The Endocannabinoid System

A New Hope for Overcoming Chronic Pain and Inflammation, Neurological Disorders, Autoimmune Disease and More

Many people wrestle with difficult health problems such as chronic pain, neurological disorders like seizures, psychological problems like bipolar mood disorder, neurological diseases like Alzheimer's and Parkinson's, autoimmune disorders, cancer and glaucoma. Now, there is new-found hope for recovery from these serious conditions thanks to the discovery the endocannabinoid system (ECS).

The ECS was discovered while researching the effects of cannabis, also known as hemp (the industrial, non-psychoactive variety) or marijuana (the psychoactive variety). This system and the compounds related to it were named after the cannabis plant in the same way opioid receptors were named for the opiates from the poppy plant. In this newsletter, you'll learn how this system works and how you can utilize phytocannabinoids to help relieve numerous serious health problems like the ones listed above.

The Purpose of the Endocannabinoid System (ECS)

The ECS helps maintain homeostasis, the normal balance of healthy conditions in the body. This balance is maintained through chemical messengers that respond to injuries, stress or other problems to help your body cope, adapt and eventually heal.

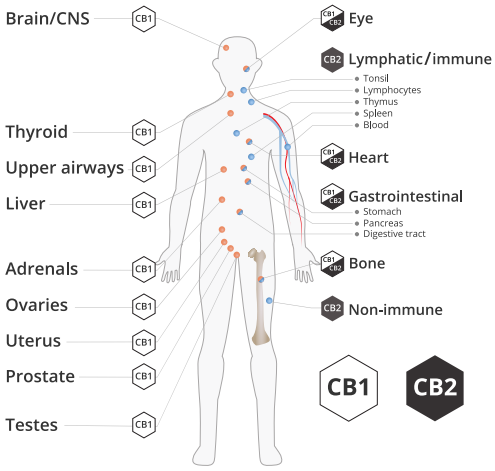
For example, if your body is injured, chemical messengers like prostaglandins and substance P evoke an inflammatory response and pain signals. Feeling pain alerts you to the injury and the inflammation triggers the immune system to repair the damage. After healing, the ECS reverses these signals reducing pain and inflammation returning your body to normal equilibrium.

The same thing happens when something causes stress. The fight-or-flight response kicks in priming your body to respond to the difficult or dangerous situation. Once the challenge is over, the ECS helps your body return to its normal relaxed state.

This means that the ECS plays a critical role in your ability to heal, both from physical injury and from emotional distress. Researchers are suggesting that many chronic illnesses may involve the ECS malfunctioning, which prevents the body from returning to the homeostasis.

How the ECS Works

The ECS consists of two types of receptors on cell membranes throughout the body, known as CB1 and CB2 receptors. They are shown in the illustration on the right.



CB1 receptors are primarily found in the brain and nervous system, although they are also located in the heart and circulatory system, the male and female reproductive system, the digestive organs, the gastrointestinal tract and other organs. Primarily CB1 receptors help balance the neurotransmitter system, including stress responses, pain and mood.

CB2 receptors are found primarily in the immune system and organs with immune functions, such as the spleen, tonsils, skin, lungs, liver and gastrointestinal tract. CB2 receptors can also be found in the brain, heart, kidneys, pancreas, bones and gallbladder. Primarily CB2 receptors help modulate immune processes and inflammation.

So far, five chemical compounds have been discovered that transmit messages within the ECS. They are known as endocannabinoids (endo meaning inner and cannabinoids referring to the compounds found in cannabis). We'll discuss the three most well researched endocannabinoids on the next page.

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Important Notice

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Three Important Endocannabinoids

Anandamide (AEA) was discovered in 1992 and is primarily involved in regulating the nervous system. The name comes from the Sanskrit—*ananda* which means inner bliss or tranquility. AEA has been called the bliss molecule, because it balances nervous system functions to promote a feeling of wellbeing and happiness. It helps decrease blood pressure and heart rate and regulates metabolism. AEA also has anti-inflammatory and anticancer effects.

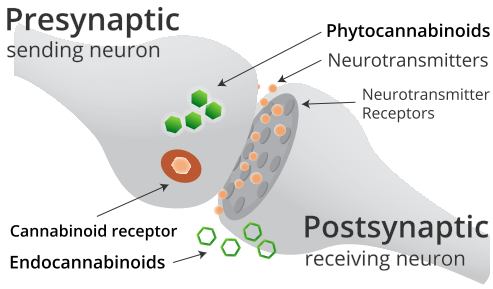
Arachidonoylglycerol (2-AG) was discovered three years later in 1995. It's the most abundant of the endocannabinoids. It is found in the central nervous system where it helps regulate neurotransmitter functions. 2-AG modulates perception of pain, feelings of anxiety or depression and helps control the tendency for addiction. It is also anti-inflammatory, modulates immune responses and regulates food intake and metabolism.

N-arachidonoyl dopamine (NADA) was discovered in 2000. It appears to play a role in inflammation and pain perception and to have a protective effect on the brain. It also relaxes blood vessels and may help the brain repair when it has been damaged.

Looking at the functions of these endocannabinoids, one can readily see how a malfunction of this system could contribute to chronic pain, various mood disorders, chronic inflammation and a malfunctioning immune system.

Endocannabinoid Signalling

The image on the right illustrates how the endocannabinoid system works within the nervous system



The presynaptic neuron (nerve cell) releases neurotransmitters into the synapse (the gap between the nerve cells). These neurotransmitters attach to receptors on the surface of the postsynaptic neuron, stimulating it to fire an electrical impulse that sends a signal to other nerve cells.

As the receiving (postsynaptic) neuron gets stimulated, it starts to produce endocannabinoids that are released back into the synapse. The endocannabinoids signal the cell releasing the neurotransmitters to stop releasing them. It's sort of like the receiving cell saying, "I got the message, you can quit sending it."

If the message is one of pain, this numbs the sensation of pain. If the message is one of distress, it calms the stressful sensations. This is how the ECS helps keep the system balanced so it doesn't overreact to problems.

Phytocannabinoids

Phytocannabinoids are compounds found in plants which attach to cannabinoid receptors. This is typical of how many compounds in medicinal plants work. These compounds attach to cellular receptors and either stimulate or inhibit them. For example, ephedrine from Chinese ephedra attaches to receptors for the neurotransmitter epinephrine and stimulates them, while lobeline from lobelia attaches to the same sites and inhibits them.

About 100 different phytocannabinoids have been identified in cannabis, but the primary ones are THC and CBD. Other cannabinoids in cannabis include CBG, CBN, CBC, THCA, CBDA, THCV, CBDV and CBGA. Cannabinoids have also been found in other herbs such as echinacea and kava kava as well as in chocolate.

This helps us have a better understanding of how these popular herbs work. For example, the phytocannabinoids in echinacea contribute to its immune enhancing effects. The kavalactones in kava kava appear to interact with the ECS to induce muscle relaxation and a sense of calm well-being. Part of the mood enhancing effect of chocolate is that it actually contains a small amount of anandamide.

The terpene ß-caryophyllene, which is found in essential oils like black pepper, cloves and copaiba has also been shown to attach to CB2 receptors, reducing inflammation and aiding healing. There may be other terpenes in essential oils that affect the ECS, too.

With this in mind, let's take a look at the two most well-researched phytocannabinoids found in cannabis, THC and CBD. This will help us understand the difference between marijuana and hemp.

THC (Delta-9-tetrahydrocannabinol)

THC was the first phytocannabinoid to be discovered. It directly binds to cannabinoid receptors and stimulates them, which means it reduces pain and anxiety, relaxes muscle spasms and has anti-inflammatory effects. Unfortunately, it's also psychoactive and responsible for the high people get when smoking marijuana recreationally.

Although THC has some medicinal properties, it also has a lot of problems. Like alcohol, it impairs brain function. It slows reaction time, inhibits memory and attention span, creates difficulty thinking and solving problems, reduces good judgment and interferes with balance and coordination. CBD, which we'll talk about next, does not have these effects, in fact, it counteracts them.

Recreational marijuana is problematic because growers have been deliberately creating strains of cannabis with higher levels of THC to produce a bigger high from using it. Marijuana grown in the 1970s had only about 1-3% THC, whereas today's varieties range from 5-30%. Both THC and CBD, are made from the same precursor chemical, which means that breeding higher levels of THC reduces the level of CBD in cannabis.

Because THC binds to ECS receptors, it causes the body to produce fewer endocannabinoids, thus down-regulating your ECS. Since your ECS kicks in to help you cope with pain and stress, using THC regularly makes you less able to deal with pain and stress naturally.

The use of THC-rich cannabis is especially risky for teenagers, whose ECS system is still developing as they learn to adapt and cope with the normal stresses of life. Heavy use of THC rich cannabis in young people has been shown to decrease IQ and increase the risk of mental illness, including schizophrenia. The down regulation of the ECS is also what makes a person dependent and causes withdrawal symptoms when a person discontinues the use of marijuana.

Fortunately, high CBD hemp does not have the drawbacks of marijuana and due to a recent change in federal law, hemp can now be legally grown in the United States. The THC content of legal

hemp must be under 0.3%. Besides being a useful source of CBD and other non-psychoactive cannabinoids, hemp is very useful for industrial purposes (see sidebar).

CBD (Cannabidiol)

CBD is the principle non-psychoactive cannabinoid. It doesn't directly stimulate cannabinoid receptors. Instead it attaches to the receptors and makes them more sensitive to the body's own endocannabinoids. This means CBD does not build tolerance, so there does not appear to be any withdrawal symptoms when discontinuing it. It is helping to normalize the body's own ECS function.

Research suggests that CBD is anti-inflammatory, anticonvulsant, reduces anxiety, eases depression and helps to ease pain and relax muscles. It also aids the immune system in fighting infections and tumors. It has potential benefits for chronic inflammatory diseases, autoimmune diseases, epilepsy, digestive disorders, anxiety, depression, psychosis and cancer.

Anyone who is concerned about the dangers of marijuana and therefore concerned about the fact that CBD comes from the cannabis plant, needs to understand that CBD itself and cannabis that is high in CBD and low in THC (which the federally mandated legal hemp is) cannot make you high and is completely safe for medicinal use.

A whole hemp CBD extract may contain small amounts of THC. While this is not dangerous to your health, it could make you test positive on a drug test. If you are concerned about this, make sure you get CBD products that are certified and tested to be THC-free.

The Entourage Effect

Many drugs used in modern medicine are based on compounds originally isolated from plants. These compounds were later modified chemically so they could be patented. This is where the bulk of medical research into cannabis is directed. Drug companies want to try to make patentable drugs to target specific parts of the endocannabinoid system.

Herbalists, on the other hand, have long asserted that whole plants have beneficial effects that isolated extracts don't. The wide variety of chemical compounds in a medicinal plant make it less prone to side effects and often help to fix the real cause of the problem, not just ease the symptoms.

The research into cannabis seems to support this assertion. Dr. Raphael Mechoulam, a PhD researcher in Israel, who also happened to be the first to isolate THC and CBD in the 1960s, has asserted that cannabinoids work better together than they do in isolation. He calls this the *entourage effect*.

This means that a whole spectrum extract containing many cannabinoids will work better than CBD alone. It also means that other compounds in cannabis, such as terpenes and flavonoids, enhance the beneficial effects of the phytocannabinoids.

For example, cannabis is rich in terpenoids, compounds found in essential oils. Cannabis contains varying amounts of about 200 terpenoids, which give different varieties of cannabis slightly different properties. There is evidence that some of the terpenoids in essential oils may influence the ECS. So, CBD appears to work synergistically with aromatherapy to balance the ECS.

There are also about 20 flavonoids in cannabis. Flavonoids work synergistically with phytocannabinoids to give whole hemp cannabis greater anti-inflammatory, antimicrobial, anticancer and anti-allergic properties than isolated CBD.

The entourage effect also suggests that CBD and phytocannabinoids should be used along with other traditional herbal remedies, nutrition and lifestyle changes when trying to overcome various diseases. Although phytocannabinoids can nudge the system back to balance, they can't provide the nutrients tissues need to heal or detoxify, nor do they make up for poor diet and lifestyle habits.

Using CBD for Specific Health Issues

The best way to use CBD is to help nudge the body back to health along with diet and lifestyle changes and appropriate supplements and not as a stand-alone miracle cure. What follows are a few practical suggestions for using CBD with other herbs, nutrients and essential oils for specific health issues.

Pain and Inflammation

Many people have found CBD helpful for relieving pain. It can be taken internally or used topically to ease the pain of arthritic joints, migraine headaches, neuropathy and pain associated with

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The Many Uses of Hemp

Hemp has been a valuable resource for the whole of Western civilization. Hemp fibers have been used to make paper, clothing, rope and sails. In fact, the word canvas probably derived from the Greek word, *kannabis*, which means two reeds or two sexes. (Cannabis has both male and female plants, something very unique in the plant kingdom.) Most rope was made from hemp until 1937 when it was replaced by synthetic fibers derived from petrochemicals.

It's interesting to note that until 1883, 75-90% of all paper was made from hemp fiber, including Bible's, maps, books, newspapers and money. The first draft of the Declaration of Independence was written on hemp paper, too. Early American clothing was often made from hemp and old cloth was gathered to be recycled as paper, hence the term rag paper.

Hemp could literally save forests. A 1916 USDA Bulletin reported that one acre of hemp could produce as much paper as 4.1 acres of trees over a twenty-year period. Hemp paper is stronger, uses less chemicals to make and is easier to recycle than wood-pulp paper.

Hemp seeds are also highly nutritious. Hemp seed is rich in omega-3 fatty acids and high in protein. In fact, hemp and flax seeds are the best sources of omega-3 and omega-6 essential fatty acids in the plant kingdom. This is another entourage effect, because essential fatty acids are needed for the production of endocannabinoids and cannabinoid receptors.

Like flaxseed (linseed) oil, hemp seed oil can be used to make paints and varnishes. Hemp-based protein powders are also becoming increasingly popular. Because the plant grows so rapidly, without severely depleting the soil, it also makes a great source of biomass for fuel.

These are only some of the many uses of this valuable plant.

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injuries or surgery. Topically it can be used synergistically with pain-relieving essential oils such as copaiba, turmeric, **wintergreen**, **clove** and **lavender**. Internally it can be used with anti-inflammatory and pain-relieving supplements like **turmeric or curcumin**, boswellia, **alpha lipoic acid**, **glucosamine** and **MSM**.

CBD for Anxiety and Insomnia

CBD may be helpful for reducing anxiety and stress, including helping people with PTSD. One study found low levels of anandamide in people with PTSD. In working with anxiety or PTSD, CBD would ideally be used along with stress-relieving herbs or essential oils such as **chamomile**, **lavender**, **hops** and **valerian**.

CBD along with the and previously mentioned herbs and essential oils may help to aid sleep. Other remedies that could work synergistically with CBD for sleep include **5-HTP**, **l-theanine** and **GABA**.

CBD for Epilepsy and Neurological Disorders

Seizures or convulsions are the result of an over excitation of the nervous system, which means there is a lack of balance in the neurotransmitters in the brain. Since the ECS helps regulate nervous system balance, it makes sense that this problem could be the result of a malfunction of the ECS.

Many people have reported that cannabis has reduced or controlled previously uncontrollable seizures. Evaluation of surgically removed brain tissue from subjects with epilepsy showed a 60% reduction in the enzymes needed to make 2-AG, an important endocannabinoid. Cerebrospinal fluid from people with epilepsy has also showed lower levels of endocannabinoids.

In animal studies CBD has been shown to have anticonvulsive activity and there are also human trials showing that CBD has reduced or eliminated seizures in both adults and children with epilepsy. Studies showed about 50-70% of the subjects had some kind of improvement.

CBD reduces neuroinflammation, reduces excitability of the neurons and suppresses glutamate activity (an excitatory neurotransmitter). Cannabis rich in ß-caryophyllene appears to increase the ability of CBD to reduce neuroinflammation, which is not only an aspect of epilepsy, it is also involved in neurodegenerative disorders like Alzheimer's and Parkinson's disease.

CBD and Immune Function

Autoimmune disorders involve the body's immune system tagging and destroying the healthy tissues. CBD shows promise in helping to regulate immune responses and reduce the chronic inflammation and tissue damage associated with these conditions.

Typically, people with autoimmune conditions also need digestive enzymes and **omega-3 essential fatty** acids to help balance immune responses. Anti-inflammatory herbs like **licorice**, boswellia, **turmeric or curcumin**, and **yucca** may also be helpful in combination with the CBD. Immune stimulants like echinacea should be avoided.

CBD may also help the immune system to better identify cancer cells and other invaders like viruses. Here, CBD would work synergistically with **echinacea** or medicinal mushrooms like miatake, **cordyceps** and others. The use of CBD for cancer is controversial, but many people have found it beneficial, both in helping the immune system fight the cancer and also in relieving side effects from chemotherapy and radiation.

Additional Help and Information

This newsletter covers just a few of the many possible benefits for CBD and other phytocannabinoids. For more help and information contact the person who gave you this newsletter. You can also consult the following books, which were also used as source material for this newsletter:

CBD: Discover CBD Oil for Getting Health Benefits by Harvey Talley
CBD: A Patients Guide by Leonard Leinow and Juliana Birnbaum
Cannabis Revealed by Bonnni Goldstein, MD
Cannabis and CBD for Health and Wellness by Aliza Sherman
The Endocannabinoid System and Cannabis by Scott A. Johnson
The Great Book of Hemp by Rowin Robinson