



CBD Training Academy

What is the Endocannabinoid System?

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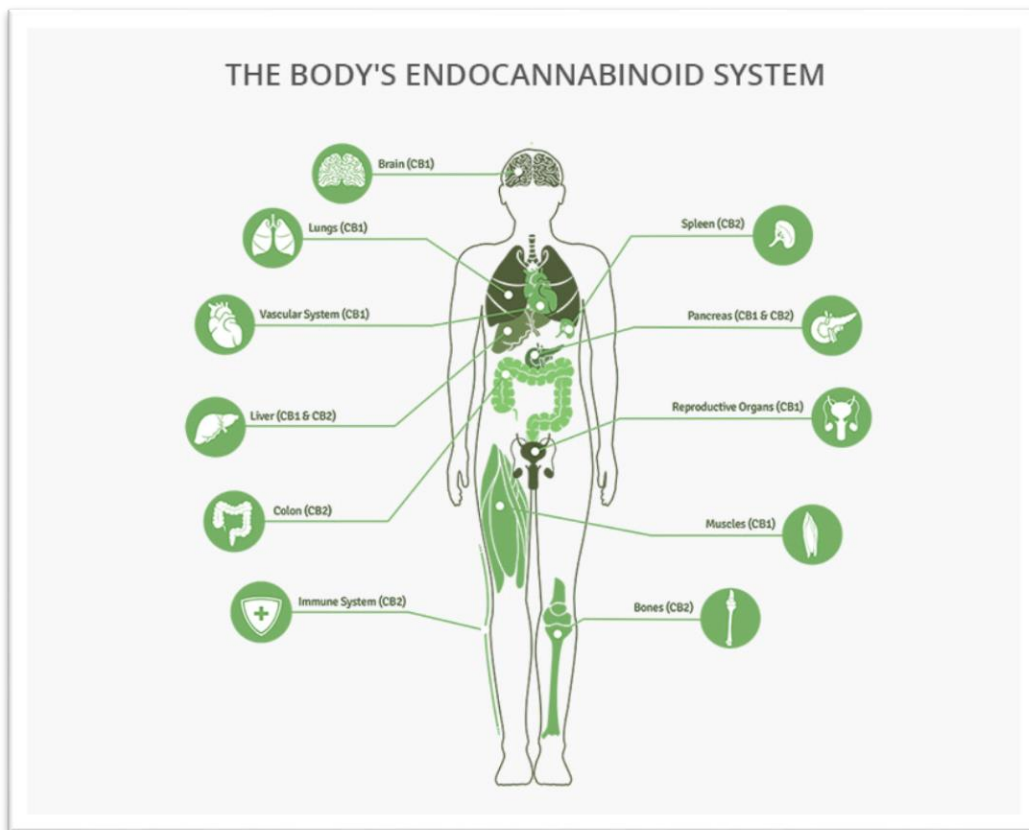
Cannabis can have a variety of medical applications due to its interaction with the human Endocannabinoid System (ECS). In order to understand how the cannabis plant interacts with our body, and can affect medical conditions, one must first have a general understanding of the ECS.

The human ECS was a recent discovery, the majority of which was led by a team of Israeli scientists in the early 1990's. The term *endocannabinoid* is derived from the words *endo* (meaning from within) and *cannabinoid* (meaning the receptors of the ECS interact with the plant cannabinoids). It is an internal signaling system found within every organ system of our body whose main purpose is to provide homeostasis. Homeostasis, is the way our bodies ensure that our internal systems are regulated to maintain a healthy state even during times of stress, illness, and injury. For example, inflammation is a normal response to injury and is a requirement for healing. However too little or too much inflammation can be problematic as is the case with arthritis. The ECS plays an important role in ensuring that inflammation is at an appropriate (homeostatic) level.

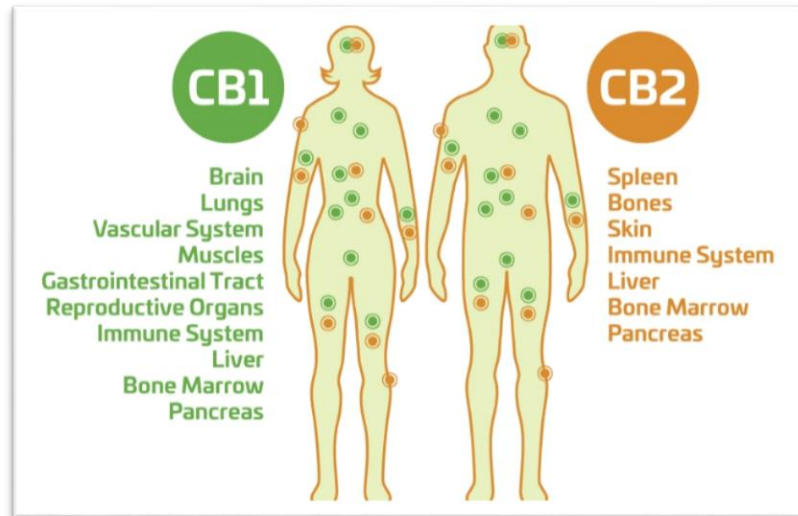
The ECS influences multiple physiological processes and plays a role in protection of our nerves (neuroprotection), modulation of our immune system, protection of our healthy cells against injury (cytoprotection) and plays a role in our protective mechanisms against cancer. This intricate system also regulates metabolism through the modulation of energy intake, nutrient transport, lipid metabolism and energy storage.

Similar to most of the cellular signaling mechanisms within our body, the ECS is composed of 3 main components: Neuromodulators (signaling molecules, in this case endocannabinoids), Receptors (which are activated by neuromodulators), and Enzymes (responsible for both the synthesis and break down of the neuromodulators).

1. **Neuromodulators** – Endocannabinoids are considered a type of neuromodulator meaning they influence the function of nerve cells. While several have been discovered, the 2 most abundant and naturally occurring endocannabinoids which serve as neuromodulators include anandamide (AEA) and 2-arachidonoyl-glycerol (2-AG). These endocannabinoids bind to a variety of receptors causing a physiological response. The compounds found within the cannabis plant known as cannabinoids or phytocannabinoids act in many similar ways as our naturally occurring endocannabinoids.



2. **Receptors** – The endocannabinoids interact with a host of receptors including cannabinoid-type 1 (CB1), cannabinoid type-2 (CB2), serotonin receptors (5-HT), vanilloid receptors (TRPV), and peroxisome proliferator activated



receptors (PPARS). The most extensively studied receptors include the CB1 and CB2 receptors. The CB1 receptors are primarily located in the brain and nervous system. They are found at the end of nerve cells and play a role in cellular signaling (for example, nerve firing during injury and pain). It is for this reason that the CB1 receptor plays an important role in the homeostasis of our nervous system. CB1 is also of particular medicinal interest. Research continues to emerge looking at targeted therapy from plant-based cannabinoids showing potential applications for a variety of neurologic conditions including: multiple sclerosis, dementia, spinal cord injury, Parkinson's disease, neuropathies and epilepsy. CB2 receptors, which are found to a lesser degree in the nervous system, are densely distributed throughout our immune system. They are found in abundance within the cells of the spleen, tonsils, and thymus gland. CB2 receptors are found on white blood cells where they are involved in the homeostasis and health of our immune system. In our gastrointestinal system activation of the CB2 receptor performs many functions including modulation of intestinal inflammation. There should be no surprise why cannabis therapeutics targeted at the CB2 receptors are showing promising results for the treatment of several inflammatory conditions including arthritis, inflammatory bowel disease, Alzheimer's disease, as well as other autoimmune conditions.

3. **Enzymes** - The endocannabinoids AEA and 2-AG are synthesized by unique enzymes during times of stress, illness, or injury. AEA is subsequently broken down by Fatty Acid

Amide Hydrolase (FAAH) while 2-AG is degraded by Mono-AcylGlycerol Lipase (MAGL). Plant-based cannabinoids can interact with these enzymes. For example, CBD has been shown to inhibit FAAH which will result in increased levels of our natural endocannabinoid AEA.

The cannabinoids found within the cannabis plant work by interacting directly with our ECS. There are currently over 100 different cannabinoids as well as other compounds within the cannabis plant known as terpenes which all interact directly and/or indirectly with our cannabinoid receptors. Additionally, they can also interact with the enzymes responsible for synthesizing and degrading our natural endocannabinoids (AEA and 2-AG). The cannabinoids found in the cannabis plant can also interact with our endocannabinoid receptors in ways which alter their function (known as allosteric modulation) as well as their interaction with our natural endocannabinoids. Future therapies will focus on a better understanding of how the numerous different cannabinoids, terpenes and other natural compounds found within the cannabis plant interact with our ECS.

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