

A Simple Guide to the Endocannabinoid System

"WHAT IS THE ENDOCANNABINOID SYSTEM (ECS)?"

The Endocannabinoid System (ECS) is the human body system that marijuana corrupts to make you high. It consists of two chemicals called neurotransmitters, anandamide and to a lesser extent, 2-Arachidonoylglycerol (2-AG), and the receptors found on nerve and brain cells they activate. Think of neurotransmitters as keys, and their receptors as the locks they open. Neurotransmitters convey information within the brain and body, helping to process thought, store memories, and regulate physical processes.

The endocannabinoid system (ECS) is a complex cell-signaling system identified in the early 1990s by researchers exploring THC, a well-known cannabinoid. Cannabinoids are compounds found in [cannabis](#).

Experts are still trying to fully understand the ECS. But so far, we know it plays role in regulating a range of functions and processes, including:

- sleep
- mood
- appetite
- memory
- reproduction and fertility

The ECS exists and is active in your body even if you don't use cannabis.

Read on to learn more about the ECS including how it works and interacts with cannabis.

How does it work?

The ECS involves three core components: endocannabinoids, receptors, and enzymes.

Endocannabinoids

Endocannabinoids, also called endogenous cannabinoids, are molecules made by your body. They're similar to cannabinoids, but they're produced by your body.

Experts have identified two key endocannabinoids so far:

- anandamide (AEA)
- 2-arachidonoylglycerol (2-AG)

These help keep internal functions running smoothly. Your body produces them as needed, making it difficult to know what typical levels are for each.

Endocannabinoid receptors

These receptors are found throughout your body. Endocannabinoids bind to them in order to signal that the ECS needs to take action.

There are two main endocannabinoid receptors:

- CB1 receptors, which are mostly found in the central nervous system
- CB2 receptors, which are mostly found in your peripheral nervous system, especially immune cells

Endocannabinoids can bind to either receptor. The effects that result depend on where the receptor is located and which endocannabinoid it binds to.

For example, endocannabinoids might target CB1 receptors in a spinal nerve to relieve [pain](#). Others might bind to a CB2 receptor in your immune cells to signal that your body's experiencing inflammation, a common sign of autoimmune disorders.

Enzymes

Enzymes are responsible for breaking down endocannabinoids once they've carried out their function.

There are two main enzymes responsible for this:

- fatty acid amide hydrolase, which breaks down AEA
- monoacylglycerol acid lipase, which typically breaks down 2-AG

What are its functions?

The ECS is complicated, and experts haven't yet determined exactly how it works or all of its potential functions.

[ResearchTrusted Source](#) has linked the ECS to the following processes:

- appetite and digestion
- metabolism
- [chronic pain](#)
- [inflammation](#) and other immune system responses

- mood
- learning and memory
- motor control
- sleep
- cardiovascular system function
- muscle formation
- bone remodeling and growth
- liver function
- reproductive system function
- [stress](#)
- skin and nerve function

These functions all contribute to homeostasis, which refers to stability of your internal environment. For example, if an outside force, such as pain from an injury or a fever, throws off your body's homeostasis, your ECS kicks in to help your body return to its ideal operation.

Today, experts believe that maintaining homeostasis is the primary role of the ECS.

How does THC interact with the ECS?

Tetrahydrocannabinol (THC) is one of the main cannabinoids found in cannabis. It's the compound that gets you "high."

Once in your body, THC interacts with your ECS by binding to receptors, just like endocannabinoids. It's powerful partly because it can bind to both CB1 and CB2 receptors.

This allows it to have a range of effects on your body and mind, some more desirable than others. For example, THC may help to reduce pain and stimulate your appetite. But it can also cause paranoia and anxiety in some cases.

Experts are currently looking into ways to produce synthetic THC cannabinoids that interact with the ECS in only beneficial ways.

How does CBD interact with the ECS?

The other major cannabinoid found in cannabis is cannabidiol (CBD). Unlike THC, CBD doesn't make you "high" and typically doesn't cause any negative effects.

Experts aren't completely sure how CBD interacts with the ECS. But they do know that it doesn't bind to CB1 or CB2 receptors the way THC does.

Instead, many believe it works by preventing endocannabinoids from being broken down. This allows them to have more of an effect on your body. Others believe that CBD binds to a receptor that hasn't been discovered yet.

While the details of how it works are still under debate, research suggests that CBD can help with pain, nausea, and other symptoms associated with multiple conditions.

What about endocannabinoid deficiency?

Some experts believe in a theory known as clinical endocannabinoid deficiency (CECD). This theory suggests that low endocannabinoid levels

in your body or ECS dysfunction can contribute to the development of certain conditions.

A [2016 article](#) [Trusted Source](#) reviewing over 10 years of research on the subject suggests the theory could explain why some people develop [migraine](#), [fibromyalgia](#), and [irritable bowel syndrome](#).

None of these conditions have a clear underlying cause. They're also often resistant to treatment and sometimes occur alongside each other.

If CECD does play any kind of role in these conditions, targeting the ECS or endocannabinoid production could be the missing key to treatment, but more research is needed.

The bottom line

The ECS plays a big role in keeping your internal processes stable. But there's still a lot we don't know about it. As experts develop a better understanding of the ECS, it could eventually hold the key to treating several conditions.

Last medically reviewed on May 17, 2019

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CBD for Fibromyalgia

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Understanding cannabidiol (CBD)

[Cannabidiol \(CBD\)](#) is a chemical compound made from [cannabis](#). CBD isn't psychoactive, unlike [tetrahydrocannabinol \(THC\)](#), the other byproduct of cannabis.

CBD is thought to activate [serotonin](#) receptors. It plays a role in:

- [pain perception](#)
- [maintaining body temperature](#)
- reducing [inflammation](#)

According to recent studies, CBD also:

- helps [ease symptoms of depression](#)
- can possibly [prevent symptoms of psychosis](#)

These [benefits](#) are what make CBD an appealing alternative treatment for pain disorders such as [fibromyalgia](#).

Research on CBD for fibromyalgia

Fibromyalgia is a [chronic pain](#) disorder that causes musculoskeletal pain in addition to:

- [fatigue](#)
- [insomnia](#)
- [cognitive issues](#)

It mostly affects women, and currently there's no known cure for the condition. However, treatment options are available that focus on pain management.

CBD has been used to [ease chronic pain symptoms](#) and reduce inflammation. It's presented as an alternative to taking [opioid prescriptions](#) which can be addictive.

However, the Food and Drug Administration (FDA) hasn't approved CBD as a treatment option for fibromyalgia or most other conditions. The CBD-based prescription drug [Epidiolex](#), an [epilepsy treatment](#), is the only CBD product that's FDA-approved and regulated.

There are currently no published studies on fibromyalgia that look at the effects of CBD on its own. However, some research does look at the effects of cannabis, which may contain multiple cannabinoids, on fibromyalgia.

The results have been mixed. More human studies are needed.

Earlier studies

A [2009 review](#)^{Trusted Source} found that CBD can be used to relieve [neuropathic pain](#). The researchers concluded that cannabinoids such as CBD might be a useful adjunct to other pain medications.

A [2011 study](#) looked at 56 people with fibromyalgia. Most of the participants were women.

Members of the study comprised two groups:

- One group was comprised of 28 study participants who weren't cannabis users.
- The second group was comprised of 28 study participants who were cannabis users. The frequency of their cannabis use, or the amount of cannabis they used, varied.

Two hours after using cannabis, the cannabis users experienced benefits such as:

- reduced pain and stiffness
- an increase in sleepiness

They also had slightly higher mental health scores than the non-users.

2019 Dutch study

A [2019 Dutch study](#) looked at the effect of cannabis on 20 women with fibromyalgia. Over the course of the study, each participant received four types of cannabis:

- an unspecified amount of a placebo variety, which contained no CBD or THC
- 200 milligrams (mg) of a variety with high amounts of both CBD and THC (Bediol)
- 200 mg of a variety with high amounts of CBD and low amounts of THC (Bedrolite)

- 100 mg of a variety with low amounts of CBD and high amounts of THC (Bedrocan)

The researchers found that the spontaneous pain scores of people using the placebo variety were similar to the spontaneous pain scores of people using some of the non-placebo varieties.

However, Bediol, which is high in CBD and THC, brought relief to a greater number of people than the placebo did. It caused a 30 percent reduction of spontaneous pain in 18 of the 20 participants. The placebo caused a 30 percent reduction of spontaneous pain in 11 participants.

Use of Bediol or Bedrocan, both high-THC varieties, significantly improved pressure pain thresholds when compared to the placebo.

Bedrolite, which is high in CBD and low in THC, didn't show any evidence of being able to relieve spontaneous or evoked pain.

2019 Israeli study

In a [2019 Israeli study](#), hundreds of people with fibromyalgia were observed over a period of at least 6 months. Of the participants, 82 percent were women.

The study participants received guidance from nurses before taking [medical cannabis](#). The nurses provided advice on:

- the 14 [cannabis strains](#) that were available
- delivery methods
- dosages

All the participants started with a low dosage of cannabis, and dosages were increased gradually over the course of the study. The median approved dosage of cannabis started at 670 mg a day.

At 6 months, the median approved dosage of cannabis was 1,000 mg a day. The median approved dosage of THC was 140 mg, and the median approved dosage of CBD was 39 mg a day.

The researchers admitted that the study had limitations. For instance, they were only able to follow up with about 70 percent of participants. The use of so many different strains also made it difficult to compare the effects of CBD-rich and THC-rich strains.

However, they still concluded that medical cannabis was a safe and effective treatment for fibromyalgia.

At the beginning of the study, 52.5 percent of participants, or 193 people, described their pain level as high. At the 6-month follow-up, only 7.9 percent of those who responded, or 19 people, reported high levels of pain.

CBD treatment options

If you want to avoid the psychoactive effects of marijuana, you can find CBD products that contain only trace amounts of THC. If you live in a place where recreational or medical marijuana is legal, you can find CBD products that contain higher concentrations of THC.

Although they each have benefits separately, CBD and TCH [likely work best when combined](#). Experts refer to this synergy, or interaction, as the “entourage effect.”

CBD also acts against THC-targeted receptors to reduce the negative [effects of marijuana](#), such as [paranoia](#) and [anxiety](#).

You can consume CBD [in a number of ways](#), including:

- **Smoking or vaping.** If you want to relieve immediate pain, smoking CBD-rich cannabis is the quickest way to reduce symptoms. Effects can last up to 3 hours. Smoking or [vaping](#) allows you to directly inhale CBD from the cannabis plant, absorbing the chemical into your bloodstream and lungs.
- **Edibles.** [Edibles](#) are foods cooked with the cannabis plant, or cannabis-infused oil or butter. It'll take longer to experience symptom relief, but the effects of edibles can last for up to 6 hours.
- **Oil extracts.** [Oils](#) can be applied topically, taken orally, or dissolved under the tongue and absorbed in mouth tissues.
- **Topicals.** CBD oils can be infused into topical [creams](#) or balms and applied directly [to the skin](#). These CBD products can be an effective option for reducing inflammation and helping with external pain.

There may be respiratory risks to smoking or vaping marijuana. People with [asthma](#) or [lung conditions](#) shouldn't use this method.

You should also follow dosage instructions carefully, especially with edibles, to avoid the negative side effects of taking too much.

CBD side effects

Cannabidiol is thought to be safe and to have minimal side effects. However, some people have experienced [the following side effects](#) after using CBD:

- fatigue
- diarrhea
- appetite changes
- weight changes

A [study on mice](#) linked CBD intake to liver toxicity. However, some of the mice in that study had been force-fed large amounts of CBD in the form of CBD-rich cannabis extract.

[Drug interactions](#) are possible with CBD. Be aware of them if you're currently taking other supplements or medications.

CBD, like [grapefruit](#), also interferes with cytochromes P450 (CYPs). This group of [enzymes](#) is important to drug metabolism.

Outlook

Researchers are still exploring whether CBD can effectively treat chronic pain disorders. Further studies are needed. There are some success stories, but CBD isn't FDA-approved for fibromyalgia. Also, research has yet to show us the long-term effects of CBD on the body.

Until more is known, [traditional fibromyalgia treatment](#) is recommended.

If you decide to use CBD products for pain management, be sure to consult with a doctor first. They can help you avoid negative side effects or harmful interactions with your current medications and treatments.

Is CBD Legal? *Hemp-derived CBD products (with less than 0.3 percent THC) are legal on the federal level, but are still illegal under some [state laws](#). Marijuana-derived CBD products are illegal on the federal level, but*

are legal under some state laws. Check your state's laws and those of anywhere you travel. Keep in mind that nonprescription CBD products are not FDA-approved, and may be inaccurately labeled.