the highest path in Mammoth Lakes. These heroic workouts make up only a small portion of Kastor's total running. At the end of each week, in the bottom right corner of her training journal, she circled "total miles run." This number almost always read between 110 and 140. While this may seem extraordinary, to Kastor it was all very ordinary. As a result, she reached the highest levels of athletic success.

Deena Kastor is hands-down the name most associated with American women's running, and for good reason. She's won an Olympic bronze

medal in the marathon, and has earned distinction in many major national races. She holds the American marathon record, having covered the 26.2 miles in just 2 hours and 19 minutes, or at a pace of 5 minutes and 20 seconds per mile. Just think about running one mile that fast, and then imagine doing it 26 times in a row. Perhaps even harder to comprehend is the 2 hour and 27 minute marathon (5 minute and 40 second mile pace) she ran at age 42. That's right, Kastor is still running insanely fast well into what should be the twilight of her endurance sports career. And although she may lose an occasional race to someone 10 to 20 years her junior, she's consistently at the front of the pack, racing against, and often beating, women young enough to be her daughters.

Ask Kastor how she's been able to sustain this level of performance and you'll get a lesson in periodization. While Kastor's quick to mention the hard work she puts in, she's equally as quick to mention the rest that follows. "The leaps and bounds I've made over the last several years have come from outside the training environment and how I choose to recover," she told *Competitor* magazine in 2009. "During a workout you're breaking down soft tissue and really stressing your body. How you treat yourself in between workouts is where you make gains and acquire the strength to attack the next one."

Kastor says she realized early on that simply working hard wouldn't do. She's even called her workouts the easy part. What sets her apart, the magic that has allowed her to run so fast and so far for the past 25 years, is how she recovers: the 10 to 12 hours of sleep she gets each night; her meticulous approach to diet; her weekly massage and stretching sessions. In other words, it's all the things she does when she isn't training that allows her to do what she does when she is. Stress demands rest, and rest supports stress. Kastor has mastered the inputs, and understands how much stress she can tolerate and how much rest she requires. Thus, the output—a lifetime of growth and excellence—isn't all that surprising.

Stress demands rest, and rest supports stress.

ALL THE BEST FOLLOW STRESS AND REST

Kastor is certainly unique, but her story is echoed by the research of Stephen Seiler. In 1996, shortly after earning his PhD in physiology in the United States, Seiler relocated to Norway. When he first arrived, he noticed something that befuddled him: During cross-training runs, world-class cross-country skiers were stopping before hills and then slowly *walking* up. Seiler didn't understand. Why were some of the best endurance athletes on the planet training so easily?

Seiler tracked down Norway's national cross-country ski coach, Inge Bråten, the man behind the training of legends such as eight-time Gold medalist Bjørn Dæhlie. He asked Bråten if he was imagining athletes slowly walking up hills in their training, and if not, could Bråten please explain what was going on. Bråten simply told Seiler that the skiers he saw walking had recently trained hard, so now they must train easy.

Upon hearing this, Seiler's mind flashed back to a paper he'd read that claimed Kenyan runners spent a majority of their training time running at a snail's pace. When he revisited the research, Seiler also saw it mentioned that the Kenyans alternated between very hard days and very easy days. At that moment, it struck Seiler that the best summer athletes in the world and the best winter athletes in the world appeared to be training quite similarly. As any good scientist would, he set out to test his hypothesis.

Seiler tracked the training of elite athletes across a variety of endurance sports including running, skiing, swimming, and cycling. He found that, irrespective of sport or nationality, their training followed roughly the same distribution. The best athletes in the world weren't adhering to a "no pain, no gain" model, nor were they doing fitness-magazine popularized high-intensity interval training (HIIT) or random "workouts of the day." Rather, they were systematically alternating between bouts of very intense work and periods of easy training and recovery, even if that meant *walking* up hills. The ongoing progression and development of elite competitors, Seiler found, was an exercise in stress and rest.

INTELLECTUAL AND CREATIVE DEVELOPMENT

Around the same time that Seiler was exploring commonalities among the top endurance athletes in the world, another researcher was exploring commonalities among the top creative and intellectual performers in the world. This researcher was Mihaly Csikszentmihalyi (pronounced chick-sent-mi-hi), PhD, a pioneer in the field of positive psychology known for his ideas on happiness, meaning, and optimal performance. If you've ever heard of the term "flow"—or a state of being fully absorbed in an activity with laserlike focus, completely in the zone—that's Csikszentmihalyi's work.

Less known than his work on flow, but equally insightful, is Csikszentmihalyi's study of creativity. Over the course of 50 years, he conducted hundreds of interviews with field-altering geniuses from diverse domains. He spoke with groundbreaking inventors, innovative artists, Nobel Prize–winning scientists, and Pulitzer Prize–winning writers. Just as Seiler found that world-class endurance athletes migrate toward a similar style of work, Csikszentmihalyi found that the same held true for creative geniuses: the brightest minds spend their time either pursuing an activity with ferocious intensity, or engaging in complete restoration and recovery. This approach, Csikszentmihalyi discovered, not only prevents creative burnout and cognitive fatigue, but it also fosters breakthrough ideas and discoveries (we'll explore why this happens in more detail in Chapter 4). Csikszentmihalyi documented a common process across almost all great intellectual and creative performers, regardless of their field:

The brightest minds spend their time either pursuing their activity with ferocious intensity, or engaging in complete restoration and recovery.

1. Immersion: total engagement in their work with deep, unremitting focus

Performance Practices

- Alternate between cycles of stress and rest in your most important pursuits.
- Insert short breaks throughout your work over the course of a day.
- Strategically time your "off-days," long weekends, and vacations to follow periods of heavy stress.
- Determine when your work regularly starts to suffer. When you find that point, insert a recovery break just prior to it.

2. Incubation: a period of rest and recovery when they are not at all thinking about their work
3. Insight: the occurrence of "aha" or "eureka" moments—the emergence of new ideas and growth in their thinking

Look familiar? The manner in which great intellectual and creative performers continually grow their minds mirrors the manner in which great physical performers continually grow their bodies. Perhaps this is because our muscles and minds are more alike than we might think. Just as our muscles deplete and run out of energy, as we're about to see, our minds do, too.

MIND AS A MUSCLE

In the mid-1990s, Roy Baumeister, PhD, a social psychologist who at the time was teaching at Case Western Reserve University, revolutionized how we think about the mind and its capacity. Baumeister wanted to get to the bottom of common-day struggles such as why we feel mentally "tired" after toiling away at a complex problem. Or when we are on a diet, why we are more likely to crack at night after diligently resisting unhealthy food all day. In other words, Baumeister was interested in

understanding how and why our intellectual power and our willpower run out of gas.

When Baumeister set out to solve this problem, he didn't need the latest and greatest brain-imaging technology. All he needed were some cookies and radishes.

In an elegantly designed experiment, Baumeister and his colleagues had 67 adults file into a room that smelled like chocolate chip cookies. After the participants had taken their seats, freshly baked cookies were brought into the room. No sooner than everyone's salivary glands began working, things got interesting. While half the study participants were allowed to eat the cookies, the other half were prohibited from doing so. Adding insult to injury, the non-cookie-eaters were given radishes and told they could eat them instead.

As you might imagine, the cookie-eaters had no problem with the first part of the experiment. Like most people in their situation, they enjoyed indulging. The radish-eaters, on the other hand, struggled mightily. "The [radish-eaters] exhibited clear interest in the cookies, to the point of looking lovingly at the display and in a few cases even picking up the cookies to sniff them," writes Baumeister. Resisting the cookies was no easy task.

This doesn't seem groundbreaking. Who wouldn't struggle to resist delicious desserts? But things got even more interesting in the second part of the experiment, during which the radish-eaters' struggles continued. After both groups finished eating, all participants were asked to solve a seemingly solvable, but actually unsolvable, problem. (Yes, this was a cruel experiment, especially for those stuck with the radishes.) The radish-eaters lasted a little over 8 minutes and gave the problem 19 attempts. The cookie-eaters, on the other hand, persisted for over 20 minutes and attempted to solve the problem 33 times. Why the stark difference? Because the radish-eaters had depleted their mental muscle by resisting the cookies, whereas the cookie-eaters had a full tank of psychological gas and thus exerted far more effort in trying to solve the problem.

Baumeister went on to repeat several variations of this study, and he

observed the same result every time. Participants who were forced to flex their mental muscle—be it to resist temptation, solve a hard puzzle, or make tough decisions—performed worse on a subsequent task that also required mental energy as compared to participants in a control group who had an easy first task, like eating fresh cookies.

RESISTING COOKIES IS A DANGEROUS GAME

It seems we have a single reservoir of brainpower for all acts of cognition and self-control, even those that are unrelated. When people are asked to suppress their emotions when under duress—for example, not showing frustration or sadness while watching a tragic film—they subsequently struggle on a wide range of unrelated tasks, such as resisting tempting foods or storing items in working memory. The phenomenon doesn't stop there. Even physical challenges (e.g., performing a wall sit) can be impaired by exerting your mental muscle beforehand. Research shows that even if their bodies are fresh, the physical performance of people who are mentally fatigued suffers. Put differently, the boundaries between mental and physical fatigue are not nearly as defined as we think.

We have a single reservoir of brainpower for all acts of cognition and self-control, even those that are unrelated.

In a study cleverly titled "Hungry for Love: The Influence of Self-Regulation on Infidelity," 32 college students in exclusive relationships interacted via chat room with a confederate (i.e., a researcher playing along) of the opposite sex. Prior to this chat, half the study participants were forced to resist eating a tempting food, while the other half could eat to their hearts' desire. As you might expect, those who were forced to resist the tempting food were more likely to give their phone number to, and even accept a coffee date with, the confederate. The study authors concluded, "Weakened self-control may be one potential cause for the levels of infidelity occurring in romantic relationships today." You may want to

think twice before encouraging your significant other to go on a diet. (But you probably already knew that.)

A LOOK INSIDE YOUR TIRED BRAIN

More recently, researchers have started studying the notion of a mental muscle with fancy imaging technology instead of just cookies and radishes. What they are finding is quite intriguing. They put people with depleted mental muscles in an fMRI machine (a technology that lets researchers look at activity inside the brain) and discovered the brain of a tired person acts in a peculiar way. When shown a tempting image, such as a juicy cheeseburger, or asked to solve a hard problem, activity in parts of the brain associated with emotional response (the amygdala and orbitofrontal cortex) supersede activity in the part of the brain tasked with thoughtful, rational thinking (the prefrontal cortex). Other experiments show that after someone is forced to exert self-control, activity in the prefrontal cortex diminishes altogether. It's no wonder that when we are mentally drained we struggle with complex problems and self-control, opting for cartoons and cookies instead.

Much like how after you've lifted weights to the point of fatigue your arms won't function very well, after you've used your mind to the point of

Performance Practices

- Remember that "stress is stress": fatigue on one task spills over into the next, even if the two are completely unrelated.
- Only take on a few challenges at once. Otherwise you'll literally run out of energy.
- Tweak your environment to support your goals. This is especially important at times when you know you'll be depleted. It's incredible how much our surroundings impact our behavior, especially when we are fatigued.

fatigue—be it to resist temptation, make tough decisions, or work on challenging cognitive tasks—it, too, won't function very well. This fatigue might lead you to eat cookies, give up on solving a tough intellectual problem, or even prematurely give in during physical challenges. In the worst case, you might even cheat on your significant other.

The good news is that just like the body, by stressing and allowing the mind to recover it also becomes stronger. Scientists have discovered that the more we resist temptation, think deeply, or focus intensely, the better we become at doing so. A new line of research contests that willpower in particular is not as limited as scientists once thought, and suggests that by successfully completing smaller productive changes we can build the strength to complete larger ones in the future. Either way, whether it is the result of willpower, ego-depletion, or some other mechanism, we cannot continuously use our mind (at least not effectively) without at some point experiencing fatigue. And we cannot take on more sizeable psychological challenges without first building strength through smaller ones. All of this takes us back to where we started: stress + rest = growth.

THE RHYTHM OF STRESS AND REST

Over the next four chapters, we'll explore each component (stress and rest) of the growth equation in great detail. You'll learn the best ways to stress and rest both your physical and psychological muscles so that you can optimize your performance over the course of a day, month, year, and lifetime. But before we go there, to reinforce the universal truth about the power of cycling between stress and rest, we'll leave you with the remarkable story of someone who harnessed it to achieve excellence with *both* his mind and his body.

Josh Waitzkin first discovered chess in New York City's Washington Square Park when he was 6 years old. He set out to the park intent on playing on the monkey bars but when he arrived, Waitzkin was captivated by the fast-paced games of chess being played by adults across the way. The checkered board and the pieces that moved across it were a

miniature world that Waitzkin would soon throw himself into and, eventually, master.

Waitzkin's mastery of chess didn't happen overnight, but close to it. While at first the young kid was nothing more than a novelty to the much-older regulars, it wasn't long before he was beating them. By age 8, Waitzkin was a dominant force, regularly defeating players five times his age. Anyone who bore witness to the Josh Waitzkin show couldn't help but notice his talent and passion for the game. Word spread quickly and it wasn't long before some of the world's finest chess masters were lining up to coach and mentor him.

From age 9 onward, Waitzkin took the US junior chess scene by storm, winning multiple national championships. At age 13, he became a National Master, one of the youngest ever chess players to earn the prestigious title. By the time he turned 16, Waitzkin had become an International Master. That same year, he was crowned US junior co-champion, an especially impressive feat given the division includes players up to age 21. The following year, he won the same championship outright.

Around the same time, Paramount Pictures released the hit film *Searching for Bobby Fischer*, which chronicled Waitzkin's rise to the top of chess. The movie illuminated what happens when deep talent meets deep passion and hard, smart work. It's a good thing Waitzkin wasn't *so* intent on the monkey bars in Washington Square Park, otherwise he might never have become an international superstar for his achievements in chess.

Just a few years later, however, when he was in his early 20s, like so many other young adults, Waitzkin's interests shifted. He became absorbed in meditation and Eastern philosophy. These new interests eventually led him to the Chinese martial art tai chi. Although he was drawn to the sport and immersed himself in it for its own sake, he was also happy to be out of the spotlight that accompanied his stardom in chess. That reprieve wouldn't last long.

Much like in chess, it wasn't long before Waitzkin had ascended to the top of the martial arts world. For the second time in his life, word spread quickly about the young man with great talent and passion. He drew inter-

est and eventual coaching and mentorship from the best tai chi teachers in the world. He won numerous national championships in just his first few years in the sport. Before he had reached 30, Waitzkin was a world champion in fixed step push hands and moving step push hands, the primary competitive iterations of tai chi.

No doubt about it, Waitzkin has natural talent; we'd be foolish to discount the role of genetics in his accomplishments. But it's hard to believe that he simply has the best DNA for *everything*. As he laid out in his wonderful book, *The Art of Learning*, it's how he cultivated that talent and his competitive drive—how he nurtured his nature—that propelled him to the top of seemingly disparate domains. Waitzkin attributes much of his success in both chess and tai chi to alternating between stress and rest:

> *There was more than one occasion that I got up from the board four or five hours into a hugely tense chess game, walked outside the playing hall and sprinted fifty yards or up six flights of stairs. Then I'd walk back, wash my face, and be completely renewed. To this day, virtually every element of my physical training also revolves around one form or another of stress and recovery . . . If you are interested in really improving as a performer, I would suggest incorporating the rhythm of stress and recovery into all aspects of your life.*

2

RETHINKING STRESS

In 1934, in McGill University's biochemistry department, a 28-year-old endocrinologist and assistant professor of medicine was attempting to discover a new hormone. His name was Hans Selye and he had every reason to believe he was making progress. When he injected rats with ovarian extract, hoping to elicit changes that could only be explained by an undiscovered sex hormone, the rats experienced a unique physiological response. Their adrenal cortexes became enlarged and their immune systems were activated. The more extract he injected, the greater the response. Selye was certain that a new sex hormone was triggering these physiological changes. He was elated. "At the age of 28, I already seemed to be on the track of a new hormone," he wrote in his journal.

Unfortunately for Selye, his enthusiasm wilted when he observed the same response after injecting rats with completely different fluids that had nothing to do with the reproductive system. Even a simple saline solution

triggered the same response. His elation turned into heartbreak: "All my dreams of discovering a new hormone were shattered. All of the time and all the materials that went into this long study were wasted. I became so depressed that for a few days I could not do any work at all. I just sat in the laboratory, brooding." Though he didn't know it at the time, Selye's insistent brooding would turn out to be a blessing in disguise.

As Selye continued to ruminate upon his experiments, eventually it occurred to him that perhaps he should evaluate what he had witnessed from a different angle entirely: Maybe the liquid in the injection wasn't causing the response. Maybe the cause was the trauma of the injection itself. With that thought in mind, Selye emerged quickly from his rut and went about systematically traumatizing rats. He injected them, shocked them, operated on them, and everything in between. With each new act of trauma, he observed the same response: The rats' adrenal and immune systems became active. The rats weren't readying themselves for sex. They were readying themselves for a fight.

While Selye's dreams of discovering a new hormone were dashed, his consolation prize was a big one. He unknowingly stumbled upon a concept that would become one of the foremost concerns in modern society: stress. By doing something—anything, really—that shocked or caused pain and discomfort in the rats, he could trigger an innate stress response that we now know is shared by just about every living organism.

THE DOSE MAKES THE POISON

Selye and those who would build upon his work started stressing humans and observed the same phenomenon that they saw in rats. But they also noticed something else. Over time, humans and rats alike seemed to adapt to each unique stressor, building up increased resistance. Certain stressors could even produce desirable effects, strengthening the specific part of the body that was under duress. They learned that stress isn't just harmful; it can also serve as a stimulus for growth and adaptation.

We now know our adaptive stress response is rooted in molecules called

Stress isn't just harmful; it can also serve as a stimulus for growth and adaptation.

inflammatory proteins and a hormone called cortisol. Inflammatory proteins and cortisol are activated by stress and serve as biological messengers, telling the body, "We're not strong enough to withstand this attack!" As a result, the body marshals an army of biochemical building blocks and directs them to the area under stress, making the body stronger and more resilient. This is the body's incredible, preprogrammed way of better preparing itself to face future threats.

As we mentioned earlier, strengthening a muscle, such as your bicep, is a wonderful example of how stress works in a positive way. Lifting a heavy weight to the point of exhaustion causes micro-tears in the muscle's tissue and triggers the stress response. The body becomes aware that it's currently not strong enough to tolerate the stress it is under. Consequently, once we cease lifting weights, the body transitions into something called an anabolic state, in which the muscle is built up so it can withstand more stress in the future. This same process unfolds after just about any hard physical effort—from lifting weights to running to rowing to a challenging CrossFit workout.

If the amount of stress is too large or lasts too long, however, the body fails to adapt. It actually does the opposite of growing stronger: it deteriorates. Selye called this the "exhaustion stage." Today, many refer to the exhaustion stage as being under "chronic stress." The body rebels and enters something called a catabolic process, or a state of persistent breakdown. Rather than signaling for repair and then subsiding, elevated inflammation and cortisol linger at toxic levels. The adrenal system, constantly on guard, becomes overworked and fatigued. This is why it's not at all surprising that chronic stress contributes to myriad health problems; the body as a whole can withstand only so much tension before it breaks.

Put all this together, and a paradox emerges. Stress can be positive, triggering desirable adaptations in the body; or stress can be negative,

The effects of stress depend almost entirely on the dose.

causing grave damage and harm. The effects of stress depend almost entirely on the dose. And when applied in the right dose, stress does more than stimulate physiological adaptations. It stimulates psychological ones, too.

SKILLS COME FROM STRUGGLE

In reflecting upon his development as an elite performer, Josh Waitzkin, the international chess prodigy turned martial arts world champion who was profiled at the end of Chapter 1, had an interesting insight: Growth comes at the point of resistance; we learn by pushing ourselves to the outer reaches of our abilities.

Although it sounds like Waitzkin is referring to a grueling martial arts workout, that's not the case. Waitzkin is referring to his process for mastering chess. Well before he even knew what tai chi was, during his chess practices Waitzkin was stressing *his mind* to the point of complete exhaustion. While there are countless books about applying athletic training to nonathletic pursuits, Waitzkin did the opposite. He took the training philosophy that turned him into a world champion in chess and used it to become a world champion in martial arts. Even when he was training only his mind, meticulously studying chess patterns and the deep structure underlying them, Waitzkin had to stress himself. In order to elicit growth, he had to push at the point of resistance. Although Waitzkin's insight occurred over 20 years ago, the latest science on learning is beginning to uncover why his method works.

The frustrations of teachers at a public high school in Oakland County, Michigan, are similar to those of teachers all over the country: oversized classes; digital device distractions; and, of course, not enough resources. But more than anything, the teachers are frustrated with the "Common Core," a standardized national curriculum to which they have

been required to adhere. However well-intentioned the Common Core may be (it aims to ensure a national baseline of education at each grade level), its result in Oakland County has not been a good one. On a recent visit, we heard the following:*

- "I get where [the federal government] is coming from in wanting some standards in education, but the result is a cookie-cutter approach to teaching. It forces us to teach to the curriculum instead of teaching to the students." (Eleventh-grade science teacher)
- "It zaps the creativity right out of the classroom because it forces us to teach to certain tests." (Ninth-grade English teacher)
- "It's awful. It forces us to spoon-feed students. It's especially bad for the brightest kids since we don't have the freedom to push them. All the teaching happens inside a box." (Tenth-grade economics teacher)

These complaints have merit. Drilling specific, testable facts in preparation for rigid, standardized tests doesn't promote learning. Rather, science shows that learning demands open-ended exploration that allows students to reach beyond their individual limits. In a series of studies involving middle school and high school math classes, students who were forced to struggle on complex problems before receiving help from teachers outperformed students who received immediate assistance. The authors of these studies summarized their findings in a simple yet elegant statement: Skills come from struggle.

Another study, titled "Why Do Only Some Events Cause Learning During Human Tutoring?", found the answer was straightforward: because most tutors swoop in with answers and support far too early. In surveying different university-level physics tutoring systems, the researchers discovered that "regardless of the tutorial explanations employed, when students were not at an impasse, learning was uncommon." The most effective tutoring systems, on the other hand, all shared one thing: They delayed

* Grade level and subject have been changed to protect the identities of these teachers.

Growth comes at the point of resistance. Skills come from struggle.

instruction until students reached the point of failure. Growth comes at the point of resistance. Skills come from struggle.

The same theme holds true in athletics. Whether it's a runner trying to get faster, a basketball player working on a new move, or a big-wave surfer attempting to master a challenging ride, the greatest gains often follow immense struggle and discomfort.

Nic Lamb is one of the best big-wave surfers in the world. He rides waves that are as tall as four-story buildings. Though his performances on the water seem magical, they are grounded in a meticulous approach to training and a bulletproof mindset that he cultivates day in and day out. When Brad interviewed Lamb for *Outside* magazine, he was especially interested to learn how Lamb prepares himself to face the strongest swells. Lamb's secret lies in making himself uncomfortable. "During training, I seek out and try to ride waves that scare me," Lamb said. "It's only when you step outside your comfort zone that you grow. Being uncomfortable is the path to personal development and growth. It is the opposite of complacency."

Lamb embraces the challenge, seeing failure not as a setback but an opportunity to grow. "If I never pushed the envelope, if I never struggled, I would never get better," he said. If anything, the times that Lamb is supremely challenged or comes up short are often the most valuable. They uncover both physical and psychological weak spots and provide insight into areas he can improve. They fully engage both his brain and body in trying to figure out the problem. And they raise the bar of what Lamb considers possible.

What Waitzkin, students who learn successfully, and Lamb practice is something known as "productive failure." There is broad scientific consensus that the most profound learning occurs when we experience this sort of failure. Rather than simply answering a specific question, it is beneficial to be challenged and even to fail. Failure provides an opportunity to analyze a problem from different angles, pushing us to understand its deep underlying structure and to hone the transferrable skill of problem-solving

itself. Sure, immediate assistance can be highly satisfying. But when we succumb to the impulse for instant resolution, we miss out on a special kind of deep learning that only a challenge can spawn.

SYSTEM 2 LEARNING

Nobel Prize–winning psychologist Daniel Kahneman, PhD, states that the human mind is divided into two types of thinking: System 1 and System 2. System 1 operates automatically and quickly. It is often driven by instinct and intuition. System 2, on the other hand, is more thoughtful and analytical and addresses effortful mental activities. System 1 is our default mode of thinking, because it requires less energy. When we are on autopilot, System 1 is at work and our current mental model of the world dominates. It's only when we activate System 2, by really working hard and struggling to figure something out, that we have the best chance of examining new information critically and integrating it into our web of knowledge. True learning requires System 2.

To understand why System 2 learning is such a challenge, we need to look deep inside the brain. Our actual web of knowledge consists of brain cells called neurons that are linked by axons, which function like fine electrical wires in the brain. When we learn something new, electrical activity travels between neurons along these axons. At first, the connections are weak (both figuratively and literally) and we struggle with the new skill, whether it's properly using grammar or using our nondominant hand on the basketball court. If we give in, opting not to struggle, System 1 takes over. We default to the already strong connections in our brain and continue using adjectives instead of adverbs or dribbling with our right hand instead of our left. But if we endure the struggle and keep working at the new skill, the connections between neurons strengthen. This occurs partially thanks to a substance called myelin. Myelin is like the brain's version of insulation, wrapping around our axons. As we work more at something, more myelin is generated, and that enables electrical activity to travel more fluidly between neurons. In other words, the connections in our brain

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strengthen. Over time, our former struggles become second nature.

If we stick at learning something for long enough, what was once a formidable System 2 challenge becomes a simple System 1 task. Just ask anyone who learned how to dribble with her nondominant hand. Or, just ask yourself: What does 3 + 2 equal? How about 6 × 4?

Think back. Answering these questions wasn't always so easy.

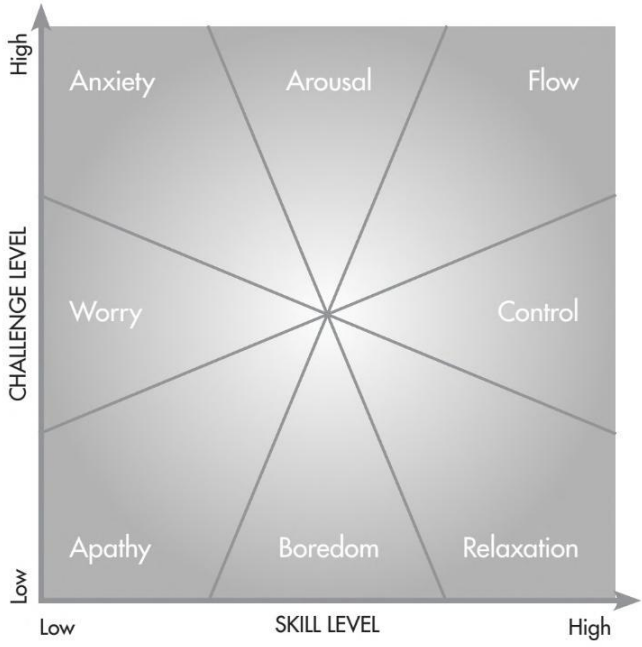
This is not to say that aimless struggle promotes learning. But it does mean that the best learning occurs when we really have to work for it. Just like struggling to eke out one last repetition in the weight room is a great method for growing the body, struggling to the point of failure and only then receiving assistance is a great recipe for growing the mind. If you want to continuously improve in whatever it is that you do, you've got to view stress as something positive, even desirable. Although too much or never-ending stress can be dangerous, the right amount serves as a powerful stimulus for growth.

Performance Practices

- Stress stimulates growth.
- As the chess prodigy turned martial arts champion Josh Waitzkin says, "growth comes at the point of resistance."
- Developing a new capability requires effort: Skills come from struggle.
- When you struggle, System 2 is activated and true development is underway; myelin is accumulating and neural connections are strengthening.
- Fail productively: Only seek out support after you've allowed yourself to struggle.

JUST-MANAGEABLE CHALLENGES

When psychologist Mihaly Csikszentmihalyi, PhD, was studying how the best performers get in the zone and continuously improve, he noticed they all regularly pushed themselves to their limits, and perhaps just a bit beyond. In an attempt to convert the mystical "zone" into something a bit less nebulous, Csikszentmihalyi developed an elegant conceptual tool.



Csikszentmihalyi's tool not only can help you find your way into the zone, but it can also double as a great way to dial in the optimal amount of stress required for growth. The best kind of stress, what we like to call "just-manageable challenges," lies in the upper right corner of the "flow" section.

Just-manageable challenges manifest when you take on something that makes you feel a little out of control but not quite anxious or overly aroused.* When the task at hand is a bit beyond your skills you're in the

* Brad first heard the term "just-manageable change" from his undergraduate school professor, Richard Price, PhD, at the University of Michigan.