

**Book Notes: How We Learn: The Surprising Truth
About When, Where, and Why it Happens
By Benedict Carey**

Chapter Two: The Power of Forgetting

- Forgetting is critical to the learning of new skills and to the preservation and reacquisition of old ones.
- Continuing to test yourself on information will increase the storage and retrieval strength of what you already remembered, as well as allowing your brain to search for more information to add. Write down as much as you can remember of the information without looking, and then repeat at a later time. It is likely that you will be able to add more information each time.
- Using memory changes memory. Forgetting enables and deepens learning, by filtering out distracting information and by allowing some breakdown that, after reuse, drives retrieval and storage strength higher than they were originally.

Chapter Three: Breaking Good Habits

- Vary the aspects of the environment in which you study. Since we cannot always predict the environment in which we have to perform, we are better off varying the circumstances in which we prepare.
- Each alteration of the routine further enriches the skills being rehearsed, making them sharper and more accessible for longer periods of time. This kind of experimenting reinforces learning and makes what you know increasingly independent of your surroundings.
 - The traditional advice to establish a strict practice routine is no way to do so. Try another room, another time of day. Go outside. Change cafés. Put on different types of music.

Chapter Four: Spacing Out

- Distributed learning can increase the amount you remember later on. Learning from cramming can occur, but the chance of long-term retrieval is low.
- Take advantage of *the spacing effect*: Study information you have to memorize for ten minutes every day.
- Break up practice time. If you plan to allot 3 hours to a particular subject, it is better to study it for 30 or 60 minutes over a few days, rather than 3 hours at a time.

- Wiseheart and Pashler (2008) calculated the optimal distribution of study time based on how long you want to remember it:

Time to Test	First Study Interval
1 week	1-2 days
1 month	1 week
3 months	2 weeks
6 months	3 weeks
1 year	1 month

Chapter Five: The Hidden Value of Ignorance

- The *fluency illusion* can interfere with test performance: Once we feel we can remember information *right now*, we often refrain from further study.
- Simply repeating facts right after you have studied them gives you no added memory benefit. Wait, and try to recollect in your own words later. When the brain is retrieving information, it is doing something different, and harder, than when it merely sees information again. The extra effort deepens storage and retrieval strength.
- When we successfully retrieve a fact, we then re-store it in memory in a different way than we did before, which gives the memory new and different connections.
- Use the *Gates ratio*: Devote 30-40% of time to reading/memorization and the rest of the time to recitation/recall.
- Reviewing or rewriting notes will not be as helpful as studying them and then trying to rewrite them without looking.
- The most effective test preparation is testing itself. Quiz yourself or take practice exams immediately after reading the material. This technique proves to be effective for long-term recall.
- Make use of *pretesting*. Unsuccessful retrieval attempts alter how we think about and store the information contained in the questions.
- Particularly on multiple-choice tests, we learn from answering incorrectly, especially when given the correct answer soon afterward.
- Guessing wrongly increases the likelihood of getting the question or a similar one correct in the future.

Chapter Eight: Being Mixed Up

- Repetition creates a powerful illusion. Skills improve quickly and then plateau. Varied practice produces a slower apparent rate of improvement in each session, but a greater accumulation of learning over time.
- Make use of the technique of *interleaving*: Mixing related but distinct material during study. This process will help you see the distinctions between each, as well as achieve a clearer grasp on each one individually.
- Surround new material with older, related material that you know, but have not revisited in a while.

Chapter Ten: You Snooze, You Win

- Sleep improves retention and comprehension of what was studied the day before. Study all material for an exam a minimum of the day before the exam, or at least take a nap in between studying and the exam.
- If you are preparing for an exam that will strain your ability to detect patterns, it is better to stay up late and sleep as late as possible. If you need to recall information, go to bed at your regular time, and get up early to do a quick review before dawn.
- Naps of 1-1.5 hours often contain both slow-wave deep sleep and REM. People who study in the morning do better on an evening test if they have had a 1.5-hour nap.

Book Notes is a series compiled by Lisa Medoff, PhD, Stanford School of Medicine's Learning Specialist. These handouts are intended to provide at-a-glance suggestions and strategies relevant to the needs of medical students. If you find the handouts helpful, I encourage you to read the original books, as they will offer much more detailed information on the topic of interest.

Please contact lmedoff@stanford.edu if you have a suggestion for a book that should be added to the series and/or if you are a student at the School of Medicine who would like to discuss in person how to implement any of the suggestions listed above.