Preface

PEOPLE GENERALLY ARE going about learning in the wrong ways. Empirical research into how we learn and remember shows that much of what we take for gospel about how to learn turns out to be largely wasted effort. Even college and medical students—whose main job is learning—rely on study techniques that are far from optimal. At the same time, this field of research, which goes back 125 years but has been particularly fruitful in recent years, has yielded a body of insights that constitute a growing science of learning: highly effective, evidence-based strategies to replace less effective but widely accepted practices that are rooted in theory, lore, and intuition. But there's a catch: the most effective learning strategies are not intuitive.

Two of us, Henry Roediger and Mark McDaniel, are cognitive scientists who have dedicated our careers to the study of learning and memory. Peter Brown is a storyteller. We have

teamed up to explain how learning and memory work, and we do this less by reciting the research than by telling stories of people who have found their way to mastery of complex knowledge and skills. Through these examples we illuminate the principles of learning that the research shows are highly effective. This book arose in part from a collaboration among eleven cognitive psychologists. In 2002, the James S. McDonnell Foundation of St. Louis, Missouri, in an effort to better bridge the gap between basic knowledge on learning in cognitive psychology and its application in education, awarded a research grant "Applying Cognitive Psychology to Enhance Educational Practice" to Roediger and McDaniel and nine others, with Roediger as the principal investigator. The team collaborated for ten years on research to translate cognitive science into educational science, and in many respects this book is a direct result of that work. The researchers and many of their studies are cited in the book, the notes, and our acknowledgments. Roediger's and McDaniel's work is also supported by several other funders, and McDaniel is the co-director of Washington University's Center for Integrative Research in Learning and Memory.

Most books deal with topics serially—they cover one topic, move on to the next, and so on. We follow this strategy in the sense that each chapter addresses new topics, but we also apply two of the primary learning principles in the book: spaced repetition of key ideas, and the interleaving of different but related topics. If learners spread out their study of a topic, returning to it periodically over time, they remember it better. Similarly, if they interleave the study of different topics, they learn each better than if they had studied them one at a time in sequence. Thus we unabashedly cover key ideas more than once, repeating principles in different contexts across the book.

The reader will remember them better and use them more effectively as a result.

This is a book about what people can do for themselves right now in order to learn better and remember longer. The responsibility for learning rests with every individual. Teachers and coaches, too, can be more effective right now by helping students understand these principles and by designing them into the learning experience. This is not a book about how education policy or the school system ought to be reformed. Clearly, though, there are policy implications. For example, college professors at the forefront of applying these strategies in the classroom have experimented with their potential for narrowing the achievement gap in the sciences, and the results of those studies are eye opening.

We write for students and teachers, of course, and for all readers for whom effective learning is a high priority: for trainers in business, industry, and the military; for leaders of professional associations offering in-service training to their members; and for coaches. We also write for lifelong learners nearing middle age or older who want to hone their skills so as to stay in the game.

While much remains to be known about learning and its neural underpinnings, a large body of research has yielded principles and practical strategies that can be put to work immediately, at no cost, and to great effect.

MAKE IT STICK