Medical Cannabis

Targets (24) Enzymes (29) Transporters (3) Biointeractions (11)

IDENTIFICATION

Name	Medical Cannabis
Accession Number	DB14009
Type	Biotech
Groups	Experimental, Investigational

Description

The use of the plant species *Cannabis sativa* and *Cannabis indica*, popularly known as marijuana, has gained popularity in recent years for the management of a wide variety of medical conditions as a wave of legalization in North America has changed public and medical opinion on its use. Consequently, an expanding body of evidence has begun to emerge that has demonstrated its potential usefulness in the management of conditions such as chronic pain, spasticity, inflammation, epilepsy, and chemotherapy-induced nausea and vomiting among many others[2]. This area of research is controversial and has been heavily debated, however, due to concerns over risks of addiction, long-term health effects, and Cannabis' association with schizophrenia.

From a pharmacological perspective, Cannabis' diverse receptor profile explains its potential application for such a wide variety of medical conditions. Cannabis contains more than 400 different chemical compounds, of which 61 are considered cannabinoids, a class of compounds that act upon cannabinoid receptors of the body [1]. Tetrahydrocannabinol (THC) and Cannabidiol (CBD) are two types of cannabinoids found naturally in the resin of the marijuana plant, both of which interact with the cannabinoid receptors that are found throughout the body. Although THC and CBD have been the most studied cannabinoids, there are many others identified to date including cannabinol (CBN), cannabigerol (CBG), Cannabidivarin (CBDV), and Tetrahydrocannabivarin (THCV) that have been shown to modify the physiological effects of cannabis [10].

While both CBD and THC are used for medicinal purposes, they have different receptor activity, function, and physiological effects. THC and CBD are converted from their precursors, tetrahydrocannabinolic acid-A (THCA-A) and cannabidiolic acid (CBDA), through decarboxylation when unfertilized female cannabis flowers are activated either through heating, smoking, vaporization, or baking. While cannabis in its natural plant form is currently used "off-label" for the management of many medical conditions, THC is currently commercially available in synthetic form as Nabilone, as purified isomer as Dronabinol, or in a 1:1 formulation with CBD from purified plant extract as Nabiximols.

Cannabinoid receptors are utilized endogenously by the body through the endocannabinoid system, which includes a group of lipid proteins, enzymes, and receptors that are involved in many physiological processes. Through its modulation of neurotransmitter release, the endocannabinoid system regulates cognition, pain sensation, appetite, memory, sleep, immune function, and mood among many others. These effects are largely mediated through two members of the G-protein coupled receptor family, cannabinoid receptors 1 and 2 (CB1 and CB2) [2]. CB1 receptors are found in both the central and peripheral nervous systems, with the majority of receptors localized to the hippocampus and amygdala of the brain. Physiological effects of using cannabis make sense in the context of its receptor activity as the hippocampus and amygdala are primarily involved with regulation of memory, fear, and emotion. In contrast, CB2 receptors are mainly found peripherally in immune cells, lymphoid tissue, and peripheral nerve terminals [4].

The primary psychoactive component of Cannabis, delta 9-tetrahydrocannabinol (Δ9-THC),

cannabis such as increased appetite, reduced pain, and changes in emotional and cognitive processes. In contrast to THC's weak agonist activity, CBD has been shown to act as a negative allosteric modulator of the cannabinoid CB1 receptor, the most abundant G-Protein Coupled Receptor (GPCR) in the body [5]. Allosteric regulation is achieved through the modulation of receptor activity on a functionally distinct site from the agonist or antagonist binding site, which is therapeutically important as direct agonists are limited by their psychomimetic effects while direct antagonists are limited by their depressant effects [5].

There is further evidence that CBD also activates 5-HT1A serotonergic and TRPV1–2 vanilloid receptors, antagonizes alpha-1 adrenergic and μ-opioid receptors, inhibits synaptosomal uptake of noradrenaline, dopamine, serotonin and gaminobutyric acid and cellular uptake of anandamide, acts on mitochondria Ca2 stores, blocks low-voltage-activated (T-type) Ca2 channels, stimulates activity of the inhibitory glycine-receptor, and inhibits activity of fatty amide hydrolase (FAAH) [6, 7].

Due to the differences in receptor profile between CBD and THC, these cannabinoids are understandably used to treat different conditions. Furthermore, when combined with THC, CBD has been shown to modulate THC's activity, resulting in differences in pharmacological effect between "strains", or chemovars, of the Cannabis plant which are bred to contain different concentrations of CBD and THC. For example, strains containing a high proportion of CBD have been shown to reduce the psychosis- and anxiety-inducing effects of THC [13]. Reliably studying the effects of Cannabis is complicated by the large variety of available strains and by the numerous other compounds that Cannabis contains such as terpenes, flavonoids, phenols, amino acids, and fatty acids among many others that have shown potential to modulate the plant's pharmacological effect [11, 12].

Synonyms

- Cannabis
- Cannabis indica
- Cannabis indica top
- Cannabis sativa subsp. indica top
- Cannabis sativa subsp. indica top extract
- Hashish top
- Marihuana
- Marijuana
- Marijuana top

Categories

- Agents producing tachycardia
- BCRP/ABCG2 Inhibitors
- Cytochrome P-450 CYP2C9 Inhibitors
- Cytochrome P-450 CYP2C9 Inhibitors (moderate)
- Cytochrome P-450 CYP2C9 Substrates
- Cytochrome P-450 CYP3A Substrates
- Cytochrome P-450 CYP3A4 Substrates
- Cytochrome P-450 Enzyme Inhibitors
- Pharmaceutical Preparations

UNII FTS5RM302N

CAS number Not Available

PHARMACOLOGY

Indication Not Available

Pharmacodynamics The primary psychoactive component of Cannabis, delta 9-tetrahydrocannabinol (Δ9-THC), demonstrates its effects through weak partial agonist activity at Cannabinoid-1 (CB1R) and Cannabinoid-2 (CB2R) receptors. This activity results in the well-known effects of smoking cannabis such as increased appetite, reduced pain, and changes in emotional and cognitive processes.

(GPCR) in the body [5]. There is further evidence that CBD also activates 5-HT1A serotonergic and TRPV1–2 vanilloid receptors, antagonizes alpha-1 adrenergic and μ-opioid receptors, inhibits synaptosomal uptake of noradrenaline, dopamine, serotonin and gaminobutyric acid and cellular uptake of anandamide, acts on mitochondria Ca2 stores, blocks low-voltage-activated (T-type) Ca2 channels, stimulates activity of the inhibitory glycine-receptor, and inhibits activity of fatty amide hydrolase (FAAH) [6, 7].

Mechanism of action

TARGET	ACTIONS	ORGANISM
(A) Cannabinoid receptor 1	negative modulator	Humans
(U) Cannabinoid receptor 2	Not Available	Humans
(U) G-protein coupled receptor 12	inverse agonist	Humans
(U) Glycine receptor subunit alpha-1	Not Available	Humans
(U) Glycine receptor (alpha-1/beta)	Not Available	Humans
(U) Glycine receptor subunit alpha-3	Not Available	Humans
(U) N-arachidonyl glycine receptor	Not Available	Humans
(U) G-protein coupled receptor 55	Not Available	Humans
(U) 5-hydroxytryptamine receptor 1A	Not Available	Humans
(U) 5-hydroxytryptamine receptor 2A	Not Available	Humans
(U) Neuronal acetylcholine receptor subunit alpha-7	Not Available	Humans
(U) Delta-type opioid receptor	Not Available	Humans
(U) Mu-type opioid receptor	Not Available	Humans
(U) Peroxisome proliferator-activated receptor gamma	Not Available	Humans
(U) Transient receptor potential cation channel subfamily V member 1	Not Available	Humans
(U) Voltage-dependent T-type calcium channel subunit alpha-1G	Not Available	Humans
(U) Voltage-dependent T-type calcium channel subunit alpha-1H	Not Available	Humans
(U) Voltage-dependent T-type calcium channel subunit alpha-1I	Not Available	Humans
(U) Transient receptor potential cation channel subfamily A member 1	Not Available	Humans
(U) Transient receptor potential cation channel subfamily M member 8	Not Available	Humans
(U) Transient receptor potential cation channel subfamily V member 2	Not Available	Humans
(U) Transient receptor potential cation channel subfamily V member 3	Not Available	Humans
(U) Transient receptor potential cation channel subfamily V member 4	Not Available	Humans
(U) Voltage-dependent anion-selective channel protein 1	Not Available	Humans

Absorption

Route of administration and formulation determine the rate of drug absorption. Smoking cannabis provides the most rapid route of absorption directly from lungs to brain (with THC levels reaching their peak within 3-10 minutes), while oral administration (with "edibles") is the slowest (with THC levels reaching their peak within 1-2 hours) [8]. In one study, maximum plasma concentration after oral administration, was found to be 4.4-11 ng/mL for 20 mg of THC and 2.7-6.3 ng/mL for 15 mg [1].

Volume of distribution

As a very lipophilic molecule, THC is rapidly distributed into highly perfused tissues such as the lungs, heart, brain, and liver resulting in rapid decreases in plasma concentration. This quick distribution is then also followed by a slow re-release from fatty tissues back into the blood stream, prolonging the half-life of THC [8, 1].

Protein binding

Not Available

Metabolism

THC is primarily metabolized in the liver by microsomal hydroxylation and oxidation reactions catalyzed by Cytochrome P450 enzymes. 11-hydroxy-▵9-tetrahydrocannabinol (11-OH-THC) is the primary active metabolite, capable of producing psychological and behavioural effects, which is then metabolized into 11-nor-9-carboxy-▵ 9-tetrahydrocannabinol (THC-COOH), THC's primary inactive metabolite [1].

Route of elimination	Cannabis is primarily eliminated through the feces, with >65% showing up in elimination studies while 20% is excreted in urine [1].
Half life	The half life of THC in the body depends on frequency of use: for a one time user, THC may be detectable in the blood for up to 1.3 days post-use, while for a frequent user may be present in the bloodstream for 5-13 days [8, 1]
Clearance	One study reported average plasma clearance rates to be 11.8± 3 L/hour for women and 14.9 ±3.7 L/hour for men [9]. Others have determined approximately 36 L/hour for naïve cannabis users and 60 L/hour for regular cannabis users [1].
Toxicity	Not Available
Affected organisms	Not Available
Pathways	Not Available
Pharmacogenomic Effects/ADRs	Not Available

INTERACTIONS

Drug Interactions

ALL DRUGS | APPROVED | VET APPROVED | NUTRACEUTICAL | ILLICIT | WITHDRAWN | INVESTIGATIONAL | EXPERIMENTAL

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DRUG	INTERACTION
(R)-warfarin	The metabolism of Medical Cannabis can be decreased when combined with (R)-warfarin.
(S)-Warfarin	The metabolism of (S)-Warfarin can be decreased when combined with Medical Cannabis.
2,5-Dimethoxy-4-ethylamphetamine	The risk or severity of Tachycardia can be increased when 2,5-Dimethoxy-4-ethylamphetamine is combined with Medical Cannabis.
2,5-Dimethoxy-4-ethylthioamphetamine	The risk or severity of Tachycardia can be increased when 2,5-Dimethoxy-4-ethylthioamphetamine is combined with Medical Cannabis.
3,4-Methylenedioxyamphetamine	The risk or severity of Tachycardia can be increased when 3,4-Methylenedioxyamphetamine is combined with Medical Cannabis.
3,5-diiodothyropropionic acid	The metabolism of Medical Cannabis can be decreased when combined with 3,5-diiodothyropropionic acid.
4-Bromo-2,5-dimethoxyamphetamine	The risk or severity of Tachycardia can be increased when 4-Bromo-2,5-dimethoxyamphetamine is combined with Medical Cannabis.
4-hydroxycoumarin	The metabolism of 4-hydroxycoumarin can be decreased when combined with Medical Cannabis.
4-Methoxyamphetamine	The risk or severity of Tachycardia can be increased when 4-Methoxyamphetamine is combined with Medical Cannabis.
5-androstenedione	The metabolism of Medical Cannabis can be decreased when combined with 5-androstenedione.

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Food Interactions Not Available

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Nervous System. Int J Mol Sci. 2018 Mar 13;19(3). pii: ijms19030833. doi: 10.3390/ijms19030833. [PubMed:29533978]
3. Pertwee RG: The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: delta9-tetrahydrocannabinol, cannabidiol and delta9-tetrahydrocannabivarin. Br J Pharmacol. 2008 Jan;153(2):199-215. doi: 10.1038/sj.bjp.0707442. Epub 2007 Sep 10. [PubMed:17828291]
4. Kaur R, Ambwani SR, Singh S: Endocannabinoid System: A Multi-Facet Therapeutic Target. Curr Clin Pharmacol. 2016;11(2):110-7. [PubMed:27086601]
5. Laprairie RB, Bagher AM, Kelly ME, Denovan-Wright EM: Cannabidiol is a negative allosteric modulator of the cannabinoid CB1 receptor. Br J Pharmacol. 2015 Oct;172(20):4790-805. doi: 10.1111/bph.13250. Epub 2015 Oct 13. [PubMed:26218440]
6. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]
7. Zhornitsky S, Potvin S: Cannabidiol in humans-the quest for therapeutic targets. Pharmaceuticals (Basel). 2012 May 21;5(5):529-52. doi: 10.3390/ph5050529. [PubMed:24281562]
8. Huestis MA: Pharmacokinetics and metabolism of the plant cannabinoids, delta9-tetrahydrocannabinol, cannabidiol and cannabinol. Handb Exp Pharmacol. 2005;(168):657-90. [PubMed:16596792]
9. Karschner EL, Schwilke EW, Lowe RH, Darwin WD, Herning RI, Cadet JL, Huestis MA: Implications of plasma Delta9-tetrahydrocannabinol, 11-hydroxy-THC, and 11-nor-9-carboxy-THC concentrations in chronic cannabis smokers. J Anal Toxicol. 2009 Oct;33(8):469-77. [PubMed:19874654]
10. Elsohly MA, Slade D: Chemical constituents of marijuana: the complex mixture of natural cannabinoids. Life Sci. 2005 Dec 22;78(5):539-48. doi: 10.1016/j.lfs.2005.09.011. Epub 2005 Sep 30. [PubMed:16199061]
11. Pollastro F, Minassi A, Fresu LG: Cannabis Phenolics and their Bioactivities. Curr Med Chem. 2018;25(10):1160-1185. doi: 10.2174/0929867324666170810164636. [PubMed:28799497]
12. Baron EP: Comprehensive Review of Medicinal Marijuana, Cannabinoids, and Therapeutic Implications in Medicine and Headache: What a Long Strange Trip It's Been .... Headache. 2015 Jun;55(6):885-916. doi: 10.1111/head.12570. Epub 2015 May 25. [PubMed:26015168]
13. Niesink RJ, van Laar MW: Does Cannabidiol Protect Against Adverse Psychological Effects of THC? Front Psychiatry. 2013 Oct 16;4:130. doi: 10.3389/fpsyt.2013.00130. [PubMed:24137134]

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CLINICAL TRIALS

Clinical Trials

Show 10 entries Search

PHASE	STATUS	PURPOSE	CONDITIONS	COUNT
0	Recruiting	Basic Science	Cannabis Dependence, Continuous / Cannabis Use Disorders	1
0	Recruiting	Other	Cannabis / Smoking	1
0	Recruiting	Other	Marijuana Impairment	1
0	Recruiting	Other	Psychomotor Impairment	1
1	Active Not Recruiting	Basic Science	COMT Gene Polymorphism	1
1	Completed	Basic Science	Cannabis	2
1	Completed	Basic Science	Cannabis Use Disorders / Dual Diagnosis / Psychotic Disorder NOS / Schizoaffective Disorders / Schizophrenic Disorders	1
1	Completed	Basic Science	Marijuana Use Disorder / Marijuana Use Disorders	1
1	Completed	Diagnostic	Cannabis Intoxication / Cannabis Toxicology	1
1	Completed	Other	Cannabis Use	1

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PHARMACOECONOMICS

Manufacturers Not Available

Packagers Not Available

Dosage forms Not Available

Prices Not Available

PROPERTIES

State	Solid
Experimental Properties	Not Available

TAXONOMY

Classification	Not classified

TARGETS

1. Cannabinoid receptor 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Yes
Actions	Negative modulator
General Function	Drug binding
Specific Function	Involved in cannabinoid-induced CNS effects. Acts by inhibiting adenylate cyclase. Could be a receptor for anandamide. Inhibits L-type Ca(2+) channel current. Isoform 2 and isoform 3 have altered l...
Gene Name	CNR1
Uniprot ID	P21554
Uniprot Name	Cannabinoid receptor 1
Molecular Weight	52857.365 Da

References

1. Pertwee RG: The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: delta9-tetrahydrocannabinol, cannabidiol and delta9-tetrahydrocannabivarin. Br J Pharmacol. 2008 Jan;153(2):199-215. doi: 10.1038/sj.bjp.0707442. Epub 2007 Sep 10. [PubMed:17828291]
2. Laprairie RB, Bagher AM, Kelly ME, Denovan-Wright EM: Cannabidiol is a negative allosteric modulator of the cannabinoid CB1 receptor. Br J Pharmacol. 2015 Oct;172(20):4790-805. doi: 10.1111/bph.13250. Epub 2015 Oct 13. [PubMed:26218440]
3. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

2. Cannabinoid receptor 2

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Cannabinoid receptor activity
Specific Function	Heterotrimeric G protein-coupled receptor for endocannabinoid 2-arachidonoylglycerol mediating inhibition of adenylate cyclase. May function in inflammatory response, nociceptive transmission and b...
Gene Name	CNR2

Uniprot ID	P34972
Molecular Weight	39680.275 Da

References

1. Pertwee RG: The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: delta9-tetrahydrocannabinol, cannabidiol and delta9-tetrahydrocannabivarin. Br J Pharmacol. 2008 Jan;153(2):199-215. doi: 10.1038/sj.bjp.0707442. Epub 2007 Sep 10. [PubMed:17828291]

3. G-protein coupled receptor 12

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Inverse agonist
General Function	Promotes neurite outgrowth and blocks myelin inhibition in neurons (By similarity). Receptor with constitutive G(s) signaling activity that stimulates cyclic AMP production.
Specific Function	G-protein coupled receptor activity
Gene Name	GPR12
Uniprot ID	P47775
Uniprot Name	G-protein coupled receptor 12
Molecular Weight	36729.785 Da

References

1. Brown KJ, Laun AS, Song ZH: Cannabidiol, a novel inverse agonist for GPR12. Biochem Biophys Res Commun. 2017 Nov 4;493(1):451-454. doi: 10.1016/j.bbrc.2017.09.001. Epub 2017 Sep 6. [PubMed:28888984]

4. Glycine receptor subunit alpha-1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Transmitter-gated ion channel activity
Specific Function	The glycine receptor is a neurotransmitter-gated ion channel. Binding of glycine to its receptor increases the chloride conductance and thus produces hyperpolarization (inhibition of neuronal firing).
Gene Name	GLRA1
Uniprot ID	P23415
Uniprot Name	Glycine receptor subunit alpha-1
Molecular Weight	52623.35 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

Kind	Protein group
Organism	Humans
Pharmacological action	Unknown
General Function	Transmitter-gated ion channel activity
Specific Function	The glycine receptor is a neurotransmitter-gated ion channel. Binding of glycine to its receptor increases the chloride conductance and thus produces hyperpolarization (inhibition of neuronal firing).

Components:

NAME	UNIPROT ID
Glycine receptor subunit alpha-1	P23415
Glycine receptor subunit beta	P48167

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

6. Glycine receptor subunit alpha-3

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Transmitter-gated ion channel activity
Specific Function	The glycine receptor is a neurotransmitter-gated ion channel. Binding of glycine to its receptor increases the chloride conductance and thus produces hyperpolarization (inhibition of neuronal firing).
Gene Name	GLRA3
Uniprot ID	O75311
Uniprot Name	Glycine receptor subunit alpha-3
Molecular Weight	53799.775 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

7. N-arachidonyl glycine receptor

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	G-protein coupled receptor activity
Specific Function	Receptor for N-arachidonyl glycine. The activity of this receptor is mediated by G proteins which inhibit adenylyl cyclase. May contribute to regulation of the immune system.
Gene Name	GPR18

Uniprot ID	Q14330
Molecular Weight	38133.27 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

8. G-protein coupled receptor 55

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	G-protein coupled receptor activity
Specific Function	May be involved in hyperalgesia associated with inflammatory and neuropathic pain (By similarity). Receptor for L-alpha-lysophosphatidylinositol (LPI). LPI induces Ca(2+) release from intracellular...
Gene Name	GPR55
Uniprot ID	Q9Y2T6
Uniprot Name	G-protein coupled receptor 55
Molecular Weight	36637.12 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

9. 5-hydroxytryptamine receptor 1A

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Serotonin receptor activity
Specific Function	G-protein coupled receptor for 5-hydroxytryptamine (serotonin). Also functions as a receptor for various drugs and psychoactive substances. Ligand binding causes a conformation change that triggers...
Gene Name	HTR1A
Uniprot ID	P08908
Uniprot Name	5-hydroxytryptamine receptor 1A
Molecular Weight	46106.335 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Virus receptor activity
Specific Function	G-protein coupled receptor for 5-hydroxytryptamine (serotonin). Also functions as a receptor for various drugs and psychoactive substances, including mescaline, psilocybin, 1-(2,5-dimethoxy-4-iodop...
Gene Name	HTR2A
Uniprot ID	P28223
Uniprot Name	5-hydroxytryptamine receptor 2A
Molecular Weight	52602.58 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

11. Neuronal acetylcholine receptor subunit alpha-7

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Toxic substance binding
Specific Function	After binding acetylcholine, the AChR responds by an extensive change in conformation that affects all subunits and leads to opening of an ion-conducting channel across the plasma membrane. The cha...
Gene Name	CHRNA7
Uniprot ID	P36544
Uniprot Name	Neuronal acetylcholine receptor subunit alpha-7
Molecular Weight	56448.925 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

12. Delta-type opioid receptor

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Opioid receptor activity
Specific Function	G-protein coupled receptor that functions as receptor for endogenous enkephalins and for a subset of other opioids. Ligand binding causes a conformation change that triggers signaling via guanine n...
Gene Name	OPRD1
Uniprot ID	P41143

UniProt ID	P41143
Molecular Weight	40368.235 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

13. Mu-type opioid receptor

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Voltage-gated calcium channel activity
Specific Function	Receptor for endogenous opioids such as beta-endorphin and endomorphin. Receptor for natural and synthetic opioids including morphine, heroin, DAMGO, fentanyl, etorphine, buprenorphin and methadone...
Gene Name	OPRM1
Uniprot ID	P35372
Uniprot Name	Mu-type opioid receptor
Molecular Weight	44778.855 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

14. Peroxisome proliferator-activated receptor gamma

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Zinc ion binding
Specific Function	Nuclear receptor that binds peroxisome proliferators such as hypolipidemic drugs and fatty acids. Once activated by a ligand, the nuclear receptor binds to DNA specific PPAR response elements (PPRE...
Gene Name	PPARG
Uniprot ID	P37231
Uniprot Name	Peroxisome proliferator-activated receptor gamma
Molecular Weight	57619.58 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Transmembrane signaling receptor activity
Specific Function	Ligand-activated non-selective calcium permeant cation channel involved in detection of noxious chemical and thermal stimuli. Seems to mediate proton influx and may be involved in intracellular aci...
Gene Name	TRPV1
Uniprot ID	Q8NER1
Uniprot Name	Transient receptor potential cation channel subfamily V member 1
Molecular Weight	94955.33 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]
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3. Iannotti FA, Hill CL, Leo A, Alhusaini A, Soubrane C, Mazzarella E, Russo E, Whalley BJ, Di Marzo V, Stephens GJ: Nonpsychotropic plant cannabinoids, cannabidivarin (CBDV) and cannabidiol (CBD), activate and desensitize transient receptor potential vanilloid 1 (TRPV1) channels in vitro: potential for the treatment of neuronal hyperexcitability. ACS Chem Neurosci. 2014 Nov 19;5(11):1131-41. doi: 10.1021/cn5000524. Epub 2014 Jul 29. [PubMed:25029033]

16. Voltage-dependent T-type calcium channel subunit alpha-1G

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Scaffold protein binding
Specific Function	Voltage-sensitive calcium channels (VSCC) mediate the entry of calcium ions into excitable cells and are also involved in a variety of calcium-dependent processes, including muscle contraction, hor...
Gene Name	CACNA1G
Uniprot ID	O43497
Uniprot Name	Voltage-dependent T-type calcium channel subunit alpha-1G
Molecular Weight	262468.62 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

17. Voltage-dependent T-type calcium channel subunit alpha-1H

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Scaffold protein binding

	calcium-dependent processes, including muscle contraction, hor...
Gene Name	CACNA1H
Uniprot ID	O95180
Uniprot Name	Voltage-dependent T-type calcium channel subunit alpha-1H
Molecular Weight	259160.2 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

18. Voltage-dependent T-type calcium channel subunit alpha-1I

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Voltage-gated calcium channel activity
Specific Function	Voltage-sensitive calcium channels (VSCC) mediate the entry of calcium ions into excitable cells and are also involved in a variety of calcium-dependent processes, including muscle contraction, hor...
Gene Name	CACNA1I
Uniprot ID	Q9P0X4
Uniprot Name	Voltage-dependent T-type calcium channel subunit alpha-1I
Molecular Weight	245100.8 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

19. Transient receptor potential cation channel subfamily A member 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Temperature-gated cation channel activity
Specific Function	Receptor-activated non-selective cation channel involved in detection of pain and possibly also in cold perception and inner ear function (PubMed:25389312, PubMed:25855297). Has a central role in t...
Gene Name	TRPA1
Uniprot ID	O75762
Uniprot Name	Transient receptor potential cation channel subfamily A member 1
Molecular Weight	127499.88 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

20. Transient receptor potential cation channel subfamily M member 8

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Calcium channel activity
Specific Function	Receptor-activated non-selective cation channel involved in detection of sensations such as coolness, by being activated by cold temperature below 25 degrees Celsius. Activated by icilin, eucalypto...
Gene Name	TRPM8
Uniprot ID	Q7Z2W7
Uniprot Name	Transient receptor potential cation channel subfamily M member 8
Molecular Weight	127684.035 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

21. Transient receptor potential cation channel subfamily V member 2

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Calcium-permeable, non-selective cation channel with an outward rectification. Seems to be regulated, at least in part, by IGF-I, PDGF and neuropeptide head activator. May transduce physical stimuli in mast cells. Activated by temperatures higher than 52 degrees Celsius; is not activated by vanilloids and acidic pH.
Specific Function	Calcium channel activity
Gene Name	TRPV2
Uniprot ID	Q9Y5S1
Uniprot Name	Transient receptor potential cation channel subfamily V member 2
Molecular Weight	85980.335 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

22. Transient receptor potential cation channel subfamily V member 3

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Calcium channel activity
Specific Function	Putative receptor-activated non-selective calcium permeant cation

Gene Name	TRPV3
Uniprot ID	Q8NET8
Uniprot Name	Transient receptor potential cation channel subfamily V member 3
Molecular Weight	90635.115 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

23. Transient receptor potential cation channel subfamily V member 4

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Non-selective calcium permeant cation channel involved in osmotic sensitivity and mechanosensitivity. Activation by exposure to hypotonicity within the physiological range exhibits an outward rectification (PubMed:18826956, PubMed:18695040). Also activated by heat, low pH, citrate and phorbol esters (PubMed:18826956, PubMed:18695040). Increase of intracellular Ca(2+) potentiates currents. Channel activity seems to be regulated by a calmodulin-dependent mechanism with a negative feedback mechanism (PubMed:12724311, PubMed:18826956). Promotes cell-cell junction formation in skin keratinocytes and plays an important role in the formation and/or maintenance of functional intercellular barriers (By similarity). Acts as a regulator of intracellular Ca(2+) in synoviocytes (PubMed:19759329). Plays an obligatory role as a molecular component in the nonselective cation channel activation induced by 4-alpha-phorbol 12,13-didecanoate and hypotonic stimulation in synoviocytes and also regulates production of IL-8 (PubMed:19759329). Together with PKD2, forms mechano- and thermosensitive channels in cilium (PubMed:18695040). Negatively regulates expression of PPARGC1A, UCP1, oxidative metabolism and respiration in adipocytes (By similarity). Regulates expression of chemokines and cytokines related to proinflammatory pathway in adipocytes (By similarity). Together with AQP5, controls regulatory volume decrease in salivary epithelial cells (By similarity). Required for normal development and maintenance of bone and cartilage (PubMed:26249260).
Specific Function	Actin binding
Gene Name	TRPV4
Uniprot ID	Q9HBA0
Uniprot Name	Transient receptor potential cation channel subfamily V member 4
Molecular Weight	98280.2 Da

24. Voltage-dependent anion-selective channel protein 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown

	the plasma membrane. The channel at the outer mitochondrial membrane allows diffusion of small hydrophilic molecules; in the plasma...
Gene Name	VDAC1
Uniprot ID	P21796
Uniprot Name	Voltage-dependent anion-selective channel protein 1
Molecular Weight	30772.39 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

ENZYMES

1. Cytochrome P450 2C9

Details

Kind	Protein
Organism	Humans
Pharmacological action	No
Actions	Substrate, Inhibitor
General Function	Steroid hydroxylase activity
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP2C9
Uniprot ID	P11712
Uniprot Name	Cytochrome P450 2C9
Molecular Weight	55627.365 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]
2. Rendic S: Summary of information on human CYP enzymes: human P450 metabolism data. Drug Metab Rev. 2002 Feb-May;34(1-2):83-448. [PubMed:11996015]
3. Nabilone FDA Label [File]

2. Cytochrome P450 2C19

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Substrate
General Function	Steroid hydroxylase activity

certain barbiturates, diazepam, propranolol, citalopram and im...

Gene Name	CYP2C19
Uniprot ID	P33261
Uniprot Name	Cytochrome P450 2C19
Molecular Weight	55930.545 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

3. Cytochrome P450 2D6

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Steroid hydroxylase activity
Specific Function	Responsible for the metabolism of many drugs and environmental chemicals that it oxidizes. It is involved in the metabolism of drugs such as antiarrhythmics, adrenoceptor antagonists, and tricyclic...
Gene Name	CYP2D6
Uniprot ID	P10635
Uniprot Name	Cytochrome P450 2D6
Molecular Weight	55768.94 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

4. Cytochrome P450 3A4

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Substrate
General Function	Vitamin d3 25-hydroxylase activity
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It performs a variety of oxidation react...
Gene Name	CYP3A4
Uniprot ID	P08684
Uniprot Name	Cytochrome P450 3A4
Molecular Weight	57342.67 Da

References

5. Cytochrome P450 3A5

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Oxygen binding
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP3A5
Uniprot ID	P20815
Uniprot Name	Cytochrome P450 3A5
Molecular Weight	57108.065 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

6. Acetyl-CoA acetyltransferase, mitochondrial

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Metal ion binding
Specific Function	Plays a major role in ketone body metabolism.
Gene Name	ACAT1
Uniprot ID	P24752
Uniprot Name	Acetyl-CoA acetyltransferase, mitochondrial
Molecular Weight	45199.2 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

7. Arylalkylamine N-acetyltransferase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Not Available
Specific Function	N-acetyltransferase activity

Uniprot Name	Arylalkylamine N-acetyltransferase
Molecular Weight	23343.8 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

8. Catalase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Receptor binding
Specific Function	Occurs in almost all aerobically respiring organisms and serves to protect cells from the toxic effects of hydrogen peroxide. Promotes growth of cells including T-cells, B-cells, myeloid leukemia c...
Gene Name	CAT
Uniprot ID	P04040
Uniprot Name	Catalase
Molecular Weight	59755.82 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

9. Prostaglandin G/H synthase 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Prostaglandin-endoperoxide synthase activity
Specific Function	Converts arachidonate to prostaglandin H2 (PGH2), a committed step in prostanoid synthesis. Involved in the constitutive production of prostanoids in particular in the stomach and platelets. In gas...
Gene Name	PTGS1
Uniprot ID	P23219
Uniprot Name	Prostaglandin G/H synthase 1
Molecular Weight	68685.82 Da

References

1. Campone M, Rademaker-Lakhai JM, Bennouna J, Howell SB, Nowotnik DP, Beijnen JH, Schellens JH: Phase I and pharmacokinetic trial of AP5346, a DACH-platinum-polymer conjugate, administered weekly for three out of every 4 weeks to advanced solid tumor patients. Cancer Chemother Pharmacol. 2007 Sep;60(4):523-33. Epub 2007 Feb 17. [PubMed:17308894]

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Prostaglandin-endoperoxide synthase activity
Specific Function	Converts arachidonate to prostaglandin H2 (PGH2), a committed step in prostanoid synthesis. Constitutively expressed in some tissues in physiological conditions, such as the endothelium, kidney and...
Gene Name	PTGS2
Uniprot ID	P35354
Uniprot Name	Prostaglandin G/H synthase 2
Molecular Weight	68995.625 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

11. Cytochrome P450 3A7

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Oxygen binding
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP3A7
Uniprot ID	P24462
Uniprot Name	Cytochrome P450 3A7
Molecular Weight	57525.03 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

12. Cytochrome P450 1A1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Vitamin d 24-hydroxylase activity
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP1A1

Uniprot ID	P04798
Molecular Weight	58164.815 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

13. Cytochrome P450 1A2

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen, reduced flavin or flavoprotein as one donor, and incorporation of one atom of oxygen
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP1A2
Uniprot ID	P05177
Uniprot Name	Cytochrome P450 1A2
Molecular Weight	58293.76 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

14. Cytochrome P450 1B1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Oxygen binding
Specific Function	Cytochromes P450 are a group of heme-thiolate monooxygenases. In liver microsomes, this enzyme is involved in an NADPH-dependent electron transport pathway. It oxidizes a variety of structurally un...
Gene Name	CYP1B1
Uniprot ID	Q16678
Uniprot Name	Cytochrome P450 1B1
Molecular Weight	60845.33 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Not Available
Specific Function	Not Available
Gene Name	DAGLA
Uniprot ID	F5GY58
Uniprot Name	Sn1-specific diacylglycerol lipase alpha
Molecular Weight	19005.05 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

16. Fatty-acid amide hydrolase 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Fatty acid amide hydrolase activity
Specific Function	Degrades bioactive fatty acid amides like oleamide, the endogenous cannabinoid, anandamide and myristic amide to their corresponding acids, thereby serving to terminate the signaling functions of t...
Gene Name	FAAH
Uniprot ID	O00519
Uniprot Name	Fatty-acid amide hydrolase 1
Molecular Weight	63065.28 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

17. Glutathione reductase, mitochondrial

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Nadp binding
Specific Function	Maintains high levels of reduced glutathione in the cytosol.
Gene Name	GSR
Uniprot ID	P00390
Uniprot Name	Glutathione reductase, mitochondrial
Molecular Weight	56256.565 Da

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

18. Glutathione peroxidase 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Sh3 domain binding
Specific Function	Protects the hemoglobin in erythrocytes from oxidative breakdown.
Gene Name	GPX1
Uniprot ID	P07203
Uniprot Name	Glutathione peroxidase 1
Molecular Weight	22087.94 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

19. 3-hydroxy-3-methylglutaryl-coenzyme A reductase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Nadph binding
Specific Function	Transmembrane glycoprotein that is the rate-limiting enzyme in cholesterol biosynthesis as well as in the biosynthesis of nonsterol isoprenoids that are essential for normal cell function including...
Gene Name	HMGCR
Uniprot ID	P04035
Uniprot Name	3-hydroxy-3-methylglutaryl-coenzyme A reductase
Molecular Weight	97475.155 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

20. Indoleamine 2,3-dioxygenase 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Tryptophan 2,3-dioxygenase activity

(PubMed:17671174). Involved in the peripheral immune tolerance, cont...

Gene Name	IDO1
Uniprot ID	P14902
Uniprot Name	Indoleamine 2,3-dioxygenase 1
Molecular Weight	45325.89 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

21. Arachidonate 5-lipoxygenase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Inhibitor
General Function	Iron ion binding
Specific Function	Catalyzes the first step in leukotriene biosynthesis, and thereby plays a role in inflammatory processes.
Gene Name	ALOX5
Uniprot ID	P09917
Uniprot Name	Arachidonate 5-lipoxygenase
Molecular Weight	77982.595 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

22. Arachidonate 15-lipoxygenase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Inhibitor
General Function	Phosphatidylinositol-4,5-bisphosphate binding
Specific Function	Non-heme iron-containing dioxygenase that catalyzes the stereo-specific peroxidation of free and esterified polyunsaturated fatty acids generating a spectrum of bioactive lipid mediators. Converts ...
Gene Name	ALOX15
Uniprot ID	P16050
Uniprot Name	Arachidonate 15-lipoxygenase
Molecular Weight	74803.795 Da

References

23. N-acylethanolamine-hydrolyzing acid amidase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Degrades bioactive fatty acid amides to their corresponding acids, with the following preference: N-palmitoylethanolamine > N-myristoylethanolamine > N-lauroylethanolamine = N-stearoylethanolamine > N-arachidonoylethanolamine > N-oleoylethanolamine. Also exhibits weak hydrolytic activity against the ceramides N-lauroylsphingosine and N-palmitoylsphingosine.
Specific Function	Hydrolase activity, acting on carbon-nitrogen (but not peptide) bonds
Gene Name	NAAA
Uniprot ID	Q02083
Uniprot Name	N-acylethanolamine-hydrolyzing acid amidase
Molecular Weight	40065.65 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

24. Quinone oxidoreductase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Zinc ion binding
Specific Function	Does not have alcohol dehydrogenase activity. Binds NADP and acts through a one-electron transfer process. Orthoquinones, such as 1,2-naphthoquinone or 9,10-phenanthrenequinone, are the best substr...
Gene Name	CRYZ
Uniprot ID	Q08257
Uniprot Name	Quinone oxidoreductase
Molecular Weight	35206.36 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

25. N-acyl-phosphatidylethanolamine-hydrolyzing phospholipase D

Details

Kind	Protein
Organism	Humans

	acylethanolamines (NAEs) and phosphatidic acid. Responsible for the generation of anandamide (N-arachidonoylethanolamine), the ligand of cannabinoid and vanilloid receptors (By similarity).
Specific Function	Identical protein binding
Gene Name	NAPEPLD
Uniprot ID	Q6IQ20
Uniprot Name	N-acyl-phosphatidylethanolamine-hydrolyzing phospholipase D
Molecular Weight	45595.15 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

26. Phospholipase A2

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Receptor binding
Specific Function	PA2 catalyzes the calcium-dependent hydrolysis of the 2-acyl groups in 3-sn-phosphoglycerides, this releases glycerophospholipids and arachidonic acid that serve as the precursors of signal molecules.
Gene Name	PLA2G1B
Uniprot ID	P04054
Uniprot Name	Phospholipase A2
Molecular Weight	16359.535 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

27. Steroid 17-alpha-hydroxylase/17,20 lyase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Steroid 17-alpha-monooxygenase activity
Specific Function	Conversion of pregnenolone and progesterone to their 17-alpha-hydroxylated products and subsequently to dehydroepiandrosterone (DHEA) and androstenedione. Catalyzes both the 17-alpha-hydroxylation ...
Gene Name	CYP17A1
Uniprot ID	P05093
Uniprot Name	Steroid 17-alpha-hydroxylase/17,20 lyase
Molecular Weight	57369.995 Da

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

28. Superoxide dismutase [Cu-Zn]

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Zinc ion binding
Specific Function	Destroys radicals which are normally produced within the cells and which are toxic to biological systems.
Gene Name	SOD1
Uniprot ID	P00441
Uniprot Name	Superoxide dismutase [Cu-Zn]
Molecular Weight	15935.685 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

29. Sphingomyelin phosphodiesterase

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
General Function	Sphingomyelin phosphodiesterase activity
Specific Function	Converts sphingomyelin to ceramide. Also has phospholipase C activities toward 1,2-diacylglycerolphosphocholine and 1,2-diacylglycerolphosphoglycerol. Isoform 2 and isoform 3 have lost catalytic ac...
Gene Name	SMPD1
Uniprot ID	P17405
Uniprot Name	Sphingomyelin phosphodiesterase
Molecular Weight	69751.3 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

TRANSPORTERS

1. Multidrug resistance-associated protein 1

Details

Organism	Humans
Pharmacological action	Unknown
Actions	Inhibitor
General Function	Transporter activity
Specific Function	Mediates export of organic anions and drugs from the cytoplasm. Mediates ATP-dependent transport of glutathione and glutathione conjugates, leukotriene C4, estradiol-17-beta-o-glucuronide, methotre...
Gene Name	ABCC1
Uniprot ID	P33527
Uniprot Name	Multidrug resistance-associated protein 1
Molecular Weight	171589.5 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

2. ATP-binding cassette sub-family G member 2

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Inhibitor
General Function	Xenobiotic-transporting atpase activity
Specific Function	High-capacity urate exporter functioning in both renal and extrarenal urate excretion. Plays a role in porphyrin homeostasis as it is able to mediates the export of protoporhyrin IX (PPIX) both fro...
Gene Name	ABCG2
Uniprot ID	Q9UNQ0
Uniprot Name	ATP-binding cassette sub-family G member 2
Molecular Weight	72313.47 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]

3. Equilibrative nucleoside transporter 1

Details

Kind	Protein
Organism	Humans
Pharmacological action	Unknown
Actions	Inhibitor
General Function	Nucleoside transmembrane transporter activity
Specific Function	Mediates both influx and efflux of nucleosides across the membrane (equilibrative transporter). It is sensitive (ES) to low concentrations of the inhibitor nitrobenzylmercaptopurine riboside (NBMPR...

Uniprot Name	Equilibrative nucleoside transporter 1
Molecular Weight	50218.805 Da

References

1. Ibeas Bih C, Chen T, Nunn AV, Bazelot M, Dallas M, Whalley BJ: Molecular Targets of Cannabidiol in Neurological Disorders. Neurotherapeutics. 2015 Oct;12(4):699-730. doi: 10.1007/s13311-015-0377-3. [PubMed:26264914]
2. Carrier EJ, Auchampach JA, Hillard CJ: Inhibition of an equilibrative nucleoside transporter by cannabidiol: a mechanism of cannabinoid immunosuppression. Proc Natl Acad Sci U S A. 2006 May 16;103(20):7895-900. doi: 10.1073/pnas.0511232103. Epub 2006 May 3. [PubMed:16672367]

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