

## Praise for *Right Kind of Wrong*

“This book is as important as any I, among the most avid of readers, have ever encountered. It’s that simple. No topic is more important than the assessment and understanding of failure. Amy Edmondson has broken entirely new ground; and for those who take the trouble, I no less than guarantee *Right Kind of Wrong* will be a game-changer. The result of serious study and application of this tome will be one of the most important steps in your professional life.”

—Tom Peters, bestselling coauthor of *In Search of Excellence*  
and author of *Tom Peters’ Compact Guide to Excellence*

“*Right Kind of Wrong* is the ultimate self-help book: powerful ideas combined with practical tools. My advice is to snap shots of the book’s eight illustrations—each a gem—and tack them up in front of your desk. You will be more effective immediately and on a faster learning curve going forward.”

—Roger L. Martin, author of *A New Way to Think*

“Amy Edmondson’s intelligent, warm, and funny *Right Kind of Wrong* will take you through the landscape of failure—the good ones that we learn from, the stupid ones we wish we could roll back, and the catastrophic ones we would all benefit from collaborating to avoid. It’s packed with examples and stories and lands with some meaningful ideas about how you can cultivate awareness to, indeed, fail well.”

—Rita McGrath, bestselling author of  
*The End of Competitive Advantage*

“Failing is such an important part of living and leading. Finally, we have the book that will help us learn how to fail well. In it, Amy shares with us very practical tools and advice illustrated by many inspiring, jaw-dropping stories. A breakthrough book that every leader needs to study and begin applying. It will make the world a better place.”

—Hubert Joly, senior lecturer at Harvard Business School, former Best Buy chairman and CEO, and author of *The Heart of Business*

“Edmondson continues to help us get to the essential simplicity on the far side of complexity. Contrary to the often prevailing belief that ‘failing is not an option,’ she makes it abundantly clear that, both personally and organizationally, we must embrace the notion that ‘failing well is the only option,’ for advancing healthier thinking, breakthrough learning, and the potential for radical growth. It really is that simple. Bravo, Amy!”

—Douglas R. Conant, founder of ConantLeadership, retired president and CEO of the Campbell Soup Company, and retired chair of Avon Products

# **RIGHT KIND OF WRONG**



# RIGHT KIND OF **WRONG**

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THE SCIENCE OF  
FAILING WELL

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ACUMEN

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*For Jack & Nick*

*With abiding love and growing admiration*





I am not afraid of storms, for I'm learning how to sail my ship.

—**Louisa May Alcott**



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# **RIGHT KIND OF WRONG**



## Prologue

June 1993. I'm sitting at the old wooden desk in my fifteenth-floor office in William James Hall, where I'm a student in the new Harvard PhD program in organizational behavior. I lean in to look more closely at the small black-and-white screen on my bulky Apple computer.\* A stack of paper surveys I'd used to measure teamwork in two nearby hospitals sits pushed up against the wall at the edge of the desk. Six months ago, hundreds of nurses and doctors had filled out those surveys, giving me a glimpse into how their teams were working. I've analyzed the data enough to learn that some of the teams were working together a whole lot better than others. Now it's time for me to discover how many mistakes they've been making. In my hand, a small computer disk holds the long-awaited data on medication errors in each team, painstakingly collected by nurses over the past six months. All I need to do is run the statistical analysis to see if the team survey data correlate with the hospitals' error data.

This is the moment right before my first major research failure.

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\*The same model (Macintosh Classic Desktop Computer, 1989) that's today in the permanent collection of New York's Museum of Modern Art, <https://www.moma.org/collection/works/142222>.

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Soon I would find myself thinking, not for the first time, that maybe I wasn't cut out for a PhD program. I had been ambivalent about graduate school. I admired people who made meaningful contributions in the world without the leg up of an advanced degree. If you were smart and resourceful, it seemed to me, you should be able to carve out a unique path forward, doing work that made a difference in the world. But a decade after graduating from college, I'd had to admit defeat.

True, much of that decade had been creative and, from certain vantages, enviable. I'd worked as chief engineer for Buckminster Fuller—the visionary inventor of the geodesic dome. After that, I made the shift from engineering to organizational development after a chance meeting with the founder of a consulting company and was soon fascinated by organizations (and their failures!). I worked with some of the oldest and largest companies in America. I met managers in the U.S. car industry in the late 1980s who saw that customers wanted fuel-efficient, high-quality cars, such as the new imports from Japan, but couldn't get their giant organizations to retool to make them. Everywhere I looked, thoughtful managers bemoaned their organization's inability to adapt to clear changes in what the world needed. I enjoyed the work immensely. My sense of defeat came from concluding that I'd gone as far as I could on my own steam. To be more effective in my new field of organizational behavior and management, I would have to go back to school. Then perhaps I could contribute in a meaningful way to the goal slowly taking shape in my mind: *helping people and organizations learn so they can thrive in a world that keeps changing*.

I had no idea how to study this, nor how to contribute to changing how organizations worked. But it seemed like a problem worth solving, and I believed that I could learn from the professors in psychology and organizational behavior and somehow find a way to make a difference in understanding—and altering—the dynamics that make it hard for people and organizations to learn and thrive.

Because of my interest in how organizations learn, as a brand-new PhD student I had been glad to accept the invitation to join a team



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of researchers studying medication errors at nearby Harvard Medical School. This ready-made project would help me learn how to conduct original research. Your first-grade teacher probably told you that errors are a crucial source of learning. And medication errors, as anyone who has ever spent time in a hospital knows, are numerous and consequential.

But suddenly, this did not seem an auspicious beginning to a research career. I had unequivocally failed to support my hypothesis. I had predicted that better teamwork would lead to fewer medication errors, measured by nurse investigators stopping in several times a week to review patient charts and talk to the nurses and doctors who worked there. Instead, the results were suggesting that better teams had *higher*—not lower—error rates. I was not just wrong. I was completely wrong.

My hope of publishing a paper on my findings evaporated as I started to question again whether I could make it as a researcher. Most of us feel ashamed of our failures. We're more likely to hide them than to learn from them. Just because mistakes happen in organizations doesn't mean learning and improvement follow. Ashamed of being wrong, I felt afraid to tell my adviser.

Within a few days, this surprise finding—this failure—would lead me gently to new insights, new data, and follow-up research projects that saved and changed the course of my academic career. I would publish a research paper from this first study called "Learning from Mistakes Is Easier Said Than Done," a precursor to so much of my later work—and a theme that runs throughout my life's work and this book.

I would also begin to understand how success as a researcher *necessitates* failure along the way. If you're not failing, you're not journeying into new territory. Since those early days, in the back of my mind, a more nuanced understanding of terms such as *error* and *failure* and *mishap* has taken shape. Now I can share it with you.



## Introduction

Success is stumbling from failure to failure  
with no loss of enthusiasm.

—Winston Churchill

The idea that people and organizations should learn from failure is popular and even seems obvious. But most of us fail to learn the valuable lessons failures can offer. We put off the hard work of reflecting on what we did wrong. Sometimes, we're reluctant to admit that we failed in the first place. We're embarrassed by our failures and quick to spot those of others. We deny, gloss over, and quickly move on from—or blame circumstances and other people for—things that go wrong. Every child learns, sooner or later, to dodge blame by pointing the finger elsewhere. Over time, this becomes habitual. Worse, these habits make us avoid stretch goals or challenges where we might fail. As a result, we lose out on countless opportunities to learn and develop new skills. This pernicious combination of human psychology, socialization, and institutional rewards makes mastering the science of failing well far more challenging than it needs to be.

It's impossible to calculate the wasted time and resources created by our failure to learn from failure. It's just as hard to measure its emo-

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tional toll. Most of us go out of our way to avoid experiencing failure, robbing ourselves of adventure, accomplishment, and even love.

This book is about what makes learning from failure so difficult to put into practice in our day-to-day lives and in the institutions we build. It's also about how we can do better. As you've already read, I've not only studied mistakes and failures, I've experienced plenty of them myself and had to learn firsthand how to feel better about being so fallible. I've had more papers than I can count get rejected from top journals. I've had my car break down by the side of the road and spent a precarious night contemplating preventive maintenance. Freshman year in college many years ago, I failed a first-semester multivariable-calculus exam. I've missed important Little League games and disappointed both of my sons. The list goes on. *And on.* To come to terms with my shortcomings, and to help others do the same, I decided to get scientific about it.

I believe that part of successfully navigating failure to reap its rewards—and, importantly, to avoid the wrong kinds of failure as often as possible—starts with understanding that not all failures are created equal. As you will see, some failures can rightly be called bad. Fortunately, most of these are also preventable. Other failures are genuinely good. They bring important discoveries that improve our lives and our world. Lest you get the wrong idea, I've had my share of failures that were bad, along with some that were good.

This book offers a typology of failure that helps you sort the “right kind of wrong” from the failures that you should work hard to prevent. You will also learn how to think differently about yourself and failure, recognize contexts in which failures are likely, and understand the role of systems—all crucial competencies for mastering the science of failing well. You will meet a handful of *elite failure practitioners* from different fields, countries, and even centuries. As their examples make clear, learning from failure takes emotional fortitude and skill. It requires learning how to conduct thoughtful experiments, how to categorize failure, and how to glean valuable lessons from failures of all types.

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The frameworks and lessons in this book are the direct result of my quarter century as an academic researcher in social psychology and organizational behavior. In this role, I've interviewed people and collected data from surveys and other sources in corporations, government agencies, start-ups, schools, and hospitals. Talking with hundreds of people in these varied organizations—managers, engineers, nurses, physicians, CEOs, and frontline employees alike—I began to see patterns that yielded a new typology of failure, as well as a host of best practices for managing and learning from failure.

Let's return to the beginning of this long journey, which started with my participation in a pioneering study of hospital medication errors.

### **Learning from Mistakes Is Easier Said Than Done**

I sat, dumbfounded, staring at the computer screen starkly displaying my failure to find support for my study hypothesis. My first thought was, How could I admit how wrong I had been to my supervisor and to the doctors leading the study? I had spent hundreds of hours developing the survey, attending biweekly research meetings with the doctors and nurses who tracked drug errors in two nearby hospitals, and periodically jumping on my bicycle to get to the hospital soon after a caregiver had reported a major error, to interview people to identify the error's underlying causes. I had been entrusted with the medical-error data and permitted to ask hundreds of busy doctors and nurses to fill out my survey. I felt guilty for taking up their valuable time and ashamed of my failure.

One of the people I'd have to talk to about the failure was Dr. Lucian Leape, a pediatric surgeon who had shifted his professional attention later in his career to the study of medical errors. Well over six feet tall, with thick white hair and eyebrows, Lucian was both avuncular and intimidating. He was also determined. One research goal for the larger study was simple: to measure the rate of medication errors in hospitals.

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Back then, little was known about how frequently errors happened, and Lucian and his colleagues had a National Institutes of Health (NIH) grant to find out. Adding to that goal, inspired by some research in aviation that showed that better teamwork in the cockpit meant safer flights, Lucian had asked whether the same might be true in hospitals.

The aviation research that inspired Lucian hadn't intended to look at teamwork, but rather at fatigue in the cockpit. It was another failed hypothesis. A team of researchers at NASA, led by human-factors expert H. Clayton Foushee, ran an experiment to test the effects of fatigue on error rates. They had twenty two-person teams; ten were assigned to the "postduty" or "fatigue" condition. These teams "flew" in the simulator as if it were the last segment of a three-day stint in the short-haul airline operations where they worked. The fatigued teams had already flown three eight- to ten-hour daily shifts. Those shifts included at least five takeoffs and landings, sometimes up to eight. The other ten teams (the "pre-duty," well-rested condition) flew in the simulator after at least two days off duty. For them, the simulator was like their first segment in a three-day shift.

Simulators provide a safe context for learning. Pilots I've spoken to say the simulator looks and feels like a real cockpit, and they feel fear when something goes wrong. But errors in a simulator don't bring down a plane. This makes it a great environment to reflect on what went wrong, so as to perfect the skills needed to safely transport hundreds of passengers in real flights. These same features also make the simulator a great research tool. While it would never be ethical to randomly assign tired pilots to fly real flights with real passengers, experimenting is fine in a simulator.

To his surprise, Foushee discovered that the teams who'd just logged several days flying together (the fatigued teams) performed *better* than the well-rested teams. As expected, the fatigued *individuals* made more errors than their well-rested counterparts, but because they had spent time working together through multiple flights, they'd made fewer errors *as teams*. Apparently, they were able to work well together, catching and

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correcting one another's errors throughout the flight, avoiding serious mishaps. The fatigued pilots had essentially turned themselves into good teams after working together for a couple of days. In contrast, the well-rested pilots, unfamiliar with one another, didn't work as well as teams.

This surprise finding about the importance of teamwork in the cockpit helped fuel a revolution in passenger air travel called crew resource management (CRM), which is partly responsible for the extraordinary safety of passenger air travel today. This impressive work is one of many examples of what I call the science of failing well.

Research on cockpit crews blossomed in the 1980s and included the work of J. Richard Hackman, a Harvard psychology professor, who studied the interplay of pilots, copilots, and navigators on both civilian and military planes to understand what effective teams had in common. His cockpit-crew research had attracted the attention of Lucian Leape. Seeing a parallel between the high-stakes work of cockpit crews and that of hospital clinicians, Lucian picked up the phone to see if Richard might be willing to help with Lucian's medication-error study. Lacking the time to commit to the project, Richard suggested that I, his doctoral student, might be put to work instead. Which is how I found myself hunched over my findings, gripped by anxiety.

I'd hoped to build on the aviation research to add another small finding to the team-effectiveness literature. The research question was simple: Does better teamwork in the hospital lead to fewer errors? The idea was to replicate the aviation findings in this new context. So what if it would not be a major discovery? As a new graduate student, I wasn't trying to set the world on fire, but just to satisfy a program requirement. Simple, unsurprising, would be just fine.

A small team of nurses would do the hard work of tracking error rates for six months in the hospital wards, talking with doctors and nurses and reviewing patients' charts several times a week. All I had to do was distribute a survey to measure teamwork in these same wards in the first month of the six-month study. Then I had to wait patiently for the error data to be collected so I could compare the two data sets—

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connecting my team measures with the error data collected over the full six months. I had Hackman's ready-made "team diagnostic survey" to get me started for measuring team effectiveness. Working with the doctors and nurses in the research team, I modified the wording to include numerous items to assess different aspects of teamwork, such as "Members of this unit care a lot about it and work together to make it one of the best in the hospital" and "Members of this unit share their special knowledge and expertise with one another," or the negatively worded item "Some people in this unit do not carry their fair share of the overall workload." The response options ranged from strongly agree to strongly disagree. I computed averages of individual responses to these types of items to assess the quality of teamwork, which I then averaged again to compute scores for each team. A healthy 55 percent of the surveys I distributed were returned, and the data showed plenty of variance across teams. Some teams appeared to be more effective than others. So far so good.

Would those differences predict the teams' propensity to make mistakes?

At first glance, everything looked fine. I immediately saw a correlation between the error rates and team effectiveness, and better yet, it was statistically significant. For those who haven't taken a stats course, this was reassuring.

But then I looked more closely! Leaning toward my computer screen, I saw that the correlation was in the *wrong* direction. The data were saying the opposite of what I'd predicted. Better teams appeared to have higher, not lower, error rates. My anxiety intensified, bringing a sinking feeling in my stomach.

Although I didn't yet know it, my no longer straightforward research project was producing an intelligent failure that would lead to an unexpected discovery.

Surprises, often in the form of bad news for a researcher's hypothesis, are common in research. None last long as scientists if they can't stand to fail, as I would soon learn. Discovery stories don't *end* with



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failure; failures are stepping stones on the way to success. There is no shortage of popular quotes on that point—many of them are sprinkled throughout this book—and for good reason. These kinds of informative, but still *undesired*, failures are the *right kind of wrong*.

### Being Wrong in New Territory

These failures are “intelligent,” as my colleague Duke professor Sim Sitkin first suggested back in 1992, because they involve careful thinking, don’t cause unnecessary harm, and generate useful learning that advances our knowledge. Despite happy talk about celebrating failures in Silicon Valley and around the world, intelligent failures are the only type genuinely worth celebrating. Also referred to as smart failures or good failures, they occur most characteristically in science, where failure rates in a successful laboratory might be 70 percent or higher. Intelligent failures are also frequent and essential in company innovation projects, say, as part of building a popular new kitchen tool. Successful innovation is only possible as a result of insights from incremental losses along the way.

In science, as in life, intelligent failures can’t be predicted. A blind date set up by a mutual friend may conclude in a tedious evening (a failure) even if the friend had good reasons to believe you’d like each other. Whether an intelligent failure is small (a boring date) or large (a failed clinical trial), we must welcome this type of failure as part of the messy journey into new terrain, whether it leads to a lifesaving vaccine or a life partner.

Intelligent failures provide valuable new knowledge. They bring discovery. They occur when experimentation is necessary simply because answers are not knowable in advance. Perhaps a particular situation hasn’t been encountered before, or perhaps one is truly standing on the front lines of discovery in a field of research. Discovering new drugs, launching a radical new business model, designing an innovative prod-

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uct, or testing customer reactions in a brand-new market are all tasks that require intelligent failures to make progress and succeed. *Trial and error* is a common term for the kind of experimentation needed in these settings, but it's a misnomer. *Error* implies that there was a "right" way to do it in the first place. Intelligent failures are not errors. This book will elaborate on this and other vital distinctions that we must make if we wish to learn to put failure to good use.

### *Solving the puzzle*

That day in William James Hall, staring at the failure displayed on my old Mac screen, I tried to think clearly, pushing aside the anxiety that only intensified as I envisioned the moment when I, a lowly graduate student, would have to tell the esteemed Richard Hackman that I had been wrong, that the aviation results didn't hold in health care. Perhaps that anxiety forced me to think deeply. To rethink what my results might mean.

Did better teams *really* make more mistakes? I thought about the need for communication between doctors and nurses to produce error-free care in this perpetually complex and customized work. These clinicians needed to ask for help, to double-check doses, to raise concerns about one another's actions. They had to coordinate on the fly. It didn't make sense that good teamwork (and I didn't doubt the veracity of my survey data) would lead to more errors.

Why else might better teams have higher error rates?

What if those teams had created a better work environment? What if they had built a climate of openness where people felt able to speak up? What if that environment made it easier to be open and honest about error? To err is human. Mistakes happen—the only real question is whether we catch, admit, and correct them. Maybe the good teams, I suddenly thought, don't *make* more mistakes, maybe they *report* more. They swim upstream against the widely held view of error as indicative

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of incompetence, which leads people everywhere to suppress acknowledging (or to deny responsibility for) mistakes. This discourages the systematic analysis of mistakes that allows us to learn from them. This insight eventually led me to the discovery of psychological safety, and why it matters in today's world.

Having this insight was a far cry from proving it. When I brought the idea to Lucian Leape, he was at first extremely skeptical. I was the novice on the team. Everyone else had a degree in medicine or nursing and deeply understood patient care in a way that I never would. My sense of failure deepened in the face of his dismissal. That in those fraught moments Lucian reminded me of my ignorance was understandable. I was suggesting a reporting bias across teams, effectively calling into question a primary aim of the overall study—to provide a good estimate of the *actual* error rates in hospital care. But his skepticism turned out to be a gift. It forced me to double down on my efforts to think about what additional data might be available to support my (new and still-shaky) interpretation of the failed results.

Two ideas occurred to me. First, because of the overall study's focus on error, when I had edited the team survey to make its wording appropriate for hospital work, I had added a new item: "If you make a mistake in this unit, it won't be held against you." Fortunately, the item correlated with the detected error rates; the more people believed that making a mistake would not be held against them, the higher the detected errors in their unit! Could that be a coincidence? I didn't think so. This item, later research would show, is remarkably predictive of whether people will speak up in a team. This, along with several other secondary statistical analyses, was entirely consistent with my new hypothesis. *When people believe mistakes will be held against them, they are loath to report them.* Of course, I had felt this myself!

Second, I wanted to get an objective read on whether palpable differences in the work environment might exist across these work groups, despite all being in the same health-care system. But I couldn't do it myself: I was biased in favor of finding such differences.

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Unlike Lucian Leape, with his initial skepticism, Richard Hackman immediately recognized the plausibility of my new argument. With Richard's support, I hired a research assistant, Andy Molinsky, to study each of the work groups carefully with no preconceptions. Andy didn't know which units had more mistakes, nor which ones had scored better on the team survey. He also didn't know about my new hypothesis. In research terminology, he was *double-blind*. I simply asked him to try to understand what it was like to work in each of the units. So, Andy observed each unit for several days, quietly watching how people interacted and interviewing nurses and physicians during their breaks to learn more about the work environment and how it differed across units. He took notes on what he observed, including jotting down things people said about working in their unit.

With no prompting from me, Andy reported that the hospital units in the study appeared wildly different as places to work. In some, people talked about mistakes openly. Andy quoted the nurses as saying such things as a "certain level of error will occur" so a "non-punitive environment" is essential to good patient care. In other units, it seemed nearly impossible to speak openly about error. Nurses explained that making a mistake meant "you get in trouble" or you get put "on trial." They reported feeling belittled, "like I was a two-year-old," for things that went wrong. His report was music to my ears. It was exactly the kind of variance in work environment that I had suspected might exist.

But were these differences in climate correlated with the error rates so painstakingly collected by the medical researchers? In a word, yes. I asked Andy to rank the teams he'd studied from most to least *open*, the word he had used to explain his observations. Astonishingly, his list was nearly perfectly correlated with the detected error rates. This meant that the study's error-rate measure was flawed: when people felt unable to reveal errors, many errors remained hidden. Combined, these secondary analyses suggested that my interpretation of the surprise finding was likely correct. My eureka moment was this: better

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teams probably don't *make* more mistakes, but they are more able to discuss mistakes.\*

### *Discovering psychological safety*

Much later I used the term *psychological safety* to capture this difference in work environment, and I developed a set of survey items to measure it, thereby spawning a subfield of research in organizational behavior. Today, over a thousand research papers in fields ranging from education to business to medicine have shown that teams and organizations with higher psychological safety have better performance, lower burnout, and, in medicine, even lower patient mortality. Why might this be the case? Because psychological safety helps people take the interpersonal risks that are necessary for achieving excellence in a fast-changing, interdependent world. When people work in psychologically safe contexts, they know that questions are appreciated, ideas are welcome, and errors and failure are discussable. In these environments, people can focus on the work without being tied up in knots about what others might think of them. They know that being wrong won't be a fatal blow to their reputation.

Psychological safety plays a powerful role in the science of failing well. It allows people to ask for help when they're in over their heads, which helps eliminate preventable failures. It helps them report—and hence catch and correct—errors to avoid worse outcomes, and it makes it possible to experiment in thoughtful ways to generate new discoveries. Think about the teams that you've been a part of at work, or at school, in sports, or in your community. These groups probably varied in psychological safety. Maybe in some you felt completely comfortable speaking

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\* Note that in this study it was not possible to assess *actual*-error rates; detected-error rates were discovered to be a necessarily biased measure because of the discovered differences across units in psychological safety.

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up with a new idea, or disagreeing with a team leader, or asking for help when you were out of your depth. In other teams you might have felt it was better to hold back—to wait and see what happened or what other people did and said before sticking your neck out. That difference is now called psychological safety—and I have found in my research that it's an emergent property of a group, not a personality difference. This means your perception of whether it's safe to speak up at work is unrelated to whether you're an extrovert or an introvert. Instead, it's shaped by how people around you react to things that you and others say and do.

When a group is higher in psychological safety, it's likely to be more innovative, do higher-quality work, and enjoy better performance, compared to a group that is low in psychological safety. One of the most important reasons for these different outcomes is that people in psychologically safe teams can admit their mistakes. These are teams where candor is expected. It's not always fun, and certainly it's not always comfortable, to work in such a team because of the difficult conversations you will sometimes experience. Psychological safety in a team is virtually synonymous with a learning environment in a team. Everyone makes mistakes (we are all fallible), but not everyone is in a group where people feel comfortable speaking up about them. And it's hard for teams to learn and perform well without psychological safety.

### What Is the Right Kind of Wrong?

You might think that the right kind of wrong is simply the smallest possible failure. Big failures are bad, and small failures are good. But size is actually not how you will learn to distinguish failures, or how you will assess their value. Good failures are those that bring us valuable new information that simply *could not have been gained any other way*.

Every kind of failure brings opportunities for learning and improvement. To avoid squandering these opportunities, we need a mix of emotional, cognitive, and interpersonal skills. These will be spelled out

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in this book in a way that I hope makes it easy to start applying them immediately.

But before we go any further, a few definitions are in order. I define *failure* as an outcome that deviates from desired results, whether that be failing to win a hoped-for gold medal, an oil tanker spilling thousands of tons of raw oil into the ocean instead of arriving safely in a harbor, a start-up that dives downward, or overcooking the fish meant for dinner. In short, failure is a lack of success.

Next, I define *errors* (synonymous with *mistakes*) as unintended deviations from prespecified standards, such as procedures, rules, or policies. Putting the cereal in the refrigerator and the milk in the cupboard is an error. A surgeon who operates on a patient's left knee when the right knee was injured has made an error. The important thing about errors and mistakes is that they are unintended. Errors may have relatively minor consequences—cereal stored in the refrigerator is inconvenient and milk left in the cupboard may spoil—while other mistakes, such as the patient who received the wrong-site surgery, have serious repercussions.

Finally, *violations* occur when an individual intentionally deviates from the rules. If you deliberately pour flammable oil on a rag, light a match to it, and throw it into an open doorway, you are an arsonist and have violated the law. If you forget to properly store an oil-soaked rag and it spontaneously combusts, you have made a mistake.

All of these terms can be so emotionally loaded that we may be tempted to simply turn and flee. But in so doing, we miss out on the intellectually (and emotionally) satisfying journey of learning to dance with failure.

## Bad Failure, Good Failure

Maybe you are one of the many people who deep down believe that failure is bad. You've heard the new rhetoric about embracing failure

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but find it hard to take it seriously in your day-to-day life. Maybe you also believe that learning from failure is pretty straightforward: reflect on what you did wrong (not trying hard enough in math class, steering the boat too close to the rocks) and just do better next time, whether by studying more or ensuring that you have the latest maps for accurate navigation. This approach sees failure as shameful and largely the fault of the one who fails.

This belief is as widely held as it is misguided.

First, failure is not always bad. Today, I don't doubt that my failure to find support for the simple research hypothesis that guided my first study was the best thing that ever happened to my research career. Of course, it didn't feel that way in the moment. I felt embarrassed and afraid that my colleagues wouldn't keep me on the research team. My thoughts spiraled out to what I would do next, after dropping out of graduate school. This unhelpful reaction points to why each of us must learn how to take a deep breath, think again, and hypothesize anew. That simple self-management task is part of the science of failing well.

Second, learning from failure is not nearly as easy as it sounds. Nonetheless, we can learn how to do it well. If we want to go beyond superficial lessons, we need to jettison a few outdated cultural beliefs and stereotypical notions of success. We need to accept ourselves as fallible human beings and take it from there.

### Road Map for the Journey Ahead

This book offers frameworks that I hope will help you think about, talk about, and practice failure in a way that allows you to work and live more joyfully.

Part one introduces a framework of failure types. The first chapter offers key concepts in failure science, followed by three chapters to describe the three failure archetypes: intelligent, basic, and complex. Understanding this taxonomy will give you a deeper understanding of



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failure's mechanisms and of what it means to fail well. This will help you design your own experiments to stretch beyond limits, self-imposed or otherwise. I will share best practices related to each type of failure—for learning from them, as well as for preventing some of them. This survey of the failure landscape will help you truly welcome the good kinds of failure, while getting better at learning from all kinds.

*Intelligent failures*, the subject of chapter 2, are the “good failures” that are necessary for progress—the small and large discoveries that advance science, technology, and our lives. Pioneers doing something new will always face unexpected problems. The key is to learn from them, rather than to deny or feel bad about them, give up, or pretend it should have been otherwise.

Chapter 3 digs into *basic failures*, the most easily understood and the most preventable. Caused by mistakes and slips, basic failures can be avoided with care and access to relevant knowledge. Mistakenly sending an email meant for your sister to a boss is a basic failure. Yes, some might call it catastrophic, but it's basic nonetheless. Checklists are just one of the tools you'll learn about for reducing basic failures.

As pernicious as basic failures can be, *complex failures*, described in chapter 4, are the real monsters that loom large in our work, lives, organizations, and societies. Complex failures *have not one but multiple causes* and often include a pinch of bad luck, too. These unfortunate breakdowns will always be with us due to the inherent uncertainty and interdependence we face in our day-to-day lives. This is why catching small problems before they spiral out of control to cause a more substantial complex failure becomes a crucial capability in the modern world.

Part two presents my latest thinking on *self-awareness*, *situation awareness*, and *system awareness*—and how these capabilities intersect with the three types of failure. This will be a chance to dig more deeply into tactics and habits that allow people to practice the science of failing well at work and in their lives. Chapter 5 explores *self-awareness* and its crucial role in the science of failure. Our human capacity for sustained

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self-reflection, humility, honesty, and curiosity propels us to seek out patterns that provide insight into our behavior. Chapter 6 digs into *situation awareness*—and learning how to read a given situation for its failure potential. You'll have a sense of what situations present an accident waiting to happen so as to help prevent unnecessary failure. Chapter 7 looks at *system awareness*. We live in a world of complex systems where our actions trigger unintended consequences. But learning to see and appreciate systems—say, family, organization, nature, or politics—helps us prevent a lot of failures.

These ideas and frameworks come together to help us answer the question, in chapter 8, of *how to thrive as a fallible human being*. All of us are fallible. The question is whether, and how, we use this fact to craft a fulfilling life full of never-ending learning.

# PART ONE

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## THE FAILURE LANDSCAPE



## CHAPTER 1

# Chasing the Right Kind of Wrong

Only those who dare to fail greatly  
can ever achieve greatly.

—Robert F. Kennedy

On April 6, 1951, forty-one-year-old cardiac surgeon Dr. Clarence Dennis was operating on five-year-old Patty Anderson in a state-of-the-art operating room. It wasn't going well. Dennis's desire to save the child, who had been diagnosed with a rare congenital heart defect, was intense and urgent. On the observation deck, several of his colleagues at University Hospital in Minnesota watched as Dennis connected his new heart-lung bypass machine to the little girl. Designed to function as the patient's lungs and heart during surgery, the machine had thus far only been tested on dogs in a laboratory. Extremely complicated, the machine required the assistance of sixteen people during the procedure; its rotating disks served as lungs; a pump performed the heart functions; and its many tubes acted as vessels moving blood throughout the body.

Dennis was among a handful of pioneering surgeons in the 1950s determined to discover a way to successfully operate on the heart of a