NEUROPHYSIOLOGY

Cannabis helps your brain perform like new

Chronic low doses of THC can restore your brain power and help you perform as if you were half your age.

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The brain is complex with a network of many different neuron clusters with different functions. Everything from your genetics to your environment influences the way your neurons communicate. Drugs can influence and alter brain function and communication pathways with a wide range of mechanisms. Recently a lot of pharmacotherapy research focus has gravitated towards the endocannabinoid system (ECS) because of the vast reach it has in the body[1]. Initially banned for sale or use with the Marijuana Tax Act of 1937, later replaced with The Controlled Substance Act of 1970, research was stalled and non-existent for a long time. The isolation of endocannabinoid chemicals in the 1960s paved the way for the discovery of cannabinoid receptors such as CB1[2,3,4]. Since these initial findings, medical potential and money have driven research into this system with an ever-increasing number of physiological functions[5].

New research implicating the ECS in a variety of homeostatic tasks, such as energy balance and hormone regulatory functions, sheds light to the critical role the ECS plays in our body[6]. CB1 receptors are predominately found in the brain as neuronal plasma membrane receptors[7]. They are also responsible for binding delta-9-Tetrahydrocannnabinol (THC), the main psychoactive compound of cannabis[8]. When activated, CB1 receptors produce a cascade effect that inhibits neurotransmitter release impacting communication among neurons. Interestingly, deletion of CB1 receptors in mice has been found to produce age-related cognitive impairment, highlighting the potential role that the ECS plays in the molecular mechanisms of aging[9,10]. Brain aging is highly associated with cognitive decline and the role and impact of the ECS as many other internal systems on the aging process remains unclear. Aging mice have been shown to have decreasing ECS activity comprised of CB1 receptor expression, as well as a decrease in 2-arachidonyl glycerol (2-AG) and anandamide[11]. 2-AG and anandamide are both molecules produced within the body that may bind to CB1 receptor[12]. Gaining great attention is new research finding improved cognitive function in old mice receiving chronic low doses of THC[13]. As any drug addiction is important to consider.

Research has revealed potential increase in dependence and increased risk taking in adolescences[14,15]. Fortunately, this new research uncovers room for older adults to reap the benefits. This study was conducted with two main groups of mice, THC-rich and THC-poor; three sub-groups young, mature and old (2, 12 and 18 months old respectively). THC was delivered through minipumps that were implanted, releasing 3 mg/kg bodyweight for a month. Tests including Morris Water Maze (MWM), training and reversal training phase, novel object recognition test and social recognition test were accomplished (Figure 1). These tests were conducted to test a variety of cognitive function such as spatial memory and learning, memory impairments and long-term memory[16,17,18]. The goal of the tests was to determine if prolonged THC exposure in low dosage had lasting effects on learning and memory. Effects of age and treatment on spatial learning and memory were assessed with the MWM. The mature and old mice treated with THC performed at the level of THC-free 2-month-old mice indicating improved spatial learning and memory. Secondly effects of learning flexibility were assessed with the reversal phase testing which entails training of an animal to respond differentially to two stimuli such as approach or avoidance, rewarding and punishing conditions when responding inappropriately. The reversal phase would include the reversal of reward and punishment rewarding what was previously punished and vice versa. “Training an animal two tricks, punishing them when they respond incorrectly. After a while, the rewards and punishment get switched, testing how long it takes for the animal to change their behavior” (Piercy from neuroanatomy). The THC mature and old mice once again showed improved cognition and improved learning flexibility. Long-term spatial memory was tested with Novel Object Location Recognition and Social Recognition Test. Once again, the cognition improved in mature and old mice that had been treated with THC (Figure 1).

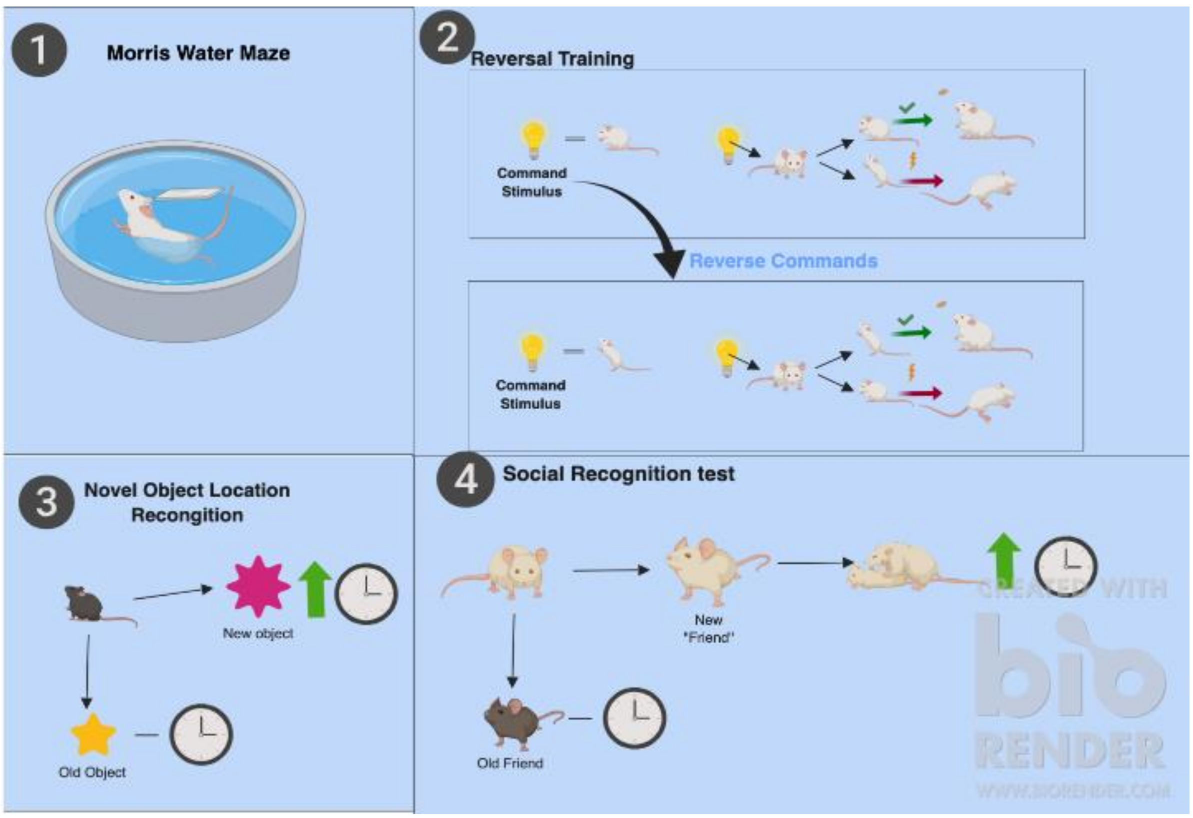

Figure 6. *1) Morris Water Maze to test spatial learning and memory 2) Reversal Training to test for learning flexibility 3) Novel Object Location Recognition and 4) Social Recognition test to test long-term memory. (Bilkei-Gorzo et al. 2017)*

Each test showed decline of THC-free cognition in mature and old mice when compared to young mice. Concurrently THC-rich cognition improved in mature and old mice and resembled patterns of THC-free young mice (Figure 2). This evidence points towards internal mechanisms that alleviate stress on the brain helping mature and old mice perform with greater accuracy and more efficiency. This research is promising for older adults that seek to gain brain performance abilities as age induces decline in brain function. The stunted research of THC has limited our knowledge, but with ever growing legalization and societal acceptance more research is needed into the impacts on the youth and the chronic impacts on adult health.

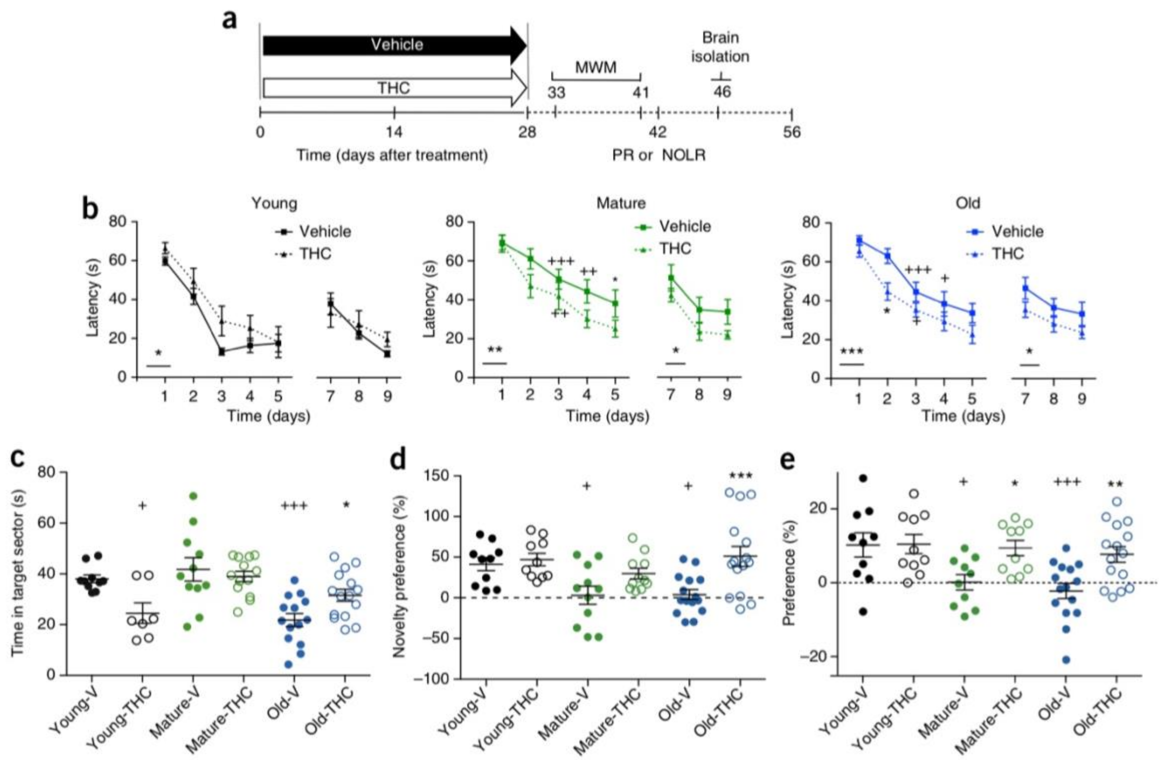

***Figure 7**. A) Timeline of treatment B) Morris Water Maze C) Probe Reversal Phase Testing D) Novel Object Recognition E) Social Recognition Test. (Bilkei-Gorzo et al. 2017)*

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