



HOW CANNABIS WORKS

Compiled by
Ray Chanmugam

Ray.chanmugam@gmail.com

Abstract

Cannabis is a panacea that has been used in religious, shamanic, or spiritual context for over 10,000 years. Since the late 1920's Cannabis has been banned from use around the world as it was classified as a demonic plant that may cause harm. In the past 20 years, the medicinal effects of Cannabis have come to light. This paper details how Cannabis works within our bodies to cure many illnesses.

HOW CANNABIS WORKS

Compiled by Ray Chanmugam

Cannabis is biologically classified as an annual flowering plant that includes 3 separate and distinct varieties, namely Sativa (*Cannabis sativa*), Indica (*Cannabis Indica*) and Ruderalis (*Cannabis Ruderalis*), and many sub-species derived from these. It is classified as a panacea, that is it cures many illnesses. Cannabis originates from the central parts of Asia and the Indian sub-continent. The word Cannabis initiated from the Babylonian word “*Canna*” meaning Cain or stork, and “*bis*” which meaning twice or 2 forms of sexes.

Cannabis is also known as Marijuana, Pot, Weed, Grass and Ganja which are the most commonly used terms. Cannabis contains various cannabinoids of which Delta 9 Tetrahydrocannabinol (THC) and Cannabidiol (CBD) are the most common. Together with THC and CBD there are a total of 113 Cannabinoid components found in the Cannabis plant. Both these substances combined together to form a majority of the cannabinoids found in the plant. These two cannabinoids have numerous medicinal properties that have been proved to favour all forms of human life.

Although Cannabis has been cultivated for over 10,000 years, the first recorded use of Cannabis was by the Chinese Emperor Shen Nung in 2737 B.C.

Cannabis has been used as a chemical substance in religious, shamanic, or spiritual context in India and Nepal since the Vedic period dating back to approximately 1500 B.C., but perhaps as far back as 2000 B.C. The earliest mention of cannabis has been found in The Vedas, or sacred Hindu texts. According to The Vedas, cannabis was one of five sacred plants and a guardian angel lived in its leaves. The Vedas call cannabis a source of happiness, joy-giver, liberator that was compassionately given to humans to help us attain delight and lose fear (Abel, 1980). It releases us from anxiety.

The god, Shiva is frequently associated with cannabis, called bhang in India. According to legend, Shiva wandered off into the fields after an angry discourse with his family. Drained from the family conflict and the hot sun, he fell asleep under a leafy plant. When he awoke, his curiosity led him to sample the leaves of the plant. Instantly rejuvenated, Shiva made the plant his favourite food and he became known as the Lord of Bhang.

Cannabis Sativa

Of the 3 varieties of Cannabis, Sativa is the most commonly used illegal drug worldwide. The Sativa plants are tall and slender, loosely branched and have long, narrow serrated leaves. The plants produce loose spear-like flower clusters (buds) that can be extremely resinous. Sativa plants are usually grown outdoors and can reach heights of up to 6 metres (20 feet).



Fig. 1 Cannabis Sativa Leaf



Fig. 2 Cannabis Sativa Plant

A sativa plant can have a THC/CBD ratio 4-5 times that of Indica, that is to say sativa strains have high levels of THC and in comparison, low levels of CBD.

Cannabis Indica

Indica is a short and stocky variety of the cannabis genus which is thought to have originated in the Hindu Kush mountain range of central Asia. Indica plants are short, densely branched and have wider leaves. They are better suited for growing indoors.

Due to the short harsh summers and variable weather Indica strains have to finish fast often reaching maturity after 8 weeks of flowering and pack on huge flowers and buds which are covered in resin. Indica strains are much shorter and stockier than sativa strains generally being around 1 metre (3 feet) in height.



Fig. 3 Cannabis Indica Leaf



Fig. 4 Cannabis Indica Plant

Indica strains have a CBD/THC ratio that can be 4-5 times higher than sativa strains. This means that Indica strains have much higher levels of CBD than sativa strains. Indica strains are often used in the Hindu Kush region for the production of hashish and hash oils. these strains are well known for their medical benefits due to their narcotic and sedative effect.

Sativa and Indica can be interbred to form Hybrids. Leafly¹ claims that they have 779 strains on their database which consist of Sativa, Indica and Hybrids.

Cannabis Ruderalis

Many believe the Ruderalis species is a descendent of Indica, that adjusted to the harsh climates of north central Asia, typically Russia where it originated. Ruderalis has developed in very harsh climates and begins flowering according to life cycle rather than photo period unlike the sativa and Indica varieties. This means that Ruderalis plants will begin to flower after 3-4 weeks from germination unlike the sativa and Indica sub species which need to receive less than 12 hours of light per day to begin flowering.

Because of these reasons Ruderalis has been described as 'auto flowering'. It has adapted to the short growing seasons and grow to a height of 300 to 750 mm (1 to 2.5 ft.).

¹ Leafly is a knowledge website that promotes information relating to Cannabis

Hybrids are grown from the amalgamation of Cannabis Ruderalis and the other 2 species to generate a thick and sturdy plant which can be grown in harsh climates, within a shorter growing period.



Fig. 5 Cannabis Ruderalis Leaf



Fig. 6 Cannabis Ruderalis Plant

All three species and their derived strains contain the Amazing substances of Cannabinoids. The quantity and potency varies with each strain, and typically provide a range of remedies.

The following is a detail of the chemical properties of the two key ingredients THC, and CBD which provide key benefits.

Delta 9 Tetrahydrocannabinol (THC)

THC is the principle psychoactive component in Cannabis. It can be an amber or gold colored glassy solid when cold, which becomes viscous and sticky if warmed². It's ability to change brain function and alter perception, mood, or consciousness, is what gives this drug the ability to cure many illnesses. The chemical composition of THC is shown overleaf³

THC was listed by the UN Convention on Psychotropic Substances under Schedule I in 1971, but reclassified to Schedule II in 1991 following a recommendation from the World Health Organisation (WHO). Based on subsequent studies, the WHO has recommended the reclassification to the less-stringent Schedule III. This classification proves that THC is less harmful than many substances legally consumed by humans worldwide. These include tobacco, alcohol and coffee.

² <https://en.wikipedia.org/wiki/Tetrahydrocannabinol>

³ By Yikrazuul - Own work, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=5951266>

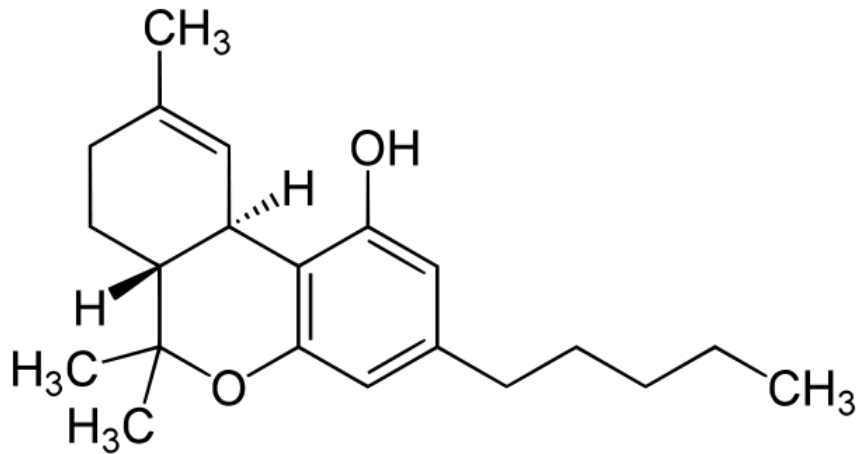


Fig. 7 Chemical Composition of THC

Cannabidiol (CBD)

CBD is the other main Cannabinoid found in Cannabis, together with THC described above. CBD has a wide scope of proven medical applications due to the lack of side effects, including psychoactive substances. The variation of CBD content together with THC provides numerous cures for a range of illnesses.

A cannabis strain called Charlotte's Web was specifically created with high CBD content to relieve the symptoms of Drevet Syndrome, suffered by a little girl called Charlotte Figi born in 2006. This is a serious form of Epilepsy, which could not be cured with conventional medication and so the Stanley brothers in Colorado (Legal growers of medicinal cannabis) specifically derived a strain to cure this dreadful disease.

The chemical composition of CBD⁴ can be found below.

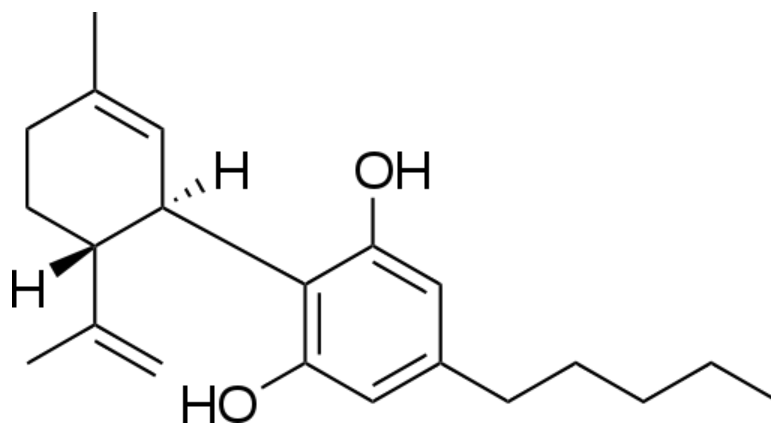


Fig. 8 Chemical Composition of CBD

⁴ By Harbin - Own work, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=7712509>

Although THC is a psychoactive component, when consumed as a whole plant extract causes CBD to neutralise the high gained from THC.

Other notable cannabinoids include the following:

1. CBG (Cannabigerol)
2. CBC (Cannabichromene)
3. CBL (Cannabicyclol)
4. CBN (Cannabinol)
5. CBV (Cannabivarin)
6. THCV (Tetrahydrocannabivarin)
7. CBDV (Cannabidivarin)
8. CBCV (Cannabichromevarin)
9. CBGV (Cannabigerovarin)
10. CBGM (Cannabigerol onomethyl Ether)
11. THCA (Tetrahydrocannabinolic acid)
12. CBDA (Cannabidiolic Acid)

Each of these Cannabinoids have a varying effect from each other and play a prominent part in the treatment of various illnesses. Isolating one or the other will not provide the same cure as that, which can be derived from the plant as a whole.

Of the 779 strains documented in the Leafly data base, following are 2 examples of each of the species, together with their derived hybrids. These are some of the popular strains available.

Cannabis Sativa Strains

Purple Haze (Ph)

Purple Haze is a strain made popular by Jimi Hendrix's 1967 classic. It delivers a dreamy burst of euphoria, together with high energy, creativity and contentment throughout the day. It is assumed to have been derived from the parentage of Purple Thai and Haze. Purple Haze delivers a mix of sweet and earthy flavors underscored by notes of berry and sharp spice. It typically flowers in 8 to 9 weeks, with buds acquiring vibrant hues of lavender that further justify the naming of this strain.

Effects: happy, euphoric, uplifted, relaxed and energetic.

Medicinal properties: stress, depression, pain, fatigue and insomnia.

Purple Haze can produce a THC content of up to 20% while the average Sativa produces a THC content of 13.5%.

Sour Diesel (Sd)

Sour Diesel sometimes called Sour D, is an invigorating sativa-dominant strain, named after its pungent, diesel-like aroma. This fast-acting strain delivers energizing, dreamy cerebral effects that have pushed Sour Diesel to its legendary status. Stress, pain, and depression fade away in long-lasting relief that makes Sour Diesel a top choice among medical patients. Sour Diesel grows tall, and flowers in 10 or 11 weeks. This strain evolved in the early 90's, and it is believed to have descended from Chemdawg 91 and Super Skunk.

Effects: happy, uplifted, euphoric, energetic, relaxed

Medicinal properties: stress, depression, pain, fatigue, lack of appetite

Test data indicate a THC value between 19% and 25% with a CBD value of 0.1% to 0.3%.

Cannabis Indica Strains

Granddaddy Purple (Gdp)

Evolved in 2003 by Ken Estes, Granddaddy Purple (or Gdp) is a famous Indica cross between Purple Urkle and Big Bud. This California staple inherits a complex grape and berry aroma from its Purple Urkle parent, while Big Bud passes on its oversized, compact bud structure. Its potent psychoactive effects are clearly detectable in both mind and body, delivering a fusion of cerebral euphoria and physical relaxation. Gdp flowers in 10 to 11 weeks, and blooms in shades of deep purple, a contrastive backdrop for its snow-like dusting of white crystal resin. A typical Indica, it grows up from 800 mm to 1 metre. The flavors include grape, berry and sweet.

Effects: relaxed, sleepy, happy, euphoric, hungry

Medicinal Properties: stress, pain, insomnia, depression, lack of appetite

Test data indicates a THC value of 17% to 23% and a CBD value of 0.1%.

Northern Lights (NI)

One of the most famous strains of all time, a pure Indica cherished for its resinous buds, fast flowering, and resilience during growth. Itself a descendant of indigenous Afghani and Thai landrace strains, NI has given rise to famous hybrids such as Shiva Skunk and Super Silver Haze. Rumor has it that NI first sprouted near Seattle, Washington, but was propagated out of Holland after 1985 at what is now Sensi Seeds. Pungently sweet, crystal-coated buds, which sometimes reveal themselves in hues of purple. NIs' psychoactive effects settle throughout the body, relaxing muscles and pacifying the mind in dreamy euphoria. A general indoor flowering time of 6 to 7 weeks. It grows up to 1 metre delivering flavors of earthy, sweet and pine.

Effects: relaxed, happy, euphoric, sleepy, uplifted

Medicinal Properties: Stress, pain, insomnia, depression, lack of appetite

Northern Lights generally has a THC potency of 17% and a CBD rating from 0.1% to 0.2%

Hybrid Strains

Blue Dream (Bd)

A Sativa-dominant hybrid originating in California, has achieved legendary status among West Coast strains. Novice and veteran consumers alike enjoy the level effects of Bd, which eases you gently into a calm euphoria. Parents of Bd are Blueberry (Indica) and Haze (Sativa) which balances full-body relaxation with gentle cerebral invigoration. Some Bd phenotypes express a more Indica-like look and feel, but the Sativa-leaning variety remains most prevalent.

With a sweet, berry aroma gained from its Blueberry parent, Bd delivers swift symptom relief without heavy sedative effects. This makes Bd a popular daytime medicine for patients treating pain, depression, nausea, and other ailments requiring a high THC strain. Bd grows tall and flowers in 9 to 10 weeks.

Effects: Happy, relaxed, euphoric, uplifted, creative

Medicinal Properties: Stress, depression, pain, headaches, fatigue

OG Kush (Ogk)

OG (Ocean Grown) Kush makes up the genetic backbone of US West Coast cannabis varieties, but in spite of its ubiquity, its genetic origins remain a mystery. Popular myth maintains that Chemdawg and Hindu Kush parented OG Kush, passing on the distinct “kush” bud structure seen in many strains today. The earliest propagators (now known as Imperial Genetics) are said to have brought the seeds out of Florida to Colorado and southern California, where it now flourishes. There are many different phenotypes of OG Kush, some of which include Tahoe OG, SFV OG, and Alpha OG. OG Kush is cherished for its ability to crush stress under the weight of its heavy euphoria. It carries an earthy pine and sour lemon scent with woody undertones, an aroma that has become the signature of OG Kush varieties and descendants. With OG Kush, patients most commonly cite improvements in migraines, ADD/ADHD, and stress disorders.

Effects: Relaxed, happy, euphoric, uplifted, hungry

Medicinal Properties: Stress, pain, insomnia, depression, headaches

THC content 15% to 18%, CBD content 0.16% to 0.19%

As can be seen from the examples above each strain has different effects and medicinal properties from one another. Furthermore, the aroma will also differ. Typically, Sativa and Sativa dominant hybrids are high in THC and low in CBD, while Indica and Indica dominant hybrids have a lower THC content and a higher CBD content to Sativa.

So how does our body process the medicinal properties offered by Cannabis?

Endocannabinoid System

The endocannabinoid system (ECS) is a group of endogenous cannabinoid receptors located in the mammalian brain and throughout the central and peripheral nervous systems, consisting of neuromodulatory lipids and their receptors. Known as "the body's own cannabinoid system", the ECS is involved in a variety of physiological processes including appetite, pain-sensation, mood, and memory, and in mediating the psychoactive effects of cannabis. The ECS is also involved in voluntary exercise and may be related to the evolution of the runner's high in human beings and related aspects of motivation or reward for locomotor activity in other animals.

Two primary endocannabinoid receptors have been identified: CB1, first cloned in 1990; and CB2, cloned in 1993. CB1 receptors are found predominantly in the brain

and nervous system, as well as in peripheral organs and tissues, and are the main molecular target of the endocannabinoid ligand (binding molecule), Anandamide, as well as its mimetic phytocannabinoid, THC. One other main endocannabinoid is 2-Arachidonoylglycerol (2-AG) which is active at both cannabinoid receptors, along with its own mimetic phytocannabinoid, CBD. 2-AG and CBD are involved in the regulation of appetite, immune system functions and pain management.

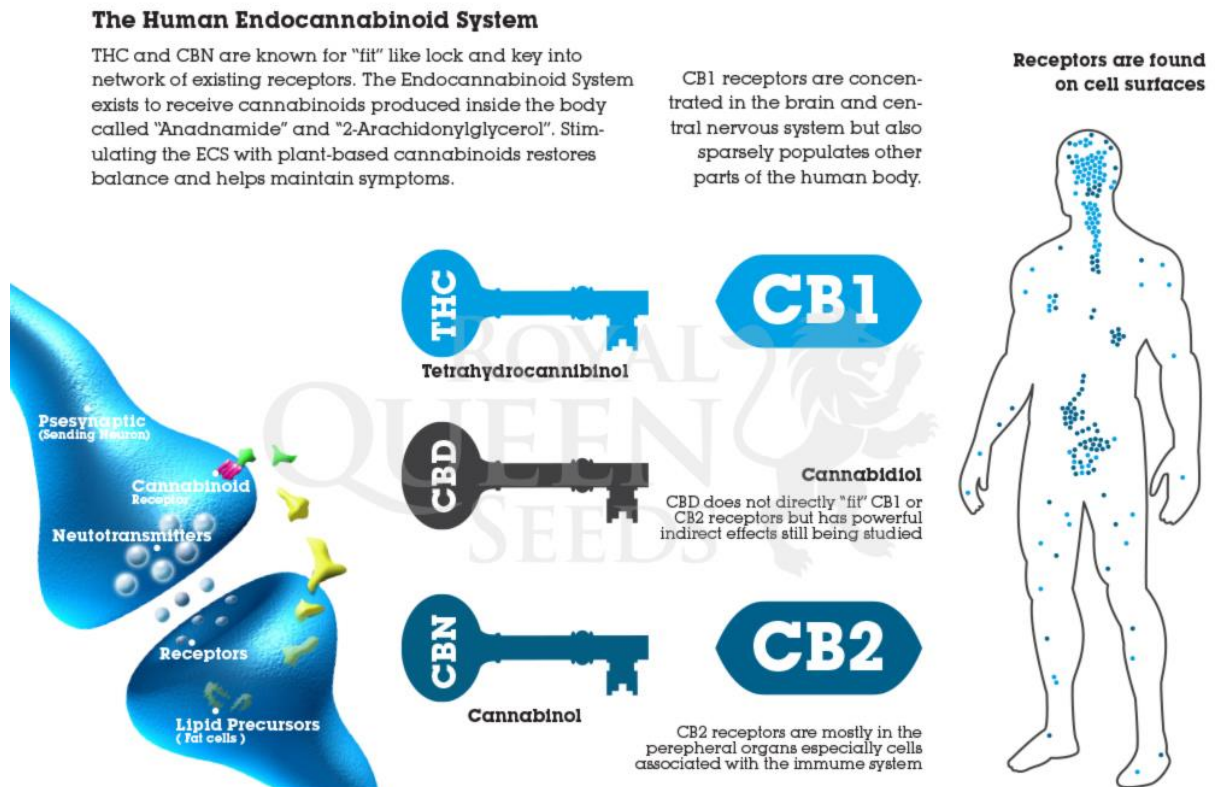


Fig. 9 The Human Endocannabinoid System

Cannabinoid Receptors

Cannabinoid receptors are of a class of cell membrane receptors under the G protein-coupled receptor superfamily. As is typical of G protein-coupled receptors, the cannabinoid receptors contain seven transmembrane spanning domains. Cannabinoid receptors are activated by three major groups of ligands: endocannabinoids, produced by the mammillary body; plant cannabinoids (such as Cannabidiol, produced by the cannabis plant); and synthetic cannabinoids (such as HU-210). All of the endocannabinoids and plant cannabinoids are lipophilic, such as fat soluble compounds.

There are currently two known subtypes of cannabinoid receptors, termed CB1 and CB2. The CB1 receptor is expressed mainly in the brain (central nervous system or

"CNS"), but also in the lungs, liver and kidneys. The CB2 receptor is expressed mainly in the immune system and in hematopoietic cells. Mounting evidence suggests that there are novel cannabinoid receptors that is, non-CB1 and non-CB2, which are expressed in endothelial cells and in the CNS. In 2007, the binding of several cannabinoids to the G protein-coupled receptor GPR55 in the brain was described.

The protein sequences of CB1 and CB2 receptors are about 44% similar. When only the transmembrane regions of the receptors are considered, amino acid similarity between the two receptor subtypes is approximately 68%. In addition, minor variations in each receptor have been identified. Cannabinoids bind reversibly and stereo-selectively to the cannabinoid receptors. Subtype selective cannabinoids have been developed which theoretically may have advantages for treatment of certain diseases such as obesity.

Comparison Between THC, CBD and Anandamide, 2-Arachidonoylglycerol

Cannabinoid plant extracts	Created by the Human Body	Area of Activity
THC	Anandamide	CB1 – Brain, Central Nervous System, Lungs, liver, kidneys, Intestines, Bladder, Pancreas and Skin
CBD	2-Arachidonoylglycerol	CB2 - Heart, Stomach, Lungs, Pancreas, Spleen, Bone Marrow and Skin

Please note that both the CB1 and CB2 receptors are both active on the Lungs, Pancreas and Skin. Isolating Cannabinoids will not have the same effect as that, which is generated from the whole plant.

View overleaf for an image showing the comparison between THC and Anandamide. A similar link is also found between CBD and 2-Arachidonoylglycerol.

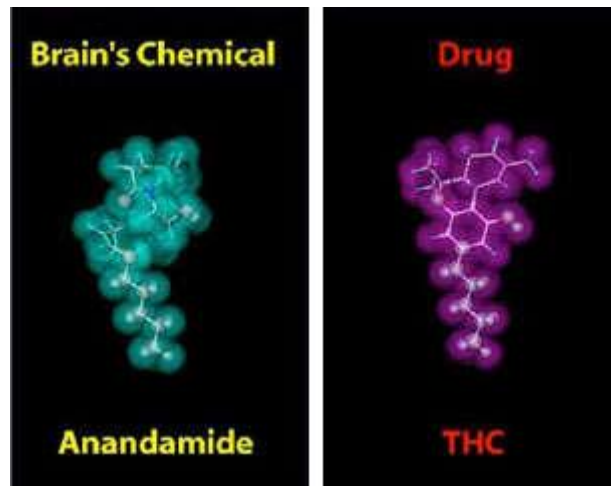


Fig. 10 Comparison between THC and Anandamide

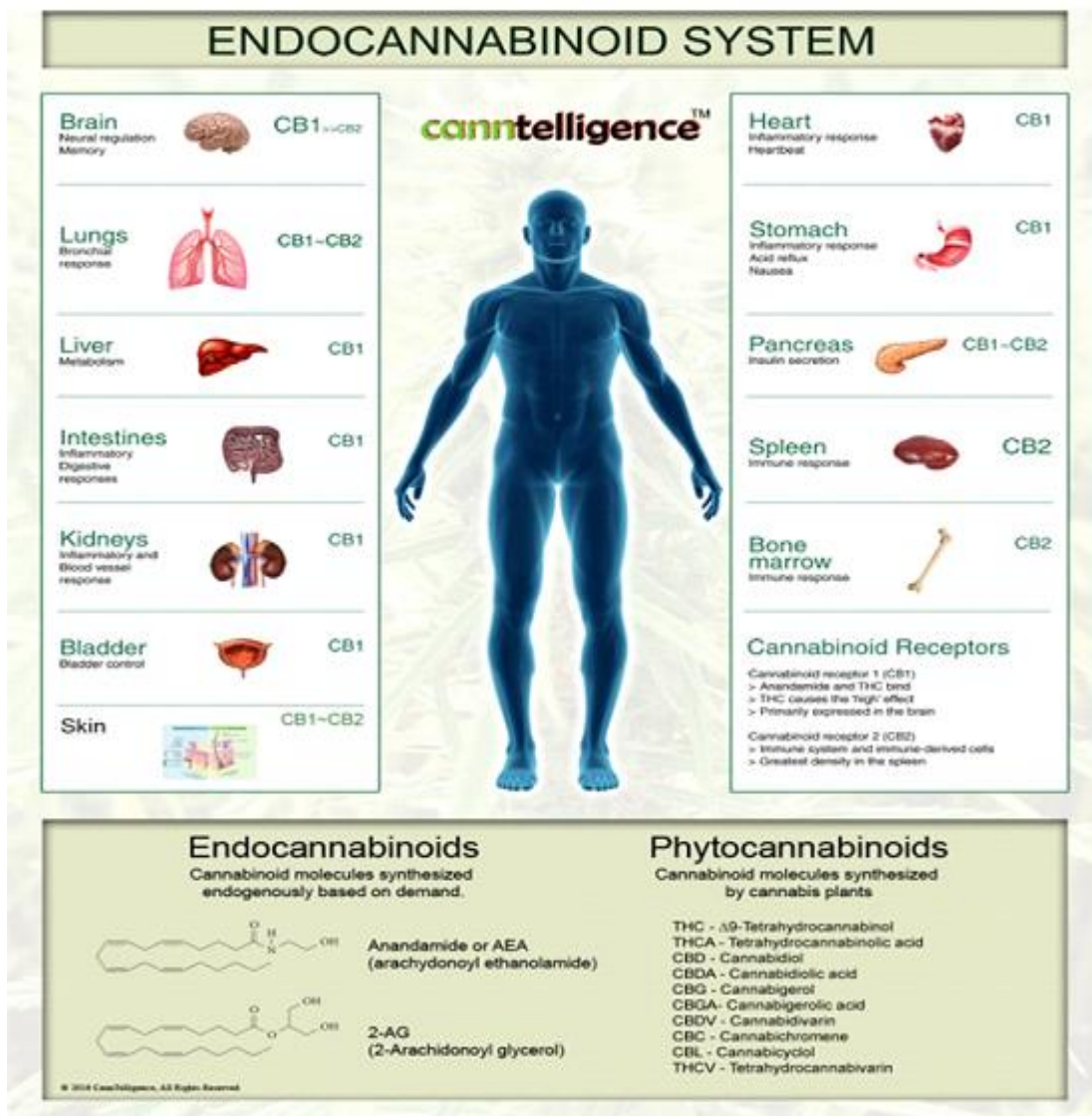


Fig. 10 Endocannabinoid System

REFERENCES

1. Wikipedia - https://en.wikipedia.org/wiki/Main_Page
2. Leafly - <https://www.leafly.com/>
3. Marijuana - The First Twelve Thousand Years - <http://druglibrary.org/schaffer/hemp/history/first12000/abel.htm>
4. 10,000-year History of Marijuana use in the World - <http://www.advancedholistichealth.org/history.html>
5. Endocannabinoid System - <http://canntelligence.com/the-endocannabinoid-system/>