

Leading the Science of Cannabis



Steep Hill, Inc. seeks to protect public health through the development of infrastructure and analytical services for legally-authorized cultivators, processors, distributors, retailers, and regulators of cannabis.

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Understanding the Science of Cannabis



Cannabinoids

Cannabinoids are chemical compounds found in cannabis plants.

They're a subset of the 80-100 terpenoid-derived molecules found in significant amounts only in cannabis. Thus, all cannabinoids are terpenoids, but not all terpenoids are cannabinoids. They all have similar structures, but have been shown to have very different effects. Cannabinoids, are found in highest concentrations within the trichomes (or resin glands) found predominately on the female flowers. Most cannabinoids are found in both acid and neutral forms, which have distinctive medical qualities about them.

Decarboxylation

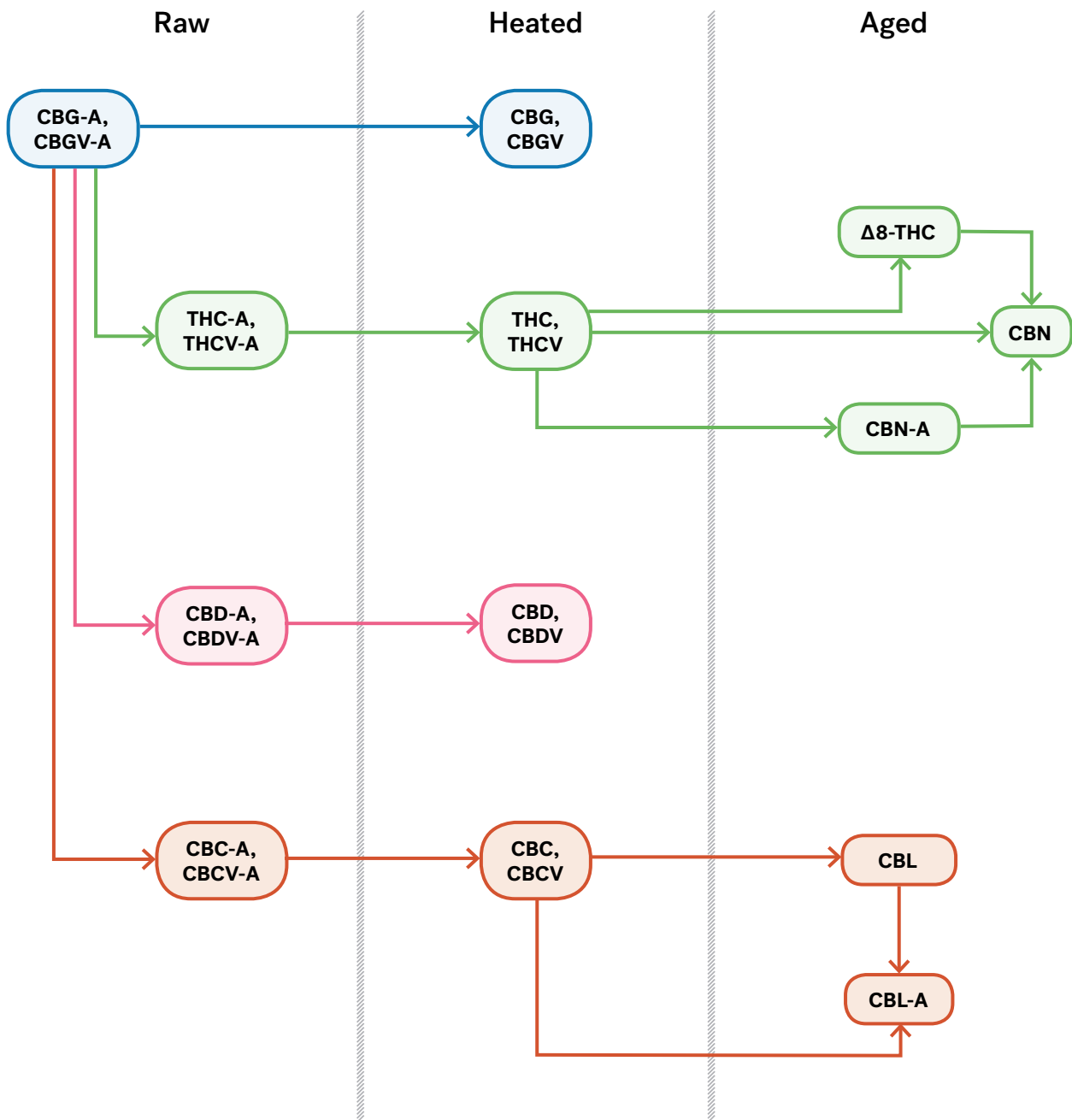
Decarboxylation is the conversion of a cannabinoid from acid form to neutral form, which occurs during heat exposure. For example, $\Delta 9$ -THC is the result of THC-A ('A' for acid) decarboxylating. The main difference between the acid and neutral forms of Tetrahydrocannabinol (THC) is that only $\Delta 9$ -THC causes the euphoric sensation associated with cannabis. THC-A, on the other hand, is not psychoactive! $\Delta 9$ -THC is the best way to measure a cannabis product's psychoactive potency, and a typical cannabis plant contains about 13% to 25%.

We Quantify 17 Cannabinoids

CBG-A	Cannabigerolic Acid
CBG	Cannabigerol
THC-A	Tetrahydrocannabinolic Acid
THC-C4	Tetrahydrocannabinol-C4
THCV-A	Tetrahydrocannabivarinic Acid
$\Delta 9$ -THC	Delta 9-Tetrahydrocannabinol
$\Delta 8$ -THC	Delta 8-Tetrahydrocannabinol
THCV	Tetrahydrocannabivarin
CBN-A	Cannabinolic Acid
CBN	Cannabinol
CBD-A	Cannabidiolic Acid
CBDV-A	Cannabidivarinic Acid
CBD	Cannabidiol
CBDV	Cannabidivarin
CBC-A	Cannabichromic Acid
CBC	Cannabichromene
CBL-A	Cannabicyclol Acid

Cannabinoid Synthesis

By simply applying heat or exposing cannabinoids to light and air there are a multitude of opportunities for other cannabinoids.



Therapeutic Properties of Cannabinoids

Each cannabinoid offers unique medical properties. Many of them have been observed in clinical settings.

Raw

CBG-A

analgesic
anti-inflammatory

THC-A

anti-cancer
anti-inflammatory
anti-spasmodic

CBD-A

anti-cancer
anti-inflammatory

CBC-A

anti-fungal
anti-inflammatory

CBGV-A, THCV-A, CBDV-A, CBCV-A

anti-inflammatory

CBG

analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bone stimulant

Heated

CBG

analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bone stimulant

THCV

anti-convulsive
anti-inflammatory
appetite suppressant
bone stimulant
neuroprotective

CBD

analgesic
anti-anxiety
anti-bacterial
anti-cancer
anti-convulsive
anti-depressant
anti-emetic
anti-inflammatory
anti-insomnia
anti-ischemic
anti-psychotic
bone stimulant
immunosuppressive
neuroprotective

Δ 9-THC

analgesic
anti-bacterial
anti-cancer
anti-inflammatory
anti-spasmodic
appetite stimulant
bronchodilator
neuroprotective

CBDV

anti-convulsive
bone stimulant

CBC

analgesic
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
anti-inflammatory
anti-insomnia
bone stimulant

Aged

Δ 8-THC

anti-anxiety
anti-emetic

CBN

analgesic
anti-bacterial
anti-convulsive
anti-inflammatory

CBL

unknown

CBL-A

anti-inflammatory

Terpenoids

Terpenoids are the compounds responsible for a plant's fragrance.

They are found within the resin glands (or trichomes). They interact with cannabinoids, called the 'entourage effect', which helps define a given strain's unique quality.

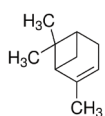
Mankind has been infatuated with terpenoids for thousands of years, enjoying the aromas and flavors in beer, candy, perfumes, fruits, incense and much more. In addition to the smells and tastes, we have continuously benefited from the diverse array of the medicinal and nutritional aspects found in terpenoids. Terpenoids likely make up the single largest family of chemical compounds available, from across the planet, to herbalists and apothecaries alike for use in compounding remedies and medicine.

We Quantify 10 Terpenoids

- Linalool
- Citronellol
- Caryophyllene Oxide
- Myrcene
- Terpinolene
- Limonene
- Alpha Pinene
- Alpha Humulene
- Beta Carophyllene
- Phytol



Therapeutic Properties of Terpenoids and their Associated Fragrance

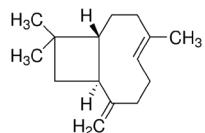


α-Pinene

anti-bacterial
anti-fungal
anti-inflammatory
bronchodilator



pine



β-Caryophyllene

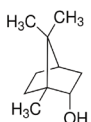
anti-bacterial
anti-cancer
anti-fungal
anti-inflammatory
anti-septic



black pepper



clove

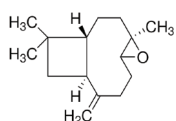


Borneol

analgesic
anti-insomnia
anti-septic
bronchodilator



camphor

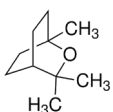


Caryophyllene oxide

anti-fungal
anti-ischemic



eucalyptus

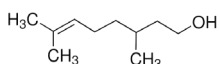


Cineol

anti-bacterial
anti-depressant
anti-inflammatory
anti-ischemic
bronchodilator



tea tree

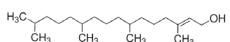


Citronellol

anti-cancer
anti-inflammatory
anti-insomnia
anti-spasmodic



rose

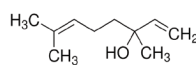


Phytol

anti-insomnia



green tea

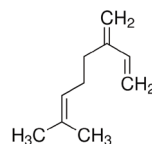


Linalool

anti-anxiety
anti-bacterial
anti-convulsive
anti-depressant
anti-insomnia



lavender

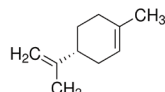


Humulene

anorectic
anti-cancer
anti-bacterial
anti-inflammatory



hops

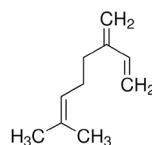


Limonene

anti-anxiety
anti-bacterial
anti-cancer
anti-depressant
anti-fungal
bronchodilator



citrus



Myrcene

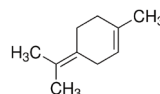
analgesic
anti-cancer
anti-inflammatory
anti-insomnia
anti-spasmodic



lemongrass



mango

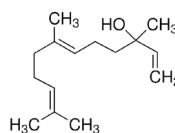


Terpinolene

anti-bacterial
anti-fungal
anti-insomnia
anti-septic



lilac



Nerolidol

anti-fungal
anti-insomnia



wood



citrus rind

Cannabis Contaminants

Potency is important, safety is our priority.



Residual Solvents

Residual Solvents are the leftover chemicals used to make various cannabinoid extracts. This method allows the lab to identify the extraction process and subsequent quality of any cannabis extract.



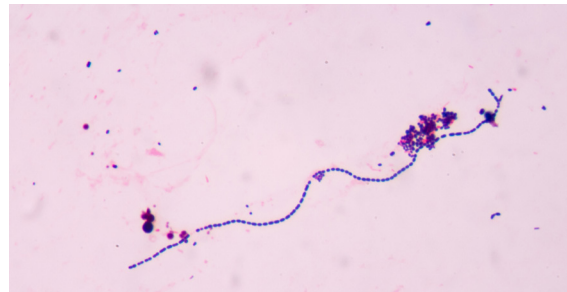
Pesticides

Pesticides are common in most agricultural settings. Cannabis is no different. Testing for these residues help protect the consumer from consuming hazardous chemicals like abamectin, bifentazate, and bifenthrin.



Mycotoxins

Mycotoxins are incredibly toxic by-products of some molds and fungi.



Microbes

Microbes are molds and bacteria that may pose a high risk to consumers (especially with suppressed immune systems.) The higher the concentration of these organisms, the greater the risk to consumers.

Types of Cannabis Products

Cannabinoids are infused into various consumer products.



Raw Flowers

Flowers are dried and cured female flowers cultivated from the cannabis plant. They contain cannabinoids in their acid forms, as well as a variety of terpenes.

Concentrates

Concentrates use solvents like Supercritical CO₂ or Nitrogen to extract the cannabinoids from the cannabis plant into a substance with substantially higher concentrations. While most raw flowers test below 20% THC, some concentrates contain over 80% THC. Concentrates contain cannabinoids (in their acid and decarboxylated forms) as well as some terpenes, depending on the type of extraction method used.

Edibles

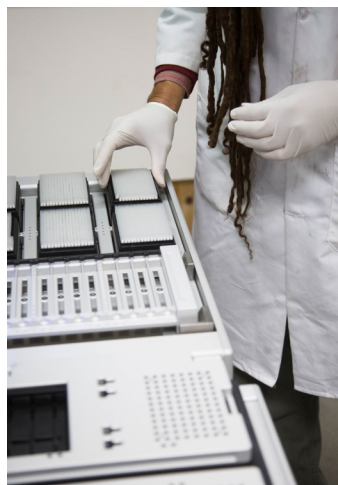
Edibles are food products infused with active cannabinoids, for example: they are available as baked goods, beverages, candy, and countless other items. Manufacturers usually make a cannabinoid extract using butter or a variety of oils, which they then use as an enhanced ingredient in their recipes.

Tinctures

Tinctures are infusions of alcohol, oil, or glycerin. They contain various levels of cannabinoid acids and their decarboxylated counterparts.

Steep Hill in the Lab

We are focused on measuring the purity and safety of all types of products containing active cannabinoids.



Testing & Analysis

We take the mystery out of medical cannabis through rigorous quality-standard protocols. We prove the safety, consistency, and potency of all cannabis products to bring guidance to distributors, cultivators, dispensaries, manufacturers, and consumers.

Genetic Services

Steep Hill offers genetic testing services to help our customers gain a better understanding of all aspects of cannabis genetics. We provide the cannabis industry, from growers and breeders to dispensaries and end users, with a suite of identification and diagnostic tools that help identify important genetic markers that can be used in breeding unique strains and in choosing the correct strain for medical purposes.

Consulting

We offer consulting services in the areas of cannabis safety, regulation, testing methodology, packaging including labeling, scientific development, processing and regulatory management.



Express Potency

Instead of waiting days for a full Cannabinoid potency, Steep Hill Express reports on THC-A, $\Delta 9$ -THC, CBD-A, and CBD in under 60 seconds.

Accurate Reporting

Steep Hill Express used our extensive knowledge from testing over 100,000 Cannabis samples using High Performance Liquid Chromatography to develop our Near-Infrared instruments.

Walk Away with Your Sample

Once your sample is ground and scanned for Express Potency you get to walk away with it, ready to roll and enjoy!

Cost Efficient

We're utilizing a test methodology that allows us to eliminate chemicals and decrease labor cost allowing us to put that money back in your pocket.

Steep Hill Express was selected for the 2016 Nor-Cal High Times Cannabis Cup. Quick results are essential with a tight deadline and accuracy matters when you're choosing the next winner!

Phenosight™

Our suite of genetic tests are designed to quicken breeding schedules, enhance efficiencies, and increase productivity.

Help Navigate the Patent Process

Curious about patenting your strain? We can help you succeed in applying for it.

Identify Unique Traits

Interested a special phenotype? We can measure its genetic identity.

Chemical Profiling

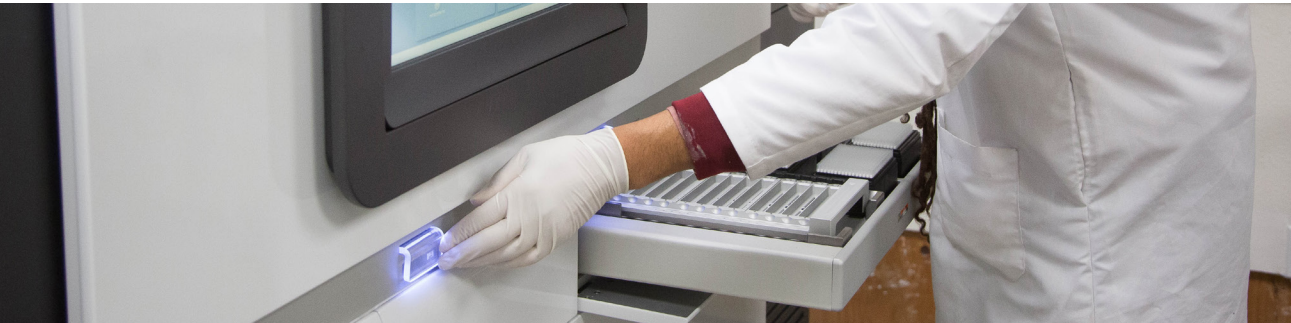
Chemistry can help you understand the real-world implications of certain genes.

Custom Genetic Marker Analysis

Pursuing a specific trait? We can help you find genetic indicators for it.

Breeding Program Refinement

Our scientists are available for private consulting to help you increase the productivity and efficiency of your breeding program using our proprietary methods, tests, and systems.



Are You Hunting for CBD?

Samples submitted via GenKit™ may also be tested for CBD markers upon request.

Steep Hill in the Field



Steep Hill is an innovative research and development lab that generates highly-differentiated products.

In addition to our lab-testing services, we have been providing ground-breaking solutions to businesses and consumers in the cannabis industry since 2008.

QuantaCann2™

QuantaCann2™ produces laboratory-grade THC-A, D9THC, CBD, CBD-A, and moisture levels for cannabis flower and leaf samples from any location in the world (with an internet connection) in under sixty seconds.

GenKit™

Using proprietary techniques and technology, Steep Hill scientists are able to swiftly and efficiently identify the males in any grow. We provide cultivators with plant sex identification within days to eliminate males from their gardens.

Strain Fingerprint™

Values and graphics are produced using cluster analysis of samples tested at Steep Hill, resulting in a composite average chemical makeup and unique strain-identifying iconography. Ranges take into account standard deviation to provide the most accurate models possible.

About Steep Hill



Founded in California in 2008, Steep Hill, Inc. is a science and technology firm that has become the industry leader in cannabis testing and analytics.

With labs in six states and a joint venture with the University of Technology in Jamaica, Steep Hill is the largest cannabis lab network in the world.

The company pioneered the first medical cannabis potency and micro-biological contaminants testing methodology for use in California—the first state to legalize medical cannabis. Steep Hill has since developed a variety of revolutionary cannabis testing products, including QuantaCann™, QuantaCann2™ and GenKit™. Steep Hill provides expert consulting services to many states, countries and municipalities, and the company is developing proprietary genetic testing, mapping and trademark protection services for the industry as well.

January 2008 Steep Hill opens the first Cannabis analytical lab in the U.S.	June 2008 Steep Hill markets first marijuana potency test in California.	March 2009 Steep Hill Identifies first high-CBD strain in CA medical marijuana supply.	April 2013 Steep Hill hired by WA for regulatory consultation and method evaluation.	February 2014 Steep Hill licensee opens in CO for Amendment 64 regulatory testing.
March 2011 Steep Hill develops QuantaCann™, the first remote instant on-site potency test.	October 2008 Steep Hill creates first microbiological safety screen for cannabis.	June 2013 Steep Hill merges with Halent Scientific.		



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November 2014
 Steep Hill and UTech
 Jamaica sign MoU opening
 3-year partnership.

April 2015
 QuantaCann2™ featured in
 CSI Las Vegas.

September 2015
 Steep Hill forms Genetic
 Research Alliance with
 University of Colorado.

March 2014
 Steep Hill opens lab in
 Washington state for
 I-502 regulatory testing.

February 2015
 Steep Hill announces GenKit™
 revolutionary new sex test for
 Cannabis breeders and growers.

June 2015
 Steep Hill presents to CA Lt.
 Governor Newsom's Blue
 Ribbon Commission.

November 2015
 Steep Hill's QuantaCann2™ is the official
 testing equipment for the High Times
 World Cannabis Cup in Jamaica.

References

Talking terpenes

Lee, Matrin A.
High Times, May 2013.

Aroma therapy

Gardner, Fred
Medical Marijuana, 2012, Spring: 29-34.

Naturally occurring anxiolytic substances from aromatic plants and genus citrus

Pimenta, Flávia Cristina Fernandes, et al
Journal of Medicinal Plants Research, 2012, 6(3): 342-347.

Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects.

Russo, Ethan B.
British Journal of Pharmacology, 2011, 163; 1344-1364.

Importance of terpenes

Spaulding, Nathan

Cannabis Review

Hazekamp, Amo
Department of Plant Metabolomics Leiden University, 2008-2009.

Non-psychoactive plant cannabinoids: new therapeutic opportunities from an ancient herb

Izzo, Angelo A, et al
Trends in Pharmacological Sciences, 2009, 30(10)

The diverse CB1 and CB2 receptor pharmacology of three plant cannabinoids: Δ9-tetrahydrocannabinol, cannabidiol, and Δ9-tetrahydrocannabivarin

Pertwee, RG
British Journal of Pharmacology, 2008.

D-Limonene: safety and clinical applications

Sun, Jidong
Alternative Medicine Review, 2007, 12(3): 259-264.

A multicenter dose-escalation study of the analgesic and adverse effects of an oral cannabis (cannador) for postoperative pain management

Holdcroft, Antita, et al
Anesthesiology, 2006, 104 (5):1030-1046.

Immunomodulatory and therapeutic properties of the Nigella sativa L. seed

Salem, Mohammed Labib
International Immunopharmacology, 2005, 5: 1749-1770.

Antileishmanial activity of the terpene nerolidol

Amud, Denise C, et al
Antimicrobial Agents and Chemotherapy, 2005, 49(5): 1679-1687.

Transdermal delivery of zidovudine: effect of terpenes and their mechanism of action

Narishetty, Sunil Thomas Kumar, et al
Journal of Controlled Release, 2004, 95: 367-379.

The inheritance of chemical phenotype in cannabis sativa L.

Meijer, Etienne PM de
Genetics, 2003, 163: 335-346.

Chronic conditions treated with cannabis. Encountered between 1990-2004. "Dr. Tod's List"

Mikuriya, Tod H.
2004.

Pharmacological actions and the therapeutic uses of cannabis and cannabinoids

Kumar, RN, et al
Anaesthesia, 2001, 56: 1059-1060.

Cannabis and cannabis extracts: greater than the sum of their parts?

McPartland, John et al
Hayworth Press, 2001.

Cannabinoids in clinical practice

Williamson, Elizabeth et al
Drugs, 2000 December.

Photography

Elizabeth Peace Photography

Pages 6, 9, 11, and 13.



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