Back to Article Click to Print

TIME
IN PARTNERSHIP WITH CNN

Friday, Jan. 29, 2010

Studies: An Idle Brain May Be Ripe for Learning

By Anita Hamilton

Why is it so hard to remember even things we don't want to forget? The problem, suggests a growing body of research, may be that we're thinking about them too much in the first place.

Popular wisdom once held that a mind at rest was like an engine idling — not much going on under the hood. To glean insights into how the brain worked, scientists would study only volunteers in action, measuring their physiological or biochemical responses as they completed specific mental tasks. But more recently, thanks in large part to the proliferation of functional magnetic resonance imaging (fMRI), which precisely maps brain activity based on changes in blood-oxygen levels, neuroscientists have found that important activity in the brain — related in particular to memory and learning — may occur when it is at rest. (See "The Year in Health 2009: From A to Z.")

Many studies over the past decade have suggested that sleep is crucial to the consolidation of memories and learning; people who take a nap after learning a new task, for instance, remember it better than those who don't snooze. And now a small but compelling new study from the lab of New York University (NYU) cognitive neuroscientist Lila Davachi finds similar evidence that the brain at rest, even while remaining awake, is conducting meaningful activity. "Your brain is doing work for you even when you're resting," says Davachi, who just published a study in *Neuron* showing that certain kinds of brain activity actually increase during waking rest and are correlated with better memory consolidation. "Taking a rest may actually contribute to your success at work or school," she adds. (Comment on this story)

The 16 participants who served as Davachi's guinea pigs in the study were each scanned, while at rest, before the experiment began. Then, each volunteer was asked to lie flat on the bed of an fMRI machine, outside the magnet, while shown a series of paired images. First they looked at pairs of faces and objects, and were instructed to imagine the person pictured interacting with the object (such as a beach ball). Then they got a few minutes' rest, before being rolled into the magnet for another scan. The experiment was repeated with pairs of new faces and scenes. Afterward, the

participants took a pop quiz to measure their recognition of the faces, objects and scenes they had previously seen. (See how to prevent illness at any age.)

The purpose of the scans was to compare the relative levels of spontaneous neural activity in two key brain regions involved in memory — the hippocampus and visual cortex — during rest, both before and after the visual tasks. The NYU team noticed that levels of activity in the two areas were more closely correlated several minutes after people had looked at the images than before they started the experiment. That suggests that the visual-learning tasks had affected the brain's seemingly random firings during rest, and perhaps that the brain was conducting memory-consolidating activity during that time.

What's more, the more closely correlated the brain activity during the rest period, the better the person performed on the tests of recognition. "We found that higher correlations [of activity in the hippocampus and visual cortex] during rest periods leads to high future memory," notes Arielle Tambini, a graduate student in Davachi's lab and lead author of the paper.

While the NYU study tested memory and simple recognition, other recent research looking at activity in the brain at rest and the learning of complex visual tasks has yielded similar results. Neurologist Maurizio Corbetta of Washington University in St. Louis recruited 14 people to use their peripheral vision to identify a hidden pattern — an inverted *T* — that was flashed briefly on a screen inside an fMRI machine. After each daily training session, lasting one to two hours for about a week, participants were given an hour's rest, during which time Corbetta scanned their brains. (Read "The fMRI Brain Scan: A Better Lie Detector?")

As reported in the *Proceedings of the National Academy of Sciences* in 2009, Corbetta's team found that spontaneous brain activity in two separate regions of the cerebral cortex appeared to be correlated after the participants had learned the visual task, but were not linked beforehand. The brain activity in those who were best at finding the hidden pattern onscreen was most strongly related. "Our test was like a video game. What this research shows is that we have a very dynamic landscape of ongoing activity [in the brain] even when we are at rest," notes Corbetta.

One question that has plagued researchers is whether the observed increase in brain activity that occurs after the completion of a mental task is just a ripple or echo effect, rather than a distinct event that helps solidify memories. Harvard researcher Dale Stevens believes he has more or less ruled out the former possibility by showing that even tasks that produce similar levels of neural activity while they are being performed, such as recognizing a face versus a landscape, result in different levels of activity after each task is completed. In Stevens' studies, brain activity remained high after people viewed landscapes, but was much lower after they looked at faces. People tend to be much better at remembering landscapes than faces, so it makes sense that those differences would be mirrored in the brain-activity levels during rest periods, says Stevens, whose paper was published online in *Cerebral Cortex* in December 2009.

While the NYU, Washington University and Harvard studies all used different approaches, their overall findings were remarkably similar. "The brain is trying to weave ideas together even when you don't think you are thinking of anything," notes Johns Hopkins behavioral neurologist and memory expert Dr. Barry Gordon. That's something to keep in mind the next time you catch yourself daydreaming in a meeting or idly surfing Facebook when you should be studying.

Read "Workouts for Your Brain."

See the best pictures of 2009.