HYPOTHALAMIC NEWSLETTER

Welcome to this edition's Hypothalamic Newsletter! We will be discussing the physiology of fear, the neuroanatomical differences between male and female cannabis users, the genes that control aging, and the stages of sleep.

The Physiology of Fear

Fear is something that is common amongst all species and can be a useful method of survival. While a seemingly simple concept, there is more to fear than one may initially assume. For one, there is no single type of fear, but several different types. One example is subjective fear. This is a form of fear seen in more intelligent life forms, such as humans, as it requires an air of self-awareness. This sort of fear is often associated with fear disorders, such as anxiety or PTSD, and is caused by irrational fear. Another form of fear to note is conditioned fear.

Another form of fear to note is conditioned fear. This is a form of fear that is taught and developed, rather than born with or instinctually possessed. This sort of fear can be brought upon by providing specific stimuli, which can be virtually anything harmless and pairing this with something frightening (loud noises, an electric shock, etc.). Repeating this process can eventually elicit a fear response (heightened blood pressure, muscle tension, release of stress hormones) upon being faced with the stimuli. Experiments involving fear conditioning and rats have helped to teach us more about the mechanisms around fear.

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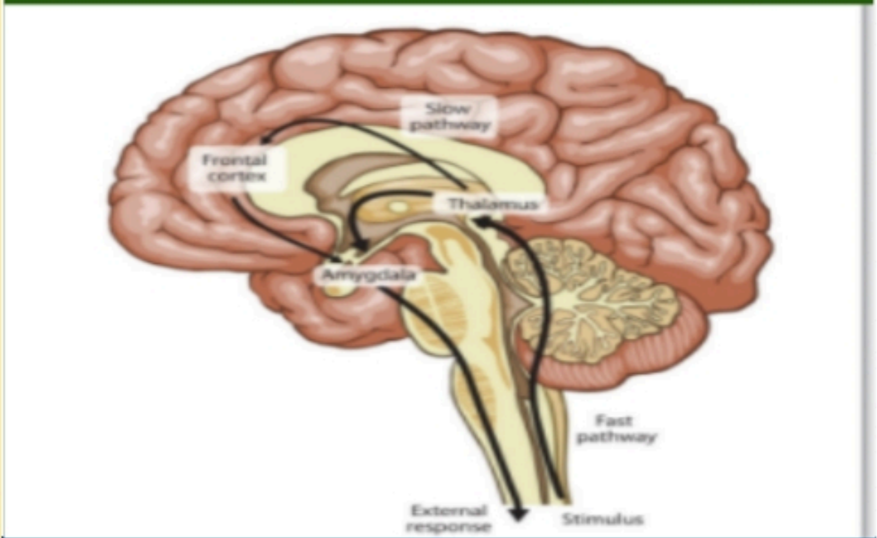
The brain can stretch to the size of a pillow

The Physiology of Fear Continued

Once the information has reached the amygdala, it is processed by several regions. The Lateral (LA) region senses pain. It sends this information to the Central (CE) region which controls the autonomic (subconscious) and endocrine (hormonal) responses. Separately, the Basal (B) and Accessory Basal (AB) regions examine the spatial surroundings of the organism in respect to the fear-causing stimuli. All of these functions are catalyzed by the permeation of calcium ions into LA synapses, which actuate protein kinases. Protein kinases are enzymes that catalyze proteins that lead to memory formation.

This process may be linked to the concept of fear conditioning. So while fear may seem like an uncomplicated reflex, many neurological processes occur in the brain to elicit fear responses that can improve the chances of survival for many animals in the wild but can often be a mental barrier for species that experience it subjectively.



Neuroanatomical Differences Between Male and Female Cannabis Users

Is there a difference in neuroanatomical changes in female and male cannabis users? To aid the previous gap in the understanding of sex differences in cannabis use patterns and the associated outcomes, Rossetti and colleagues assessed whether there are differences in volume in specific neuroanatomical regions. This includes the amygdala, nucleus accumbens, insula, anterior cingulate cortex, cerebellum, orbitofronta cortex, and hippocampus. The study had 129 regular cannabis users and 114 controls. The regular cannabis users were split between 70 recreational users and 59 individuals dependent on cannabis.

Neuroanatomical Differences Continued

Rossetti and colleagues found that dependent cannabis users who were females had significantly less brain volume in their lateral orbitofrontal cortex and white matter volume in the cerebellum, compared to the recreational user group and the control group. The orbitofrontal cortex is responsible for decision-making, while the cerebellum is responsible for spatial judgment, balance, and movement. Therefore, the findings obtained from the study by Rossetti and colleagues are critical. Additionally, to further validate these results, Rossetti and colleagues found that the sex, female, was significantly negatively correlated with brain volume the orbitofrontal cortex, and white matter in the cerebellum. This suggested that females dependent on cannabis may be at increased vulnerability to adverse outcomes than cannabis-dependent males, and both males and females who recreationally use cannabis, but are not dependent.

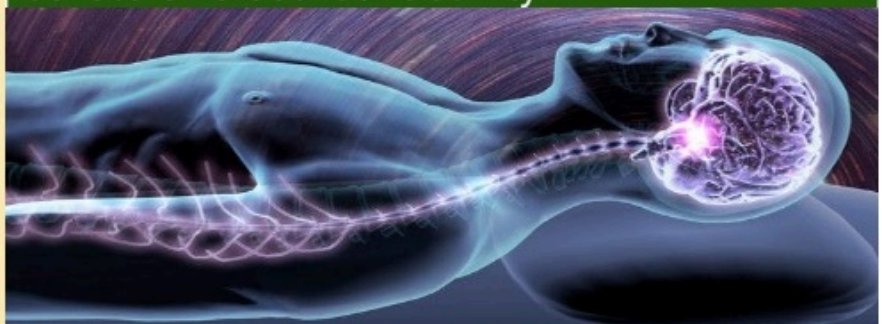
Which genes control aging in the human and animal bodies?

A new study shows that only 30% are controlling age while the others reflect the body's response to bacteria. In a study to better understand the role of bacteria in health and disease, National Institutes of Health researchers fed fruit flies antibiotics and monitored the lifetime activity of hundreds of genes that scientists have traditionally thought control aging. To their surprise, the antibiotics not only extended the lives of the flies but also dramatically changed the activity of many of these genes. Dr. Ginger's team studies the genetics of aging in a type of fruit flies called Drosophila, this time they checked the effects of bacteria on the flies by giving newborn male flies antibiotics. At first, they thought little or nothing would happen, but to their shock, it lengthened the flies' life by 6 days. This is like gaining 20 years of your human life. Overall the gene activity of the treated flies changed very slightly with age. Regardless of their age, they looked like they were 30 days old. This appeared to be due to a flat line in the activity of about 70% of the genes the researchers surveyed, many of which are thought to control aging. Finally, the team found an explanation for why antibiotics extended the lives of flies in the remaining 30% of the genes they analyzed. In short, the rate at which the activity of these genes changed with age was slower than normal in flies that were fed antibiotics.

The Stages of Sleep

Teens usually neglect sleep, however to achieve optimal brain function throughout the day, sleep is necessary. There are various stages of brain activity during sleep, which cycle throughout the night. This is an overview of what occurs to the brain during sleep stages. There are two basic types of sleep: rapid eye movement (REM) sleep and non-REM sleep (which has three different stages). During a typical night, you cycle through all stages of non-REM and REM sleep multiple times, with longer, deeper REM episodes happening closer to dawn. The transition from wakefulness to sleep is called Stage 1 non-REM sleep. Your pulse, breathing, and eye movements slow down during this brief phase of very light sleepir alertness patterns during the day.

Stage 2 non-REM sleep is a light sleep stage that precedes deeper sleep. Your breathing and pulse rate slow, and your muscles relax even more. The warmth of your body decreases, and your eye motions come to a halt. The activity of the brain waves decreases, although there are short bursts of electrical activity.



Stage 2 sleep takes up more of your sleep cycles than the previous sleep phases. Stage 3 non-REM sleep is the time of deep sleep required to wake up feeling refreshed. It happens more frequently in the first portion of the night. During sleep, your heartbeat and breathing decrease to their lowest levels. It may be tough to wake you up since your muscles are relaxed. The brain waves slow down even further. About 90 minutes after falling asleep, REM sleep begins. Behind closed eyelids, your eyes travel quickly from side to side. The activity of mixed frequency brain waves approaches that of alertness. The majority of your dreams happen during REM sleep, although some can happen during non-REM sleep as well. The muscles in your limbs become temporarily immobilized, preventing you from acting out your dreams. As you become older, you spend less time in REM sleep. Both non-REM and REM sleep are likely required for memory consolidation. Therefore, sleep is an integral part of brain maintenance and must not be neglected.