Cannabigerol (CBG)

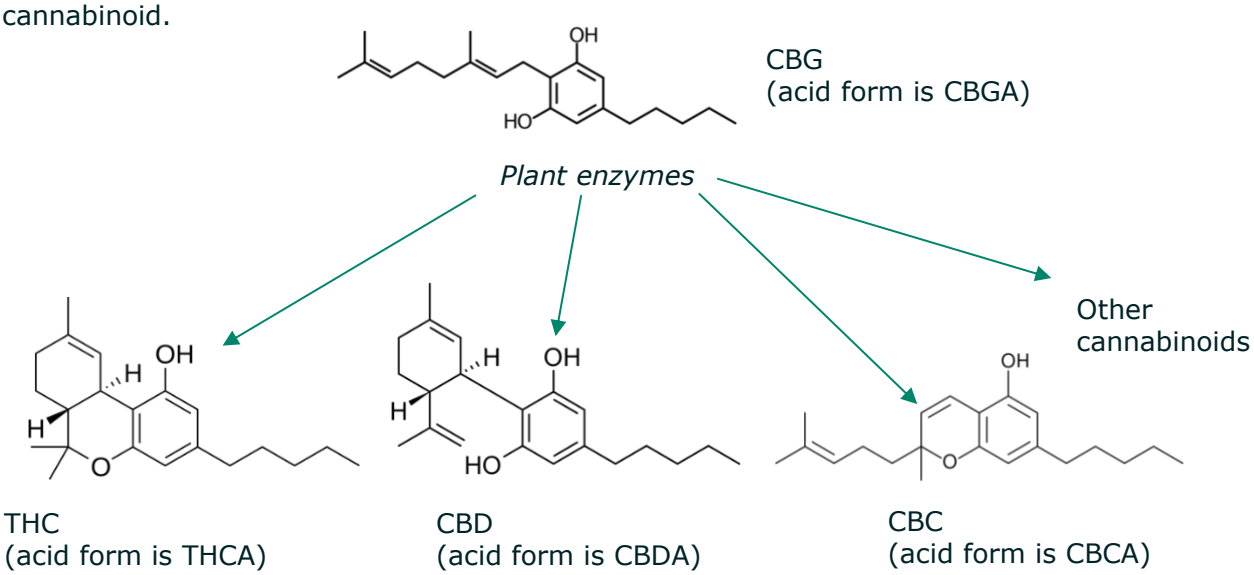
Introduction and selected scientific references

Updated: June 30, 2022

Cannabigerol (CBG)

Introduction

CBG, sometimes called the "**mother cannabinoid**" or "**skin cannabinoid**", is the parent molecule from which other cannabinoids are made in both marijuana and hemp. But since it's mostly converted into other cannabinoids, such as THC and CBD, very little of it remains intact in the plant (typically <0.5% by weight). Due to its scarcity, up until now, customers and patients have struggled to access the benefits of this important non-intoxicating cannabinoid.



Plant cannabinoids are naturally produced in the acid form. Prior to consumption, they are typically converted into their better-known neutral form by heating. In this way, CBG is made from CBGA.

Potential benefits

There is a growing body of primary scientific research exploring the potential benefits of CBG, both on its own as well as in combination with other cannabinoids (e.g. CBD). Below is a summary of some of the main areas under investigation:

1. Antibacterial (e.g. MRSA, dental plaque);
2. Antioxidant;
3. Dry skin;
4. Inflammation (general);
5. Skin inflammation;
6. GI inflammation;
7. Neuroinflammation and neurodegeneration;
8. Insulin resistance;
9. Ocular tension;
10. Loss of appetite;
11. Mood disorders;
12. Neuropathic pain;
13. Cancer (in vitro studies);
14. Bladder dysfunction;
15. Stroke;
16. Epilepsy;
17. Covid-19;
18. Cardiovascular.

Scientific literature

Subject	Quotation	Ref.
Antibacterial	"CBG potently inhibit[s] **MRSA**, repress[es] biofilm formation (Fig. 1b) and effectively eradicate[s] persister cells…CBG (Fig. 2a) exhibiting the most potent anti-biofilm activity…CBG was the most potent cannabinoid against persisters."	1
	"In conclusion, our study shows that CBG is a potential **anti-biofilm** agent via inhibition of the QS cascade."	2
	"We demonstrated that CBG exerts a **bacteriostatic** effect at a concentration of 2.5μg/ml and the growth-inhibitory effect of CBG is affected by the initial cell density. At the higher concentrations of 5–10μg/ml, CBG had a bactericidal effect as shown by 98.5–99.9% reduction of viable bacteria after 8 h."	3
	"These data demonstrate a positive drug-drug interaction with a silver-containing medicament used in combination with a cannabinoid, in particular illustrating a stronger **antibiotic** action of using CBG in combination with silver nitrate as opposed to using either compound on its own."	4
Antioxidant	"The presented data prove that all the examined cannabinoids [CBG] exhibit **antioxidant** activity…Although the intensity of these activities is not the same for the individual cannabinoids it is comparable for all of them with that of E vitamin."	5
Dental health	"In our study, cannabinoids were found to be more effective in reducing the colony count of the bacterial strains (**dental plaque** biofilm) as compared to the well-established synthetic oral care products such as Oral B or Colgate…In the DPSI (-3) group (chalk hardened dental plaque biofilm), the maximum number of colonies was found in the Oral B treatment and the minimum number in the CBGA treatment."	6
	"Cannabinoids (CBD/CBG) infused mouthwashes together with other natural key ingredients shows promising bactericidal activity in vitro against total-culturable aerobic bacterial content in **dental plaque**, with efficiency equivalent to or better than that of the gold standard (0.2% chlorhexidine)."	7
	"Our data show that CBG has anti-biofilm activities against *S. mutans* and might be a potential drug for preventive treatment of **dental caries**."	8
Dry skin	"CBG and CBGV, in contrast to CBC, CBDV and THCV, behaved in an 'endocannabinoid-like' way, and increased sebaceous lipid synthesis of the sebocytes (Fig. 1a,b) raising the possibility of their administration in the management of conditions, such as **dry-skin syndrome**, **xerosis** and even **skin ageing**."	9

Subject	Quotation	Ref.
Inflammation	"Cannabigerol (CBG) can have anti-inflammatory effects, i.e., suppress degranulation, by either (1) suppressing a pro-secretory pathway or (2) stimulating an anti-secretory pathway, or both…We further demonstrated **strong synergistic effects** of the minor cannabinoid, cannabigerol (CBG), on mast cell degranulation when it is combined with other cannabinoids and/or terpenes."	10
	"In conclusion, this study has provided evidence that CBD and CBG formulated appropriately exhibit **anti-inflammatory** activity. Our observations suggest that these non-psychoactive cannabinoids may have beneficial effects in treating diseases characterised by airway inflammation."	11
	"In multiple experimental models, both *in vitro* and *in vivo*, several phytocannabinoids, including Δ9-tetrahydrocannabinol (THC), cannabidiol (CBD) and cannabigerol (CBG), exhibit activity against **inflammation**…Synergy between phytocannabinoids, as well as between phytocannabinoids and terpenes, has been demonstrated."	12
Skin inflammation	"Not only THCV, but also CBG, CBGV, CBC and CBDV sup-pressed LPS-induced pro-inflammatory response of the sebocytes (Figure S9a–e). These findings together with the known antiproliferative actions of the pCBs (Fig. 3) (33) raise the possibility that administration of these substances may be beneficial not only in acne, but also in other **inflammation-accompanied skin diseases**, for example in **psoriasis**."	9
	"CBG **inhibits pro-inflammatory cytokine**…release from several inflammatory inducers, such as ultraviolet A (UVA), ultraviolet B (UVB), chemical, C. acnes, and in several instances does so more potently than CBD."	13
	"[T]he increase in the **anti-inflammatory** PEA [N-palmitoylethanolamine, an endocannabinoid-like compound] following CBG treatment seems to be of note because a recent study showed that CBG, when applied topically, promotes skin health by reducing the appearance of redness and improving barrier function via anti-inflammatory activity."	14
	"IL-1 alpha: CBG alone showed 12.9% inhibition (2 µg/ml), Paeonia extract at 1000µg /ml (P. lactiflora) showed 22.9% inhibition, but together they showed synergistic **anti-inflammatory** activity of 54.6% IL-1 alpha inhibition…TNF alpha: CBG alone showed 26.8% inhibition (2 /mµlg), Paeonia extract at 1000µg/ml (P. lactiflora) showed 18% inhibition, but together they showed synergistic anti- inflammatory activity of 60.5% TNF alpha inhibition."	15

Subject	Quotation	Ref.
GI inflammation	"Our results show that the non-psychotropic plant cannabinoid CBG exerts protective effects in a murine experimental model of **IBD**…Also, CBG exerts antioxidant effects in the **inflamed gut** as well as in intestinal epithelial cells exposed to **oxidative stress**…Our results suggest that CBG may represent a new therapeutic opportunity in IBD."	16
	"CBG, but not CBC, given by oral gavage, ameliorated DNBS-induced colonic inflammation. FO [fish oil] pretreatment (at the inactive dose) increased the **anti-inflammatory** action of CBG and rendered oral CBD effective while reducing endocannabinoid levels. Furthermore, the combination of FO, CBD, and a per se inactive dose of CBG resulted in intestinal anti-inflammatory effects."	17
Neuroinflammation/ neurodegeneration	"CBG pre-treatment, both alone and association with CBD at all doses tested, was able to **reduce neuroinflammation**…The benefits shared by CBD and CBG are **enhanced when they are combined**…In the present study, we confirmed the **anti-inflammatory, antioxidant**, and **anti-apoptotic** effects of CBG and CBD previously described."	18
	"On the bases of these results, thanks to its **neuroprotective effects**, we encourage the use of CBG against neurodegeneration and in those pathological conditions where neuroinflammation and oxidative stress play a main role…We have already demonstrated the CBG antioxidant properties in macrophages stimulated with hydrogen peroxide (H2O2). Also anti-inflammatory and neuroprotective effects were reported for CBG…"	19
	"CBG was extremely active as **neuroprotectant** in mice intoxicated with 3-nitropropionate (3NP) (HD mouse model), improving motor deficits and preserving striatal neurons against 3NP toxicity."	20
	"Studies indicate that CBG may have therapeutic potential in treating **neurological disorders** (e.g. Huntington's disease, Parkinson's disease, and multiple sclerosis), inflammatory bowel disease, as well as having antibacterial activity."	21
	"CBD and CBG showed **neuroprotective** effects against H_2O_2 or rotenone…Our results contribute to the understanding of the neuroprotective effect of CBD and CBG, showing differences with their acid forms, and also highlight the role of 5-HT1A receptors in the mechanisms of action of CBG."	22
	"Using NSC-34 cells to model spinal cord injury in vitro, our work evaluated the properties of CBG treatments in motor neuron regeneration…Our results indicate CBG as a phytocompound worth further investigation in the field of **neuronal regeneration**."	23

Subject	Quotation	Ref.
Neuroinflammation/ neurodegeneration	"CBGA exhibited significant neuroprotection against STSR[Staurosporin]-induced cytotoxicity when in contact with differentiated SH-SY5Y cells…In contrast, other cannabinoids, such as CBN, CBND and CBD, used at the same concentration range did not protect differentiated SH-SY5Y cells from STSR-induced insult…Such **neuroprotective** effect [of] CBGA from cytotoxicity under these conditions could potentially prevent neuronal damage in the setting of neuron generative diseases."	24
Insulin resistance	"Our study highlights phytocannabinoids as a potential novel pharmacological tool to regain control of functional adipose tissue in unregulated energy homeostasis often occurring in metabolic disorders including **type 2 diabetes** mellitus (T2DM), aging and lipodystrophy...We provide evidence that CBD, CBDA, CBGA and THCV (5 μM) increase the number of viable BM-MSCs; whereas only CBG (5 μM) and CBD (5 μM) alone or in combination promote BM-MSCs maturation into adipocytes via distinct molecular mechanisms…CBD and CBG might be an **effective treatment for insulin sensitization**."	25
Ocular tension	"These results suggest that cannabigerol and related cannabinoids may have therapeutic potential for the treatment of **glaucoma**."	26
	"These results indicate that chronic administration of these cannabinoids lowers **ocular tension** considerably. Like marihuana and delta-9-tetrahydrocannabinol, cannabinol produced both ocular toxicity and neurotoxicity. As cannabigerol lacked these toxicities, it appears that the ocular hypotensive effect of this cannabinoid is somewhat dissociable from both the adverse central and ocular effects accompanying marihuana intake."	27
Loss of appetite	"The data presented here demonstrate that CBG has protective effects against multiple components of **chemotherapy-induced cachexia** pathophysiology, including anorexia, weight loss, muscle atrophy, and metabolic dysregulation."	28
	"We demonstrate for the first time that CBG elicits **hyperphagia**, by reducing latency to feed and increasing meal frequency, without producing negative neuromotor side effects."	29
Mood disorders	"The data presented suggest that CBG may induce **antidepressant** effects. Moderate doses of CBG produced behaviours that were consistent to imipramine in the tail suspension test and as such the use of this naturally occurring cannabinoid may have beneficial effects over that of HCA antidepressants such as imipramine which are known to cause many side effects in users."	30

Subject	Quotation	Ref.
Mood disorders	"This is the first patient survey of CBG-predominant cannabis use to date, and the first to document self-reported efficacy of CBG-predominant products, particularly for **anxiety**, chronic pain, **depression**, and insomnia."	31
Neuropathic pain	"CBG, CBD and THC demonstrated potent dose-related inhibition of capsaicin responses in DRG [dorsal root ganglion] neurons when applied individually in vitro, and enhanced when applied in combination, being most effective at 90 μM. Thus, efficacy and tolerability of THC could be improved in combination with CBG and CBD at optimal concentrations, which deserve further studies *in vivo*."	32
	"This finding demonstrates that the cannabinoids CBDV, THCV and CBG are superior to CBD in their ability to treat the **neuropathic pain** brought about by the animal model used in this experiment."	33
	"A previous study reported that CBG (10 μM) blocks voltage-gated sodium (Nav) currents in CNS neurons; however, the underlying mechanism is not well-understood…We found that CBG is a ~10-fold state-dependent Nav inhibitor (K_I -K_R : ~2-20 μM) with an average Hill-slope of ~2…Inhibition of Nav1.7 in DRG neurons may underlie CBG-induced **neuronal hypoexcitability**."	34
Cancer	"CBG inhibited the growth of xenograft tumours as well as chemically induced **colon carcinogenesis**. CBG hampers colon cancer progression in vivo and selectively inhibits the growth of CRC cells…CBG should be considered translationally in CRC prevention and cure."	35
	"Geraniol (1), olivetol (2), cannabinoids (3 and 4) and 5-fluorouracil (5) were tested for their growth inhibitory effects against **human oral epitheloid carcinoma** cell lines (KB) and NIH 3T3 fibroblasts using two different 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) assay and sulforhodamine B protein (SRB) assay. Cannabigerol (3) exhibited the highest growth-inhibitory activity against the cancer cell lines."	36
	"Cannabigerol(3) was synthesized and evaluated for its inhibitory activity against mouse **skin melanoma** cells. Cannabigerol displayed significant antitumor activity [inhibitory concentration (IC50)=31.3l μ/mL] in vitro assay."	37
	"This study evaluated the synergistic **anti-cancer** potential of cannabinoid combinations across…human breast cancer cell lines…The most promising cannabinoid combination (C6) consisted of tetrahydrocannabinol, cannabigerol (CBG), cannabinol (CBN), and cannabidiol (CBD), and displayed favorable dose reduction indices and limited cytotoxicity against the non-cancerous breast cell line, MCF-10A."	38

Subject	Quotation	Ref.
Cancer	"Among primary brain tumors, glioblastoma is the most aggressive...[N]ontoxic cannibigerol (CBG), being recently shown to exhibit anti-tumour properties in some carcinomas, is assayed here for the first time in glioblastoma with the aim to replace THC…CBG can destroy therapy-resistant **glioblastoma** cells, which are the root of cancer development and extremely resistant to various other treatments of this lethal cancer. CBG should present a new yet unexplored adjuvant treatment strategy for glioblastoma."	39
	"DNA topoisomerases are proved cancer therapeutic targets with clinically successful anticancer drugs for decades. However, the role of RNA topoisomerase (TOP3β) remained mysterious especially in cancer, and no targeted agent has been reported yet…We demonstrated that CBG directly engaged with TOP3β, and promoted TOP3β depletion in wildtype but not mutant cancer cells…We also demonstrated that CBG induced formation of stress granule, RNA-loop and asymmetric DNA damages in cancer cells, and all these phenotypes were significantly attenuated in TOP3B knockout cells…Our findings not only highlighted TOP3β as a promising therapeutic target of cancer, but also identified CBG as a lead chemical inhibitor of TOP3β for **cancer therapy**."	40
Bladder dysfunction	"There are anecdotal reports that some Cannabis preparations may be useful for **bladder dysfunctions**… The rank order of efficacy was CBG=THCV>CBD>CBDV. In depth studies on CBG showed that the effect of this phytocannabinoid on acetylcholine-induced contractions was not affected by CB1 or CB2 receptor antagonists. Additionally, CBG also reduced acetylcholine-induced contractions in the human bladder."	41
Stroke	"We show that CBG and CBDV were protective against [oxygen glucose deprivation] mediated injury in three different cells that constitute the [blood brain barrier], modulating different hallmarks of ischemic **stroke** pathophysiology. These data enhance our understanding of the protective effects of CBG and CBDV and warrant further investigation into these compounds in ischemic stroke."	42
Epilepsy	"These results suggest CBGA, CBDVA and CBGVA may contribute to the effects of cannabis-based products in childhood **epilepsy**."	43
COVID	"In follow-up virus neutralization assays, cannabigerolic acid and cannabidiolic acid prevented infection of human epithelial cells by a pseudovirus expressing the **SARS-CoV-2 spike** protein and prevented entry of live SARS-CoV-2 into cells."	44
	"This study intended to examine the anti-inflammatory activity of cannabis on immune response markers associated with coronavirus disease 2019 **(COVID-19) inflammation**…To conclude, treatment with cannabis compounds CBD, CBG, and THCV may have clinical value in reducing cytokine secretion and ACE2 expression in lung epithelia cells."	45

Subject	Quotation	Ref.
COVID	"Among the studied phytoligands, cannabigerolic acid (2), cannabigerol (8), and its acid methyl ether (3) possessed the highest binding affinities to **SARS-CoV-hACE2** complex essential for viral entry…These non-psychoactive cannabinoids could represent plausible therapeutics with added-prophylactic value as they halt both viral entry and replication machinery."	46
	"It is worth noting that the **anti-inflammatory** and antiviral potential are shown not only by well-known cannabinoids, such as cannabidiol (CBD), but also secondary cannabinoids, such as cannabigerolic acid (CBGA) and terpenes, emphasizing the role of all of the plant's compounds and the entourage effect."	47
Cardiovascular	"These findings suggest that acute cannabigerol **lowers blood pressure** in phenotypically normal mice likely *via* an α2AR mechanism, which may be an important consideration for therapeutic cannabigerol administration."	48

References

1. Farha et al. ACS Infectious Diseases. March 2020; 6, 3, 338-346. *Uncovering the Hidden Antibiotic Potential of Cannabis.*
2. Aqawi et al. Front Microbiol. May 2020; 11(article 858). *Cannabigerol Prevents Quorum Sensing and Biofilm Formation of Vibrio harveyi.*
3. Aqawi et al. Front Microbiol. Apr 2021; 12: 646471. *Antibacterial properties of cannabigerol toward* Streptococcus mutans.
4. WO2022016269. 2022. *Silver enhanced cannabinoid antibiotics.*
5. Dawidowicz A L et al. Fitoterapia 2021 Jul; 152:104915. *CBG, CBD, Δ9-THC, CBN, CBGA, CBDA and Δ9-THCA as antioxidant agents and their intervention abilities in antioxidant action.*
6. Stahl V et al. Cureus 12(1): e6809, January 2020. *Comparison of Efficacy of Cannabinoids versus Commercial Oral Care Products in Reducing Bacterial Content from Dental Plaque: A Preliminary Observation.*
7. Vasudevan et al. Journal of Cannabis Research. June 2020; 2, 20 (2020). *Cannabinoids infused mouthwash products are as effective as chlorhexidine on inhibition of total-culturable bacterial content in dental plaque samples.*
8. Aqawi et al. Microorganisms. 2021, 9(10), 2031; Sep 2021. *Anti-Biofilm Activity of Cannabigerol against Streptococcus mutans.*
9. Olah et al. Exp Dermatol. September 2016; 25(9):701-7. *Differential effectiveness of selected non-psychotropic phytocannabinoids on human sebocyte functions implicates their introduction in dry/seborrhoeic skin and acne treatment.*
10. WO2018144637. 2018. *Cannabinoid containing complex mixtures for the treatment of mast cell-associated or basophil mediated inflammatory disorders.*
11. Robaina Cabrera et al. Pulm Pharmacol Ther. 2021 June 1; 69: 102047. *The anti-inflammatory effects of cannabidiol and cannabigerol alone, and in combination.*
12. Anil SM et al. Front Pharmacol. 2022 May 9; 13: 908198. doi: 10.3389/fphar.2022.908198. *Medical Cannabis Activity Against Inflammation: Active Compounds and Modes of Action.*
13. Perez E et al. Molecules 2022, Jan 13; 27: 491. doi: 10.3390/molecules27020491. *In vitro and clinical evaluation of cannbigerol (CBG) produced via yeast biosynthesis: a cannabinoid with a broad range of anti-inflammatory and skin health-boosting properties.*
14. Di Meo C et al. Int J Molec Sci. 2022 May 12; 23(10): 5430. *Effects of rare phytocannabinoids on the endocannabinoid system of human keratinocytes.*
15. WO2022091077. 2022. *Compositions for treating inflammations, wounds and scarring.*
16. Borrelli et al. Biochem Pharmacol. May 2013; 1;85(9):1306-16. *Beneficial effect of the non-psychotropic plant cannabinoid cannabigerol on experimental inflammatory bowel disease.*
17. Pagano E et al. Phytother Res. January 2021 35(1): 517-529. *Efficacy of combined therapy with fish oil and phytocannabinoids in murine intestinal inflammation.*
18. Mammana et al. Medicina (Kaunas). November 2019; 55(11): 747. *Could the Combination of Two Non-Psychotropic Cannabinoids Counteract Neuroinflammation? Effectiveness of Cannabidiol Associated with Cannabigerol.*
19. Gugliandolo et al. Int J Mol Sci. July 2018; 19(7): 1992. *In Vitro Model of Neuroinflammation: Efficacy of Cannabigerol, a Non-Psychoactive Cannabinoid.*
20. Valdeolivas et al. Neurotherapeutics. January 2015;12(1):185-99. *Neuroprotective properties of cannabigerol in Huntington's disease: studies in R6/2 mice and 3-nitropropionate-lesioned mice.*

21. Nachnani R et al. J Pharmacol Exp Therapeut. Feburary 2021; 376(2): 204-212. *The pharmacological case for cannabigerol CBG.*
22. Echeverry C et al. Neurotox Res. 2021 Apr; 39(2):335-348. *A comparative* in vitro *study of the neuroprotective effect induced by cannabidiol, cannabigerol, and their respective acid forms: relevance of the 5-HT$_{1A}$ receptors.*
23. Valeri A et al. Pharmaceuticals (Basel). 2022 Jan 19; 15(2):117. doi: 10.3390/ph15020117. *Will cannabigerol trigger neuroregeneration after a spinal cord injury? An in vitro answer from NSC-34 scratch-injured cells transcriptome.*
24. WO2022082313. 2021. *Composition and methods for treating neuronal disorders with cannabinoids.*
25. Fellous et al. Biochemical Pharmacology. May 2020; Volume 175: 113859. *Phytocannabinoids promote viability and functional adipogenesis of bone marrow-derived mesenchymal stem cells through different molecular targets.*
26. Colasanti. Journal of Ocular Pharmacology and Therapeutics. March 2009; Vol. 6, No. 4. *A Comparison of the Ocular and Central Effects of Δ9-Tetrahydrocannabinol and Cannabigerol.*
27. Colasanti et al. Exp Eye Res. September 1984; 39(3):251-9. *Intraocular pressure, ocular toxicity and neurotoxicity after administration of cannabinol or cannabigerol.*
28. Brierley et al. J. of Cachexia, Scarcopenia and Muscle. April 2019; Volume10 (4): 844-859. *Chemotherapy-induced cachexia dysregulates hypothalamic and systemic lipoamines and is attenuated by cannabigerol.*
29. Brierley, DI et al. Psychopharmacology. 233, 3603–3613, Aug 2016. *Cannabigerol is a novel, well-tolerated appetite stimulant in pre-satiated rats.*
30. US8481085. 2013. *Pharmaceutical compositions comprising cannabigerol.*
31. Russo EB et al. Cannabis Cannabinoid Res. September 27 2021. doi: 10.1089/can.2021.0058. *Survey of patients employing cannabigerol-predominant cannabis preparations: perceived medical effects, adverse events, and withdrawal symptoms.*
32. Anand U et al. 2021. Journal of Pain Research 14: 3603–3614. *Dose-related inhibition of capsaicin responses by cannabinoids CBG, CBD, THC and their combination in cultured sensory neurons.*
33. WO2012160358. 2011. *Cannabinoids for use in the treatment of neuropathic pain.*
34. Ghovanloo, M-R et al. Br J Pharmacol. 2022 Mar 16. doi: 10.1111/bph.15833. *Inhibition of sodium conductance by cannabigerol contributes to a reduction of dorsal root ganglion neuron excitability*
35. Borrelli et al. Carcinogenesis. September 2014; vol.35 no.12 pp.2787–2797. *Colon carcinogenesis is inhibited by the TRPM8 antagonist cannabigerol, a Cannabis- derived non-psychotropic cannabinoid.*
36. Baek et al. Arch. Pharm. Res. 21, 353, June 1998. *Boron trifluoride etherate on silica-A modified lewis acid reagent (VII). Antitumor activity of cannabigerol against human oral epitheloid carcinoma cells.*
37. Baek et al. Arch. Pharm. Res. 19, 228–230, June 1996. *Synthesis and antitumor activity of cannabigerol.*
38. Schoeman R et al. Molecules. 25(20): 4682, October 2020. *Cannabinoid combination induces cytoplasmic vacuolation in MCF-7 breast cancer cells.*
39. Lah TT et al. Cells. 10(2): 340, February 2021. *Cannabigerol is a potential therapeutic agent in a novel combined therapy for glioblastoma.*
40. Zhang X et al. December 2021. Pharmacol Res.174: 105927. doi: 10.1016/j.phrs.2021.105927. Epub 2021 Nov 2. *Small molecule targeting topoisomerase 3β for cancer therapy.*
41. Pagano E et al. Natural Prod Commun. 10(6): 1009-1012, June 2015. *Effect of non-psychotropic plant-derived cannabinoids on bladder contractility: focus on cannabigerol.*

42. Stone NL et al. Cannabis Cannabiniod Res. 2021 Mar 17. doi: 10.1089/can.2020.0159. *Protective effects of cannabidivarin and cannabigerol on cells of the blood-brain baririer under ischemic conditions.*
43. Anderson LL et al. Br J Pharmacol. 2021 Aug 12; doi: 10.1111/bph.15661. Online ahead of print. *Cannabigerolic acid, a major biosynthetic precursor molecule in Cannabis, exhibits divergent effects on seizures in mouse models of epilepsy.*
44. van Breemen RB et al. J Nat Prod 2022 Jan 28; 85(1): 176-184. *Cannabinoids block cellular entry of SARS-CoV-2 and the emerging variants.*
45. Anil SM et al. Sci Rep 2021: 11: 1462 doi: 10.1038/s41598-021-81049-2. *Cannabis compounds exhibit anti-inflammatory activity in vitro in COVID-19-related inflammation in lung epithelia cells and proinflammatory activity in macrophages.*
46. Khattab AR and Teleb M. Future Virol. 2022 April 4. doi: 10.2217/fvl-2021-0309. In silico *discovery of non-psychoactive scaffolds in Cannabis halting SARS-CoV-2 host entry and replication machinery.*
47. Janeki M et al. Int J Mol Sci 2022 Apr 10; 23(8): 4170. *Anti-inflammatory and antiviral effects of cannabinoids in inhibiting and preventing SARS-CoV-2 infection.*
48. Vernail VL et al. Frontiers Physiol 2022 May 9; 13:871962. doi: 10.3389/fphys.2022.871962. *Acute cannabigerol administration lowers blood pressure in mice.*

Disclaimer

USE OF CREO PRODUCTS IN CONSUMER PACKAGED GOODS MAY BE REGULATED BY THE FOOD AND DRUG ADMINISTRATION ("FDA"). THE PRODUCTS OFFERED FOR SALE BY CREO HAVE NOT BEEN APPROVED FOR A SPECIFIC PURPOSE BY THE FDA NOR HAVE ANY OF THE STATEMENTS CONTAINED HEREIN BEEN EVALUATED FOR SAFETY OR EFFIC ACY BY THE FDA. THE PRODUCTS SOLD BY CREO ARE NOT INTENDED TO DIAGNOSE, TREAT, CURE OR PREVENT ANY DISEASE. CREO HAS PROVIDED RESEARCH MATERIALS PERTAINING TO CANNABIGEROL ("CBG") SOLELY TO PROVIDE THE READER WITH INFORMATION ON THE TYPES OF STUDIES BEING CONDUCTED ON CBG AND/OR OTHER CANNABINOIDS.

CREO MAKES NO REPRESENTATION AS TO THE ACCURACY OR VALIDITY OF THE RESEARCH REFERENCED HEREIN OR AS TO THE SAFETY OR VALIDITY OF ANY CONCLUSIONS DRAWN BY ANY STUDIES REFERENCED HEREIN. SUCH STUDIES MAY OR MAY NOT BE PEER-REVIEWED AND MAY HAVE NOT BEEN REVIEWED BY THE FDA. ANY QUOTED EXCERPTS PROVIDED HEREIN MAY NOT BE AN ACCURATE SUMMARY OF THE RESEARCH CONTAINED IN THE REFERENCED STUDY AND ARE MERELY INCLUDED TO INDICATE THAT SOME RESEARCH IS BEING CONDUCTED WITH RESPECT TO CANNABINOIDS AND THE REFERENCED SUBJECT. READERS SHOULD READ THE ENTIRE STUDY IN ORDER TO DRAW THEIR OWN CONCLUSIONS REGARDING THE VALIDITY OF SUCH STUDY.

ANY CUSTOMER OF CREO THAT DESIRES TO USE CREO'S PRODUCTS SHOULD NOT MAKE ANY CLAIMS REGARDING THE EFFECTIVENESS OF SUCH PRODUCTS IN DIAGNOSING, TREATING, CURING OR PREVENTING ANY DISEASE OR MEDICAL CONDITION UNLESS SUCH CUSTOMER HAS INDEPENDENTLY RECEIVED APPROVAL FROM THE RELEVANT REGULATORY BODY OR BODIES (E.G. FDA) TO MAKE SUCH CLAIMS.