

## Well

WELL | TARA PARKER-POPE

## Valuable Lessons in Learning

DOES A GOOD GRADE always mean a student has learned the material? And does a bad grade mean a student just needs to study more?

In the new book, "How We Learn: The Surprising Truth About When, Where, and Why It Happens" (Random House), Benedict Carey, a science reporter for The New York Times, challenges the notion that a high test score equals true learning. He argues that although a good grade may be achieved in the short term by cramming for an exam, chances are that most of the information will be quickly lost. Indeed, he argues, most students probably don't need to study more — just smarter.

Mr. Carey offers students old and young a new blueprint for learning based on decades of brain science, memory tests and learning studies. He upends the notion that "hitting the books" is all that is required to be a successful student, and instead offers a detailed exploration of the brain to reveal exactly how we learn, and how we can maximize that potential.

"Most of us study and hope we are doing it right," Mr. Carey says. "But we tend to have a static and narrow notion of how learning should happen."

For starters, long and focused study sessions may seem productive, but chances are you are spending most of your brainpower on trying to maintain your concentration for a long period of time. That doesn't leave a lot of brain energy for learning.

"It's hard to sit there and push yourself for hours," Mr. Carey says. "You're spending a lot of effort just staying there, when there are other ways to make the learning more efficient, fun and interesting."

The first step toward better learning is to simply change your study environment from time to time. Rather than sitting at your desk or the kitchen table studying for hours, finding some new scenery will create new associations in your brain and make it easier to recall information later.

"The brain wants variation," Mr. Carey says. "It wants to move, it wants to take periodic breaks."

Understanding how the brain processes, stores and retrieves information can also improve your study habits. For some people, cramming for a test can work in the short term, but by studying only once in a concentrated fashion, the learner has not signaled to the brain that the information is important. So while the initial study session of French vocabulary words starts the process of learning, it's the next review session a few days later that forces the brain to retrieve the information — essentially flagging it as important and something to be remembered.

"When you are cramming for a test, you are holding that information in your head for a limited amount of time," Mr. Carey says. "But you haven't signaled to the brain in a strong way that it's really valuable."

One way to signal to the brain that information is important is to talk about it. Ask a young student to play "teacher" based on the information they have studied. Self-testing and writing down information on flashcards also reinforces learning.

Another technique is called distributed learning, or "spacing," and it's a particularly relevant aspect of brain science for ambitious students. Mr. Carey compares it to watering a lawn. You can water a lawn once a week for 90 minutes or three times

### Cramming is not the best way to retain information.

a week for 30 minutes. Spacing out the watering during the week will keep the lawn greener over time.

Studies have shown that for a student to learn and retain information like historical events, vocabulary words or science definitions, it's best to review the information one to two days after first studying it. One theory is that the brain actually pays less attention during short learning intervals. So repeating the information over a longer interval — say a few days or a week later, rather than in rapid succession — sends a stronger signal to the brain that it needs to retain the information.

Spaced study can also add contextual cues. At home, a student trying to memo-

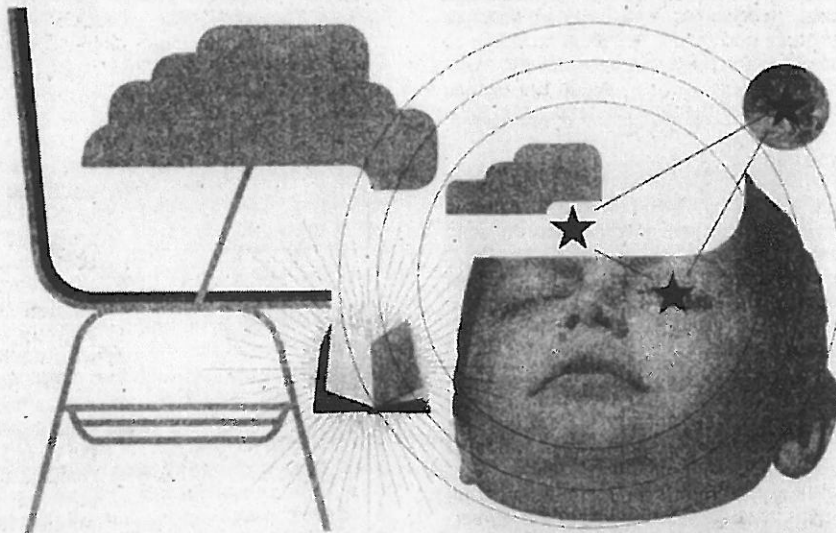
rize the presidents may hear the dog bark or phone ring. Move the study time to the coffee shop a few days later, and the student hears the barista steaming milk. Now the list of presidents is embedded in the student's memory in two contexts, and that makes the memory stronger.

In a 2008 study of 1,300 people, University of California, San Diego researchers tested their subjects on obscure facts. (What's the name of the dog on the Cracker Jack box? Answer: Bingo) The study subjects reviewed the material twice at different intervals: some just a few minutes apart, others a day or a week apart.

From the data, the scientists determined the optimal intervals for learning information. If your test is a week away, you should plan two study periods at least one to two days apart. For a Friday test, study on Monday and review on Thursday. If your test is a month away, begin studying in one-week intervals.

And not surprisingly, sleep is an important part of good studying. The first half of the sleep cycle helps with retaining facts; the second half is important for math skills. So a student with a foreign language test should go to bed early to get the most retention from sleep, and then review in the morning. For math students, the second half of the sleep cycle is most important — better to review before going to bed and then sleep in to let the brain process the information.

"Sleep is the finisher on learning," Mr. Carey says. "The brain is ready to process and categorize and solidify what you've been studying. Once you get tired, your brain is saying it's had enough."



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