The Synapse: Intercollegiate science magazine

Volume 1 | Issue 1 Article 7

2-1-2012

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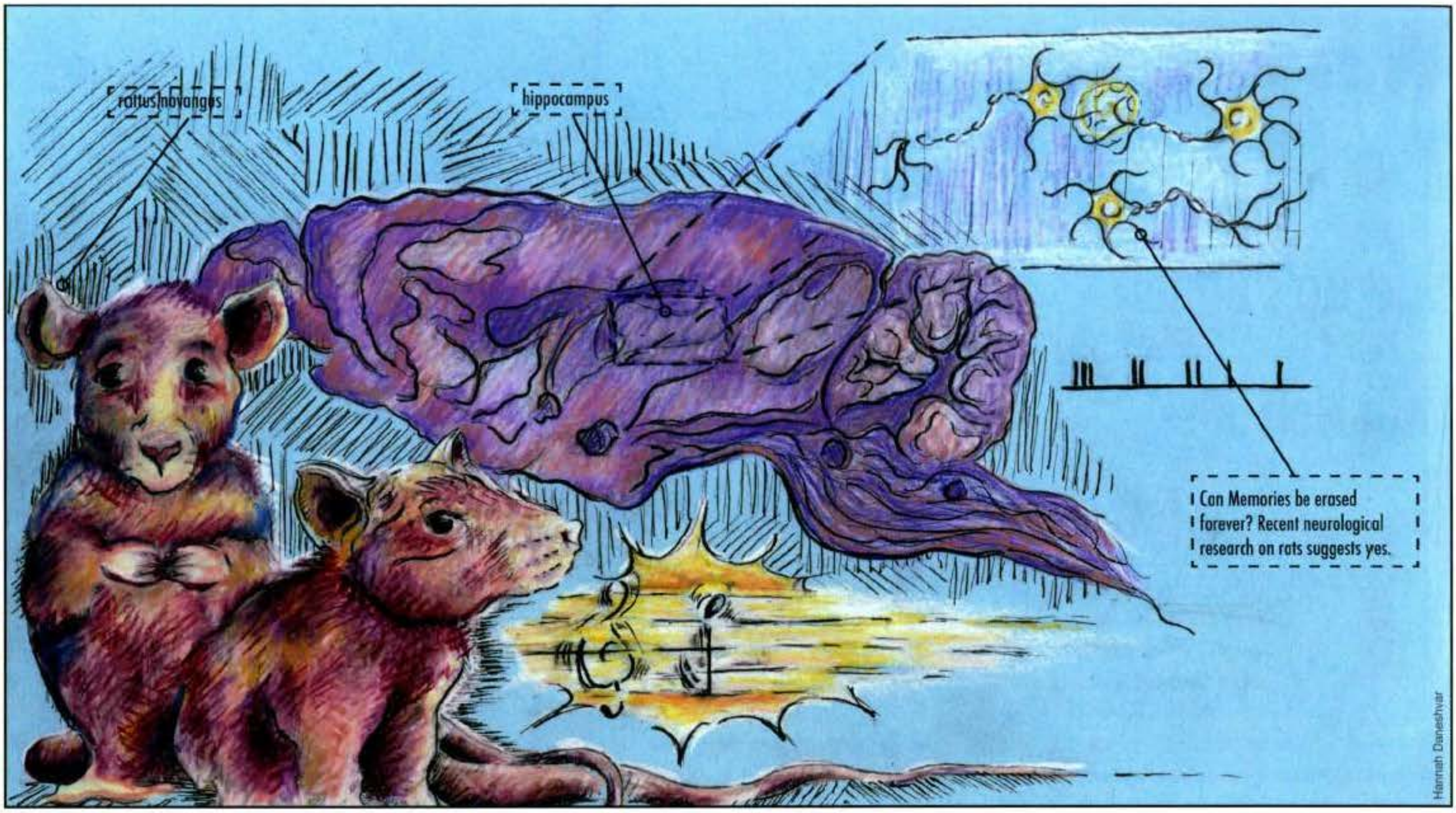
Recommended Citation

Goldberg, Elie (2012) "500 Milligrams for Arachnophobia, 1000 for the Ex-Wife: The Science of Memory Erasure," *The Synapse: Intercollegiate science magazine*: Vol. 1: Iss. 1, Article 7.
Available at: https://digitalcommons.denison.edu/synapse/vol1/iss1/7



500 Milligrams for Arachnophobia, 1000 for the Ex-Wife: The Science of Memory Erasure

By Elie Goldberg

Science has made us gods even before we are worthy of being men. Jean Rostand, a French biologist, expressed this fear nearly 70 years ago. Today, science has advanced to a state where there is more convergence between scientific research and ethical concerns than ever before. At the core of this convergence — between philosophical anxieties, progress, knowledge, creativity, hubris, and imagination — lies neuroscience, the magnum opus of the life sciences. Each day, we are expanding our understanding of the brain to new and unprecedented levels. Recent advances in memory research have enabled scientists to target and erase specific memories in live animals. Ironically, if Rostand were still alive today, his fears of scientific progress could soon be targeted and erased, without affecting any of his other mental capabilities. Of course, surrounding this scientific power is an ominous cloud of dystopian mind control, reeking of the spotless mind and the matrix; but at least we might one day be able to sleep soundly without the haunting memories of Krislov's naked body and scary clowns.

Before elaborating on the breakthroughs in research surrounding memory erasure, a cursory understanding of memory formation and maintenance is required. Scientists do not claim to understand the entire biological basis of memory

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formation, but one crucial process is fairly well documented. The process of long-term potentiation, or LTP, has been observed as one of the major cellular mechanisms that is crucial to memory formation in the hippocampus, cortex, amygdala, and many other areas of the brain. Simply, "memories" are formed by the steady chemical and electrical communication between neurons. This type of steady communication between cells, which causes the process of LTP, is largely driven by two membrane receptors, the α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor and N-methyl-D-aspartate (NMDA) receptor. The membrane receptors on one cell receive electrical and chemical signals from another cell. Consequently, the concentration of these receptors determines the strength of the connection between the two neurons; the presence of more receptors indicates a stronger connection. Interestingly, the process of LTP automatically increases or decreases the number of AMPA receptors on a neuron based on how frequently that neuron is activated. In other words, the neuronal connection responsible for a memory becomes stronger or weaker, depending on how frequently it is activated, or "remembered". If this neuronal connection is not frequently stimulated, it will die out and be forgotten. However, the agent responsible for regulating the number of membranous AMPA receptors, and consequently the strength and permanence of a memory, had not been discovered, until recently.

Perhaps the most shocking part about this recent breakthrough is not its potential ethical re-