

High hopes: The quest to turn cannabis into a potent medicine

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Credit: Pixabay/CC0 Public Domain

Marijuana shows promise in treating illnesses ranging from depression and addiction to arthritis and epilepsy.

Callie Seaman was 16 when she started smoking cannabis to control her epilepsy. The seizures that had started two years earlier were affecting her ability to function and, while she'd excelled at school until her diagnosis, her studies were now suffering.

That was back in 1997, when cannabis was still illegal throughout Europe even for [medical use](#). Anyone who wanted to acquire some was forced to do business with a street dealer or rely on someone else to do so.

Reassuring changes

"I never took it for the euphoric high," said Seaman, who lives near Sheffield in the U.K. "I took it to give me a good night's sleep—not getting enough sleep is a huge trigger for a seizure—and it worked."

Seaman continues to be a daily consumer of cannabis and, since 2018, key compounds from the Cannabis sativa plant have been available to her by prescription. She's reassured to know that the medication is now quality controlled, containing predictable amounts of active ingredient.

"I haven't had a seizure for two years," Seaman said. "Epilepsy can kill, so it's very possible cannabis has saved my life."

Yet how cannabis works isn't entirely clear.

"Never has it been more important to understand it better, to find ways both to use it in medicine and to reduce the potential harm when it's used recreationally," said Micah Allen, a professor at the Center of Functionally Integrative Neuroscience at Aarhus University in Denmark.

Laws on cannabis are changing regularly. In most European countries, one of its active ingredients—cannabidiol, or CBD—is legal. But cannabis for personal use generally isn't, even if medical marijuana is becoming increasingly available on the continent.

Some cannabis compounds are believed to help with depression, anxiety, addiction, [chronic pain](#), inflammatory diseases and the nausea associated with chemotherapy, among other things.

And though cannabis can be misused—some people such as teenagers and pregnant women would probably be better off avoiding it altogether—European scientists are on a quest to make full use of the health-giving properties of some of its ingredients.

Allen leads a research project that received EU funding to learn more about how cannabis compounds including CBD affect human health. Called [CANNABODIES](#), the five-year project is due to run until the end of January 2027.

Key compounds

Of the thousands of compounds produced by the cannabis plant, a group of 100-plus ones known as cannabinoids is of most medical interest. Of those, CBD and tetrahydrocannabinol, or THC, are seen as the most clinically relevant.

Both CBD and THC trigger the release of chemical messengers in the brain that can affect pain, mood, sleep and memory. But THC induces a

so-called high, whereas CBD doesn't. That makes THC open to misuse.

Cannabinoids are no cure for disease. Instead, they work by changing how symptoms—physical or mental—register on a conscious level. By tweaking the [nervous system](#), these chemicals have the power to alter a person's perception of, say, pain.

They can also change the [emotional response](#) to a stressful situation and, less positively, diminish motivation.

Exactly how cannabinoids influence the human brain and body remains poorly understood because most studies have been carried out on animals.

"This severely limits our ability to design effective cannabinoid-based treatments," said Allen.

Perceptive powers

CANNABODIES is looking at how THC and CBD influence something called "interoception"—the perception by people of the internal state of their bodies and how this affects decisions.

Examples of interoception include mentally focusing on hunger, heartbeat or pain.

For instance, is a person who registers less physical pain after taking CBD inclined to work harder at a task? Or is someone more in tune with the heartbeat after taking THC liable to feel increased anxiety?

While people's descriptions of experiences with cannabinoids suggest big changes in body sensations, no scientific studies have examined this matter, according to Allen.

"Many psychiatric disorders involve a disruption to healthy interoception," he said. "So if cannabinoids prove to be therapeutic in this area, this will be valuable information."

Allen plans to establish some basic science.

"We want to determine what happens in the brain when a person uses a cannabis product," he said. "Which neural pathways fire up when they ingest CBD, THC or a placebo?"

Brain-scan quizzes

For this research, participants inside an MRI scanner will be given tasks to perform.

Mostly, the participants will be asked to squeeze a [handheld device](#) or to breathe into a tube in response to simple challenges usually involving images appearing on a screen, akin to a video game. They'll be awarded points with every correct choice and receive a financial reward of around 100 Danish kroner—roughly €13—for completing a task.

The speed and accuracy of responses, the participants' willingness to put in extra effort and their perception of discomfort will be among the factors that Allen will be exploring.

In learning more about the effects of cannabinoids on interoception, Allen aims to advance the goal of developing new treatments based on either CBD or THC that are safe, effective and customized.

Circulation hurdle

Sold as an oil or infused into novel foods and drinks, CBD is already

widely marketed as a potent treatment for all manner of ailments from anxiety and arthritis to bowel disease and multiple sclerosis.

But there's a big drawback with products sold today: bioavailability, which is the proportion of a drug or other substance that enters the circulation when introduced in the body.

Once the active ingredient of a CBD product from a shop has been ingested, only a small amount—as low as 6%—enters the circulation and becomes available to the brain. That means significant amounts of CBD must be taken for it to have an effect.

Researchers at the University of Minho in Portugal are halfway through a two-year project to shed light on the metabolic processes that determine how much CBD is available to the body after ingestion.

"There's variability from person to person, but the reasons for this are poorly understood," said Dr. Renata Vardanega, a bioengineering expert who coordinates the EU-funded project. Called [CBDHIGHBIO](#), it is scheduled to end in October 2024.

Vardanega and her team are studying what determines how much ingredient is absorbed after CBD has been ingested. For instance, does it depend on what else the person has eaten or drunk?

Delivery duos

They're also working to improve the absorption of CBD by pairing it with a long-chain fatty acid during delivery. This method diverts the absorption route to prevent CBD from being metabolized by the liver.

A third strand of work involves finding a way to boost the absorption of CBD by combining it with piperine, a compound derived from black

pepper.

Because it is an excellent bioenhancer, piperine increases the bioavailability of another substance, according to Professor Antonio Vicente, a bioengineer on the project.

"We're looking for ways to capitalize on this property to make CBD more available to the body," he said.

The project's overarching goal is to create cannabinoid edibles such as chocolates, drinks or butters that are far more potent than any current product but that contain as little CBD as possible.

"What people are consuming today is expensive, not terribly effective and unpleasant for many to ingest," said Vicente. "We think we can do a lot better."

More information:

- [CANNABODIES](#)
- [CBDHIGHBIO](#)

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