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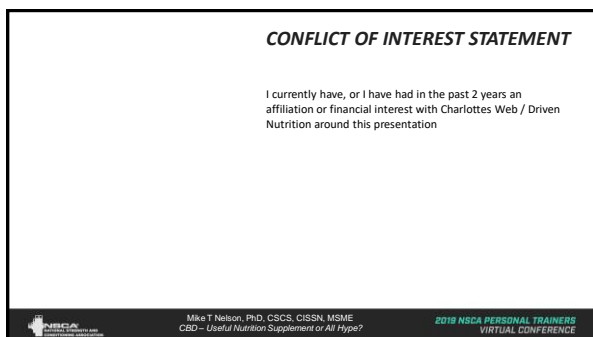
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HOW CAN I BE SO SURE?



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I will speak English  
(only a little geek).



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## ETHICS

- Talking only about research / experience, not ethics or legality
- As of this recording, THC/ marijuana is federally illegal
- Talk to your doc if you are using it for medical reasons



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## OUTLINE

- Cannabinoids background / research
- Strains / compounds
- Delivery methods
- Exercise
- CBD and Sleep
- #1 CBD Use



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## RESEARCH



Source: <http://mentalfloss.com/article/78547/there-was-once-secret-pool-mojave-desert>



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## CANNABIS



Source: By Walther Otto Müller - From Franz Eugen Köhler's Medizinal-Pflanzen. Published and copyrighted by Gera-Untermyhaus, FE Köhler in 1887 (1883–1914).



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## WEED SCHOOL: IN





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## Cannabis

- Subtypes:
- Sativa
- Indica
- Ruderalis



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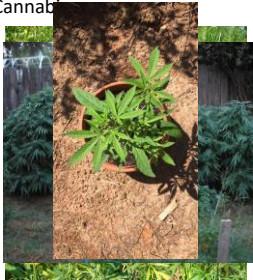
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Cannab



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STRAINS

- 14,031 single-nucleotide polymorphisms (SNPs) genotyped in 81 marijuana and 43 hemp samples
- Marijuana and hemp are significantly differentiated at a genome-wide level
- *Moderate* correlation between the genetic structure of marijuana strains and their reported sativa and indica

APASawler, J., Stout, J. M., Gardner, K. M., Hudson, D., Vidmar, J., Butler, L., Page, J. E., ... Myles, S. (2015). The Genetic Structure of Marijuana and Hemp. *PLoS one*, 10(8), e0133292. doi:10.1371/journal.pone.0133292

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STRAINS

*"... strain names often **do not** reflect a meaningful genetic identity."*



APASawler, J., Stout, J. M., Gardner, K. M., Hudson, D., Vidmar, J., Butler, L., Page, J. E., ... Myles, S. (2015). The Genetic Structure of Marijuana and Hemp. *PLoS one*, 10(8), e0133292. doi:10.1371/journal.pone.0133292

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## COMPOUNDS

- Phytocannabinoids – cannabinoids that are found in leaves, flowers, stems, and seeds collected from the Cannabis sativa plant.
- Endogenous – cannabinoids that are made by the body; examples include N-arachidonylethanolamine or anandamide (AE) or 2-arachidonoylglycerol (2-AG).



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## COMPOUNDS

- Purified – compounds isolated from plant sources: examples include cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC).
- Synthetic – cannabinoids synthesized in a laboratory: examples include CB1 agonists (CPP-55, ACPA), CB2 agonists (JWH-133, NMP7, AM1241), CB1/CB2 nonselective agonist (CP55940), ajulemic acid (AJA), nabilone, and dronabinol

Source NIH Research on Marijuana and Cannabinoids



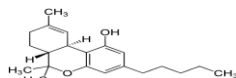
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## COMPONENTS

Marijuana vs. hemp

- THC content
- Delta-9-tetrahydrocannabinol



Source:  
<https://commons.wikimedia.org/wiki/File:Tetrahydrocannabinol.svg>



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## CANNABINOIDS

- 113 cannabinoids identified in cannabis
- THC
  - Isolated in 1964
  - Only psychoactive cannabinoid
- CBD
  - Isolated in 1940
  - Non-psychoactive
  - Currently "legal"
- CB1 and CB2 receptors



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## CANNABINOIDS

- Cannabis as a plant is a scheduled 1 drug by Federal Government
  - High addiction potential
  - No medical use
- Dronabinol (Marinol) is a synthetic form of delta-9-tetrahydrocannabinol
  - Approved May 31, 1985
  - Schedule III drug



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## CANNABINOIDS

### Position Statement: Medical Use of Cocaine

National Statement, Quality and Safety, North American, AAO/AAO/AAO, 2018



The American Academy of Otolaryngology-Head and Neck Surgery considers cocaine to be a valuable anesthetic and vasoconstricting agent when used as part of the treatment of a patient for a medical condition. No other single drug combines the anesthetic and vasoconstricting properties of cocaine.

More Resources About

Related Publications

Related Publications

Adopted 12/18/1988  
Revised by House 4/15/1995  
Revised by House 3/1/1998  
Revised 3/1/1998  
Revised 3/1/2001

Source: <https://www.entnet.org/content/medical-use-cocaine>



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### REVERSE GAINZZZ



Still look like this



Want to look like this

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Credit: Jeff S. PhD – *Useful Nutrition Supplement or All Hype?*

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### DELIVERY METHODS

1870 - The Boston Medical and Surgical Journal. Grimault's Indian Cigarettes



Source: <https://www.leafly.com/news/cannabis-101/cannabis-history-journey-joint>

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### DELIVERY METHODS

- Inhale / Smoke
  - Vaporize
    - Oil vs. flower



- Old school
  - 1870 first modern reference
- Eat (edibles)
  - Liver → 11-hydroxy-THC
- Other
  - Transdermal, etc

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## DECARBOXYLATION

*"The two main catalysts for decarboxylation to occur are **heat and time**. Drying and curing cannabis over time will cause a partial decarboxylation to occur. ... Smoking and vaporizing will instantaneously decarboxylate cannabinoids due to the extremely high temperatures present, making them instantly available for absorption through inhalation."* – Patrick Bennet

Patrick Bennet, CANNABIS 101: What is Decarboxylation, and Why Does Your Cannabis Need It? Leafly, April 30, 2016, accessed Oct 2017, URL <https://www.leafly.com/news/cannabis-101/what-is-decarboxylation>



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## EXERCISE PERFORMANCE

- 1975 Study
- 20 healthy subjects
- 1.4 g cannabis in a glass pipe
- Slight increase in heart rate, blood pressure
- Decreased work capacity
- No change in FVC or grip strength

Steadward RD, Singh M. The effects of smoking marijuana on physical Performance. Med Sci Sport. 1975;7:309-311.



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## EXERCISE PERFORMANCE

- 12 young healthy volunteers
- Single cigarette of smoked cannabis
- 1.7% THC
- No placebo condition



*"Cannabis use reduced max work capacity raised heart rate, and increased metabolic rate."*

Renaud AM, Cormier Y. Acute effects of marijuana smoking on maximal exercise performance. Med Sci Sports Exerc. 1986;18:685-689.



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## EXERCISE PERFORMANCE

*"...there is no direct evidence of performance-enhancing effects in athletes.*

*The potential beneficial effects of cannabis as part of a pain management protocol, including reducing concussion-related symptoms, deserve further attention."*

Ware, M. A., Jensen, D., Barrette, A., Verne, A., & Derman, W. (2018). Cannabis and the Health and Performance of the Elite Athlete. Clinical Journal of Sport Medicine : official journal of the Canadian Academy of Sport Medicine, 28(5), 480-484.



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## ACCEPTED MANUSCRIPT

1

Title: Cannabis exercise performance and sport: A systematic review

Author: Michael T. Kennedy

Institution: St. John's University, Department of Health, Behavior, and Society, St. John's University

Address: 100 College Avenue, St. John's University, New York, NY 10008

Corresponding author: Michael T. Kennedy (mike.kennedy@stjohns.edu)

Word count: 375

No funding was provided for this study.

There are no commercial interests involved and the author does not have any conflict of interest.

Abstract

**Objectives:** To review the evidence relating to the effects of cannabis on exercise performance.

**Design:** A systematic review of published literature.

**Methods:** PubMed, Cochrane, and EMBASE were searched for studies of cannabis.

**Results:** A search was conducted using PubMed, Medline and Embase searching for cannabis, medicine,



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## EXERCISE PERFORMANCE

- 15 published studies
- Effects of THC in association with exercise
- None showed any improvement in aerobic performance.
- Exercise induced asthma was shown to be inhibited.

*Some subjects could not complete an exercise protocol because adverse reactions caused by cannabis.*



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## EXERCISE PERFORMANCE

*"...much more scientific information is needed, based on current animal and human studies as well as on interviews with athletes and information from the field, cannabis can be performance enhancing for some athletes and sports disciplines.."*

Huestis, M. A., Mazzoni, I., & Rabin, O. (2011). Cannabis in sport: anti-doping perspective. *Sports medicine (Auckland, N.Z.)*, 41(11), 949-66.



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## EXERCISE PERFORMANCE

*".. THC has a direct dose-dependent toxic effect on brain mitochondria and to demonstrate for the first time that THC mainly inhibits complexes I, II, and III of the mitochondrial respiratory chain and decreases mitochondrial coupling."*



APAWolff V., Schlagowski A. I., Rouyer, O., Charles, A. L., Singh, F., Auger, C., Schini-Kerth, V., Marecaux, C., Raul, J. S., Zoll, J., ... Geny, B. (2015). Tetrahydrocannabinol induces brain mitochondrial respiratory chain dysfunction and increases oxidative stress: a potential mechanism involved in cannabis-related stroke. *BioMed research international*, 2015, 323706.



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## EXERCISE PERFORMANCE

*"....THC increases ROS production by the brain, which likely participates in its toxicity"*



Research Article

**Tetrahydrocannabinol Induces Brain Mitochondrial Respiratory Chain Dysfunction and Increases Oxidative Stress: A Potential Mechanism Involved in Cannabis-Related Stroke**

Valérie Wolff,<sup>1,2</sup> Anna-Sofie Schlagowski,<sup>1,3</sup> Olivier Rouyer,<sup>1,4</sup> Anne-Liane Charles, François Hugel,<sup>1,5</sup> Cyril Augier,<sup>1</sup> Valérie Schini-Kerth,<sup>1,6</sup> Valérie Marecaux,<sup>1</sup> Jean-Benoît Raul,<sup>1</sup> Jeffrey Zoll,<sup>1,7</sup> and Bernard Geny<sup>1,8</sup>

APAWolff V., Schlagowski A. I., Rouyer, O., Charles, A. L., Singh, F., Auger, C., Schini-Kerth, V., Marecaux, C., Raul, J. S., Zoll, J., ... Geny, B. (2015). Tetrahydrocannabinol induces brain mitochondrial respiratory chain dysfunction and increases oxidative stress: a potential mechanism involved in cannabis-related stroke. *BioMed research international*, 2015, 323706.



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## CANNABINOIDS SAFE?

Generally, yes

- Ahmed AJ, van den Elsen GA, Colbers A, van der Marck MA, Burger DM, Feuth TB, et al. Safety and pharmacokinetics of oral delta-9-tetrahydrocannabinol in healthy older subjects: a randomized controlled trial. *Eur Neuropsychopharmacol*. 2014;24(9):1475-82.
- van den Elsen GA, Ahmed AJ, Lammers M, Kramers C, Verkes RJ, van der Marck MA, et al. Efficacy and safety of medical cannabinoids in older subjects: a systematic review. *Ageing research reviews*. 2014;14:56-64.
- Sachs J, McGlade E, Yurgelun-Todd D. Safety and Toxicology of Cannabinoids: Neurotherapeutics: the Journal of the American Society for Experimental NeuroTherapeutics. 2015;12(4):735-46.
- Kersten BP, McLaughlin ME. Toxicology and management of novel psychoactive drugs. *Journal of pharmacy practice*. 2015;28(1):50-65.
- Sarne Y, Mechoulam R. Cannabinoids: between neuroprotection and neurotoxicity. Current drug targets CNS and neurological disorders. 2005;4(6):677-84.



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## CONVERSION

Decarboxylation (decarb)

- Convert CBDA and THCA-A to actives

Function of

- Time
- Temperature
- Atmosphere (pressure)

Pacifici R, Marchei E, Salvatore F, Guandalini L, Busardo FP, Pichini S. Evaluation of cannabinoids concentration and stability in standardized preparations of cannabis tea and cannabis oil by ultra-high performance liquid chromatography tandem mass spectrometry. *Clinical chemistry and laboratory medicine*. 2017;55(10):1555-63.



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## CANNABINOIDS

Vary depending on temperature

Compound	Boiling point
THC	157 C
CBD	160 -180 C
CBN	185 C
B-CARYOPHYLLENE	130 C

Cannabis and Cannabis Extracts: Greater Than the Sum of Their Parts?

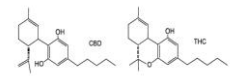
McPartland & Russo, 2001 Haworth Press



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## RECOVERY: CBD / THC



CBD      THC

B

Figure 1. The minimal energy conformations of CBD and  $\Delta^9$ -tetrahydrocannabinol (THC) are shown in 1A. THC has a fairly planar conformation whereas CBD has a bent conformation. This difference results in different pharmacological profiles even though there is considerable structural overlap of both when viewed in a two-dimensional as shown in 1B. CBD refers to (-)-CBD here and throughout this paper.



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## CBD: NON-PSYCHOACTIVE

- Dr. Peter Rouse
- Patent 6,630,507, titled "Cannabinoids as antioxidants and neuroprotectants,"
- issued on Oct. 7, 2003
- Expires 2019
- Hemp and Farm Bill  
"More legal" to produce CBD  
Not all products are equal



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## CBD: NON-PSYCHOACTIVE

- Epidiolex, GW Pharmaceuticals  
*"...proprietary oral solution of pure plant-derived cannabidiol, or CBD. ...concentrating on severe, orphan, early-onset, treatment-resistant epilepsy syndromes including Dravet syndrome, Lennox-Gastaut syndrome (LGS), Tuberous Sclerosis Complex (TSC) and Infantile Spasms (IS)."*

Source: <https://www.wikileaf.com/thestash/epidiolex-nearing-approval/>



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## RECOVERY: SLEEP

Can Psychol Aug 2013; 13(2):  
245-10. doi:10.1016/j.cpsych.2013.07.004

NEUROSCIENCE / PSYCHOLOGY / SECTION EDITOR

Cannabis, Cannabinoids, and Sleep: a Review of the Literature

Kinderly A. Baines<sup>1</sup>, James Smith<sup>2</sup>, Isabelle Hankins<sup>2</sup>

*"... CBD may hold promise for REM sleep behavior disorder and excessive daytime sleepiness"*

- Maybe?
- Anxiety driven sleep loss



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## HEAD TRAUMA

- 3 retrospective reviews of data
  - 446 patients sustaining a TBI
  - Toxicology screen for THC
  - THC illegal, only retrospective
- "...positive-THC screen was associated with a decreased mortality in adult patients sustaining TBI."*

Nguyen BM, Kim D, Bricker S, Bongard F, Neville A, Putnam B, et al. Effect of marijuana use on outcomes in traumatic brain injury. The American surgeon. 2014;80(10):979-83.



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## PRACTICAL POINTS

- Risk / reward
- Standard warning about legality
- THC vs. CBD
- Methods of consumption
- Sport dynamics
- Test your outcomes
- Data is currently lacking



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## PRACTICAL POINTS: CBD

- Pros
  - May help inflammation and pain
  - Currently legal
  - TBI / Head trauma risk?
- Cons
  - Expensive (pro?)
  - Not much long term data
- Starting point
  - Mixed cannabinoids standardized to 18 mg
  - CBD → *highly theoretical*



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## SLIDES &amp; EXTRAS



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