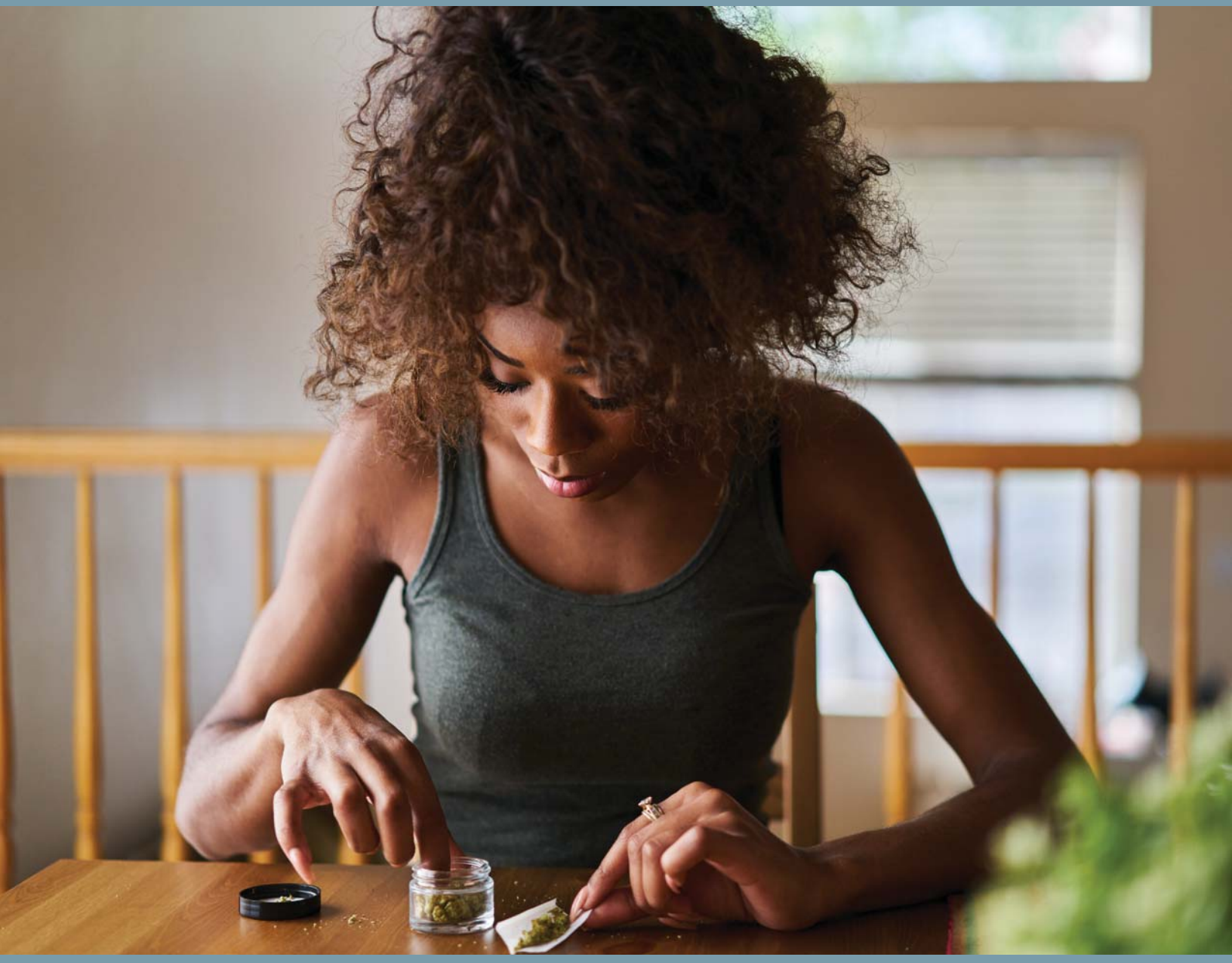
empower
GENOMICS

CANNABIS REPORT



Sample Report

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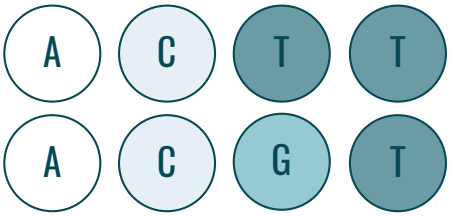
BASICS OF BIOLOGY

To get the most of of this report it will be helpful to understand some commonly used terms in biology. Please take a minute to read this section before moving on to the rest of your report!

There are four letters to your genetic code: A, T, C, and G. These letters are often called alleles.

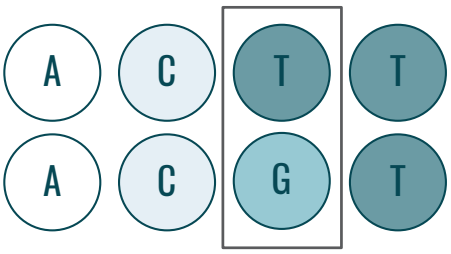
You have two copies of your genetic code, one from your mom and another from your dad.



Copy from Mom

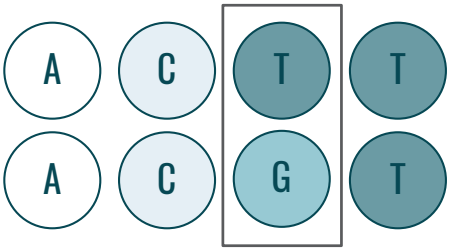
Copy from Dad

Changes in your genetic code are called “SNP.” The sequence of genetic code at a SNP is called a “genotype.”



C/T genotype

SNPs are always named with a number that begins with “rs.”



C/T genotype at SNP rs1234

ABOUT CANNABIS

Effects of THC and CBD

The two predominant cannabinoids in the cannabis plant are tetrahydrocannabinol (THC) and cannabidiol (CBD). THC has traditionally been the better known compound as it is responsible for the psychoactive effects of cannabis. Simply put, THC gives you the *high* that is associated with marijuana. However, CBD has recently been gaining popularity due to its medical benefits, legality, and lack of psychoactive effects. This is not to say that THC does not have its own host of medical benefits, which are relatively similar to those of CBD as outlined in the following table:

Characteristic	CBD	THC
Illegal	No	Yes
Psychoactive	No	Yes
Interacts with Endocannabinoid System	Yes	Yes
Side Effects	Rarely	Likely
Pain Reliever[71]	Yes	Yes
Reduces Nausea[74]	Yes	Yes
Increases Appetite	No	Yes
Helps Insomnia[72]	Yes	Yes
Eases Depression	Yes	No
Anti-Inflammatory[71]	Yes	Yes
Decreases Seizures	Yes	No
Helps with Psychosis[73]	Yes	No

ABOUT CANNABIS

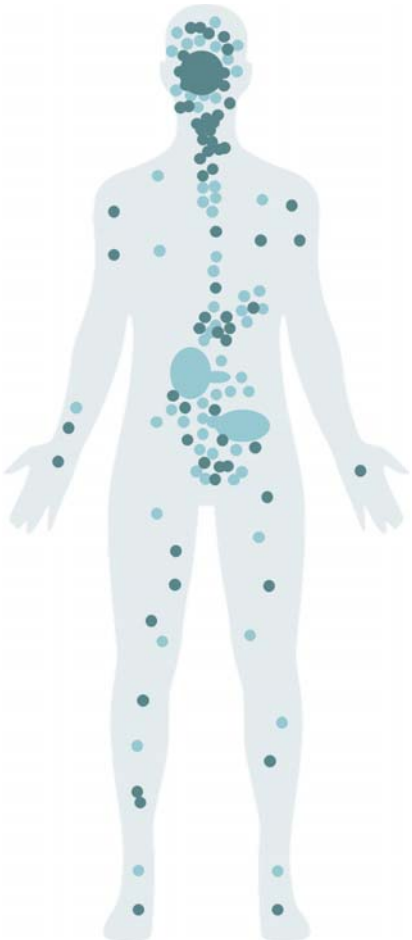
The Endocannabinoid System in Humans

Broadly speaking, **cannabinoids** are a diverse class of both synthetic and naturally-occurring chemical compounds. Most people are aware that the cannabis plant produces a wide variety of cannabinoids, but many people are surprised to learn that the human body actually produces its own cannabinoids and relies on them for a number of different cellular and neurological functions. Cannabinoids that are produced within the human body are referred to as **endocannabinoids** and the complex framework of receptors and neurotransmitters in the body is referred to as the **endocannabinoid system (ECS)**. Cannabinoids that are produced by plants are broadly referred to as **phytocannabinoids**.

The full role of the human ECS is still an area of active research. However, it is clear that the ECS is involved in a wide variety of physiological functions and cognitive processes, including:

- Memory
- Sleep
- Reproduction
- Mood
- Appetite

The diversity of functions is due to the fact that components of the ECS are found all throughout the body. The backbone of the human ECS are endocannabinoid receptors **CB1** and **CB2**. These two proteins may be thought of as a sort of gate for the effects of cannabinoids in the human body. When cannabinoids bind to these receptors, they trigger a complex cascade of cellular events that influence physiological and cognitive processes. Our endocannabinoid system largely acts to help our bodies maintain homeostasis, or a state of balance. Phytocannabinoids, such as those from marijuana, can interact with our body to influence a wide variety of cognitive and physiological processes. THC is known to interact predominantly with CB1 in the central nervous system, which likely explains the psychoactive effects associated with THC.



CB1

Cognitive Functions
Motor Skills
Appetite
Memory
Pain Perception

CB2

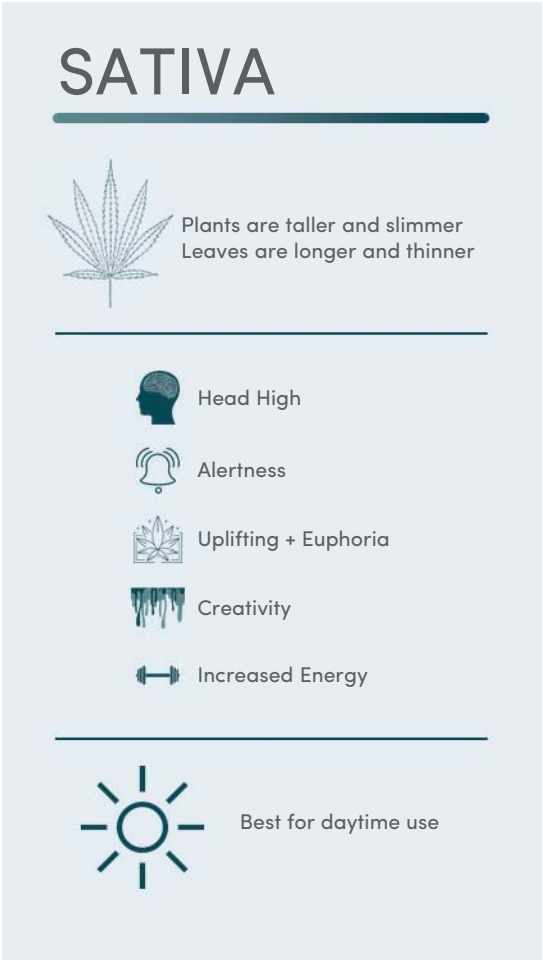
Digestive Organs
Skeletal System
Respiration
Skin
Cardiovascular System
Immune System

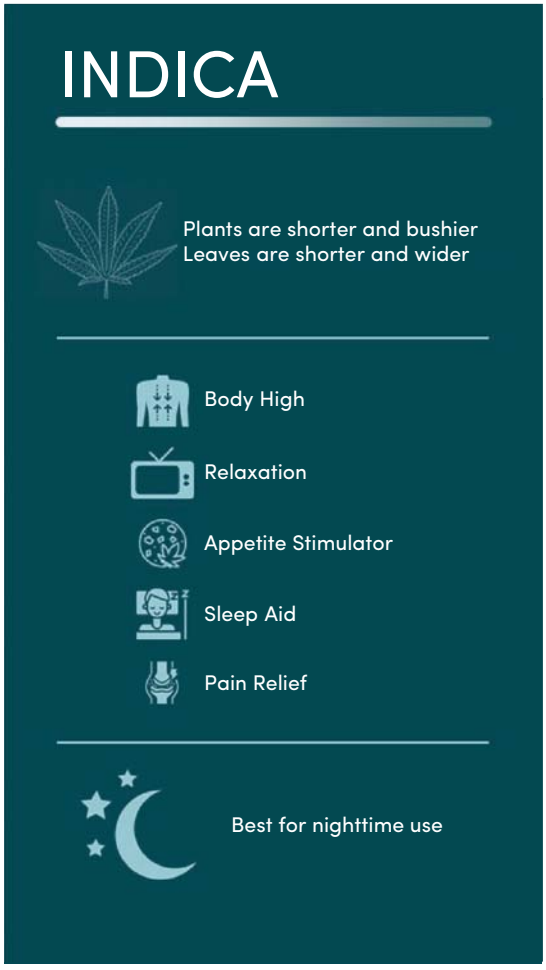
ABOUT CANNABIS

Types of Cannabis – *C. indica* vs. *C. sativa*

When it comes to selecting a strain of cannabis there are lots of options. The world of marijuana strains is a confusing one. Due to a lack of a standardized naming or classification system, the variance and nomenclature of cannabis strains is considerable. Even popular strains such as "Pineapple Express" and "White Widow" are known to be wildly different from dispensary to dispensary. Given this, the content of this report will focus on selecting cannabis strains based on more general characteristics.

The first major consideration when selecting a cannabis product is the species of the plant. There are two major species of the genus *Cannabis: Cannabis sativa* and *Cannabis indica*. Generally speaking, sativa species are known for having a higher THC content as compared to CBD, while indica species have a more balanced THC to CBD ratio. This difference in cannabinoid profile produces distinct effects outlined in the table below:



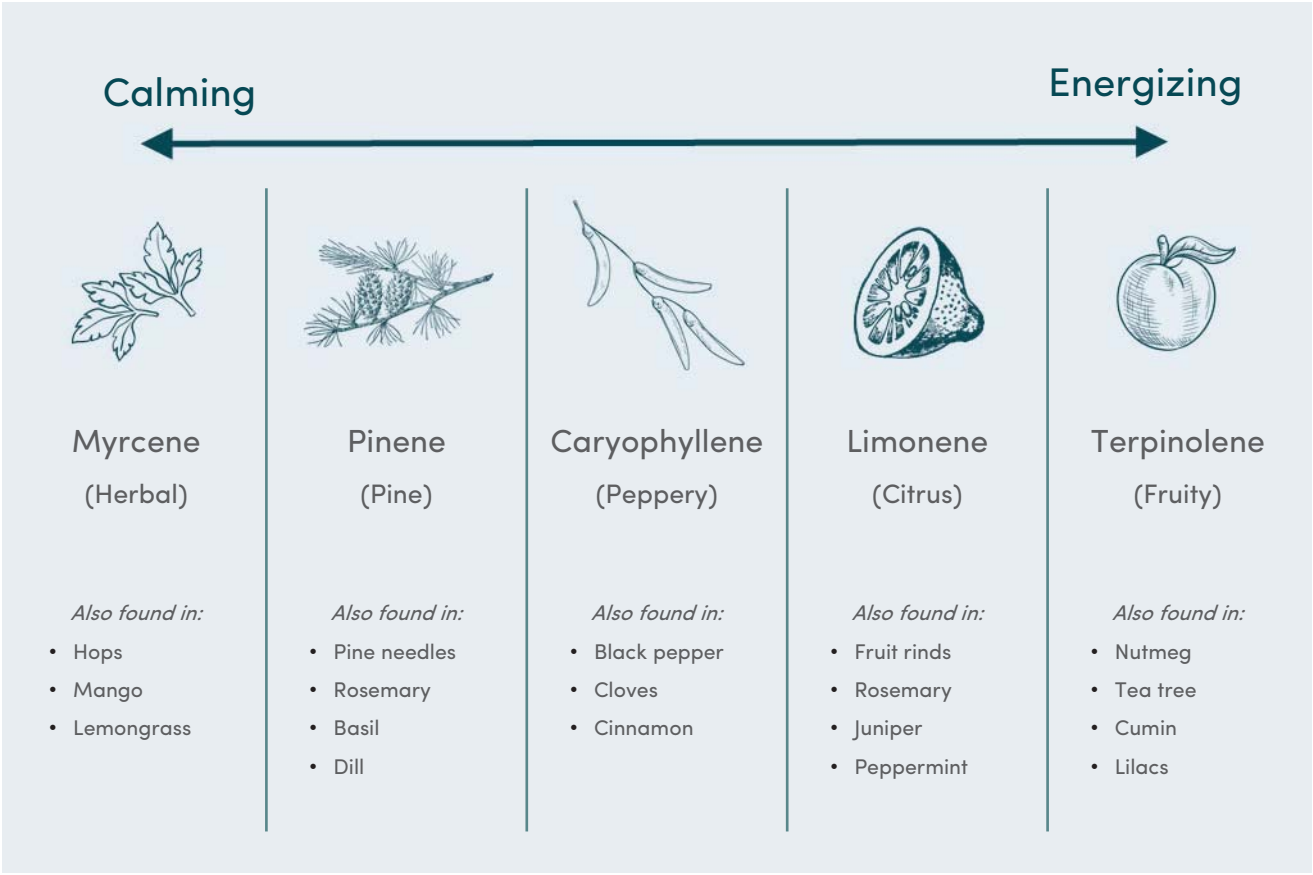


This being said, there is still considerable variance among Cannabis strains of the same species. We feel the best approach is to select a strain that has a known THC to CBD ratio, as the ratio of cannabinoids is ultimately what determines the effects. Reputable dispensaries will be able to provide this information for any cannabis product, whether it be dried flowers, edibles, oils, or tinctures.

ABOUT CANNABIS

Terpenes

Another consideration when selecting a cannabis strain is the terpene profile of the plant. Simply put, terpenes are aromatic oils that are secreted by a plant. Most plants produce a wide variety of terpenes for the dual purposes of attracting pollinators while deterring pests and herbivores. There are a tremendous variety of terpenes, with the cannabis plant capable of producing over 100 different varieties. Despite this complexity, there are major terpenes that are almost universally recognizable. The table below describes some of the most well-known terpenes:



There is a limited body of evidence suggesting that terpenes have their own therapeutic properties. Terpenes such as Myrcene are thought to promote relaxation and relieve stress while those found in citrus fruits are thought to be more energizing. Whether or not there is any therapeutic benefit to terpenes, they can significantly alter the taste and smell of cannabis products. If you are someone who enjoys the subtle differences in wine or the complexity of a well-seasoned dish, then you will likely appreciate the impact of terpenes on cannabis. This report will make general terpene recommendations, but these should always be factored into a decision only after the correct THC to CBD ratio is determined.

ABOUT CANNABIS

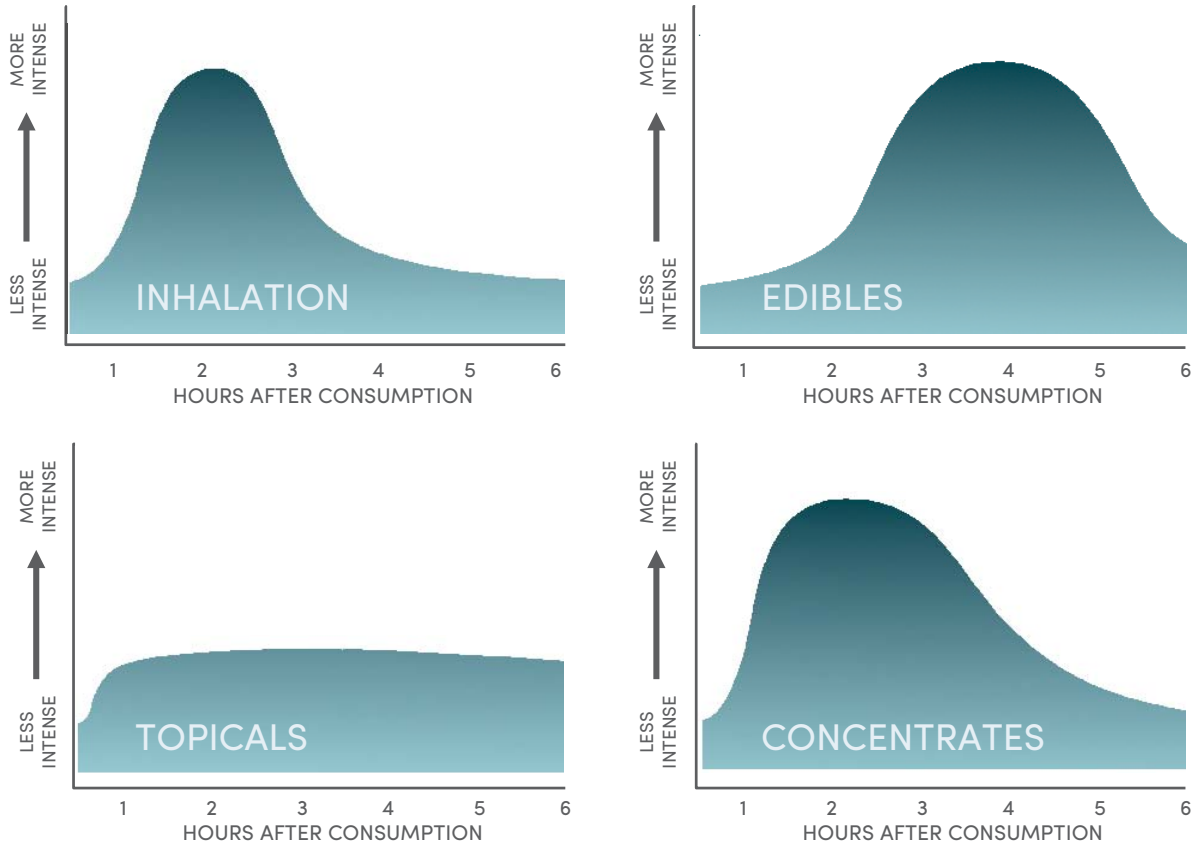
Dosing

The overall goal of this report is to provide the user with the information required to make the correct dosing decision. Selecting the correct dose of cannabis is one of the biggest challenges in using the product, especially for beginning users. This difficulty is due to a number of different factors, including variability between strains, various methods of consumption, level of desired effect, and large differences in CBD and THC metabolism. Your own genetics play a pivotal role in dosing, as many people metabolize CBD and THC much faster or much slower than average. Please see the CBD and THC metabolism traits for specific information regarding your genetic profile.

Genetics aside, there are some universal considerations that should be taken into account with any cannabis dose. The first of these is the manner in which you consume a cannabis product. There are now many different ways to consume cannabis, but they can all be grouped into the following categories:

- Inhalation (smoking dried marijuana flowers, vaporizers, oils)
- Edibles (gummies, baked goods, tablets)
- Topicals (lotions and lubricants)
- Concentrates (tinctures, resin, hash, wax)

As you can see in the graphs below, the intensity and duration of the effects from cannabis are highly dependent on the method of ingestion. Those who are trying to avoid acute psychoactive experiences should avoid inhalation-based methods and concentrates, while those who are looking for extended duration effects should consider an edible or topical form of cannabis.



Another important consideration is the degree of psychoactive effect that you wish and/or are comfortable experiencing. Those who are trying to avoid a significant psychoactive effect should consider a CBD-only preparation or a product with a very high CBD:THC ratio. Those who are comfortable with or are actively seeking the psychoactive effects of cannabis still have a wide dosing range to choose from. Dosing guidelines can be found at the end of this report.

ABOUT CANNABIS

Side Effects and Other Considerations

As with any medicine, there are potential side effects to using cannabis that should be understood prior to use. Generally speaking, cannabis is very well-tolerated by people, especially CBD. The majority of common side effects results from the use of high-THC strains. Cannabis products are generally seen as a relatively safe substance, but due to the drug's long history of illegality, limited long term studies have been conducted. We feel that the best approach, as with most things in life, is moderation.

Common Side Effects

- Paranoia and anxiety
- Dry mouth
- Red eyes
- Extreme hunger
- Lethargy
- Impaired memory
- Addiction and dependence
- Potential for lung damage
- Potential drug interactions

Combatting a Cannabis High that is Too Intense

Despite the best laid plans, cannabis users sometimes find that they have ingested too much and have become uncomfortable with the psychoactive effects. While this can be very uncomfortable, it is important to remember a few key points that will calm your nerves.

Don't Panic

No one has ever died from consuming too much cannabis. Remember that these feelings will eventually pass. Consult your physician if you are having symptoms of a panic attack.

Distract Yourself

Watch a show, listen to some music, talk to a friend. Focus your mind on something else.

Try to Sleep

While often easier said than done, sleeping is often the best way to get through an uncomfortable high.

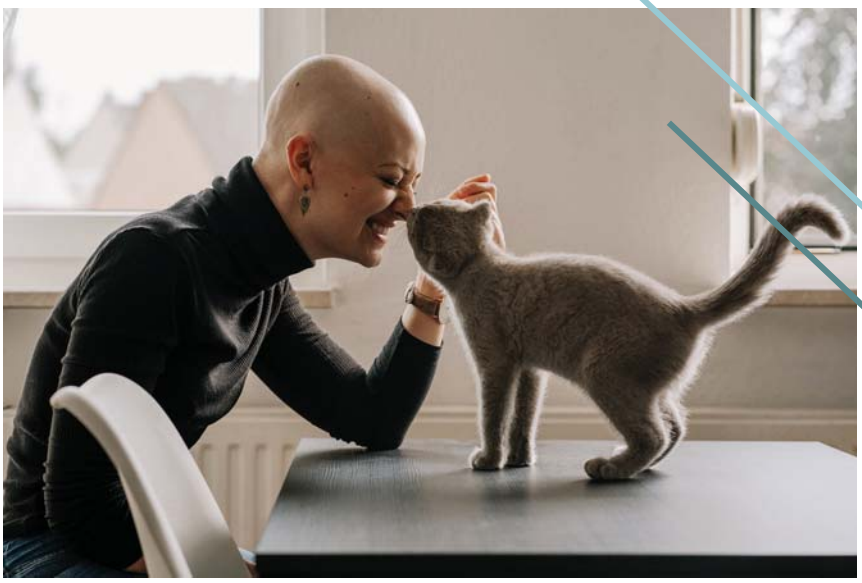
Get Some Exercise

While this may seem unappealing, some fresh air, a change of scenery, and a little exercise often goes a long way in improving an overly intense cannabis high.

Diet and Hydration

Be sure to stay hydrated and try some light snacks. Avoid caffeine, alcohol, and overly sugary foods. Some people swear by smelling and/or chewing on black peppercorns to help shift your attention from an intense high.

PAIN MANAGEMENT



YOUR RESULTS

Pain Threshold -
Typical Sensitivity

Inflammation -
Average

Medicinal use of cannabis has been focused on pain relief for millennia. The oldest known use of cannabis for medicinal purposes was in China around 2900 BCE and it was used throughout the ancient world for a variety of symptoms, including pain relief.[1] However, it wasn't introduced to Western medicine until the mid-nineteenth century, after which point it was relatively common until the US passed the Marihuana Tax Act in 1937, prohibiting the possession of marijuana.[2] It wasn't until 1996, when California legalized medical marijuana, that the modern push to legalize marijuana began, and has been further strengthened by the opioid crisis that began in the early 2000's.

Effectively managing pain is a complex task, made more difficult by the number of treatments available and the fact that ultimately, pain is a subjective experience that a physician can't objectively measure.

A doctor relies on their patient to tell them how severe their pain is, and that helps determine the treatment course. Typically, a more mild analgesic is prescribed for mild pain, while more severe and chronic pain can be treated with opioids. However, opioid use has been shown to have numerous severe drawbacks, such as the potential for addiction and abuse which often leads to fatal overdoses, so many patients are looking into medical marijuana as an alternative for long-term pain management. In fact, chronic pain is the most common reason patients turn to medical marijuana. A study on the medical marijuana market in Colorado, one of the states where both medical and recreational marijuana is legal, found that 94% of patients with medical marijuana cards listed "severe pain" as one of their qualifying medical conditions.[3] The most comprehensive governmental review of the current research on medicinal cannabis use found substantial evidence that cannabis is an effective treatment for chronic pain in adults.[4] There is also evidence that legalization of medical cannabis results in a decrease in opioid prescriptions as well as a reduction in the opioid overdose mortality rate.[5]

The traits in this section detail how your body deals with pain. If you find your pain is interfering with your daily life, speak to your physician.

PAIN THRESHOLD

YOUR RESULT:

Typical Sensitivity

Based on your COMT profile, you probably experience a typical sensitivity to pain.

GENE	SNP	YOUR GENOTYPE
COMT	rs6269	AA
COMT	rs4633	TT
COMT	rs4680	AA

Everyone experiences pain a little differently. Some people may have no trouble sitting still for an elaborate tattoo, while others may find tears in their eyes after stubbing their toe. Having a low pain tolerance may seem like a bad thing but pain is an important message our bodies send to our brains. Pain is our body's way of telling us: "Hey, something is wrong!" If you aren't getting as many of these signals, or your brain has gotten used to ignoring these signals, you may be at higher risk of injury or disease. At the opposite end of the spectrum are those that suffer from chronic pain or have unusual pain sensitivities, which not only interfere with your daily life but can be extremely debilitating.

There are many factors that contribute to an individual's pain tolerance including biological, environmental, emotional, and social factors. Past experiences, including conditioning, trauma, or previous diseases or injuries, can impact our perception of pain as well. In addition, scientists are discovering that there are genetic factors that influence our pain tolerance. The *COMT* gene codes an enzyme responsible for breaking down catecholamines like dopamine, epinephrine, and norepinephrine. Studies have found that mutations within this gene can result in either a lower or higher than average pain sensitivity.[6]

INFLAMMATION

YOUR RESULT:

Average

Your results indicate that you have average levels of C-Reactive Protein (CRP) which should not result in atypical inflammation.

GENE	SNP	YOUR GENOTYPE
CRP	rs2794520	AA
CRP	rs12093699	AG
TNF	rs1800629	AA
IL1B	rs16944	AG
TNF	rs361525	GG
HNF1A	rs7953249	AA
HNF1A	rs735396	TT

Inflammation is a natural process in which the body increases blood flow to areas that have been injured in order to repair them. It's a chain reaction that starts when white blood cells recognize injury or infection and release chemicals that continue the inflammation process, triggering other chemicals and proteins that direct the process of repairing the injury or fighting the infection.

Part of this process is the release of c-reactive protein, or CRP, which is often used as a measurement of overall inflammation. Most people's baseline CRP levels are relatively low, with some variation among individuals due to a variety of factors including genetics.[7–9] Other inflammatory proteins include TNF-α and IL-1β, signaling proteins that are most abundant when you're fighting off an infection.[10–13]

Common symptoms of inflammation include, pain, swelling, redness, stiffness, immobility and heat.

SLEEP

YOUR RESULTS

Sleep Duration -
Average Sleep

Sleep Quality -
Normal Sleep Patterns

Insomnia -
Average

Sleep is a universal experience and a biological necessity, but scientists aren't totally sure why we need sleep. While most biological processes slow down when we sleep, a few are actually increased: the release of growth hormones, some digestion activities, and cell repair and growth. This suggests that sleep plays an important role in these physical processes.[14]

We also know that sleep is important for psychological processes because sleep deprivation can have psychological effects like slower reaction times and impaired judgement, attention, and decision making, which can increase the possibility of workplace errors and accidents. Insufficient sleep has been implicated in serious disasters like the 1979 Three Mile Island nuclear disaster, the 1986 Chernobyl nuclear disaster, the 1986 Challenger explosion, and the 1989 Exxon Valdez oil spill. Sleep deprivation is also believed to be a factor in an average of 72,000 vehicle crashes in the US each year.[15]

Numerous factors affect both the quantity and quality of sleep, including the genetic traits we explore in this section. One of the biggest factors is age, but things like how active we are, our work or school schedule, and what foods we eat or medication we take can all impact our sleeping habits. Due to the relaxing effects of cannabis, many patients who have trouble falling asleep or staying asleep have turned to cannabis for help. Research has shown that cannabinoids can be effective in treating insomnia that arises due to other conditions, such as chronic pain, anxiety, PTSD, or sleep apnea, because cannabis can be effective in treating that underlying condition.[4,16]

SLEEP DURATION

YOUR RESULT:

Average Sleep

No known genetic variants are present that influence your duration of sleep. However, if you have one or more "G" alleles at rs228697 you may be genetically prone to staying up late.

GENE	SNP	YOUR GENOTYPE
BHLHE41	rs121912617	GG
ABCC9	rs11046205	GG
PER3	rs228697	CC

The amount of sleep you get each night can vary widely, but studies have shown there is a genetic component to your average sleep duration.[17–19] If you are genetically prone to a shorter average sleep duration and feel like you aren't getting enough sleep at night, you can employ good sleep hygiene practices like limiting your daytime naps, avoiding caffeine and nicotine, limiting your alcohol intake in the evenings, getting lots of sunlight during the day, and limiting your nighttime exposure to the blue light of electronic screens like your phone, TV, or computer.

SLEEP QUALITY

YOUR RESULT:

Normal Sleep Patterns

Individuals with your genotype are likely to experience typical energy levels in the evening and follow an average sleep pattern.

GENE	SNP	YOUR GENOTYPE
TMEM165	rs1801260	AA

The quality of your sleep can have many different effects throughout your body. The most notable areas of impact include muscle building, muscle recovery, appetite, weight loss, overall physical performance, learning, memory, and other cognitive functions. Sleep is generally regulated by a process known as the Circadian rhythm, better known as your internal clock. By testing your Circadian Locomotor Output Cycles Kaput (*CLOCK*) gene, your results can indicate whether or not you carry any genetic variants that could disturb your circadian rhythm.[20] These results can also help explain whether or not someone might be a night owl or a morning person.

INSOMNIA

YOUR RESULT:

Average

You have decreased chances of experiencing insomnia. Nevertheless, if you are having trouble sleeping try a THC-dominant edible form of cannabis to help you go to sleep and stay asleep longer.

GENE	SNP	YOUR GENOTYPE
MEIS1	rs113851554	GG
Intergenic	rs147549871	TT
SCFD2	rs574753165	GG
DCT-2535I10.1	rs34670506	TT
NTF3	rs7138947	CC
WDR27	rs13192566	CG
Intergenic	rs71554396	ID

Fatigue, low energy, difficulty concentrating, mood disturbances, and decreased performance at work or school are all symptoms of insomnia. Most of us experience acute (short-term) insomnia from time to time, usually due to circumstances in our daily lives like stress or anxiety over work, school, or relationships. Chronic insomnia, however, is a long-term pattern of insufficient sleep that occurs at least three nights a week over at least three months.

There are a number of medical issues that can cause insomnia, such as allergies, acid reflux, chronic pain, or neurological conditions like Parkinson's. Insomnia can also be a symptom of psychiatric conditions such as depression, anxiety, or PTSD (post-traumatic stress disorder). Additionally, insomnia can be a side effect of many medications like allergy medication, blood pressure medication, or antidepressants.

Studies have identified several genetic variants that are linked to higher rates of insomnia.[21,22] If you're suffering from insomnia, it's always a good idea to speak to a medical professional to make sure there is no underlying medical condition that could be causing it.

SIDE EFFECTS

YOUR RESULTS

Memory Impairment-
Less Likely

Cannabis Dependence -
Average Risk

Psychosis of Marijuana -
Decreased Risk

There are a number of side effects that many people experience when using cannabis. These include relatively benign effects like dry mouth, red eyes, hunger, or lethargy. More severe side effects can include paranoia, addiction, the potential for lung damage if smoking, and the potential for interactions when taking other drugs or medication while using cannabis. Due to cannabis's effects on the brain, especially on the developing brains of adolescents, cannabis use can have both short and long-term effects on mood, memory, attention, and learning.[23] However, much more research needs to be done to determine how this is happening.

Many factors influence the possible side effects a person can experience when using cannabis. The traits in this section look at how your genetics impact a few possible side effects.

MEMORY IMPAIRMENT

YOUR RESULT:

Less Likely

You are less likely to experince symptoms of working memory impairment, meaning that your short term memory and informational processing skills should not be degraded when using cannabis.

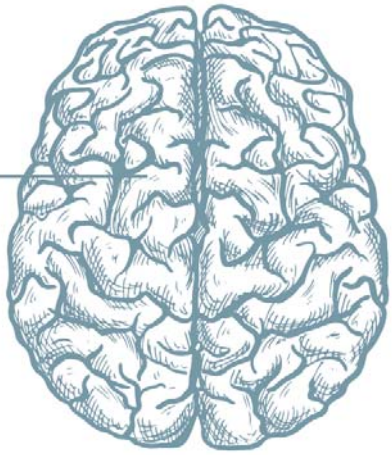
GENE	SNP	YOUR GENOTYPE
COMT	rs4680	AA

While our memories may seem to be an intangible part of our mind, they are actually wholly biological. When memories are formed, neurons initiate protein synthesis that creates a chain reaction of molecules that create, strengthen, or remodel neuronal networks within the hippocampus and between the hippocampus and the cortex.[24,25] This process is called encoding. The patterns of connectivity within those neuronal networks are how memories are then retrieved by the cortex.

Based on this biological understanding of memory, it's no surprise that our genetics play a large role in how well we can remember things.[26,27] But there are several steps we can take to improve our recall abilities. Like many cognitive functions, memory is greatly affected by both exercise and sleep. Mild cardiovascular exercise has been shown to improve study participants' performance on both short-term and long-term memory tasks.[28,29] Sleep is believed to be necessary for a memory process called consolidation, which is when your short-term memories become long-term memories.[30] Numerous studies have confirmed that being well-rested improves recall ability.[31–34] Additionally, preliminary research suggests that regular yoga practice can improve memory.[35]

Cannabis use is well-known to produce short-term memory impairments that resolve once cannabis use is stopped. However, more research is showing that chronic cannabis use, especially in strains high in THC, can result in these impairments becoming more long-lasting.[36]

Hippocampus
A structure in your brain that has been associated with various memory functions.



CANNABIS DEPENDENCE

YOUR RESULT:

Average Risk

You have average chances of developing a dependence to cannabis. Take regular breaks inbetween administrations to reduce the possibility of dependence.

GENE	SNP	YOUR GENOTYPE
CNR1	rs6454674	TT
FAAH	rs324420	AC
CNR1	rs806368	TT
CNR1	rs2023239	TT
DRD2	rs1076560	CC
Intergenic	rs10969106	GG
RP11-206M11.7	rs143244591	GG
ABCB1	rs1045642	AG

Cannabis is the most commonly used illegal substance, both in the United States and globally.[37] A common misconception is that marijuana is not addictive, however chronic cannabis use can result in both tolerance (needing more of a substance to feel the same effects) and dependence (experiencing withdrawal symptoms when users don't use the substance), both classic signs of addiction.[38]

In fact, chronic marijuana use has been shown to downregulate cannabinoid receptors in the brain.[39] These receptors are what THC acts on to produce the high when using marijuana, but they're also part of the natural function of our brain by playing a role in regulating the release of neurotransmitters in response to endocannabinoids, naturally occurring molecules in our brain that trigger cannabinoid receptors.[40] Both endocannabinoids and THC trigger these receptors to elicit the release of neurotransmitters like dopamine, but overuse of marijuana results in these receptors being less effective, so not only does it take more marijuana for a user to feel high, the brain's normal level of endocannabinoids isn't resulting in the same level of dopamine release, leading to changes in mood and behavior.[38]

While this is a relatively new area of research, several genes have been shown to be associated with cannabis dependence. The gene *CNR1* codes for one of the cannabinoid receptors, CB1, and has been linked with higher risk for cannabis dependence.[41] Another gene, *ABCB1*, is involved in transporting molecules across the blood-brain barrier and has been implicated in drug resistance.[42]

If you or a loved one is struggling with cannabis use, you should speak with your doctor because there are many available treatment options.

PSYCHOSIS FROM MARIJUANA

YOUR RESULT:

Decreased Risk

You have decreased chances of developing a psychiatric disorder as a result of habitual cannabis use. Consider refraining from everyday use to further reduce this risk.

GENE	SNP	YOUR GENOTYPE
COMT	rs4680	AA
AKT1	rs2494732	TT
DRD2	rs1076560	CC
CNR1	rs12720071	TT

The vast majority of cannabis users do not experience psychosis as a side effect, but the fact remains that some do. While research is still being done trying to find the cause, an association has been found between cannabis use and the development of schizophrenia later in life in a small percentage of individuals.[43]

A number of genes have been examined to determine if this link may be genetic, and evidence suggests that it might be. These genes include *COMT*,[44] which is related to other psychotic disorders; *AKT1*,[45,46] which has been shown to be activated by THC; *DRD2*,[47] a gene that codes for a dopamine receptor and has been implicated in the development of schizophrenia; and *CNR1*,[48] one of the cannabinoid receptor genes.

It's important to note that this research has shown that these genetic mutations may increase the risk of developing psychosis after cannabis, but it is not a guarantee as there are many other factors that influence these disorders. Conversely, even if a person doesn't have these genetic mutations, it is still possible to be affected.

STRESS + ANXIETY

YOUR RESULTS

Stress Response -
Poor Response

Generalized Anxiety -
Possibly Increased

Tendency to Overeat -
Less Likely

Anxiety is the most common mental disorder in the U.S., affecting 40 million adults in the U.S. alone.[49] There is a widespread belief that anxiety is a feature of our modern lives, but it has been discussed in medical literature since ancient times. Hippocrates, the ancient Greek physician who lived around the year 400 BCE, described one of his patients who would undoubtedly be diagnosed with social anxiety disorder today: "He dare not come into company for fear he should be misused, disgraced, overshoot himself in gestures or speeches, or be sick; he thinks every man observeth him."[50] It's hard to know if the amount of stress and anxiety in our lives is actually increasing compared to previous generations, or if we are now more able to talk about it and so it just seems more prevalent.

One of the places people turn to help them manage their stress and anxiety is cannabis use. Because the endocannabinoid system plays an important role in our stress response, it's no surprise that phytocannabinoids can modulate our anxiety. However, the effects are dependent on both the dose taken and the amounts of THC and CBD. THC can reduce anxiety at low doses, but will actually increase anxiety in high doses, which can cause the common side effect of paranoia. CBD however, decreases anxiety at all doses that have been researched.[51]

STRESS RESPONSE

YOUR RESULT:

Poor Response

You may not manage stress as well as the average individual. If you are having a hard time managing your stress make sure to take care of your mind and body. Eat well, exercise, discuss your stressors, and make more time for hobbbies.

GENE	SNP	YOUR GENOTYPE
NPY	rs16147	CC
FKBP5	rs1360780	TT
COMT	rs4680	AA

Stress is an unavoidable part of life, and the stress response is necessary for all biological organisms. You've undoubtedly felt a stress response before: a rush of adrenaline that boosts your heart rate and respiration, increased attention and focus on the threat at hand, and tensing of muscles to prepare for fight or flight. This kind of response is necessary for escaping predators or running down prey, but in our modern lives it can also follow psychological or social stressors like negotiating finances, taking a test, or arguing with a partner. The magnitude of our stress response is determined by our perception of the stressful event: if we perceive the stressor as being unmanageable or unpredictable, we will have a greater response to it than if we perceive the stressor as being something that we are capable of coping with or even something that isn't stressful at all.

Obviously, a lot of our unique stress response is based on environmental factors like our upbringing, our culture, or whether we've encountered similar stressors before. But there are genetic factors at play too; genes have been linked to the neurotransmitters and hormones that play a role in the stress response.[52,53]

In some cases, a stress response can be a good thing. Athletes need a bit of pressure to perform well at a big game; students can use the pressure of a test to help them focus. This type of good stress is called eustress. But chronic bad stress, or distress, can have long-term effects. Chronically elevated levels of stress hormones like adrenaline and cortisol have been shown to have harmful consequences like heart disease, diabetes, anxiety, and depression.[54] But if we learn how to manage our stress response, we can benefit from the good effects and minimize the bad effects. Ways to reduce immediate stress include positive self-talk, deep breathing or counting to ten before reacting, taking a walk or mediation break, or reaching out to someone in your support system like a family member, friend, or colleague who could help you with your task. If you still find yourself struggling with too much stress, it may be time to speak to your doctor about learning better coping mechanisms.

GENERALIZED ANXIETY

YOUR RESULT:

Possibly Increased

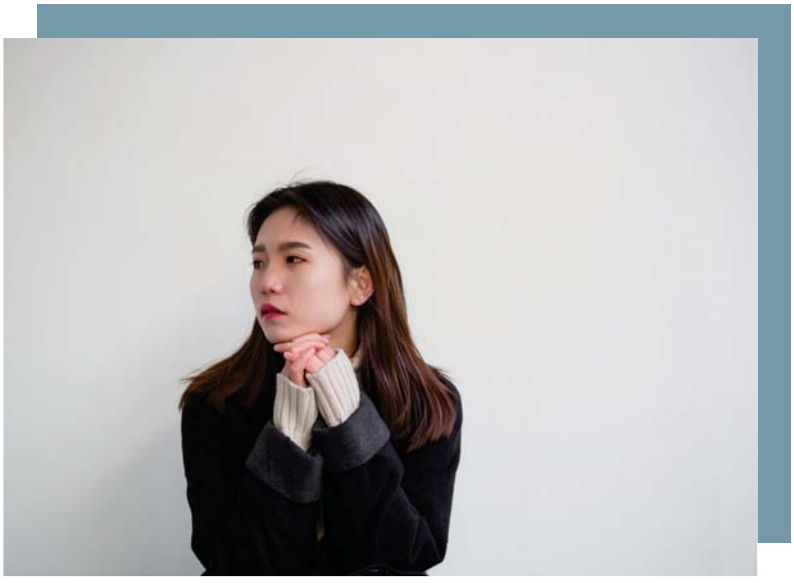
You have one or more genetic markers that may contribute to anxiety. Consider regular exercise and improved sleep habits to help control comon levels of anxiety.

GENE	SNP	YOUR GENOTYPE
BDNF-AS	rs6265	TC
COMT	rs4680	AA
RGS2	rs4606	CC

Everyone experiences anxiety from time to time. Worry and apprehension are normal responses to stressful situations and life events: it's how our brains predict and plan for threats so that we'll be better prepared when it comes time to face them. Some people, however, experience more anxiety than others. Generalized anxiety disorder is one of the most prevalent psychiatric conditions and is more common in females than males; the World Health Organization estimates that 7.7% of the female population in the Americas suffers from some form of anxiety.[55] Additionally, it shows a high rate of heritability of over 30%, suggesting a strong genetic component.[56]

The genes *BDNF* and *RGS2* have been linked with an increase in anxiety-related behaviors in both animal models and human studies.[57–59] *HTR1A*, a gene that codes for the most common subtype of serotonin receptor, has also been associated with higher anxiety.[60,61]

Healthy habits like regular exercise, sleeping well, and limiting caffeine and alcohol can help control common levels of anxiety. Additionally, techniques like mindfulness and meditation have been shown to help control anxiety.[62] However, if healthy habits and positive thinking aren't enough to keep the worry away, it may be time to speak to your physician.



TENDENCY TO OVEREAT

YOUR RESULT:

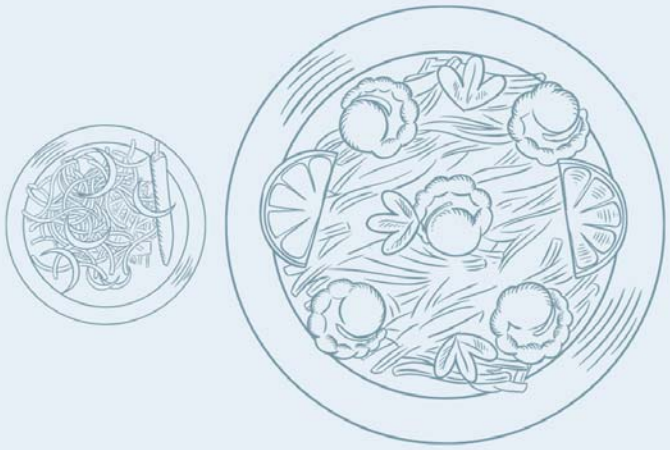
Less Likely

Your genotype is not associated with a tendency to overeat.

GENE	SNP	YOUR GENOTYPE
ANKK1	rs1800497	GG

It is safe to say that nearly everyone will overeat at some point in their lifetime. Most often, it is the result of a favorite meal or special event. However, some people overeat on a regular basis which can lead to increased caloric intake and multiple negative health outcomes. The tendency to overeat in some individuals is thought to occur as a result of how the brain processes reward signals using neurotransmitters such as dopamine.

Similar mechanisms have been hypothesized to predispose an individual to engaging in addictive behaviors. One of the genes most closely associated with this is *ANKK1-DRD2*, which ultimately influences how the brain uses dopamine. If you are prone to overeating, you may want to limit you portion size and avoid foods that are high in sugar and/or fat.[63]



Tip:
To learn how to eat proper food portions, use a smaller plate and utensils.

METABOLISM + DOSING

YOUR RESULTS

THC Metabolism -
Poor Metabolizer

CBD Metabolism -
Intermediate Metabolizer

Most people think of "metabolism" in the context of losing weight, and they aren't wrong, but there's more to it than that. Essentially, metabolism is the process our body uses to break down the things we ingest in order to release energy and molecules that can then be used to create the things our body needs to make, like proteins, lipids, and so on. Drug metabolism operates in a similar way, by breaking the substances down into smaller molecules (called metabolites), but this process uses a different system of enzymes to do so, since these enzymes have to be ready to process a wide variety of chemicals that aren't part of our normal biochemistry. (Note that in scientific terms, a "drug" is simply anything that is consumed for non-nutritional purposes that has the ability to alter our bodies or minds. This includes medication, illicit substances, and even things like coffee and alcohol.)

While the metabolic pathways (the series of chemical reactions that accomplish metabolism) that are used for nutrition are aimed at gaining energy, the main purpose of the metabolic pathways used in drug metabolism is detoxification: breaking down and excreting foreign substances to ensure they don't build up in the body and become toxic.[64,65]

The majority of drug metabolism occurs in the liver, where there are high concentrations of those enzymes. The largest family of these enzymes is called Cytochrome P450, and they are abbreviated as CYPs. There are at least 57 genes that code for these enzymes and individual genetic mutations within these genes can impact their efficiency.[66]

This section of your report looks at a range of CYP genes that are related to metabolizing the two most important chemicals in cannabis: THC and CBD, followed by personalized dosing recommendations.

THC METABOLILSM

YOUR RESULT:

Poor Metabolizer

You metabolize THC much slower than the average individual. This can result in excessively intense experiences at standard doses. Start with the low THC doses suggested for you at the end of this report.

Like most other drugs, tetrahydrocannabinol (THC) is metabolized in the liver by CYP enzymes. The initial chemical, Δ9-THC, is broken down into an active metabolite, 11-OH-THC, which has similar effects as Δ9-THC, and then is broken down further into an inactive metabolite, THC-COOH, which can then be excreted from the body.[67]

Inhaling THC results in almost immediate effects, with Δ9-THC being absorbed by the lungs and moving directly into the blood stream. Bioavailability, meaning how much of the compound is actually able to be used by your body, varies depending on depth and duration of inhalation as well as how frequent a user you are, but tends to range between 10-30%. Oral ingestion of THC results in delayed effects, since it has to travel through the digestive system and be absorbed by the small intestine before it can move into the blood stream. While this process takes only minutes when THC is inhaled, it may take several hours before effects can be felt following oral ingestion.

When levels of THC in the blood are high, the body will begin storing it in fat cells, then release it back into the blood stream as levels drop. This means that Δ9-THC can be detected in the body long after the effects have worn off. The exact amount of time depends on many factors, but on average, the half-life for an infrequent user is a little over a day and for a frequent user can be up to 13 days. Metabolites may be detectable in chronic users for up to a month after last use.

GENE	SNP	YOUR GENOTYPE
CYP2C9	rs28371685	CC
CYP2C9	rs9332239	CC
CYP2C9	rs72558187	TT
CYP2C9	rs72558189	GG
CYP2C9	rs72558190	CC
CYP2C9	rs1799853	TT
CYP2C9	rs1057910	AA
CYP2C9	rs56165452	TT
CYP2C9	rs28371686	CC
CYP2C9	rs9332131	II
CYP3A4	rs12721629	GG
CYP3A4	rs12721627	GG
CYP3A4	rs28371759	AA
CYP3A4	rs2740574	TT
CYP3A4	rs55785340	AA
CYP3A4	rs67666821	DD
CYP3A4	rs35599367	AG
CYP3A4	rs4646438	DD

THC DOSING

THC DOSING FOR PSYCHOACTIVE EFFECT

Poor Metabolizer	Desired Psychoactive Effect			
	Minimal	Mild	Moderate	Significant
Target mg of THC	0-0.5	0.5-1	2-3	>4

How Many mg of THC in Flowers?

Consumption Method	%THC (Flower)			
	5%	10%	15%	20%
Joint (0.32 g)	16	32	48	64
Bowl (0.25 g)	12.5	25	37.5	50
One-hitter (0.10 g)	5	10	15	20

How Many mg of THC in Edibles?

Split Doses	mg THC/Standard Dose			
	100	50	10	5
1/2 Dose	50	25	5	2.5
1/3 Dose	33	16	3	1.5
1/4 Dose	25	12.5	2.5	1.3
1/6 Dose	16	8	1.6	<1

CBD METABOLISM

YOUR RESULT:

Intermediate Metabolizer

You metabolize CBD slower than the average individual. This will likely result in you needing a lower dose of CBD to control your symptoms. Follow the personalized CBD dosing information at the end of this report for the best effects.

Unlike THC, cannabidiol (CBD) is non-psychoactive and non-addictive. CBD is also metabolized by the liver's CYP enzymes, but can also have an additional effect on them: it can function as a competitive inhibitor, meaning if a molecule of CBD is bound to the enzyme, it will be unable to bind other molecules, reducing that enzyme's efficiency at metabolizing other drugs and medications.[68] That's why it's important to discuss your CBD use with your doctor, so they can evaluate any other medication you're on and let you know if there might be an interaction.

Similar to THC, the bioavailability of CBD is much lower when ingested orally compared to inhalation. Oral bioavailability is only 6%, while inhaled bioavailability is around 30%.[69] Research has shown that plasma levels of CBD will be higher when CBD is administered with food or when a meal is consumed before or shortly after administration.[70]

GENE	SNP	YOUR GENOTYPE
CYP2C19	rs6413438	CC
CYP2C19	rs12248560	CC
CYP2C19	rs4244285	GG
CYP2C19	rs4986893	GG
CYP2C19	rs28399504	AA
CYP2C19	rs56337013	CC
CYP2C19	rs72552267	GG
CYP2C19	rs72558186	TT
CYP2C19	rs41291556	TT
CYP2C19	rs17884712	GG
CYP3A4	rs12721629	GG
CYP3A4	rs12721627	GG
CYP3A4	rs28371759	AA
CYP3A4	rs2740574	TT
CYP3A4	rs55785340	AA
CYP3A4	rs67666821	DD
CYP3A4	rs35599367	AG
CYP3A4	rs4646438	DD

CBD DOSING

Intermediate Metabolizer	Severity of Symptoms (e.g. pain, anxiety, etc.)			
	Minimal	Mild	Moderate	Significant
Target mg of CBD	24	48	72	96

Your Reported Weight: 175 lbs
Your weight is factored into your customized dosing.

Your Relative CBD to THC Metabolism

CBD Dominant

Your body will process CBD more efficiently than THC. It is recommended that you start with a strain that has a CBD to THC ratio of 10:1 or greater.

Your relative CBD to THC metabolism is referring to how fast your body metabolizes CBD as compared to how fast you metabolize THC. For example, you may metabolize CBD and THC very slowly, but as compared to one another, you have a CBD to THC metabolism of 1:1. The goal of this element of the report is to bring balance to your cannabis experience, as CBD and THC are known to have synergistic effects when used together. It is still important to pay attention to the suggested dosage of THC described earlier in this report to avoid weak or overwhelming results.

DOSING CONSIDERATIONS

Choosing a Product

Very inefficient at processing THC

Greatly increased risk of anxiety and paranoia
Start with very low doses of THC
Recommended CBD:THC ratio of 10:1 or greater
Recommend starting with edibles to have more control over THC dosage.

Slightly inefficient at processing CBD

No increased benefits from high-CBD products
Start with slightly lower doses of CBD
May require less frequent use of CBD products

Average tolerance to pain

Average genetic risk of addiction and dependence

Customized Dosing Guidelines

Begin with a product that has a CBD:THC ratio of 10:1 or greater

Edibles

- Decide what level of psychoactive effects you want to experience (see THC trait page) and adjust dosage accordingly.

Minimal:	0-0.5 mg
Mild:	0.5-1 mg
Moderate:	mg
Significant:	>4 mg

- Wait at least 1.5 hours after initial dose before consuming a second dose.

Inhalation (Smoking or Vaping)

- Decide what level of psychoactive effects you want to experience (see THC trait page) and adjust dosage accordingly.
- Select flowers or concentrates with a lower percentage of THC to have more control over your dose.
- Use a method of consumption that is conducive to your recommended amount of THC.
- Start with 1-2 quick puffs.
- Between self-administrations, wait 15-20 minutes between inhalations.

Cut out your DNA Dosing Card and fold in half to keep on hand for easy reference.

empower GENOMICS

Sample Report

Very inefficient at processing THC

Greatly increased risk of anxiety and paranoia
Start with very low doses of THC
Recommended CBD:THC ratio of 10:1 or greater

Slightly inefficient at processing CBD

No increased benefits from high-CBD products
Start with slightly lower doses of CBD
May require less frequent use of CBD products

METHODOLOGY

Laboratory specimens associated with this report were analyzed using a DNA microarray. Genomic DNA was extracted from the submitted specimen and amplified using whole genome amplification techniques. The polymorphisms assayed in this report were targeted through the use of oligonucleotide primers. Single nucleotide polymorphisms were determined by fluorophore-based detection of a labeled probe hybridized to the complementary target sequence.

LIMITATIONS

This test detects polymorphisms other than those listed in this report. Polymorphisms not detected in this analysis include known mutations that result in an altered predisposition to the conditions discussed in this report. The absence of a detectable gene variant or polymorphism does not rule out the possibility that the test subject has an increased chance of developing any conditions discussed here. In very rare circumstances, polymorphisms in the primer or probe binding site may affect genotyping results. This test does not identify non-genetic factors that may contribute to an individual's predisposition to developing any of the conditions discussed in these findings. This test has not been approved by the United States Food and Drug Administration (FDA) and should not be used as the sole evidence of diagnosis. Genetic screening does not replace the need for regular clinical screenings for any of the conditions or analytes mentioned in this report.

DISCLAIMER

The information contained within this report is intended for informational purposes only. Do not alter any regularly scheduled health screenings due to the findings of this genetic analysis.

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