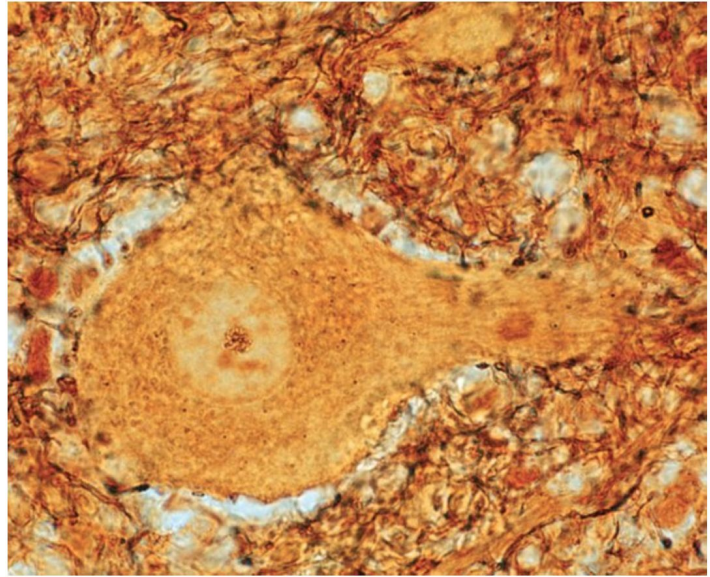


Sleep Shrinks the Brain's Synapses to Make Room for New Learning

The process keeps the attic of your mind well organized

By Bahar Gholipour on May 1, 2017

Every day you wake up with a slightly less connected brain than the night before. New research in mice reveals that during sleep the connections between brain cells, which hold information learned throughout the day, undergo massive shrinkage. The process makes room for learning new memories while shedding weak ones. As author Marie Kondo would put it, this is the brain's very own “life-changing magic of tidying up.”



Credit: Biophoto Associates, *Science Source*

“When we are awake, learning and adapting to the environment, synapses—or the connections between neurons—get strengthened and grow,” says neuroscientist Chiara Cirelli of the University of Wisconsin–Madison. “But you can’t keep growing the synapses. At some point, you will saturate them.”

After more than a decade of study, Cirelli and her colleagues have finally found direct evidence that synapses reset at night. They reported their findings in February in *Science*. Using electron microscopy to look at thousands of ultrathin brain slices taken from awake and sleeping mice, they found that after sleep, the size of most synapses—specifically, the surface area where two neurons touch each other—shrank by about 18 percent.

Although the findings were in mice, Cirelli suspects this synaptic resetting also occurs in people. Indirect evidence, for example, from electrophysiological recordings of the human brain before and after sleep, is consistent with this idea, she says.

This shrinkage appears to spare important memories. About 20 percent of synapses, which were the largest and may hold well-established memories, did not shrink. Less important memories may not get entirely axed but merely pared down—although each synapse shrinks, the overall pattern of connections that constitute a memory remains.

The brain needs to be off-line for this shrinking to occur, Cirelli says, which could be one reason we sleep: “It’s the price we have to pay to be able to learn new things.” Yet the primary purpose of snoozing remains debated. Some suggest sleep’s central function is to repair worn-out cellular machinery, and numerous studies have shown sleep’s critical role in consolidating memories. Together with previous research in flies, “these findings strongly support the idea that synaptic resetting is an evolutionarily old function of sleep,” says Niels C. Rattenborg of the Max Planck Institute for Ornithology in Munich, who was not involved in the new study. In other words, forgetting nonessential information might be just as vital as learning new material.

Answer: How does sleep help you remember and forget? Why is this Important? [To be handed in. Due by the end of class.]