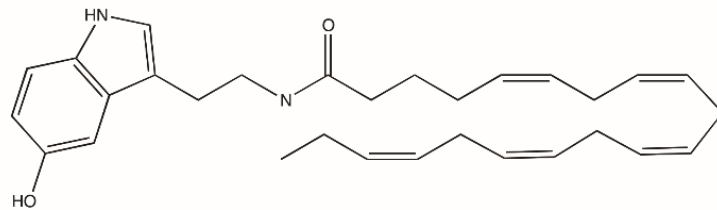
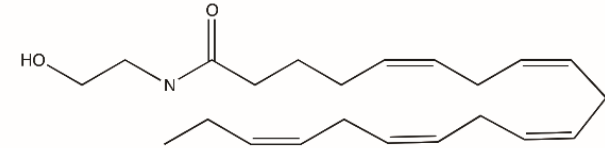
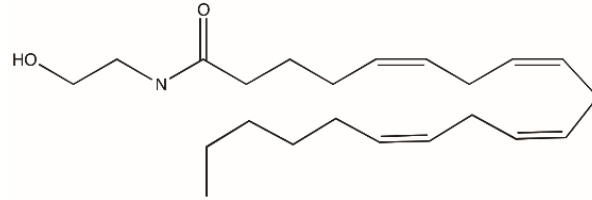
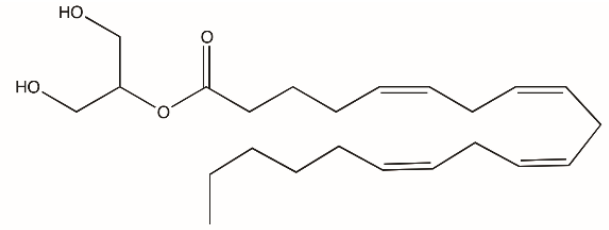


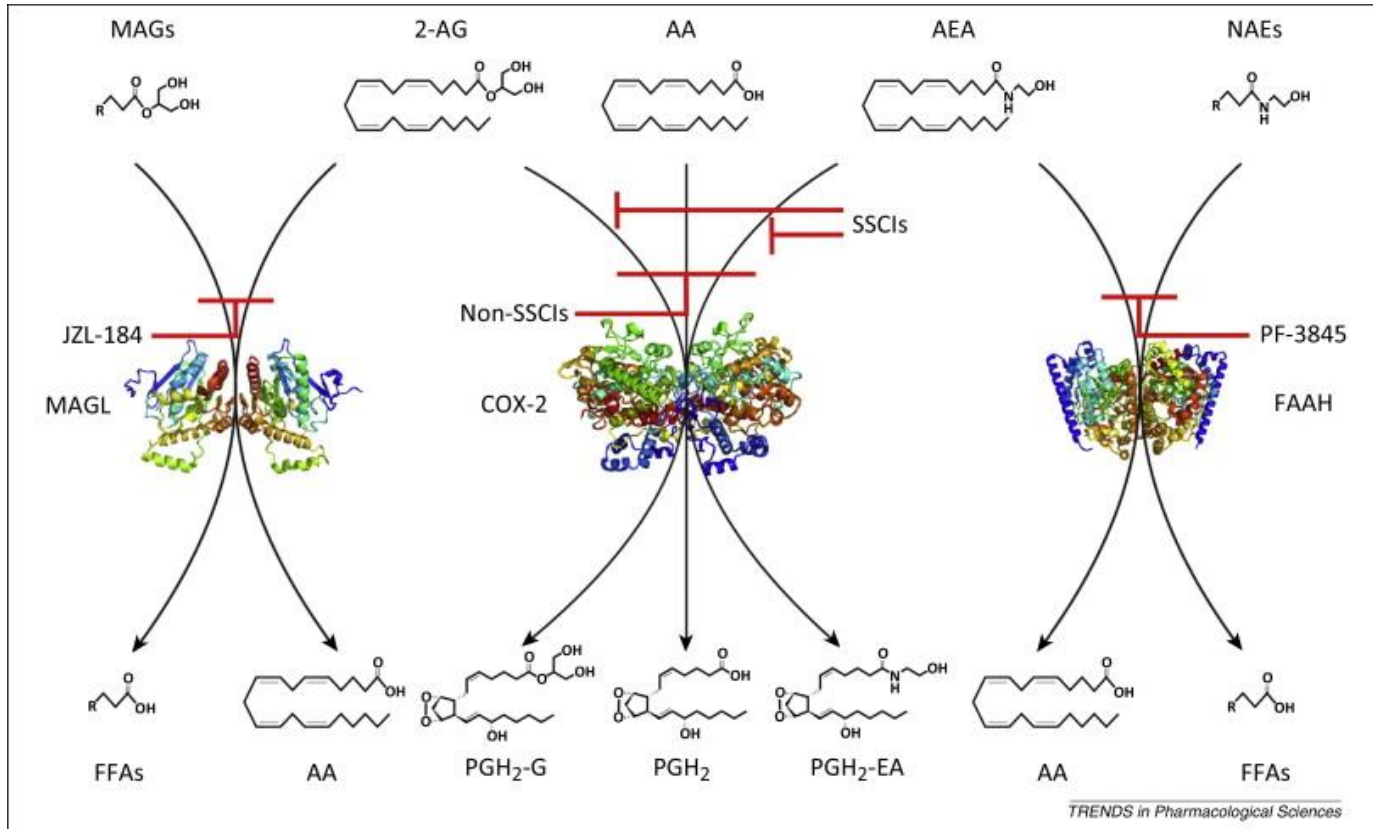
Cannabinoids and terpenoids: Pharmacology, pharmacogenomics and the complex interactions of the endocannabinoid system with terpenoids and phytocannabinoids, implications in oncology.

Steve Ottersberg, Founder
Green Lab Solutions Company LLC,
Durango, CO, USA

Endocannabinoids

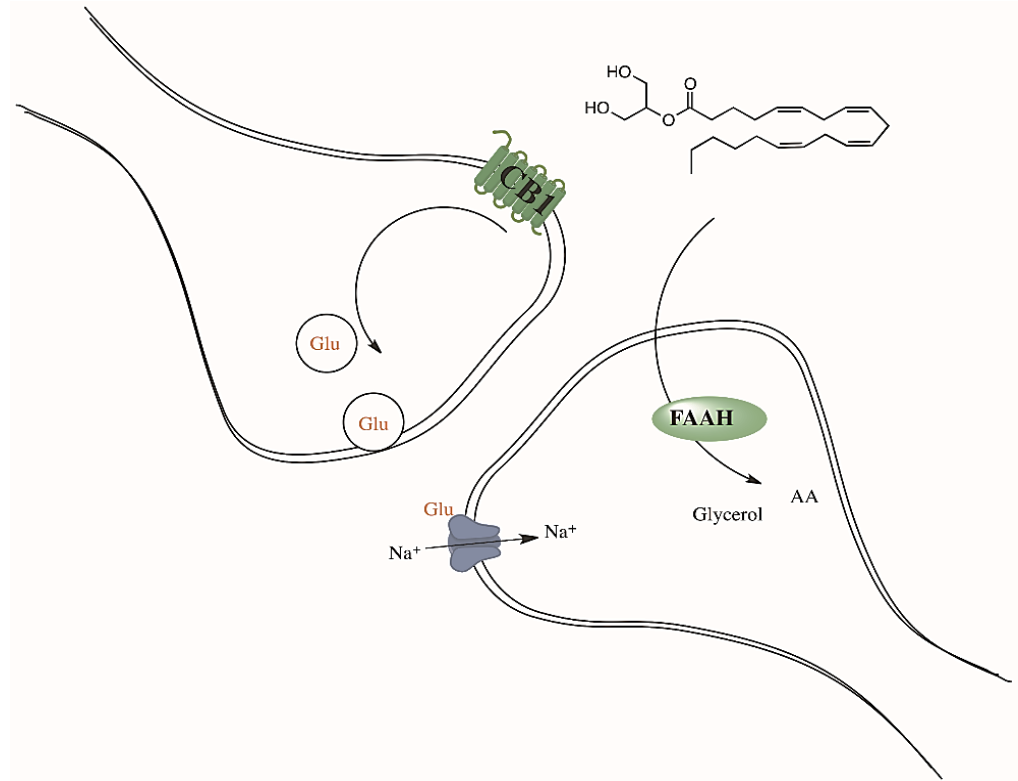
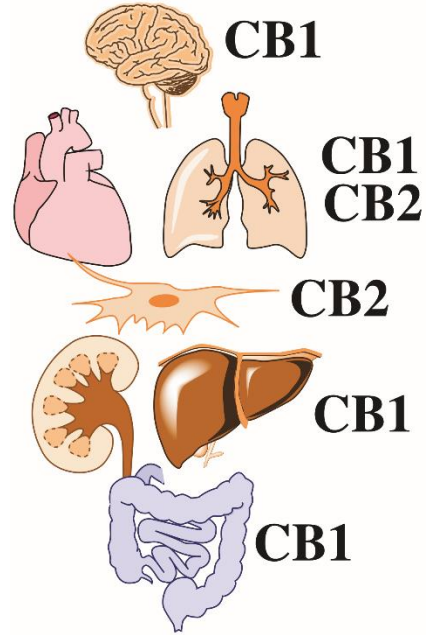
Fatty acid esters that
act upon cannabinoid
receptors

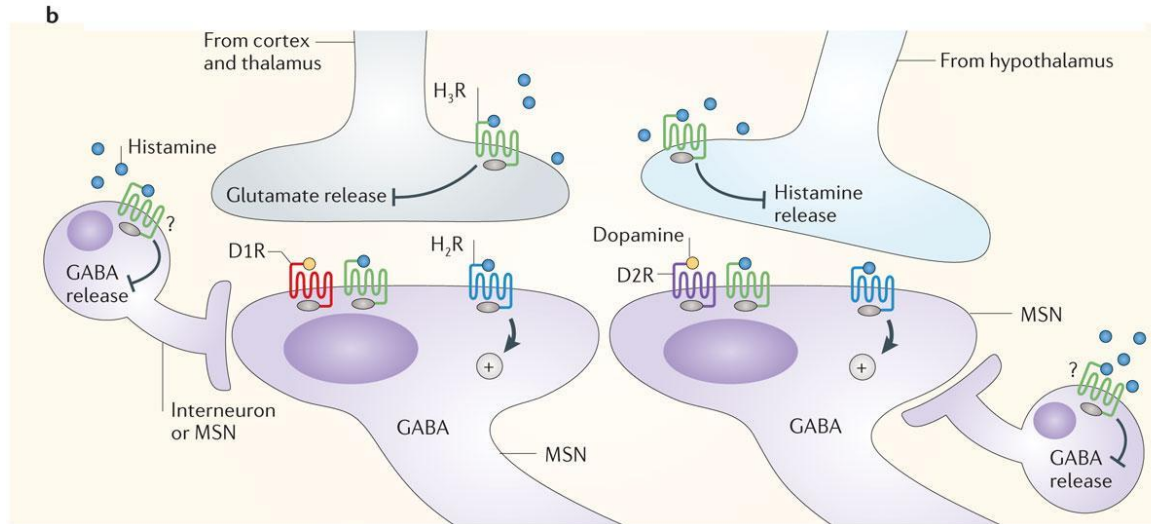
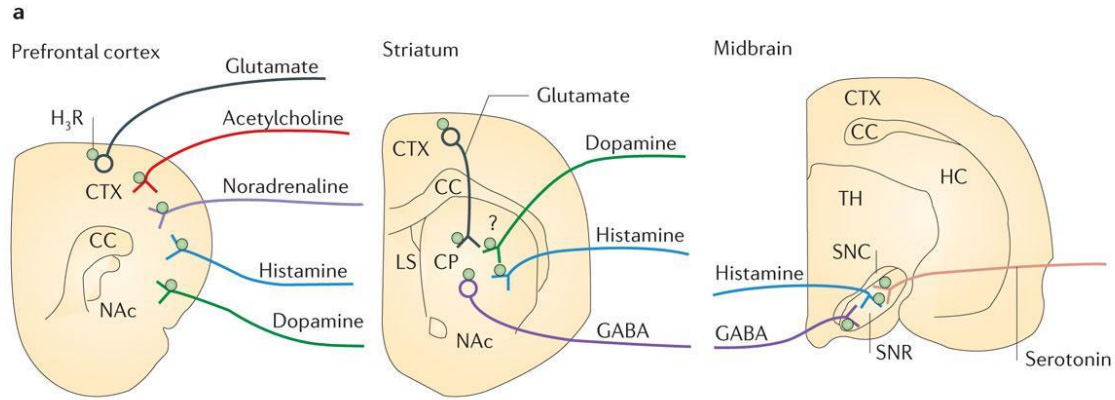


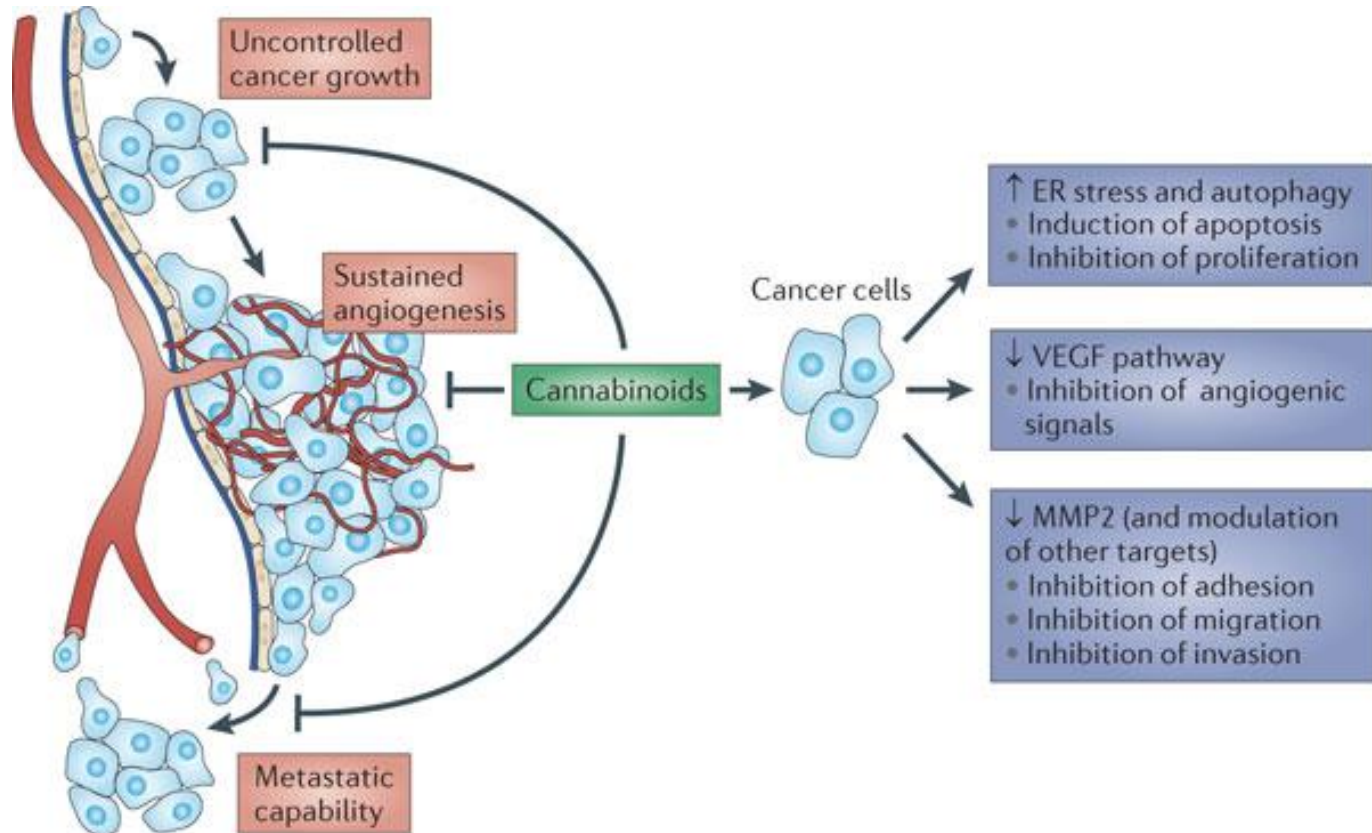


TRENDS in Pharmacological Sciences

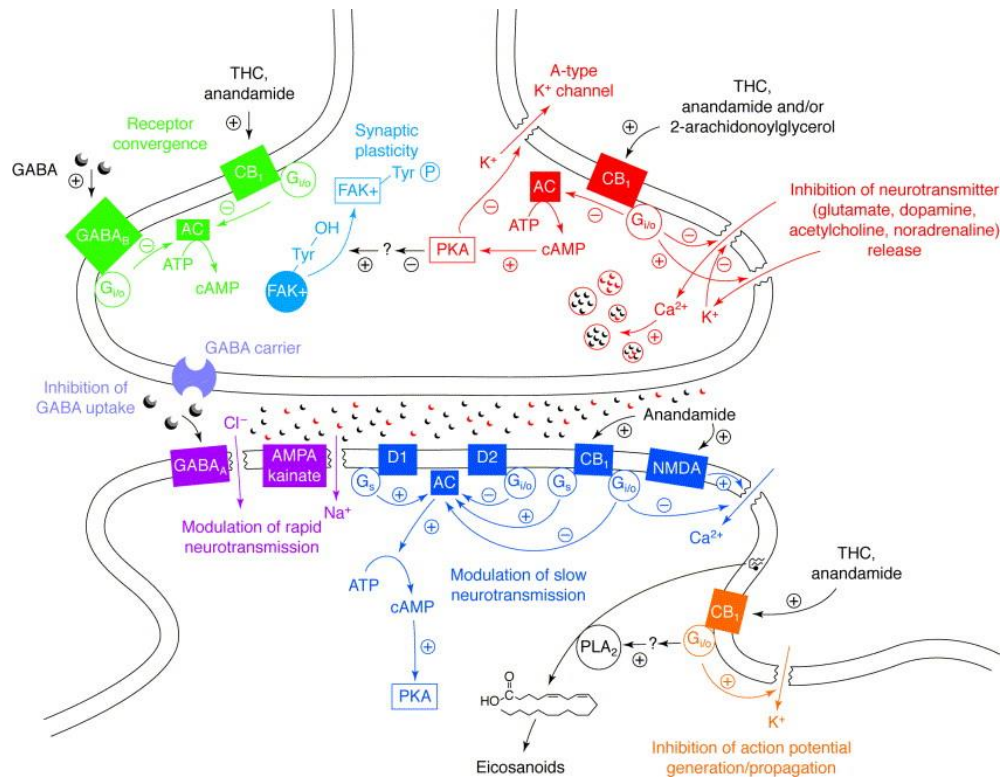
Cannabinoid Receptors







Histamine



THC and HNMT

[J Pharmacol Exp Ther.](#) 1985 Feb;232(2):513-8.

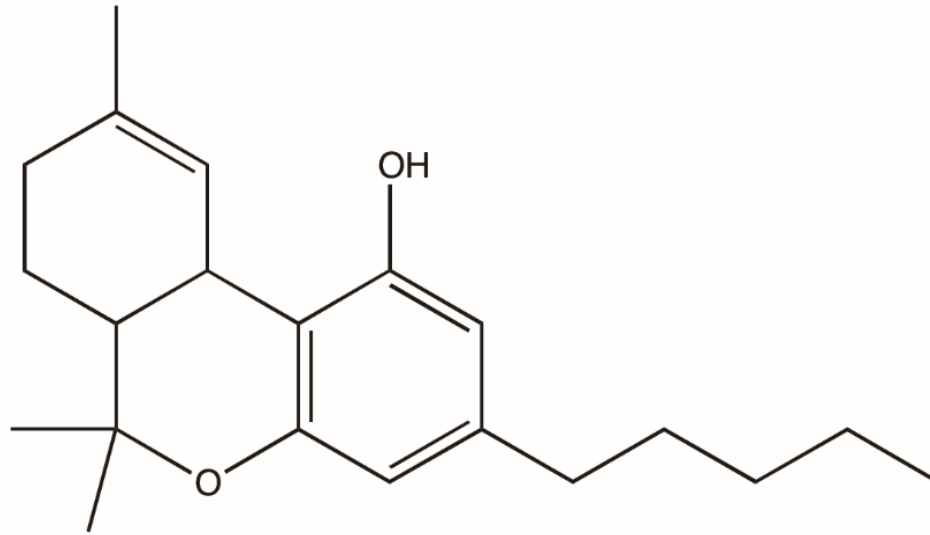
delta 9-Tetrahydrocannabinol decreases turnover of brain histamine.

[Oishi R](#), [Itoh Y](#), [Nishibori M](#), [Saeki K](#).

Abstract

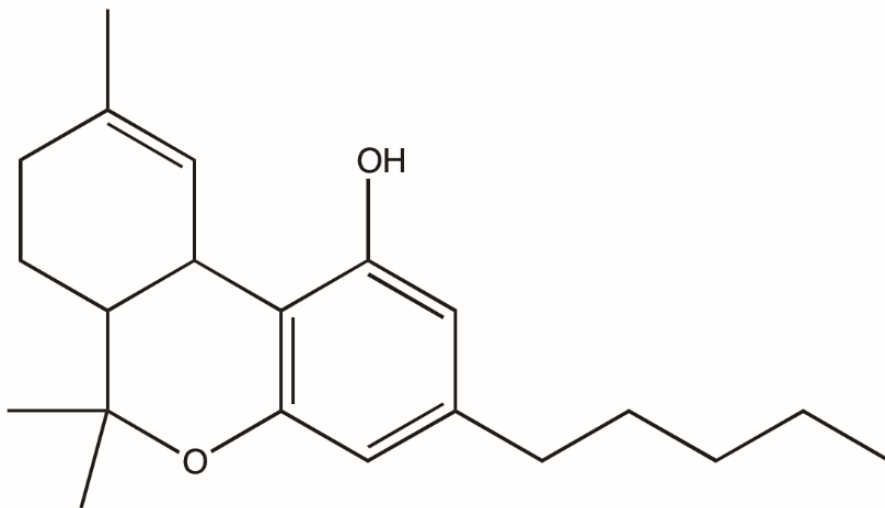
Histamine (HA) is a neurotransmitter present in the brain. As there is little information on the effect of delta 9-tetrahydrocannabinol (delta 9-THC) on brain histaminergic activity, the possible delta 9-THC-induced changes in brain HA turnover were studied in rats and mice. Whereas various doses of delta 9-THC had no influence on the brain HA levels in these species, high doses of delta 9-THC reduced the content of tele-methylhistamine (t-MH), a predominant HA metabolite in the brain, in mice. A moderate dose of delta 9-THC was effective in decreasing the brain t-MH content in the rats. Pargyline (65 mg/kg i.p.) caused a 101 ng/g accumulation of t-MH in mice and an 80 ng/g accumulation of t-MH in rats 105 min after the injection. delta 9-THC significantly suppressed the pargyline-induced t-MH accumulation at 50 mg/kg in mice whereas only 2 mg/kg of this compound was effective in rats, when administered i.v. 15 min after pargyline treatment. delta 9-THC (50 mg/kg i.v.) delayed the depletion of neuronal HA in the mouse brain, as induced by treatment with a specific histidine decarboxylase inhibitor alpha-fluoromethylhistidine (50 mg/kg i.p.). delta 9-THC (30 and 100 microM) significantly inhibited the K⁺-induced release of endogenous HA from guinea-pig hypothalamic slices. These results suggest that delta 9-THC decreases HA turnover in the brain.

PMID: 2578567 [PubMed - indexed for MEDLINE]

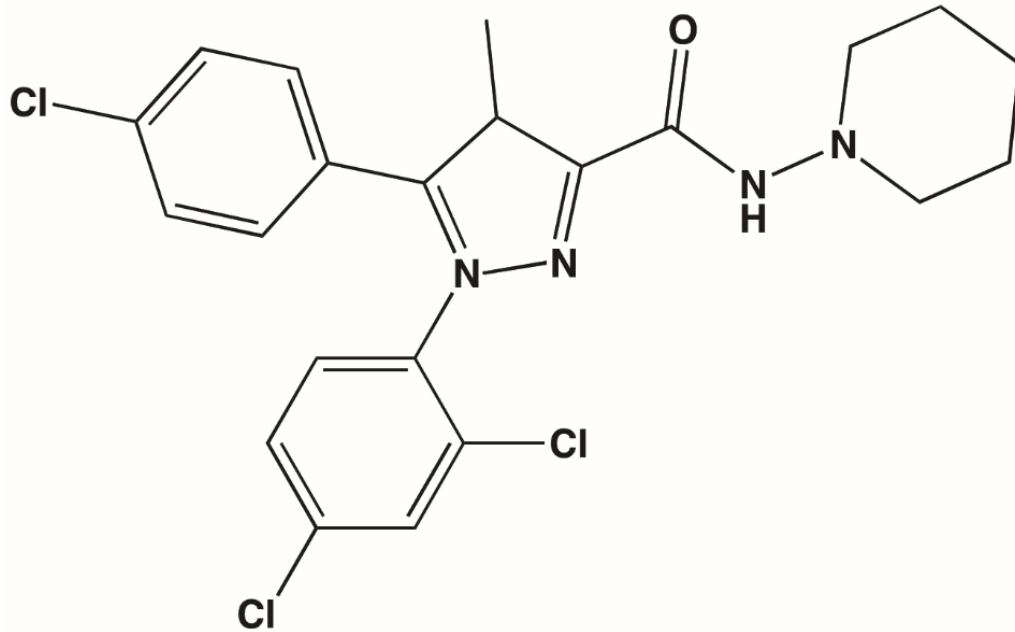


BP 157 °C

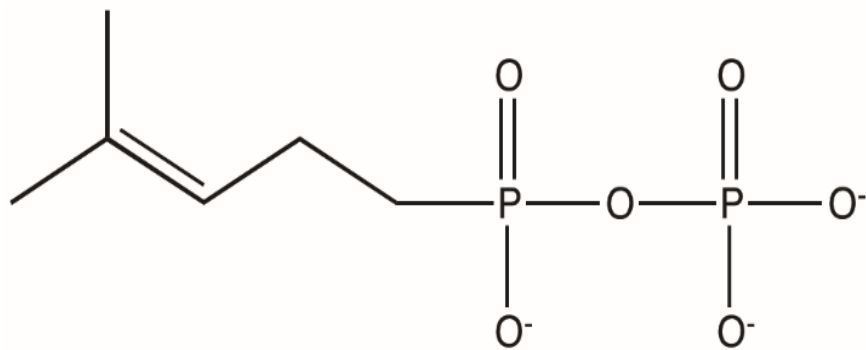
Delta-9 Tetrahydrocannabinol



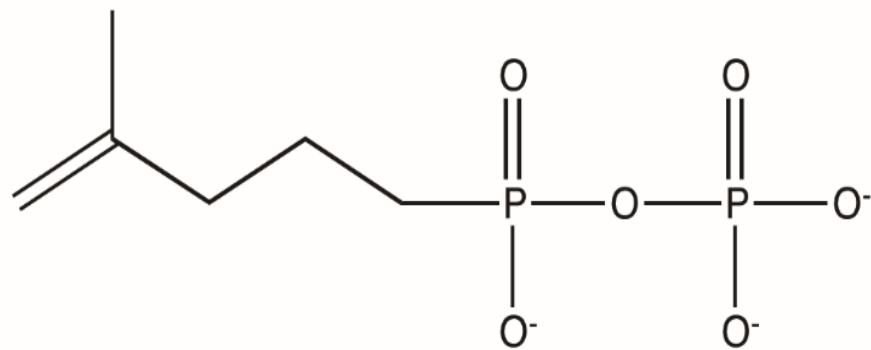
Marinol, what we learned from pharma.



Rimonabant, what we learned from pharma.



dimethylallyl pyrophosphate



isopentenyl pyrophosphate

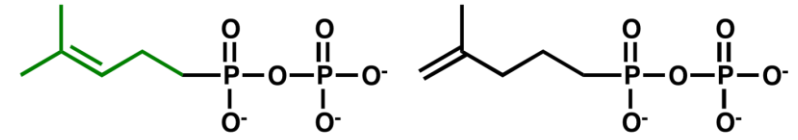
Isoprenes

Terpene Synthesis

Isoprenes

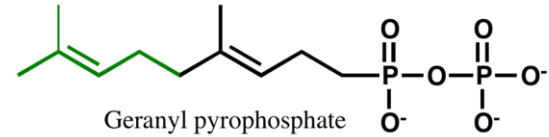
Monoterpenes

Sesquiterpenes

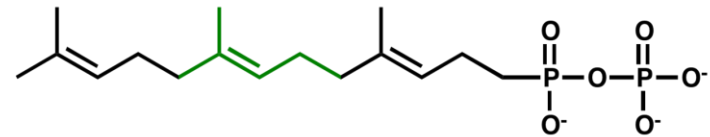


Dimethylallyl pyrophosphate

Isopentenyl pyrophosphate



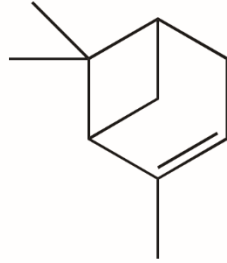
Geranyl pyrophosphate



Farnesyl pyrophosphate

A

α -Pinene



BP 156 °C

Cedarwood, Pine, Sharp

Rosemary oil¹ 10-20%

Boswellia serrata, 5-10%

¹[Foods](#). 2017 Mar 5;6(3). pii: E20. doi: 10.3390/foods6030020.

Anti-inflammatory

Bronchodilator

Stimulant

Antimicrobial

Nootropic




Moby Dick

Gorilla Glue

Blue Dream

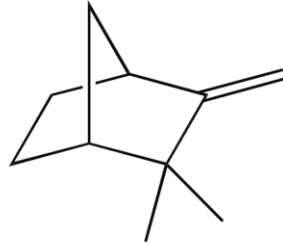


Terpenes

Terpene	%	mg/g
 Pine	2.0%	20.3 mg/g
 Hops	0.8%	7.9 mg/g
 Cinnamon	0.7%	6.5 mg/g
β -Myrcene	0.2%	2.3 mg/g
β -Pinene	0.1%	0.9 mg/g

Ca

Camphene



BP 159.00 to 160.00 °C

Camphor, Mothball, Oil,
Warm

Zingiber officinale

Rosmarinus officinalis

Salvia officinalis

Analgesic
Anti-inflammatory
Sedative
Antimicrobial



Terpenes



Pine



Sweet



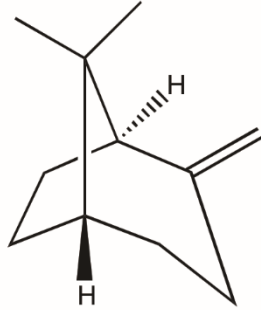
Eucalyptus

Terpene	%	mg/g
β -Pinene	0.3%	2.9 mg/g
Camphene	0.1%	1.2 mg/g
δ -3-Carene	0.1%	0.5 mg/g
α -Humulene	0.0%	0.4 mg/g
p-Cymene	0.0%	0.4 mg/g

Ghost OG
Strawberry
Mendo Purps

β P

β -Pinene



BP 165 °C

Pine, Polish, Wood

Cuminum cyminum

Pinus sylvestris

Petroselinum crispum (parsley)

Myristica fragrans (nutmeg)

Analgesic

Anti-Inflammation

Stimulant

Nootropic



Terpenes



Pine



Cinnamon

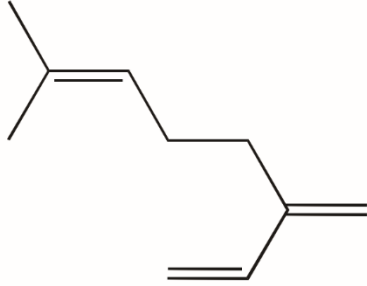


Hops

Terpene	%	mg/g
α -Pinene	1.5%	15.1 mg/g
β -Pinene	0.5%	5.2 mg/g
β -Caryophyllene	0.4%	3.6 mg/g
β -Myrcene	0.2%	1.9 mg/g
R(+)-Limonene	0.2%	1.7 mg/g

My

β -Myrcene



BP 167 °C

Balsamic, Fruit, Geranium, Herb, Must

Elettaria cardamomum

Origanum vulgare

Piper nigrum

Boswellia sacra

Anti-nociceptive
Anti-inflammatory
Sedative
Euphoric
Anti-mutagenic



Terpenes



Hops



Pine



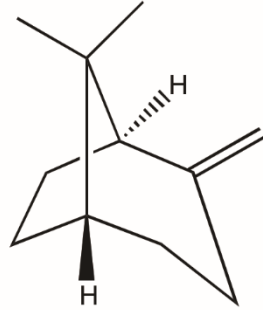
Cinnamon

Terpene	%	mg/g
β -Myrcene	2.7%	27.4 mg/g
α -Pinene	0.6%	5.6 mg/g
β -Pinene	0.2%	2.2 mg/g
β -Caryophyllene	0.1%	1.0 mg/g
α -Bisabolol	0.1%	0.5 mg/g

White Widow
Skunk
Himalayan

ΔC

Δ-3-Carene



BP 170 °C

Lemon

Pinus roxburghii (chir pine)

Piper nigrum

Thymus vulgaris

Illicium verum (star anise)

Anti-inflammatory
Sedative
Nootropic



Terpenes



Turpentine



Hops



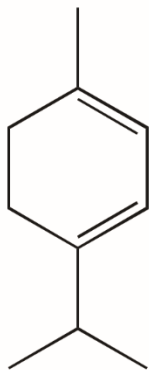
Cinnamon

β-Pinene	0.3%	2.6 mg/g
Ocimene	0.2%	2.1 mg/g
α-Humulene	0.1%	1.4 mg/g
δ-3-Carene	0.1%	0.8 mg/g
Linalool	0.1%	0.6 mg/g
α-Bisabolol	0.0%	0.4 mg/g

Skunk

α T

α -Terpinene



BP 173.5-174.8 °C

Lemon

Melaleuca alternifolia

Cuminum cyminum

Origanum syriacum

Analgesic
Anti-inflammatory
Stimulant
Antimicrobial



Terpenes



Pine



Cinnamon



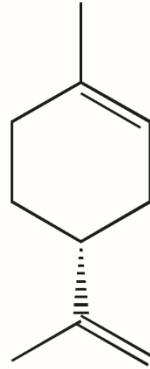
Hops

Terpene	%	mg/g
α -Pinene	1.5%	15.1 mg/g
β -Pinene	0.5%	5.2 mg/g
β -Caryophyllene	0.4%	3.6 mg/g
β -Myrcene	0.2%	1.9 mg/g
R(+)-Limonene	0.2%	1.7 mg/g

White Widow
OG Kush
GSC

Li

d-Limonene



BP 177.6 °C
Citrus, Mint

Vitex agnus-castus

Citrus limon

Apium graveolens (celery)

Anti-tumor

Anti-inflammatory

Cannabinoid agonist

Antidepressant

Stimulant

Calming

Nootropic

Euphoric

Cinex

Goji OG

Kosher Kush



Terpenes



Orange



Cinnamon



Hops

Terpene	%	mg/g
R(+)-Limonene	0.6%	6.2 mg/g
β -Caryophyllene	0.5%	4.9 mg/g
β -Myrcene	0.2%	1.9 mg/g
α -Humulene	0.2%	1.5 mg/g
β -Pinene	0.1%	1.4 mg/g

<https://www.mskcc.org/cancer-care/integrative-medicine/herbs/d-limonene>

D-Limonene and its metabolites, perillic acid, dihydroperillic acid, uroterpenol, and limonene1,2-diol, may inhibit tumor growth via inhibition of p21-dependent signaling and apoptosis resulting from induction of the transforming growth factor beta-signaling pathway [\(9\)](#) [\(10\)](#). D-Limonene metabolites also cause G1 cell cycle arrest, inhibit post-translational modification of signal transduction proteins, and cause differential expression of cell cycle- and apoptosis-related genes [\(6\)](#).

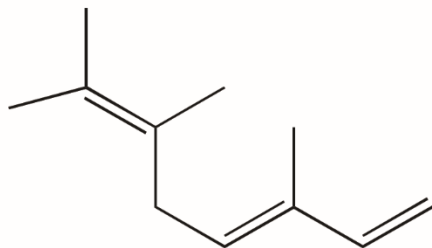
D-limonene induces apoptosis via the mitochondrial death pathway and suppression of the PI3K/Akt pathway in human colon cancer cells [\(16\)](#). Animal studies show activity of D-limonene against pancreatic, stomach, colon, skin, and liver cancers [\(5\)](#) [\(17\)](#). Data also indicate that D-limonene slows the promotion/progression stage of carcinogen-induced tumors in rats [\(11\)](#) [\(12\)](#). The chemopreventive activity of D-limonene may be via inhibition of inflammation, oxidative stress and Ras-signaling as well as the induction of pro-apoptotic state in a mouse model of skin tumorigenesis [\(18\)](#).

D-limonene and its metabolite perillyl alcohol were shown to affect wound healing by decreasing systemic cytokine production, and by inhibiting endothelial P-selectin expression and neo-vascularization [\(21\)](#).

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14. Manuele MG, Barreiro Arcos ML, Davicino R, et al. [Limonene exerts antiproliferative effects and increases nitric oxide levels on a lymphoma cell line by dual mechanism of the ERK pathway: relationship with oxidative stress](#). *Cancer Invest*. 2010 Feb;28(2):135-45.
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16. Jia SS, Xi GP, Zhang M, et al. [Induction of apoptosis by D-limonene is mediated by inactivation of Akt in LS174T human colon cancer cells](#). *Oncol Rep*. 2013 Jan;29(1):349-54.
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Oc

β -Ocimene



BP 176-178 °C

Floral

Ocimum basilicum

Rosmarinus officinalis

Tagetes lucida (Mexican Mint)

Marigold)

Antifungal



Terpenes



Earthy



Hops



Pine

Terpene	%	mg/g
Ocimene	0.5%	5.3 mg/g
β -Myrcene	0.5%	4.9 mg/g
β -Pinene	0.1%	1.4 mg/g
α -Pinene	0.1%	1.2 mg/g
δ -3-Carene	0.1%	0.6 mg/g

Strawberry

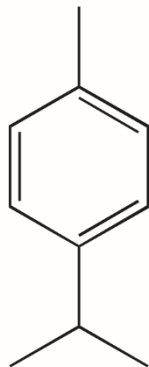
Cough

Golden Goat

Chernobyl

pC

p-Cymene



BP 177 °C

Citrus, Fresh, Solvent

Trachyspermum copticum

(caraway)

Cuminum cyminum

Thymus Lamiaceae

Analgesic

Anti-inflammatory

Nootropic

Antimicrobial



Terpenes



Herbal



Cinnamon

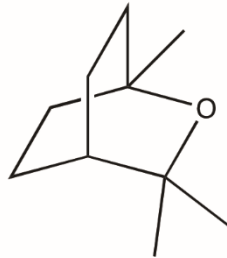


Pine

Terpene	%	mg/g
p-Cymene	0.6%	6.4 mg/g
β -Caryophyllene	0.6%	5.6 mg/g
α -Pinene	0.3%	2.7 mg/g
β -Pinene	0.2%	1.9 mg/g
α -Humulene	0.2%	1.7 mg/g

Eu

Eucalyptol



BP 176-177 °C

Camphor, Cool, Eucalyptol, Mint

Angelica archangelica (wild
parsnip)

Rosmarinus officinalis

Ocimum tenuiflorum (holy basil)

Analgesic

Anti-inflammatory

Stimulant




Calming

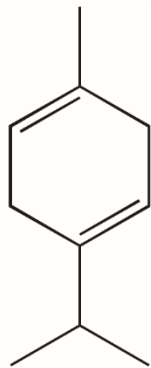
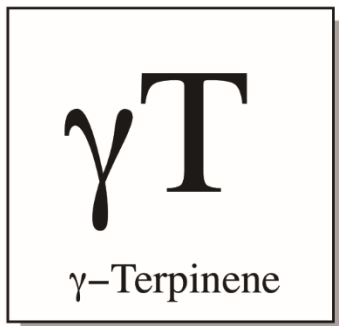
Nootropic

Euphoric



Terpenes

		
Wood	Cinnamon	Chamomile
Guaiol	0.4%	3.7 mg/g
β -Caryophyllene	0.4%	3.6 mg/g
α -Bisabolol	0.3%	2.9 mg/g
β -Myrcene	0.2%	1.7 mg/g
α -Humulene	0.2%	1.5 mg/g
1,8-Cineole	0.1%	0.6 mg/g



BP 182 °C
Bitter, Citrus

Origanum majorana
Melaleuca alternifolia
Citrus reticulata
Cuminum cyminum

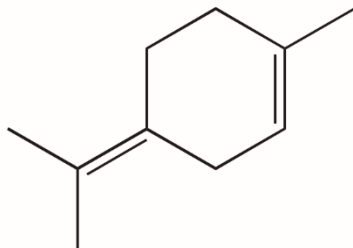
Anti-inflammatory
Immuno-modulating
Anti-nociceptive
Stimulant
Anti-fungal



Terpenes		
Cinnamon	Hops	Chamomile
α -Pinene	0.3%	2.5 mg/g
β -Pinene	0.2%	2.2 mg/g
1,8-Cineole	0.2%	1.7 mg/g
γ -Terpinene	0.1%	0.7 mg/g
α -Terpinene	0.1%	0.5 mg/g
Geraniol	<LOQ	<LOQ

Te

Terpinolene



BP 187 °C

Pine, Sweet

Pastinaca sativa (parsnip)
Melaleuca alternifolia
Petroselinum crispum (parsley)
Valeriana officinalis

Sedative
Calming



Terpenes



Turpentine



Hops



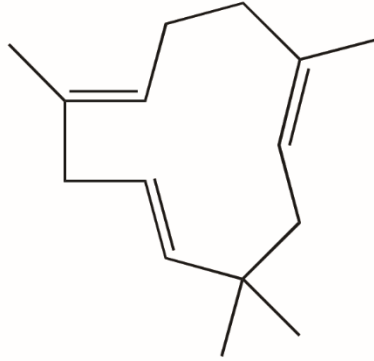
Pine

Terpene	%	mg/g
Terpinolene	1.1%	10.5 mg/g
β -Myrcene	0.4%	4.2 mg/g
β -Pinene	0.2%	2.3 mg/g
Ocimene	0.2%	2.1 mg/g
β -Caryophyllene	0.2%	1.9 mg/g

Headband
Clementine
Lemon Haze

Hu

α -Humulene



BP 166-168 °C

Woody, earthy, hoppy

Humulus lupulus

Scutellaria lateriflora

Syzygium aromaticum (clove)

Tamarindus indica

Analgesic
Anti-inflammatory
Calming
Euphoric
Appetite-
Suppressant



Terpenes



Cinnamon



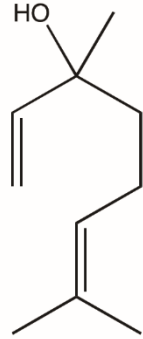
Hops



Lavender

Terpene	%	mg/g
β -Caryophyllene	1.1%	11.3 mg/g
α -Humulene	0.4%	3.6 mg/g
β -Myrcene	0.4%	3.5 mg/g
Linalool	0.3%	2.6 mg/g
β -Pinene	0.1%	1.4 mg/g

Skywalker
Trainwreck
GDP



BP 198-200 °C

Coriander, Floral, Lavender, Lemon,
Rose

Coriandrum sativum
Ocimum basilicum
Origanum vulgare
Vitis vinifera

Analgesic
Anti-inflammatory
Sedative
Euphoric



Terpenes



Hops



Pine



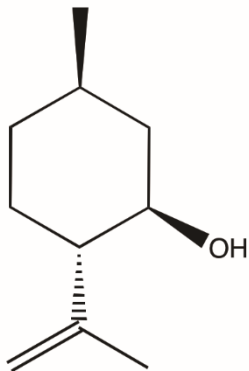
Cinnamon

β-Myrcene	3.5%	34.8 mg/g
α-Pinene	1.1%	10.6 mg/g
β-Caryophyllene	0.8%	8.4 mg/g
β-Pinene	0.5%	5.4 mg/g
R(+)-Limonene	0.4%	4.2 mg/g
Linalool	0.4%	4.2 mg/g

DGP
ATF

Pu

Isopulegol



BP 212 °C

Mint, Cool

Mentha x rotundifolia
Mentha pulegium
Eucalyptus citriodora

Analgesic
Anti-inflammatory
Sedative
Antifungal
Anticonvulsant



Terpenes



Herbal



Hops



Mint

Terpene	%	mg/g
p-Cymene	0.2%	2.4 mg/g
α -Humulene	0.2%	1.9 mg/g
Isopulegol	0.1%	1.0 mg/g
Nerolidol	0.1%	0.8 mg/g
δ -3-Carene	0.1%	0.6 mg/g

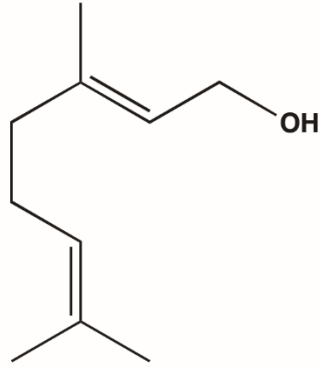
So Cal AI
Cherry Lime Hz

Ge

Geraniol

BP 230°C

Geranium, Lemon Peel, Passion Fruit,
Peach, Rose



Nepeta cataria
Camellia sinensis
Vitis vinifera
Myristica fragrans

Analgesic
Anti-inflammatory
Euphoric
Anti-microbial



Terpenes



Pine



Mint



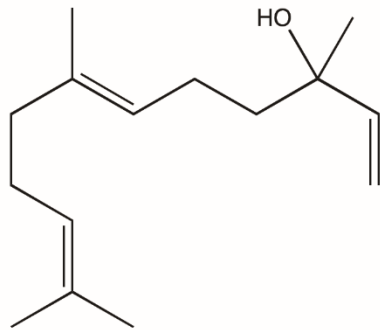
Hops

Terpene	%	mg/g
β -Pinene	0.3%	3.2 mg/g
α -Pinene	0.1%	0.9 mg/g
Isopulegol	0.1%	0.7 mg/g
α -Humulene	0.1%	0.6 mg/g
1,8-Cineole	0.1%	0.5 mg/g

Death Star
Tangerine Haze

Ne

Nerolidol



BP 276-277°C

Fir, Linoleum, Pine

Eucalyptus nova-anglica

Elettaria cardamomum

Ocimum basilicum

Camellia sinensis

Anti-inflammatory
Sedative



Terpenes



Herbal



Hops



Pine

Terpene	%	mg/g
p-Cymene	0.2%	1.6 mg/g
α-Humulene	0.1%	1.4 mg/g
α-Pinene	0.1%	1.0 mg/g
Isopulegol	0.1%	0.9 mg/g
Nerolidol	0.1%	0.7 mg/g

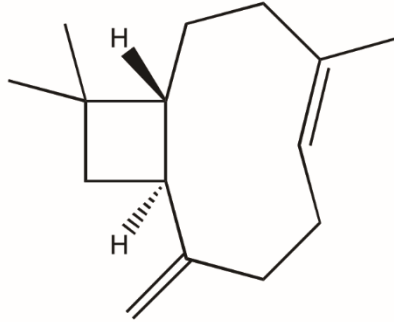
Banana Kush
Mango

Ca

β -Caryophyllene

BP 268 °C

Fried, Spice, Wood



Syzygium aromaticum
Piper nigrum
Perilla frutescens (Shiso)
Rosmarinus officinalis

Analgesic
Anti-inflammatory
Calming
Nootropic
Euphoric
Antifungal

Gorilla Glue
Blue Cheese
Sour Diesel



Terpenes



Cinnamon



Hops



Orange

Terpene	%	mg/g
β -Caryophyllene	19.9%	198.7 mg/g
α -Humulene	6.6%	66.1 mg/g
Nerolidol	2.3%	22.8 mg/g
Linalool	1.6%	15.9 mg/g
α -Bisabolol	1.5%	15.2 mg/g

CB2/Terpenoids

Mol Nutr Food Res. 2016 May 28. doi: 10.1002/mnfr.201600197. [Epub ahead of print]

β -Caryophyllene attenuates palmitate-induced lipid accumulation through AMPK signaling by activating CB2 receptor in human HepG2 hepatocytes.

Kamikubo R¹, Kai K¹, Tsuji-Naito K², Akagawa M¹.

⊕ Author information

Abstract

SCOPE: Nonalcoholic fatty liver disease (NAFLD) is currently the most common chronic liver disease worldwide, characterized by excessive hepatic lipid accumulation without significant ethanol consumption. We have performed a screening for medicinal foods that inhibit hepatocytic lipid accumulation through activation of AMP-activated protein kinase (AMPK), which is a critical regulator of the hepatic lipid metabolism.

METHODS AND RESULTS: We found that clove (*Syzygium aromaticum*), which is commonly used as a spice, markedly inhibits palmitate-inducible lipid accumulation in human HepG2 hepatocytes. Analyses of the clove extracts found that β -caryophyllene, an orally-active cannabinoid, is the principal suppressor of the lipid accumulation, and stimulates the phosphorylation of AMPK and acetyl-CoA carboxylase 1 (ACC1). Our data also showed that β -caryophyllene prevents the translocation of sterol regulatory element-binding protein-1c (SREBP-1c) into the nucleus and forkhead box protein O1 (FoxO1) into the cytoplasm through AMPK signaling, and consequently, induces a significant downregulation of fatty acid synthase (FAS) and upregulation of adipose triglyceride lipase (ATGL), respectively. Moreover, we demonstrated that the β -caryophyllene-induced activation of AMPK could be mediated by the cannabinoid type 2 receptor-dependent Ca^{2+} signaling pathway.

CONCLUSION: Our results suggest that β -caryophyllene has the potential efficacy in preventing and ameliorating NAFLD and its associated metabolic disorders. This article is protected by copyright. All rights reserved.

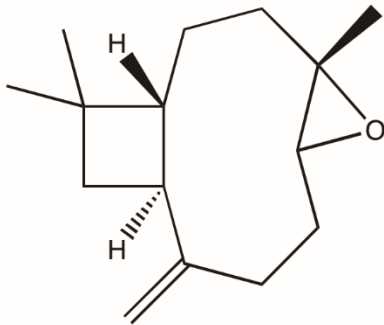
This article is protected by copyright. All rights reserved.

KEYWORDS: AMP-activated protein kinase (AMPK); Cannabinoid type 2 (CB2) receptor; Clove (*Syzygium aromaticum*); NAFLD; β -Caryophyllene

PMID: 27234712 [PubMed - as supplied by publisher]

Co

β -Caryophyllene
Oxide



BP 279 °C

Herb, Must, Spice, Wood

Boswellia sacra

Ptychopetalum

olacoides

Perilla frutescens

Citrus limon

Analgesic

Anti-inflammatory

Calming

Nootropic

Euphoric

Antifungal

Gorilla Glue

Blue Cheese

Sour Diesel



Terpenes



Cinnamon



Hops

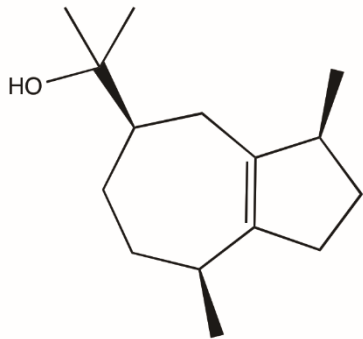


Chamomile

β -Caryophyllene	18.7%	187.2 mg/g
α -Humulene	6.8%	68.3 mg/g
α -Bisabolol	6.4%	63.7 mg/g
Linalool	1.6%	16.4 mg/g
Nerolidol	1.3%	12.6 mg/g
Caryophyllene Oxide	0.9%	8.8 mg/g

Gu

(-)-guaiol



BP 309-310 °C

Herb, Must, Spice, Wood

Cymbopogon parkeri
Eucalyptus citriodora
Ferula gummosa
Guaiacum sp.

Analgesic
Anti-inflammatory
Calming
Nootropic
Euphoric
Antifungal



Terpenes



Wood



Cinnamon



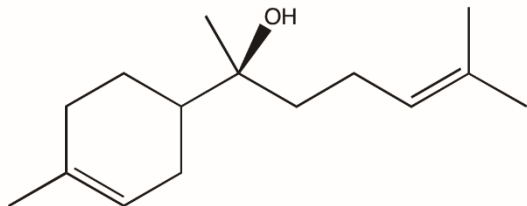
Chamomile

Terpene	%	mg/g
Guaiol	0.3%	3.1 mg/g
β -Caryophyllene	0.3%	3.0 mg/g
α -Bisabolol	0.2%	1.9 mg/g
β -Myrcene	0.1%	1.4 mg/g
α -Humulene	0.1%	1.2 mg/g

Gorilla Glue
Blue Cheese
Sour Diesel

Bi

Alpha Bisabolol



BP 309-310 °C

Herb, Must, Spice, Wood

Matricaria recutita
Achillea millefolium
Sideritis mugronensis
Scutellaria parvula
Lavandula latifolia

Analgesic
Anti-inflammatory
Sedative
Calming



Gorilla Glue
NYCD
Master Kush

Terpenes



Cinnamon



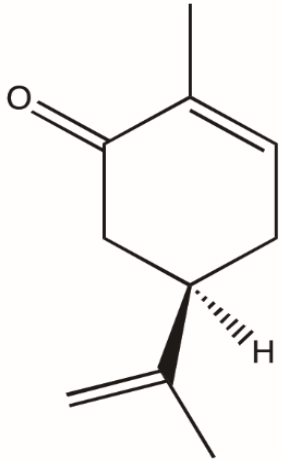
Hops



Chamomile

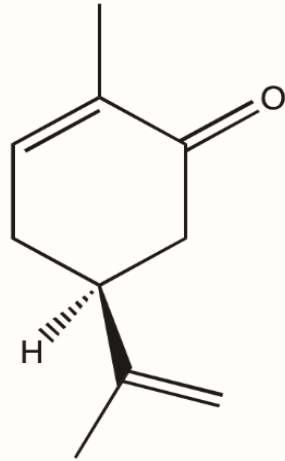
β -Caryophyllene	18.7%	187.2 mg/g
α -Humulene	6.8%	68.3 mg/g
α -Bisabolol	6.4%	63.7 mg/g
Linalool	1.6%	16.4 mg/g
Nerolidol	1.3%	12.6 mg/g
Caryophyllene Oxide	0.9%	8.8 mg/g

Chiral Terpenoids



(R)-Carvone

Spearmint



(S)-Carvone

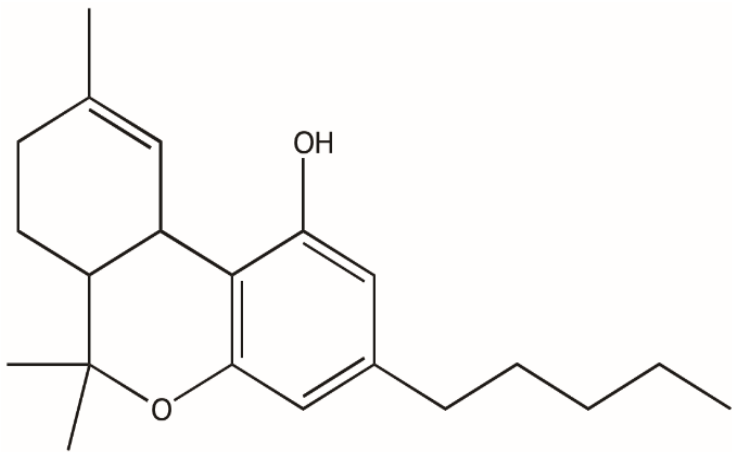
Caraway



Right handed smells like
spearmint

Left handed smells like
caraway

Cannabinoids



BP 157 °C

Δ9-
Tetrahydrocannabinol

Analgesic
Anti-inflammatory
Antiemetic

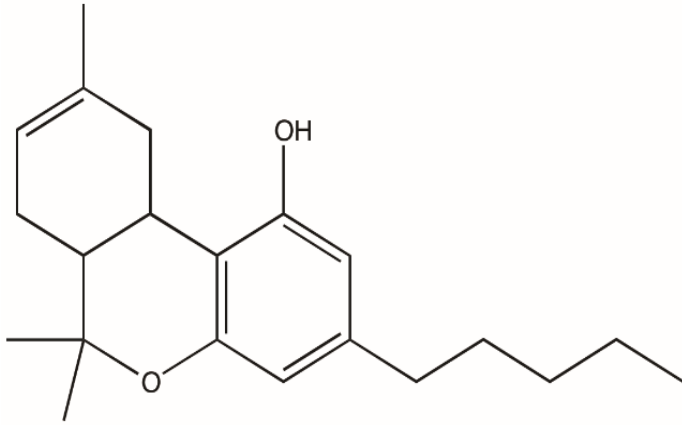
[Cochrane Database Syst Rev.](#) 2018 Mar 7;3:CD012182. doi: 10.1002/14651858.CD012182.pub2. [Epub ahead of print]

[Cancer Med.](#) 2018 Mar;7(3):765-775. doi: 10.1002/cam4.1312. Epub 2018 Feb 23.

[FASEB J.](#) 2016 Nov;30(11):3682-3689. Epub 2016 Jul 19.

Sido, J.M., Jackson, A.R., Nagarkatti, P.S. et al. J Mol Med (2016) 94: 1039. <https://doi.org/10.1007/s00109-016-1404-5>

Cannabinoids

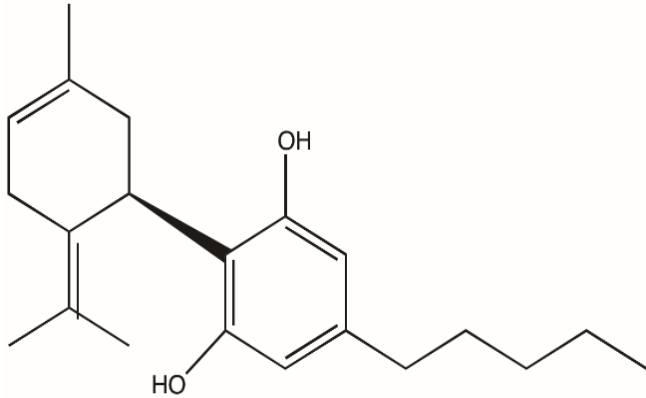


BP 175-178 °C

Δ8-Tetrahydrocannabinol

Analgesic
Anti-inflammatory
Antiemetic
More Stable

Cannabinoids



BP 160-180°C

Cannabidiol

Anxiolytic
Analgesic
Antipsychotic
Anti-inflammatory
Antispasmodic

US Patent 6,630,507

United States Patent
Hampson , et al.

6,630,507
October 7, 2003

Please see images for: (Certificate of Correction)

Cannabinoids as antioxidants and neuroprotectants

Abstract

Cannabinoids have been found to have antioxidant properties, unrelated to NMDA receptor antagonism. This new found property makes cannabinoids useful in the treatment and prophylaxis of wide variety of oxidation associated diseases, such as ischemic, age-related, inflammatory and autoimmune diseases. The cannabinoids are found to have particular application as neuroprotectants, for example in limiting neurological damage following ischemic insults, such as stroke and trauma, or in the treatment of neurodegenerative diseases, such as Alzheimer's disease, Parkinson's disease and HIV dementia. Nonpsychoactive cannabinoids, such as cannabidoil, are particularly advantageous to use because they avoid toxicity that is encountered with psychoactive cannabinoids at high doses useful in the method of the present invention. A particular disclosed class of cannabinoids useful as neuroprotective antioxidants is formula (I) wherein the R group is independently selected from the group consisting of H, CH.sub.3, and COCH.sub.3. ##STR1##

Inventors: Hampson; Aidan J. (Irvine, CA), Axelrod; Julius (Rockville, MD), Grimaldi; Maurizio (Bethesda, MD)
Assignee: The United States of America as represented by the Department of Health and Human Services (Washington, DC)
Family ID: 26767641
Appl. No.: 09/674,028
Filed: February 2, 2001
PCT Filed: April 21, 1999
PCT No.: PCT/US99/08769

CBD references

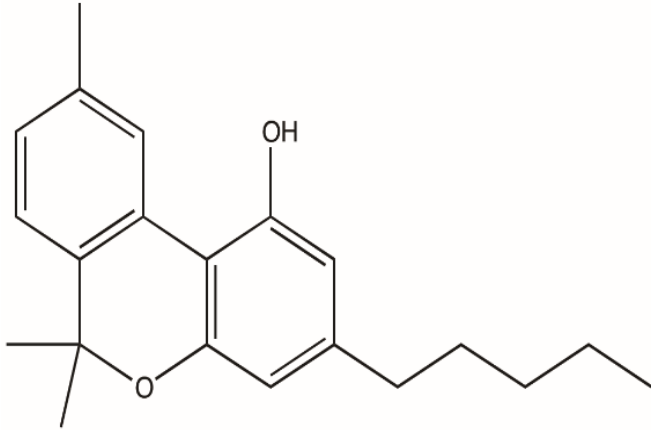
[Neuropharmacology](#). 2018 Mar 3;135:22-33. doi: 10.1016/j.neuropharm.2018.03.001. [Epub ahead of print]

[Cannabis Cannabinoid Res.](#) 2018 Feb 1;3(1):11-20. doi: 10.1089/can.2017.0041. eCollection 2018.

[Am J Psychiatry](#). 2018 Mar 1;175(3):225-231. doi: 10.1176/appi.ajp.2017.17030325. Epub 2017 Dec 15.

[Prog Neuropsychopharmacol Biol Psychiatry](#). 2017 Apr 3;75:94-105. doi: 10.1016/j.pnpbp.2016.11.005. Epub 2016 Nov 23.

Cannabinoids



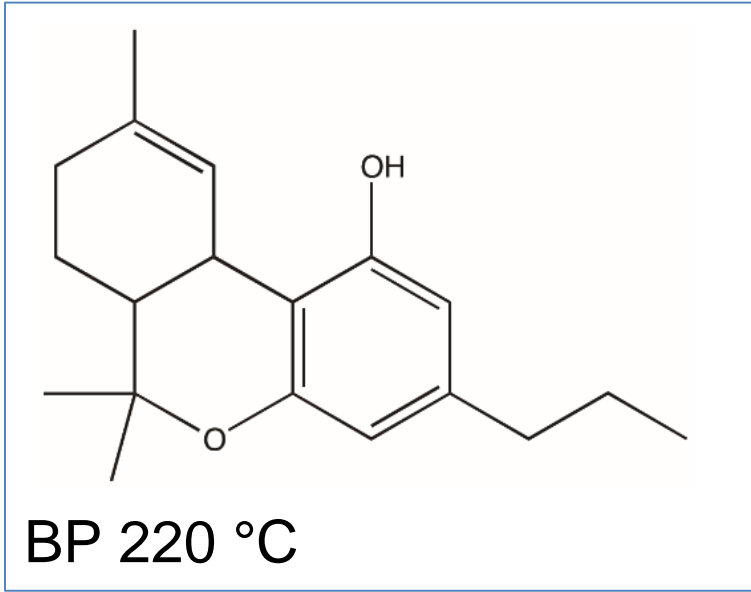
BP 185 °C

Cannabinol

Sedative
Antibiotic

Evans, F. J. (2007). Cannabinoids: The separation of central from peripheral effects on a structural basis. *Planta Medica*, 57(S 1), S60–S67.<http://doi.org/10.1055/s-2006-960231>.

Cannabinoids



Tetrahydrocannabivarin

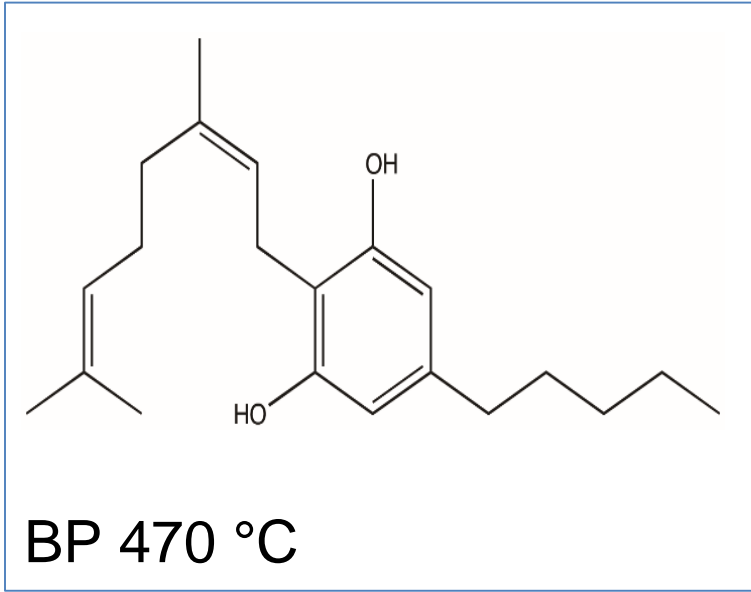
Antipsychotic
Anti-diabetic
Improves Insulin Sensitivity

[Br J Pharmacol.](#) 2015 Mar;172(5):1305-18. doi: 10.1111/bph.13000.

[Diabetes Care.](#) 2016 Oct;39(10):1777-86. doi: 10.2337/dc16-0650. Epub 2016 Aug 29.

[Nutr Diabetes.](#) 2013 May 27;3:e68. doi: 10.1038/nutd.2013.9.

Cannabinoids



Cannabigerol

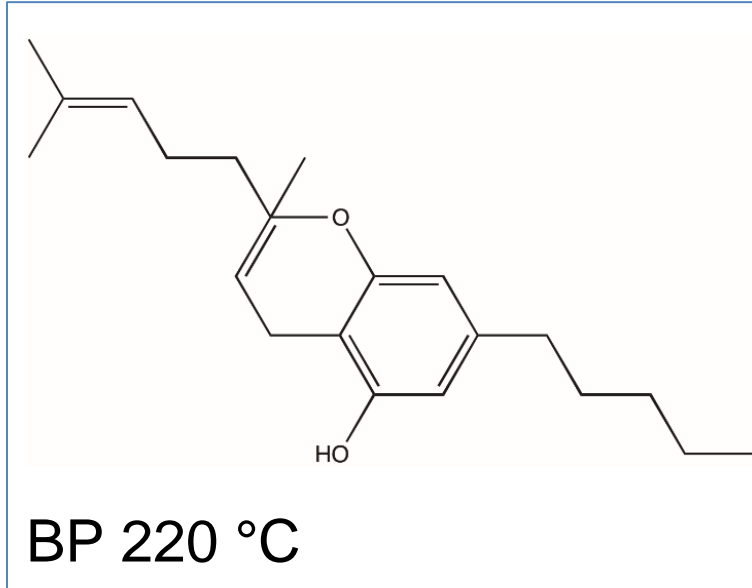
Appetite Stimulant
Neuroprotective

[Psychopharmacology \(Berl\)](#). 2016 Oct;233(19-20):3603-13. doi: 10.1007/s00213-016-4397-4. Epub 2016 Aug 9.

[Neurotherapeutics](#). 2015 Jan;12(1):185-99. doi: 10.1007/s13311-014-0304-z.

[Behav Pharmacol](#). 2017 Jun;28(4):280-284. doi: 10.1097/FBP.0000000000000285.

Cannabinoids



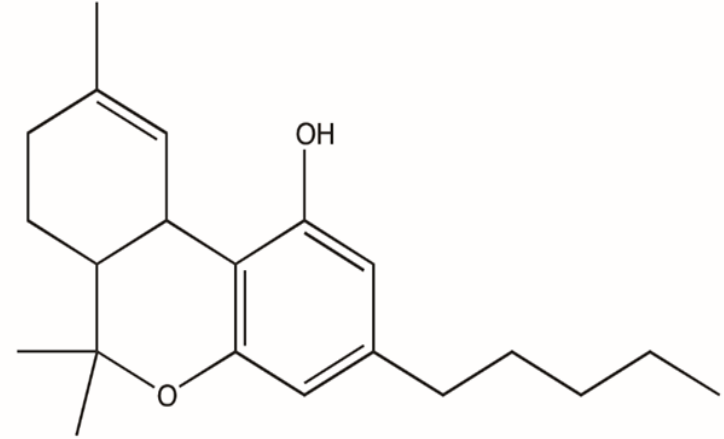
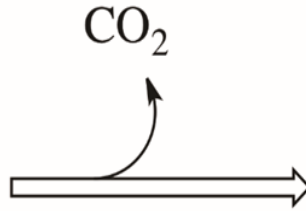
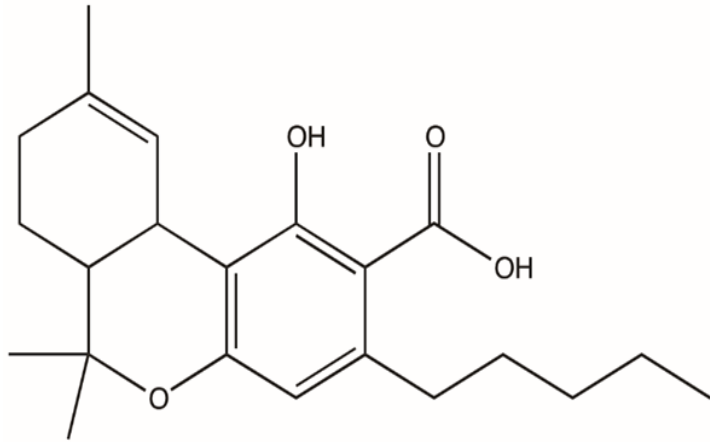
Cannabichromene

Inhibits NO
Reduces Inflammation-
induced GI Hypermotility

[Br J Pharmacol.](#) 2013 May; 169(1): 213–229.

[Br J Pharmacol.](#) 2012 Jun;166(4):1444-60. doi: 10.1111/j.1476-5381.2012.01879.x.

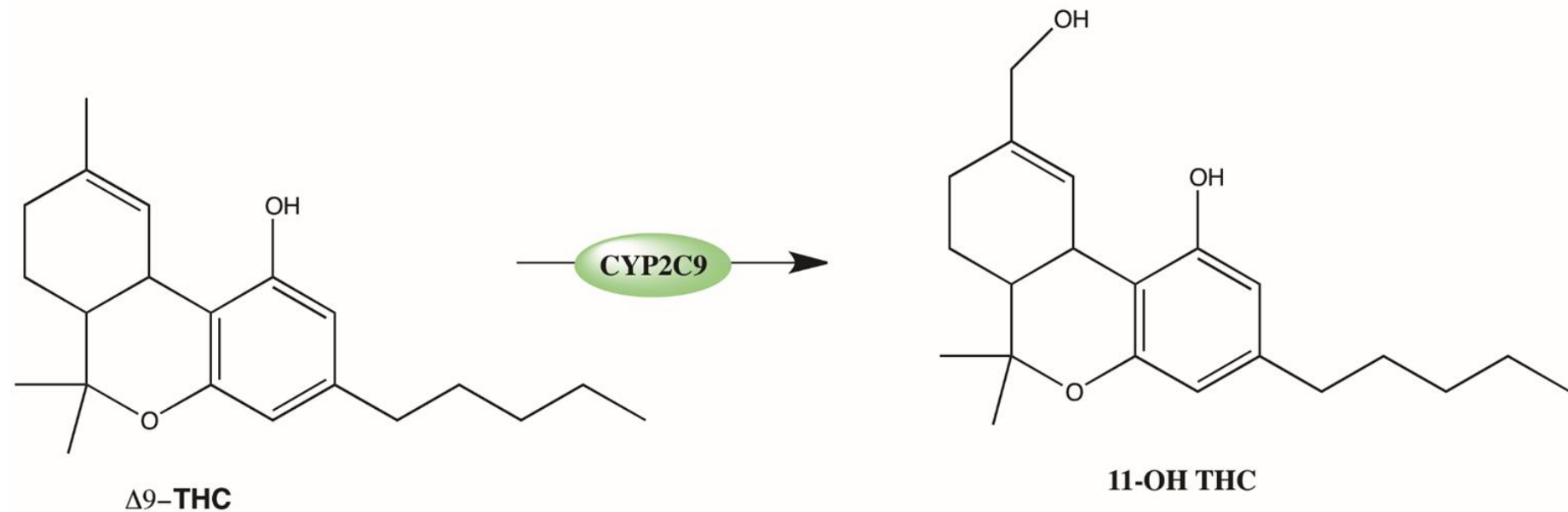
Decarboxylation



Much less psychoactive

Psychoactive

Edibles



Mild and friendly....

Scares Snoop...

THANK YOU!

Steve Ottersberg
Green Lab Solutions Company
