FORENSIC TOXICOLOGY:
FROM CRIME SCENE TO VIRTUAL LAB
MODULE 1

Chapter 1: Cannabis

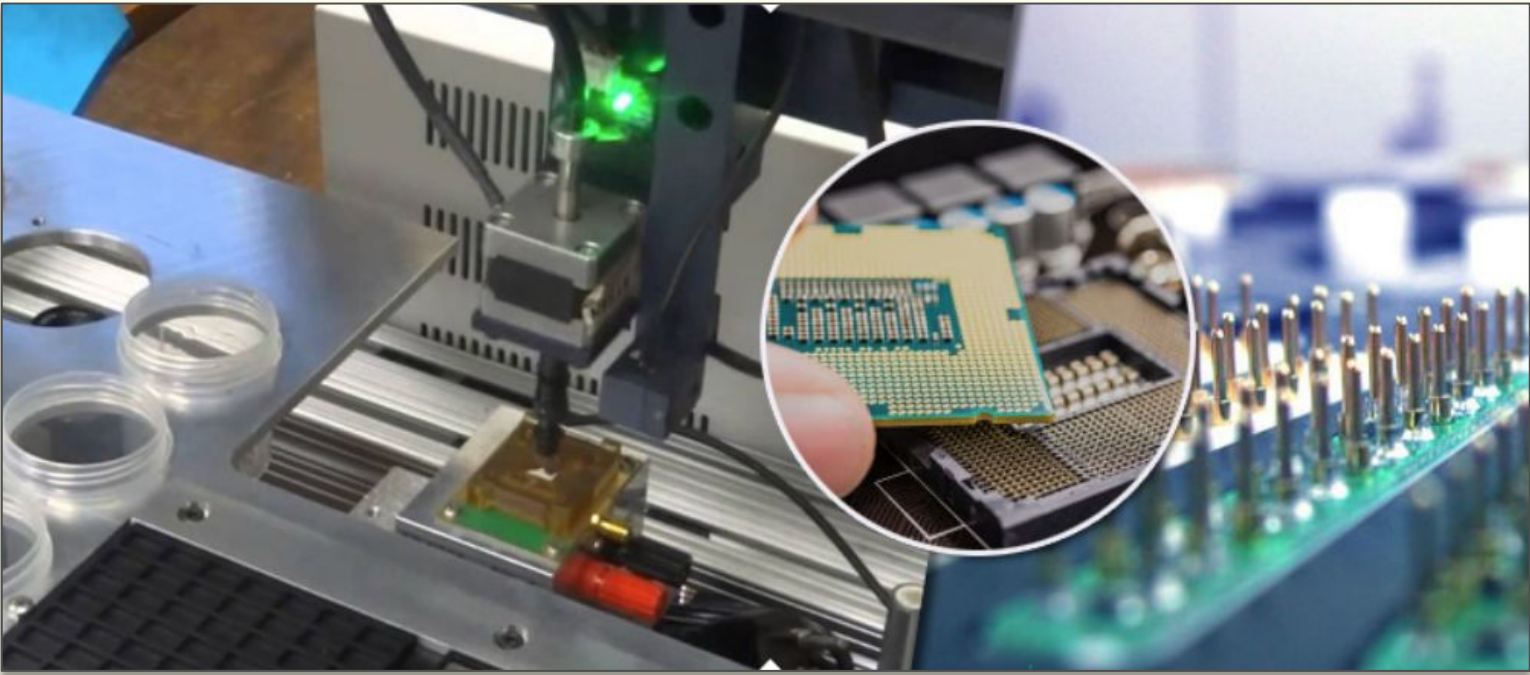# CURRENT ADVANCES IN FORENSIC SCIENCE RELATED TO CANNABIS

NIST

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UPDATES

Spotlight: Understanding the Chemical Compounds in Cannabis

February 16, 2021

...paving the way for a roadside marijuana breathalyzer

NIST

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NEWS

NIST Study Will Help Labs Distinguish Between Hemp and Marijuana

From a legal perspective, a small number makes a big difference.

January 14, 2021

TABLE OF CONTENTS

01: Historical Uses of Cannabis

WHAT IS CANNABIS?

- **Cannabis**:
  - Group of three plants with psychoactive properties:

    1. **Cannabis sativa**

       - Long stem and narrow leaves; grown for hemp fiber and psychoactive drug use

    2. **Cannabis indica**

       - Shorter stem and broad, deep green leaves; grown for use in reducing nausea/pain/insomnia and increasing bodily relaxation

    3. **Cannabis ruderalis**

       - Smaller in height, thin and slightly fibrous stem with little branching; grown for medical use due to its low THC content

  - Made up of more than 120 components called "***Cannabinoids***"
  - Primary psychoactive compound: **Δ^9-tetrahydrocannabinol (THC)**
  - **Phytocannabinoid:** any cannabinoid produced in the trichomes of a cannabis plant

HISTORICAL BACKGROUND OF CANNABIS

The cannabis (hemp) plant is one of the most well-known plants across the globe. It is grown in almost every part of the world, with its principle use being a strong fibre for the manufacturing of textiles and rope. In these areas, cannabis was not used as a drug, but rather as a material. Depending on the geographical regions it can grow in, the varying temperatures and conditions modified the pharmacokinetics of cannabis, leading to its first drug-based discovery in the Himalayan region of central Asia, spreading to India, Asia Minor, North Africa, and sub-Saharan Africa.
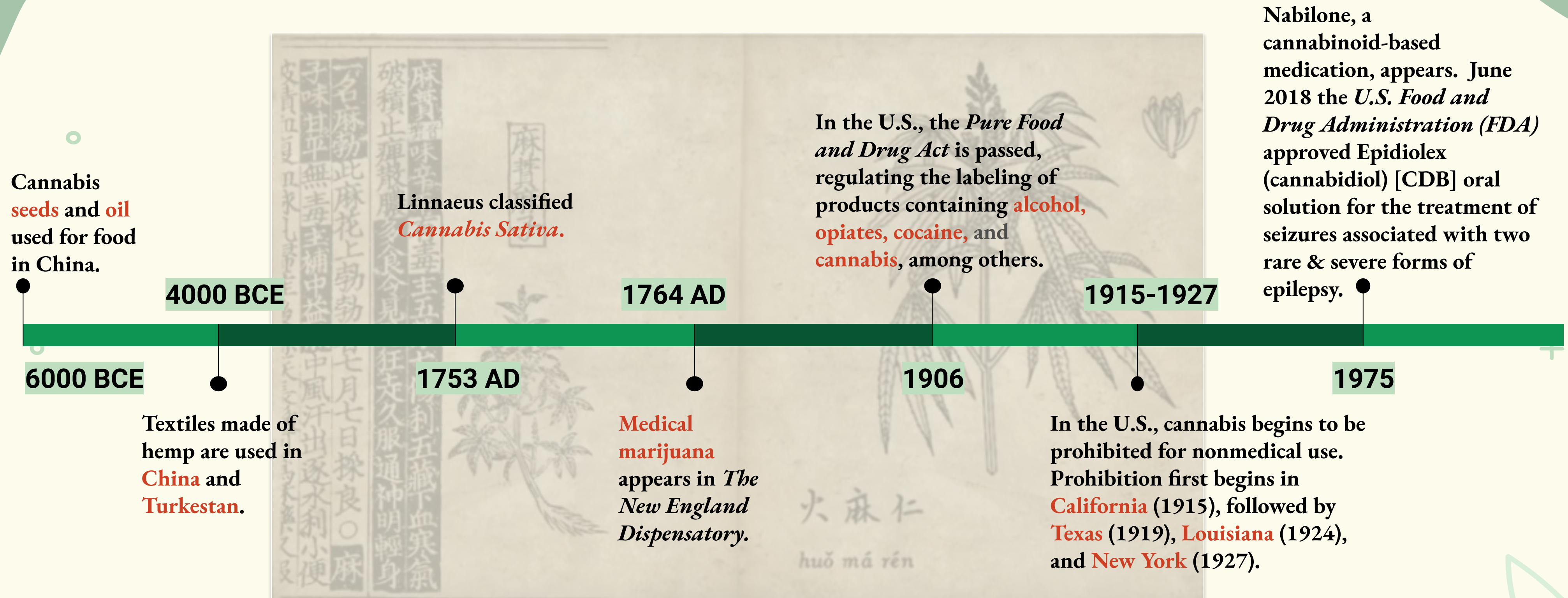

Map of Cannabis Discovery:
Traces of potent cannabis were identified as early as 2,500 years old in wooden artifacts found buried with people living among the Silk Road in China.

(*National Geographic, 2019*)

HISTORICAL BACKGROUND OF CANNABIS

Cannabis **seeds** and **oil** used for food in China.

Linnaeus classified *Cannabis Sativa.*

In the U.S., the *Pure Food and Drug Act* is passed, regulating the labeling of products containing **alcohol, opiates, cocaine,** and **cannabis**, among others.

Nabilone, a cannabinoid-based medication, appears. June 2018 the *U.S. Food and Drug Administration (FDA)* approved Epidiolex (cannabidiol) [CDB] oral solution for the treatment of seizures associated with two rare & severe forms of epilepsy.

4000 BCE

1764 AD

1915-1927

6000 BCE

1753 AD

1906

1975

Textiles made of hemp are used in **China** and **Turkestan**.

Medical marijuana appears in *The New England Dispensatory.*

In the U.S., cannabis begins to be prohibited for nonmedical use. Prohibition first begins in **California** (1915), followed by **Texas** (1919), **Louisiana** (1924), and **New York** (1927).

火麻仁

huǒ má rén

HISTORICAL BACKGROUND OF CANNABIS IN CANADA

01

1930s

MID-TO-LATE 1960s

1979

1990s

2018

No reliable accounts of non-medical use of cannabis predating 1930s.
25 total convictions for cannabis possession during the '30s in all of Canada.

HIPPIE-MOVEMENT
Cannabis introduced into the current culture, youths and adults

1962: 20 cases reported
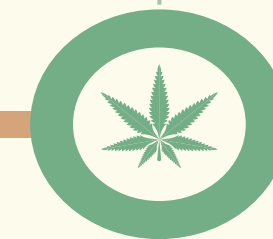**1963**: Over 2300 cases reported
1972: Nearly 12,000 cases reported

Canada: Signed UN's *Convention on Psychotropic Substances (1971)*, which halted any plans to legalize cannabis.

ONTARIO: Substantial increase in cannabis use:
1993-1994: 4.2-7.4% increase
1996-2000: Much higher in 18-29 age groups (18-28%)

**LEGALIZATION**: *"Cannabis Act"*, legalizing cannabis growth and use across the nation.

02: LEGAL VS. ILLEGAL ACTIVITIES

CANNABIS IN CANADA

WHAT YOU NEED TO KNOW

Government of Canada   Gouvernement du Canada
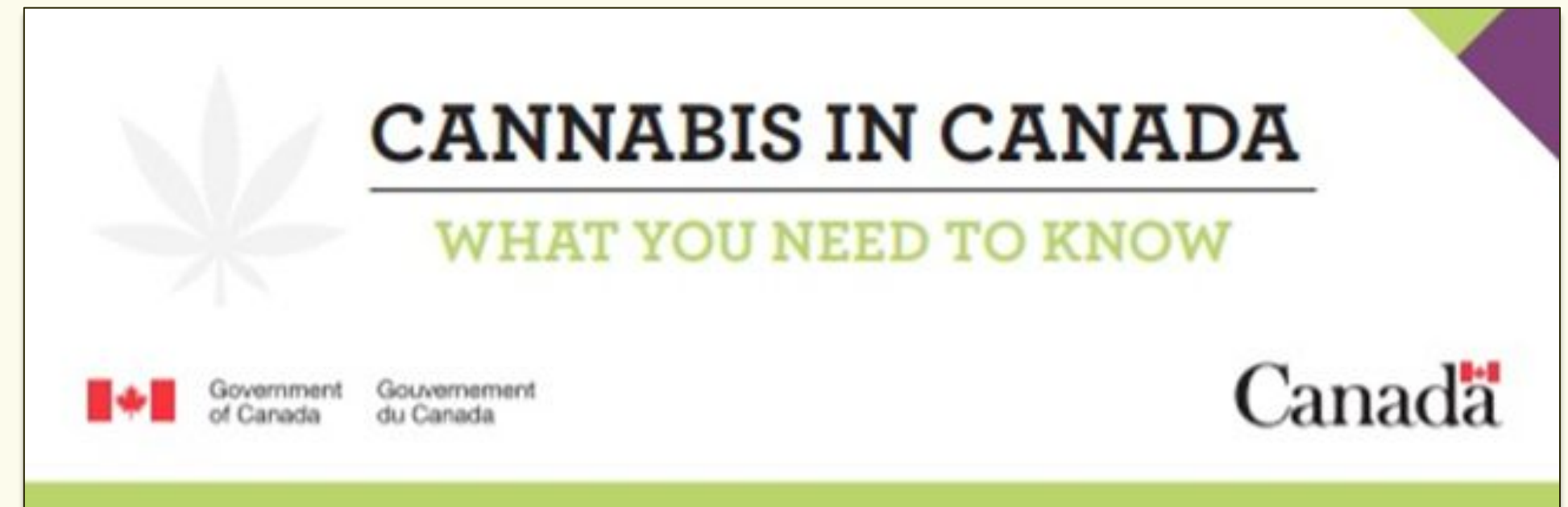
Canada

THE CANNABIS ACT

- Instated **October 17, 2018** in Canada
- To buy or possess cannabis, **you must be of legal age** (18 or 19 or older), depending on province/territory.
- You can possess **up to 30g of legal dried cannabis** in public.
- Legal cannabis products have an **excise stamp** on the packaging in different colours for each province/territory.
- It's **illegal to travel across the Canadian border** with cannabis.
- In **late 2019**, edible cannabis, extracts, and topicals were legalized.
- It can take **up to two hours** to begin to feel effects of cannabis
- **Don't drive high or work impaired**. It is a serious criminal offence.
- **Store cannabis away** from children, youth, and pets.
- Under the *Cannabis Act*, **access to cannabis for medical purposes** continues to those authorized.
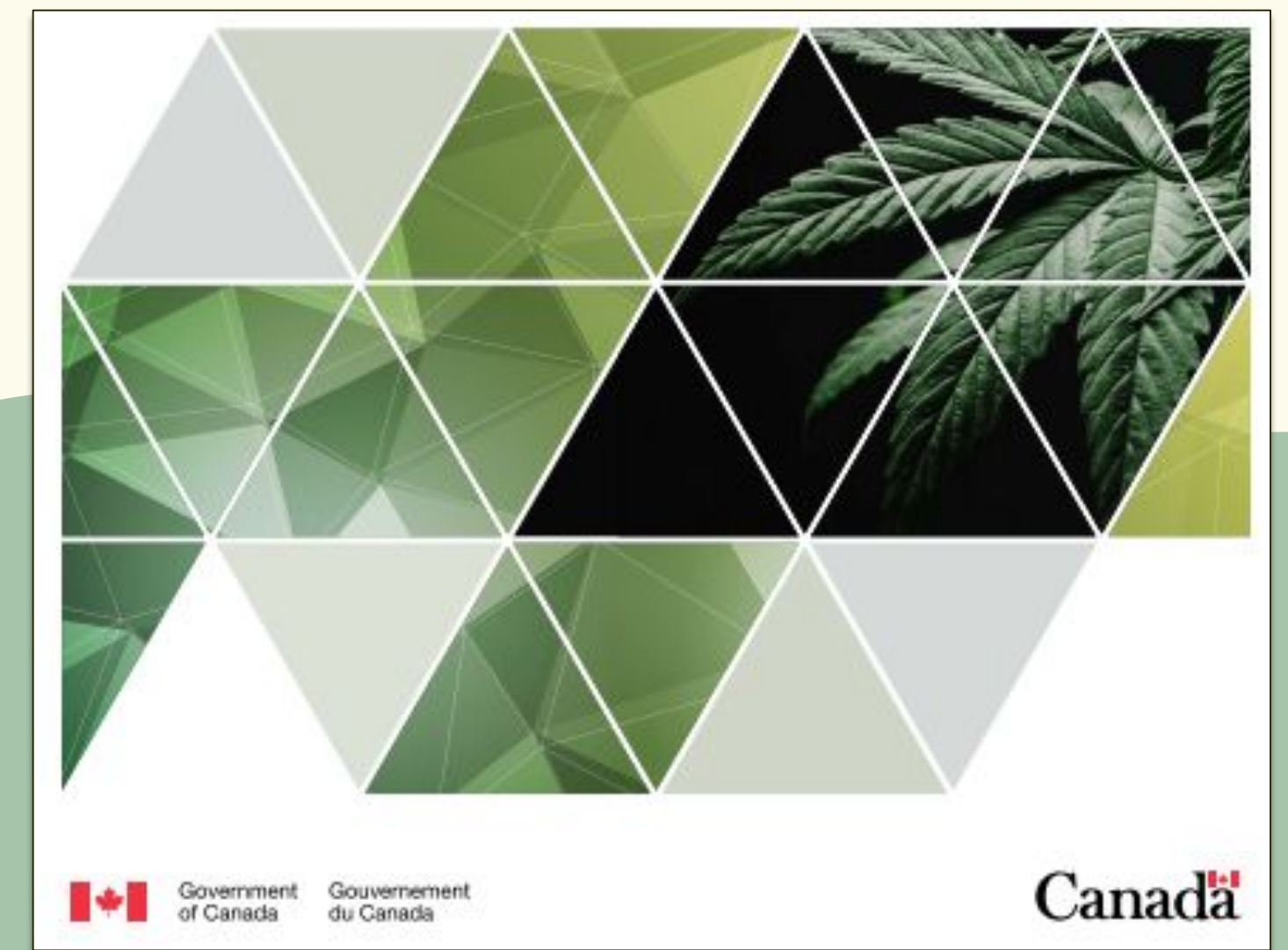
LEGALITIES IN " "

According to (2018), the following are **LEGAL** rules that are tightly regulated for cannabis use in Canada:

1. You must be **19 or older** to buy, use, possess, and grow recreational cannabis.

2. You can **smoke and vape** in the following places: Private residences, many outdoor public places (ex. Sidewalks, parks), designated smoking guest rooms (hotels, motels, inns), residential vehicles and boats, research and testing facilities (for research purposes only), controlled areas such as long-term care homes/hospices/government-funded housing

3. You can **possess up to 30 g** (one ounce) of dried cannabis in public at any time.

4. You can **grow up to 4 plants** per residence (not per person).

5. Cannabis **edibles** were legalized on **October 17, 2019.**

6. **Extracts and topicals** were legalized on **October 17, 2019.**

7. **Medical cannabis** is legal if purchased through a federally licensed producer, by written order, or over the and delivered by secure mail.

LEGALITIES IN "THE CANNABIS ACT"

According to *The Cannabis Act* (2018), the following are **ILLEGAL** rules that are tightly regulated for cannabis use in Canada:

YOUTH CANNABIS DIVERSION PROGRAM
is designed to provide youth (age **12-18** years) with an online digital experience program that educates them about the risks associated with cannabis use at their stage of development. It also provides youth with information to enhance their understanding of Ontario laws related to cannabis. It promotes confidence and self-awareness for youth to assess the impacts of cannabis use to make positive choices.

1. An online education and prevention program for youth between the ages of 12 and 18, called **Youth Cannabis Diversion Program**, is available online. Youth who come into conflict with the law can be provided with this program by law enforcement and courts.

2. You **cannot smoke or vape** in the following areas: Indoor common areas (condos, apartments, university/college residences, enclosed public places / workplaces, and non-designated guest rooms (hotels, motels, inns)), schools and places where children gather, hospitals and other facilities, publicly owned spaces (sports fields), while operating a vehicle or boat.

3. **Edible** cannabis must contain **zero nicotine or alcohol** products.

4. **Extracts and topicals** are **prohibited** from being attractive to **youth** or making health/beauty claims.

5. Recreational cannabis in an **enclosed workplace remains illegal.**

03: CANNABIS EXTRACTION & PROCESSING

In Ontario, it is legal to own and cultivate up to 4 cannabis plants in your household (aged 19+) either indoors or in your yard. To start growing a cannabis plant, there is a lot to consider:

1. **Start with Seeds or Clones**
2. **Growing Conditions**: Depends on **INDOOR or OUTDOOR** growth
3. **Harvesting and Use**

Apricot Kush Seeds (Regular) (OCS, 2021)

Extraction of Cannabis:

Since **THC** and **CBN** are the main psychoactive cannabinoids in cannabis, high extraction selectivity for these compounds is a key method for the purification and full use of cannabis. Conventional and domestic methods of extraction currently exist, including **distillation, solvent extraction, Soxhlet, maceration,** and **sonication**. Modern extraction techniques are less time-consuming and invasive, and include ultrasound-assisted extraction (**UAE**), supercritical fluid extraction (**SFE**), and pressurized hot water extraction (**PHWE**).

HOW IS CANNABIS PROCESSED FOR USE?

Methods:

Soxhlet
Sonication
Distillation
Maceration
Solvent Extraction

Interested in learning about

Check out this link!

Ultrasound-Assisted Extraction (UAE)
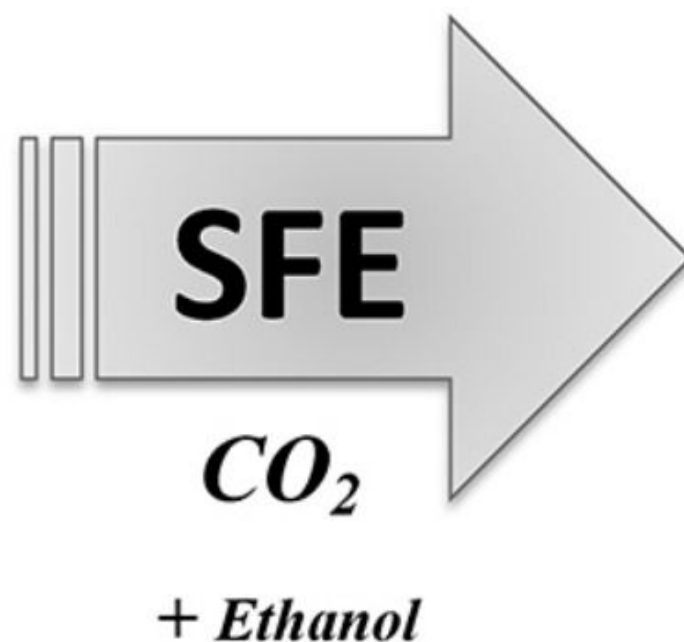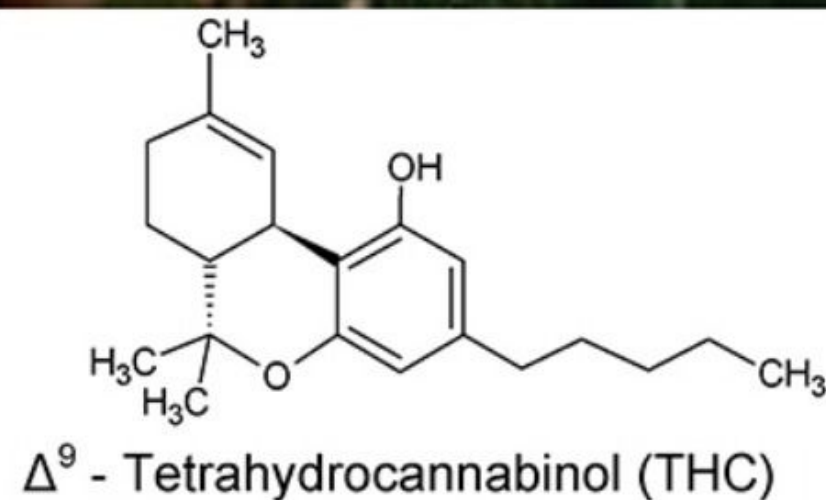**Supercritical Fluid Extraction (SFE)**
Pressurized Hot Water Extraction (PHWE)

SFE (supercritical fluid extraction): supercritical fluid extraction uses carbon dioxide (CO_2) as the solvent. The cannabis sample is placed in the extraction vessel and pressurized using CO_2, which is cooled down to ensure liquid state of the solvent.

Filtration
The solution is ran through a büchner filter to separate lipids (waxes, fats)

Finished Product
Pure concentrated cannabis oil

Emulsification
Dehydrogenated oil is mixed on a molecular level with pure alcohol, then crystallized

Refinement
The pure alcohol is distilled from the cannabinoids
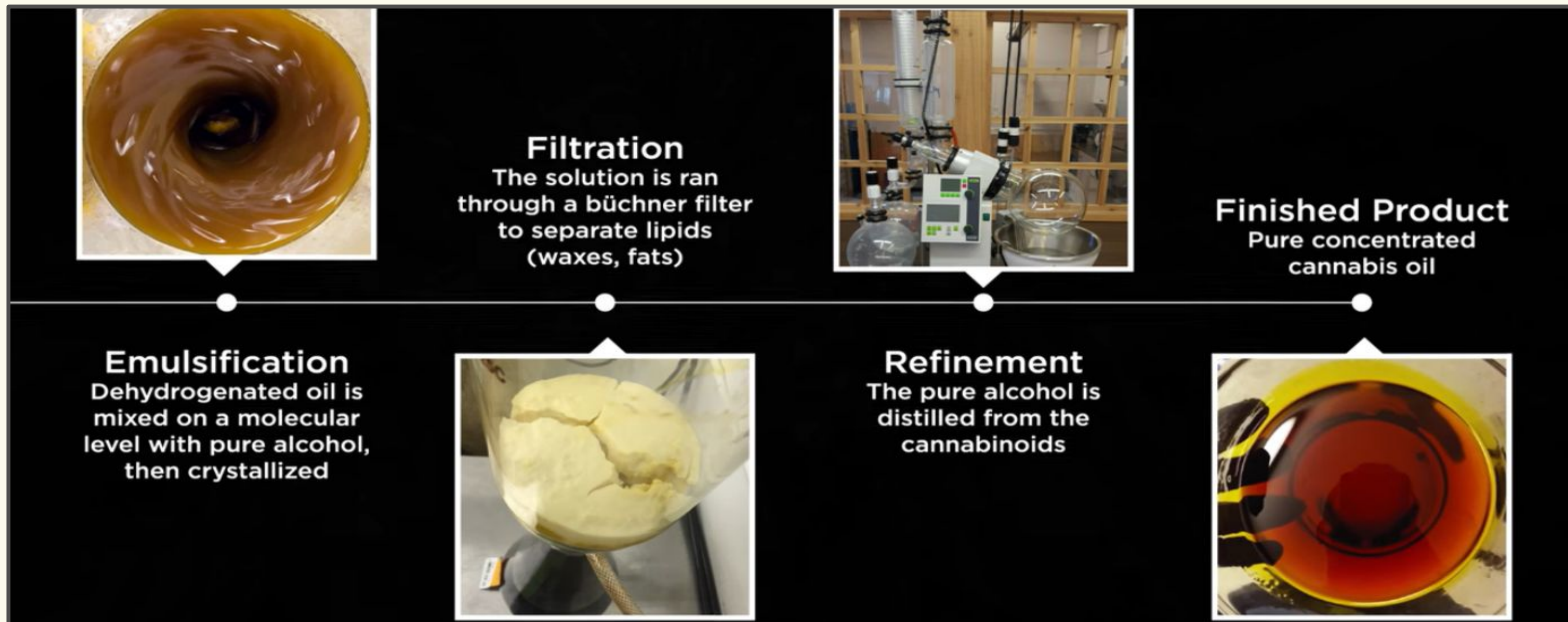
SFE (Supercritical Fluid Extraction):

Cannabis Sativa L.

Δ^9 - Tetrahydrocannabinol (THC)

SFE

CO_2

+ Ethanol

Cannabinoids extracts

- 17 MPa
- 24 MPa
- 34 MPa
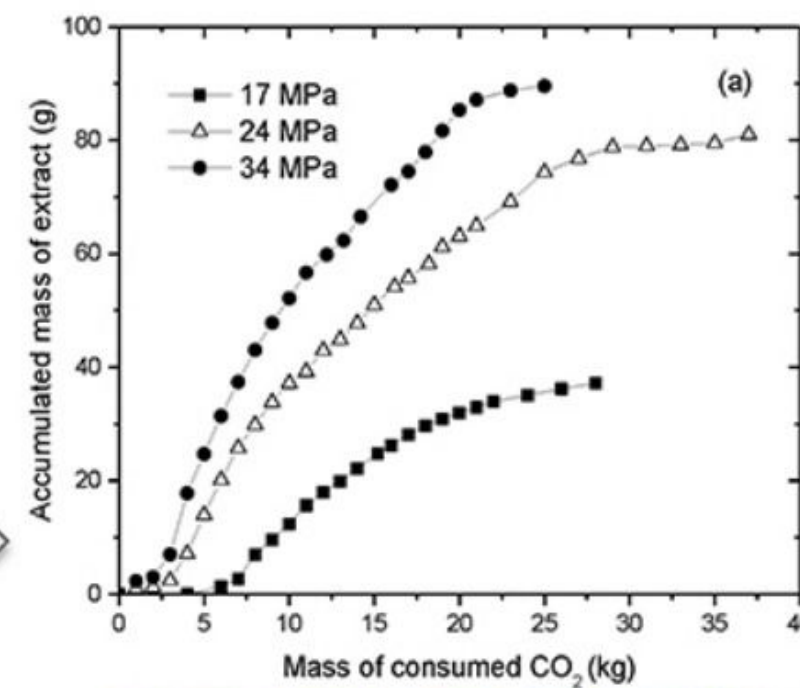
Higher amount of carbon dioxide = HIGHER amount of extract isolated

Higher pressure used = HIGHER amount of extract isolated

04: COMMON CANNABINOIDS OF CANNABIS

COMMON CANNABINOIDS OF CANNABIS

NON-PSYCHOACTIVE

PSYCHOACTIVE

CBG

Cannabigerols

CBD

Cannabidiols

CBC
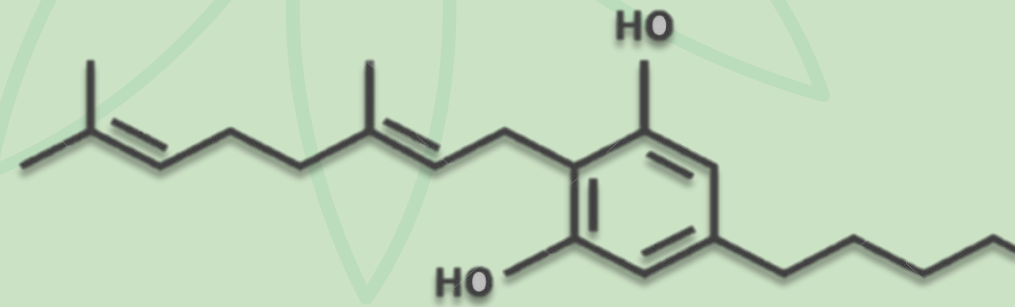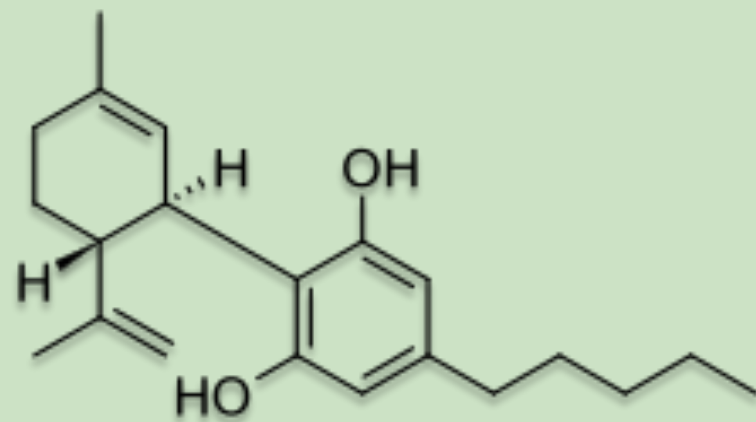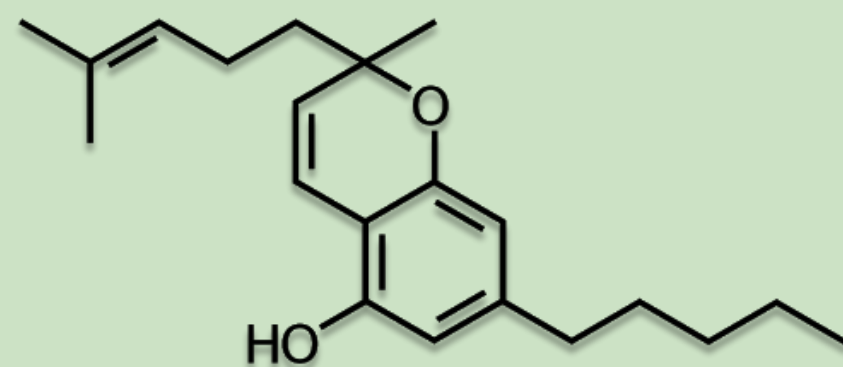
Cannabichromenes

CBN

Cannabinols

THC

Tetrahydrocannabinols

THCV

**Tetrahydrocannabivarins**

CANNABIS

Hua et al., *Cell, 2016*
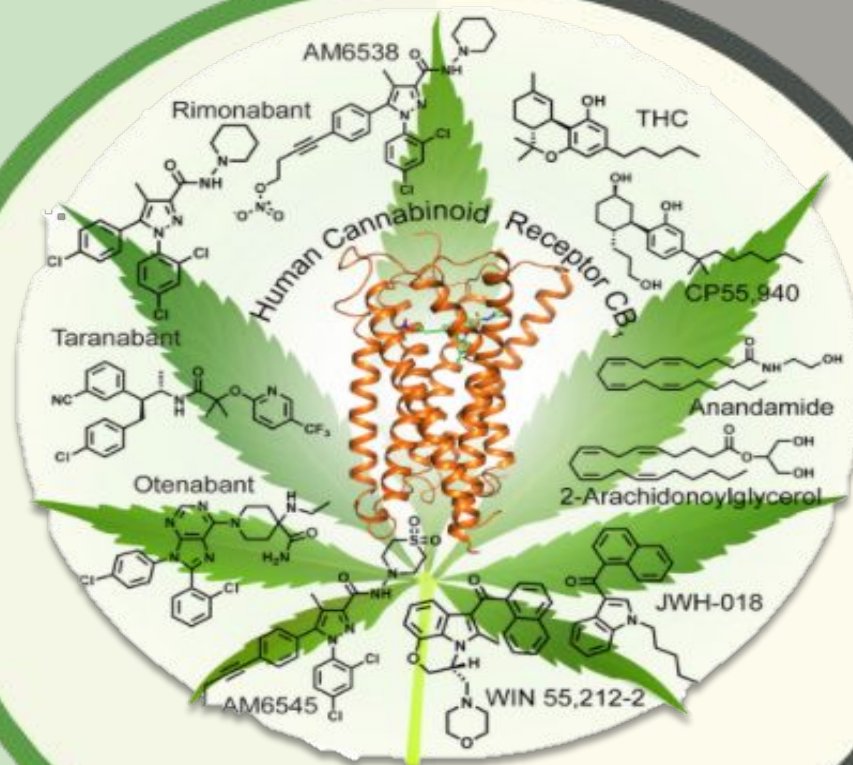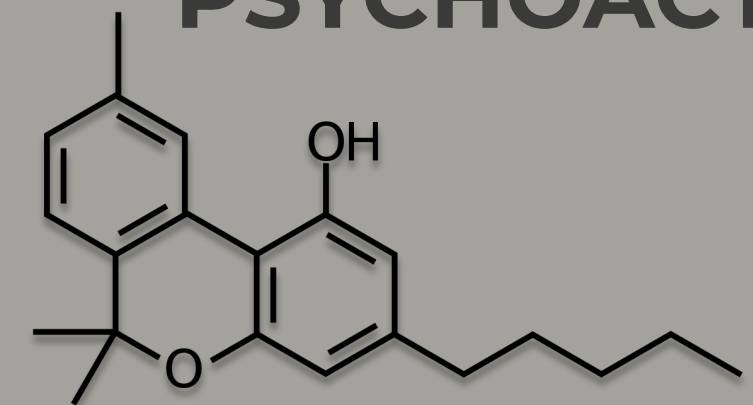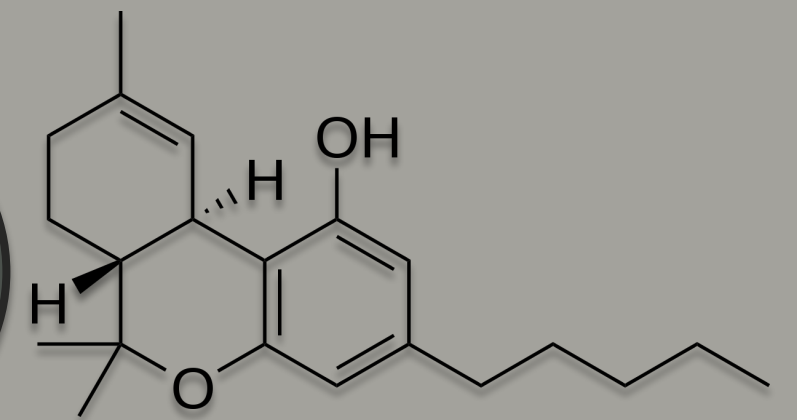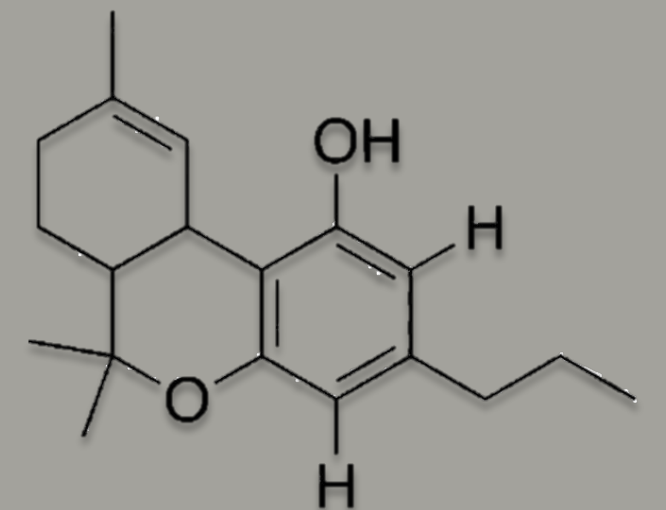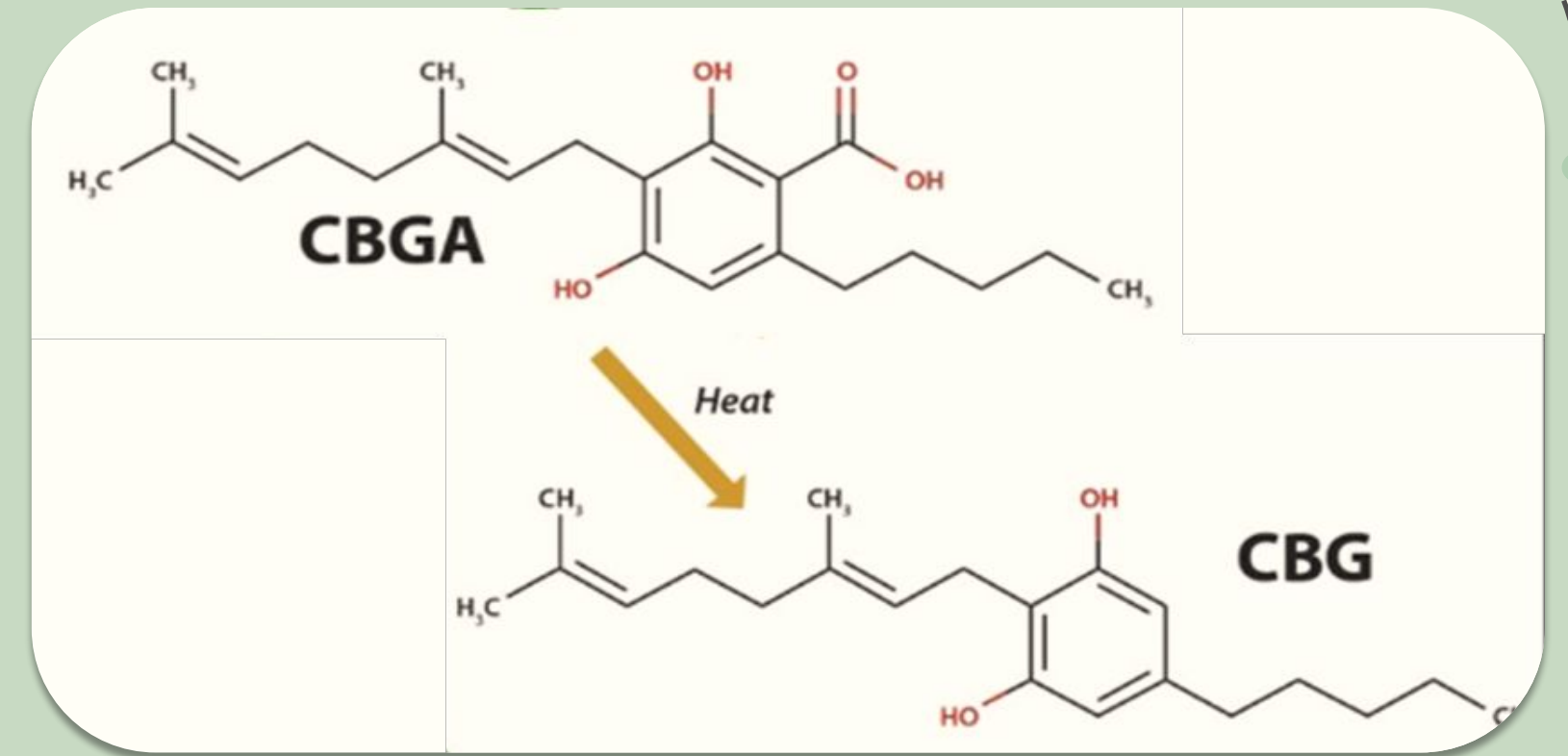
NON-PSYCHOACTIVE

CANNABIS

NON-PSYCHOACTIVE

- Begins as cannabidiolic acid (CBDA); when heated, decarboxylated into CBD

- Type of phytocannabinoid that lacks detectable psychoactivity and does not bind to CB_1 or CB_2 receptors in the body

- Interacts with human Endocannabinoid System (ECS) to encourage release of our own endocannabinoids, rather than binding to CB1 receptors

- Affects the activity of ion channels, receptors, and enzymes (e.g.) blocks activity of FAAH (increases anandamide levels), agonist of TRPV1 channel, positive allosteric modulator of glycine receptors, and acts as anti-oxidant and reactive oxygen species (ROS) scavenger
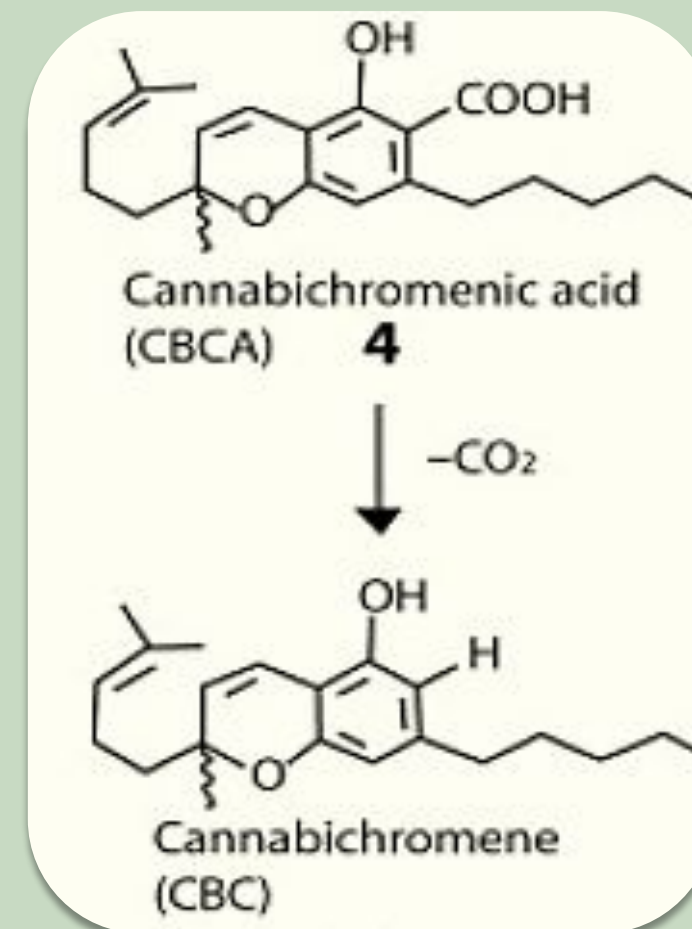

CBD   R = H
CBDA   R = COOH
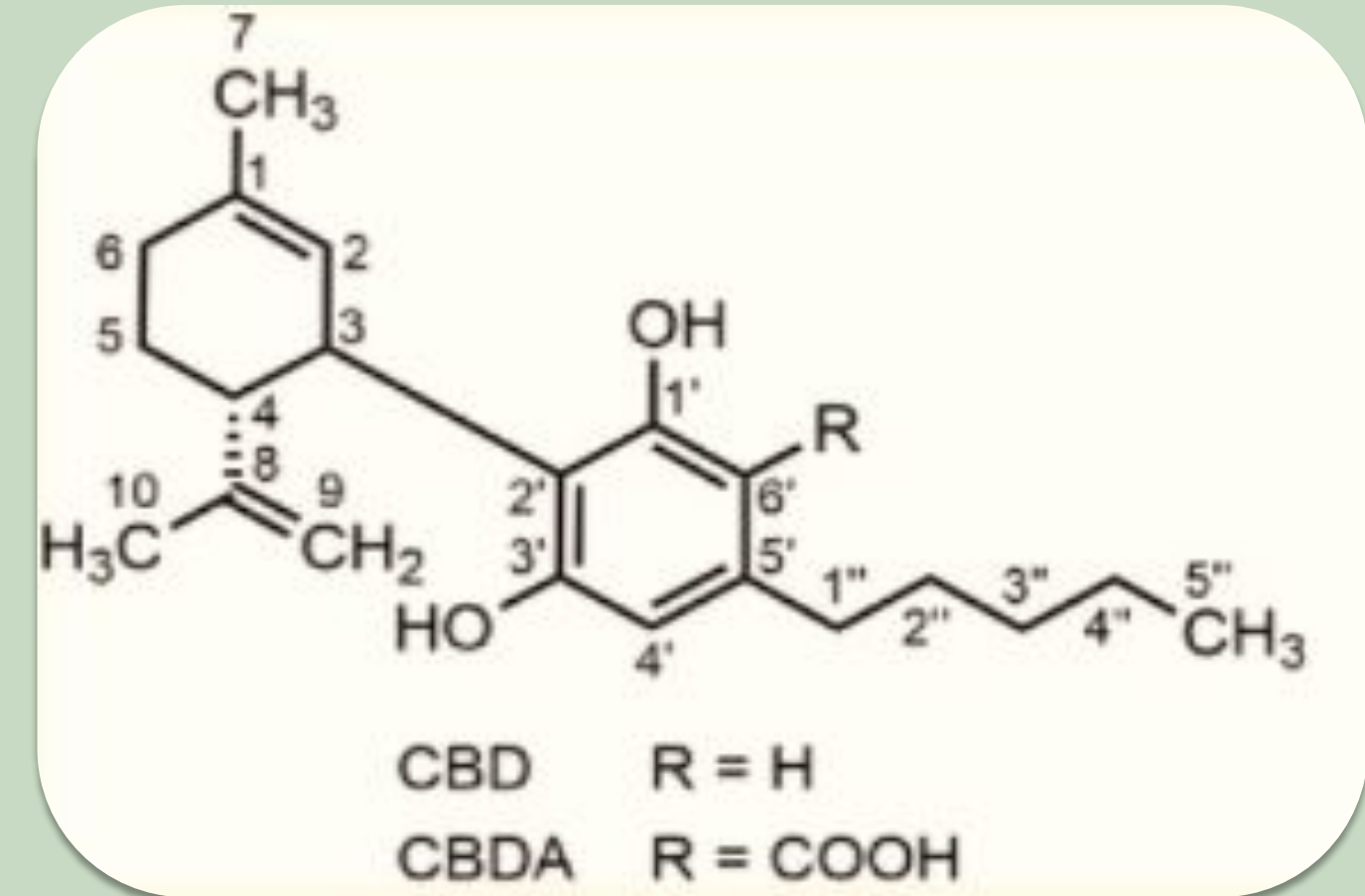
NON-PSYCHOACTIVE

- Begins as cannabigerolic acid (CBGA); when heated, decarboxylated into CBG

- Type of phytocannabinoid that lacks detectable psychoactivity and only partially binds to the $CB_{1/2}$ receptor (agonist)

- *In vitro* assays have shown at 100 µg/mL (not biologically relevant concentration), CBG can inhibit cyclooxygenase (COX) 1 & 2 enzymes with 30% efficiency, can block $5-HT_{1A}$ receptors, and act as an α_2-adrenoreceptor agonist

- Evidence further suggests partial signs of analgesia by activation of α_2-adrenoreceptors

NON-PSYCHOACTIVE

Cannabichromenic acid (CBCA) **4**

$-CO_2$

Cannabichromene (CBC)

- Second most abundant cannabinoid in some strains of cannabis, and <u>directly synthesized from cannabichromenic acid (CBCA)</u>

- Type of phytocannabinoid that lacks detectable psychoactivity and <u>possesses poor affinity</u> to the CB_1 and CB_2 receptors

- <u>Recent study</u> proved CBC acts as a selective CB_2 receptor agonist that signals through the $G_{i/o}$ type G proteins and induces CB_2 receptor signalling, indicating this cannabinoid may act as a potential therapeutic agent that influence the non-psychotropic CB_2 pathways of the ECS

- Activates the transient receptor potential ankyrin-type 1 (TRPA1) and <u>inhibits endocannabinoid inactivation</u> both involved in inflammatory responses
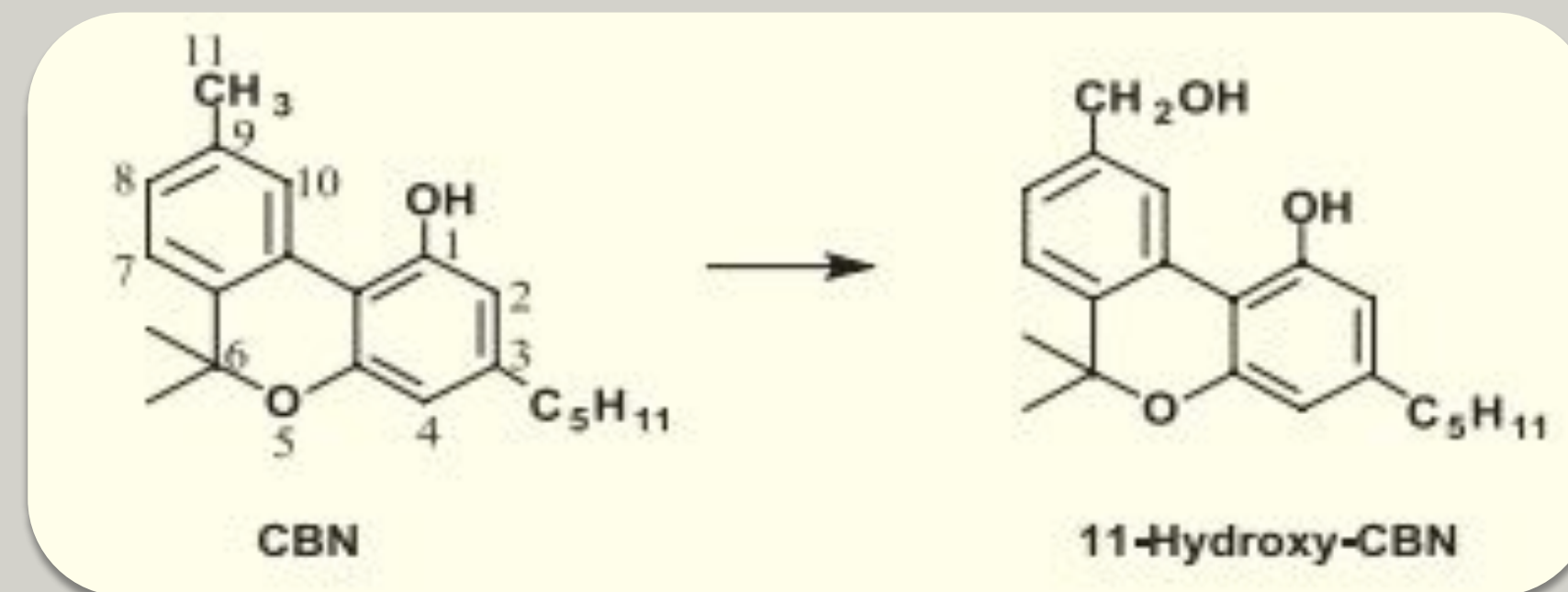
PSYCHOACTIVE

CANNABIS

Cannabinols (CBNs)

- CBNs are a product of the Δ^9-THC oxidation and have 10% of the Δ^9-THC activity at the CB_1 receptor

CBN → 11-Hydroxy-CBN

- High hydrophobicity allows CBNs to easily transport across the aqueous layer of the skin, with permeation of CBN being 10-fold higher than for Δ^8-THC

- CBNs have a high level of distribution in blood plasma (50 L/kg), significantly higher than THC and CBD

- Polyaromatic hydrocarbons found in cannabis induce the expression of CYP1A2, with CBNs inhibiting the activity of CYP1A1, 1A2, 1B1, and 2A6 enzymes

- CBN is metabolized by CYP 2C9 and 3A4, but can also act as a potential substrate for CYP 2C19
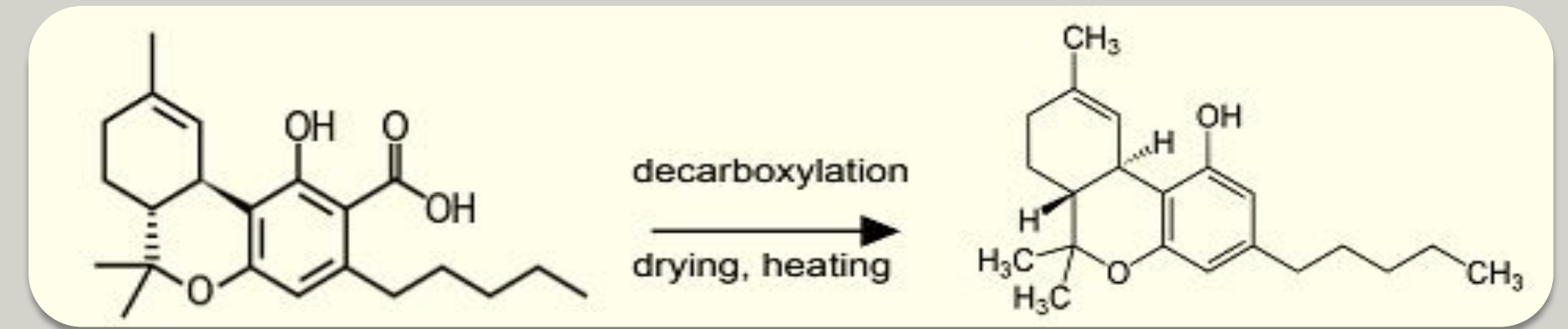
COMMON CANNABINOIDS & METABOLITES

PSYCHOACTIVE

Tetrahydrocannabinols (THCs)

- Principal phytocannabinoid that binds to and activates the CB_1 and CB_2 receptors

- Derived from the inactive tetrahydrocannabinolic acid (THCA) and is activated once decarboxylated into THC via heating above 120°C (complete decarboxylation after 4 h)

- Most commonly studied cannabinoid, as it is responsible for the majority of physical & psychotropic effects of cannabis through the CB_1 receptor

- Acts as a partial agonist at both CB receptors, and produces CBN products

- Distribution is time-dependent & begins immediately after absorption into the bloodstream (10 L/kg)

Tetrahydrocannabivarins (THCVs)

- Type of minor phytocannabinoid that acts as a CB_1 receptor antagonist and CB_2 receptor partial agonist both *in vitro* and *in vivo*, as well as a $5\text{-}HT_{1A}$ receptor agonist and exhibits anti-oxidant effects

(a) THC
(b) Δ9-THCV

- At a dose of 10 mg/kg, has been shown to reduce acute nausea in rats, potentially through the CB_1 receptor-independent mechanism

- Several *in vitro* studies show that THCV binds with high affinity to CB_1 receptors, but it does not appear to be a potent CB_1 receptor agonist

- CB_1 receptor antagonist and potent CB_2 receptor partial agonist at low-mid level concentrations
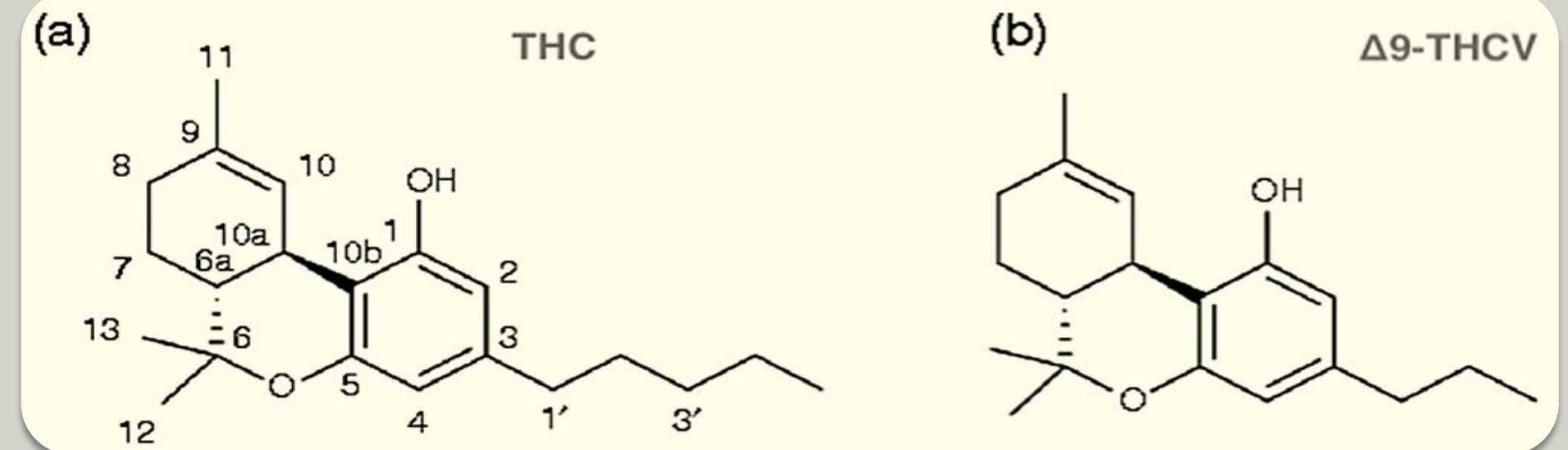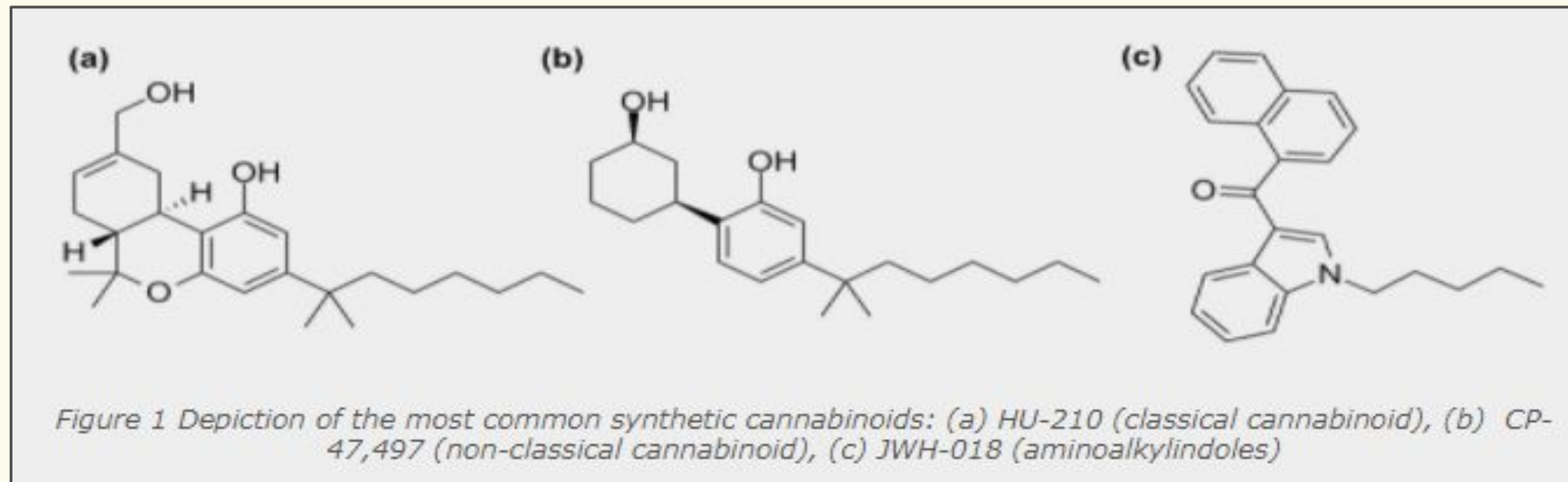
SYNTHETIC CANNABINOIDS

- **Synthetic Cannabinoids:** class of man-made molecules that bind to the same receptors as cannabinoids; considered "designer drugs"
- Can be significantly **more toxic** than cannabis, including raising heart rate, increasing vomiting, agitation, confusion, and hallucinations

Classified as "Classical Cannabinoids" or "Non-Classical Cannabinoids"

1. **Classical**: similar behaviour to THC, much more potent than THC (ex. HU-210: 100 times more potent than THC, similar structure to THC)

1. **Non-Classical:** include cyclohexylphenols or 3-arylcyclohexanols (CP compounds), and aminoalkylindoles (naphthoylindoles (JWH-018)) often slightly more potent than THC

Figure 1 Depiction of the most common synthetic cannabinoids: (a) HU-210 (classical cannabinoid), (b) CP-47,497 (non-classical cannabinoid), (c) JWH-018 (aminoalkylindoles)

CASE STUDY:

On July 12, 2016, a synthetic cannabinoid caused mass intoxication of 33 persons in one New York City neighborhood, in an event described in the popular press as a "zombie" outbreak because of the appearance of the intoxicated persons.
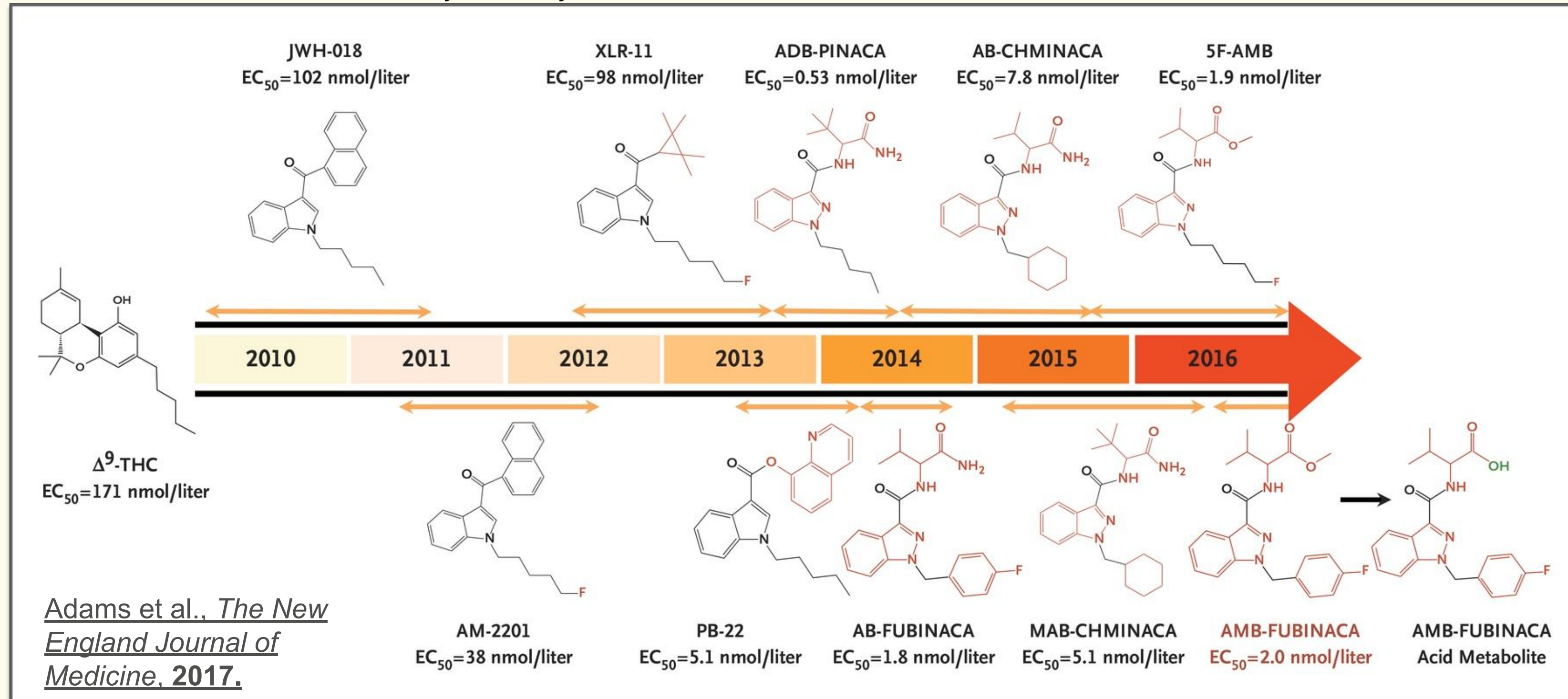

AK-47 24 Karat Gold Foil Wrapper Containing Herbal Products Recovered from a Patient Involved in the Outbreak

SYNTHETIC CANNABINOIDS

Evolution of Synthetic Cannabinoids:

- "Zombie" outbreak caused by the synthetic cannabinoid AMB-FUBINACA in New York

Adams et al., *The New England Journal of Medicine*, **2017.**

SYNTHETIC CANNABINOIDS

- Canada's Addiction Services warning about the uses of Synthetic Cannabinoids
- Age distribution of synthetic cannabinoid and marijuana-related emergency department (ED) visits in 2010

05: COMMON ROUTES OF CANNABIS EXPOSURE

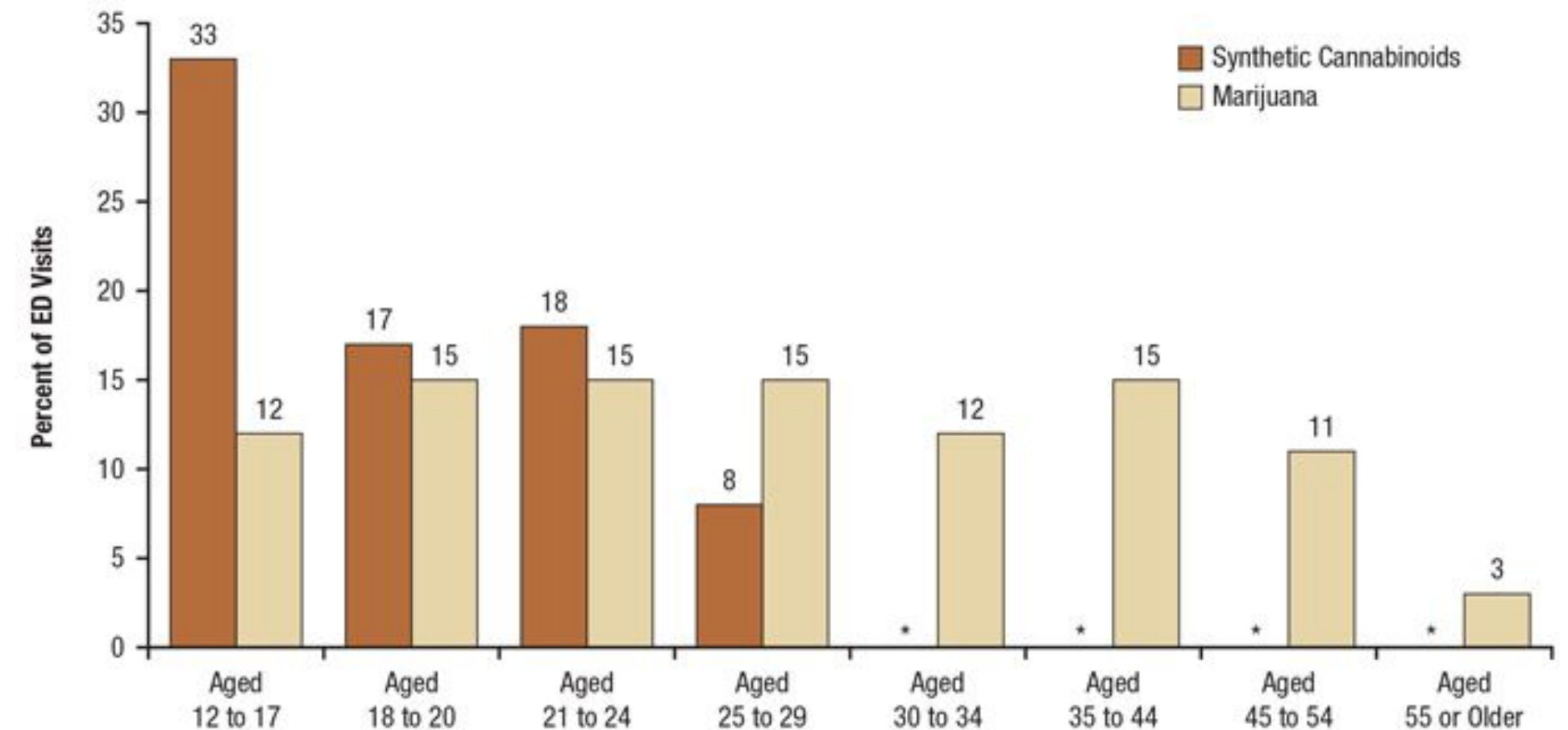# ROUTES OF ADMINISTRATION

- Smoking → Joints, spliffs (cannabis rolled in cigarette paper, can be mixed with tobacco), pipes and bongs, blunts (cigar wrappers filled with cannabis)

- Drinking / Eating → Teas, sodas, cannabis oil, baked goods (cookies, brownies, loaves, etc.)

- Vaporizing & Vaping → Breathing in dried cannabis or liquid cannabis vapours through a vaporizer or vaping device

- Dabbing → Breathing in very hot vapours from heating cannabis concentrates

No.	Form	Source	Methods of Use
1.		Dried leaves, stalks, flower, and seeds	Smoked as joint
2.		Fresh leaves and stalk	Mixed with food items (consumed orally)
3.		Leaves, seeds, stem and flower soaked in oil/solvent	Smoked as joint, consumed orally

Headband Pre-Roll (OCS, 2021)

*Soft Baked Chocolate Cookies (OCS, 2021)*

CANNABIS EFFECTS ON THE BODY

1. **Impairs ability** to drive safely or operate equipment: Causes drowsiness, slower reaction times, lowers ability to pay attention and impairs coordination

1. Impairs **thinking, concentration, memory and decision-making**

1. Can cause **anxiety and panic**, as well as possible triggering of psychotic episodes (hallucinating, experiencing paranoia, etc.)

CANNABIS EFFECTS ON THE BODY

1. **Hurt your lungs** permanently, make it harder to breathe (if smoked)
2. Frequent use of THC over a long period increases the risk of **cannabis dependence**, also called: addiction, cannabis use disorder, problematic cannabis use.
3. Associated with risk of developing / worsening disorders relating to **depression and anxiety**
4. THC products with levels higher than 20% [200 mg/g] or more additionally increases the **risk of mental health** problems over time
5. **Cannabis poisoning** consuming too much can cause effects to last up to 12 hr
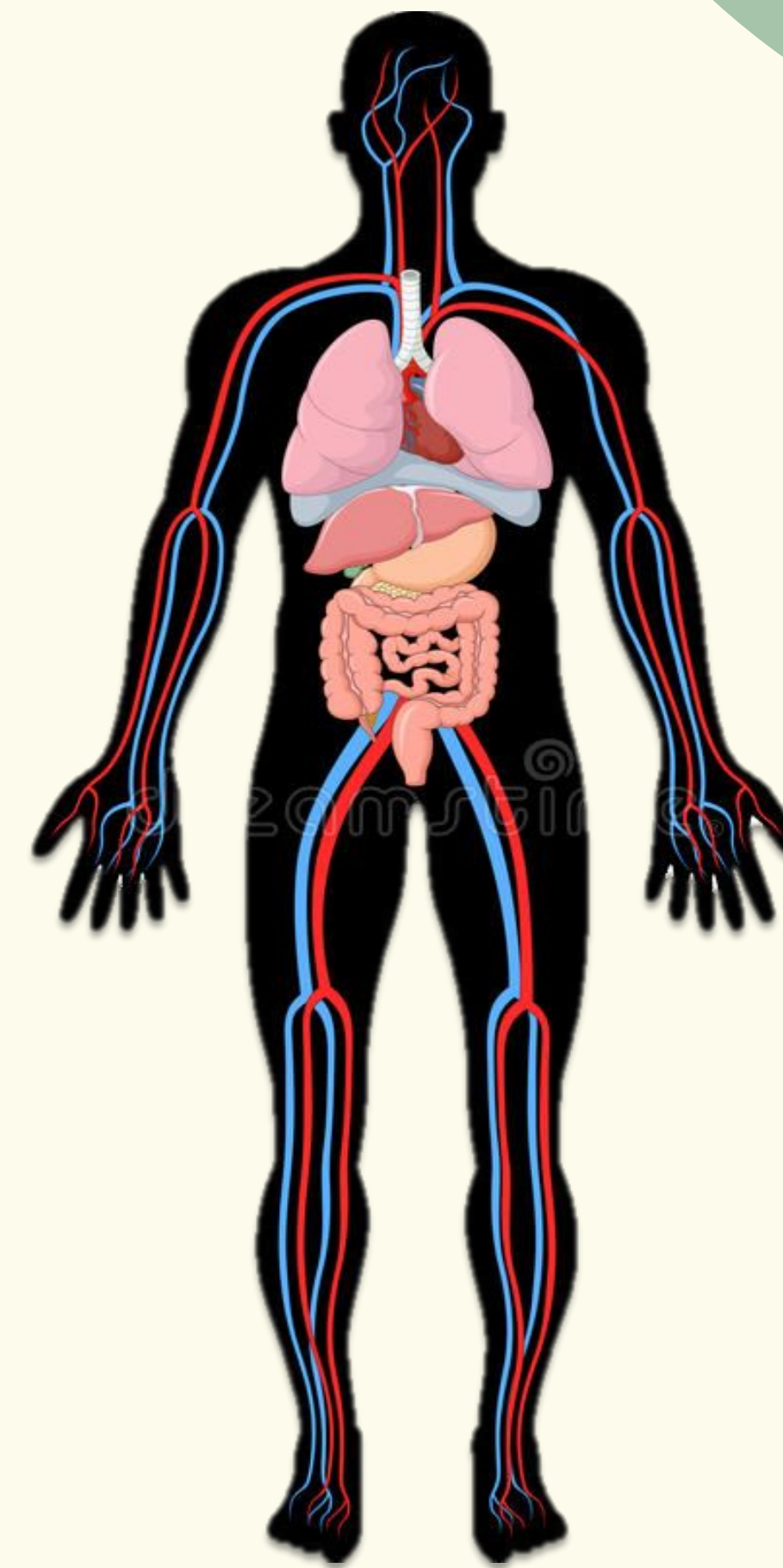
CANNABINOID DRUG PROPERTIES

, **,** **and** fit like a lock and key in the receptors of the human ECS. These receptors are responsible for modulating pain mechanisms, memory, appetite, anti-inflammatory responses.

CB_1 receptors are primarily found in the brain and central nervous system (CNS).

CB₁

- Brain
- Immune System
- Lungs
- Vascular System
- Muscles

- GI Tract
- Liver
- Pancreas
- Reproductive Organs
- Bone Marrow
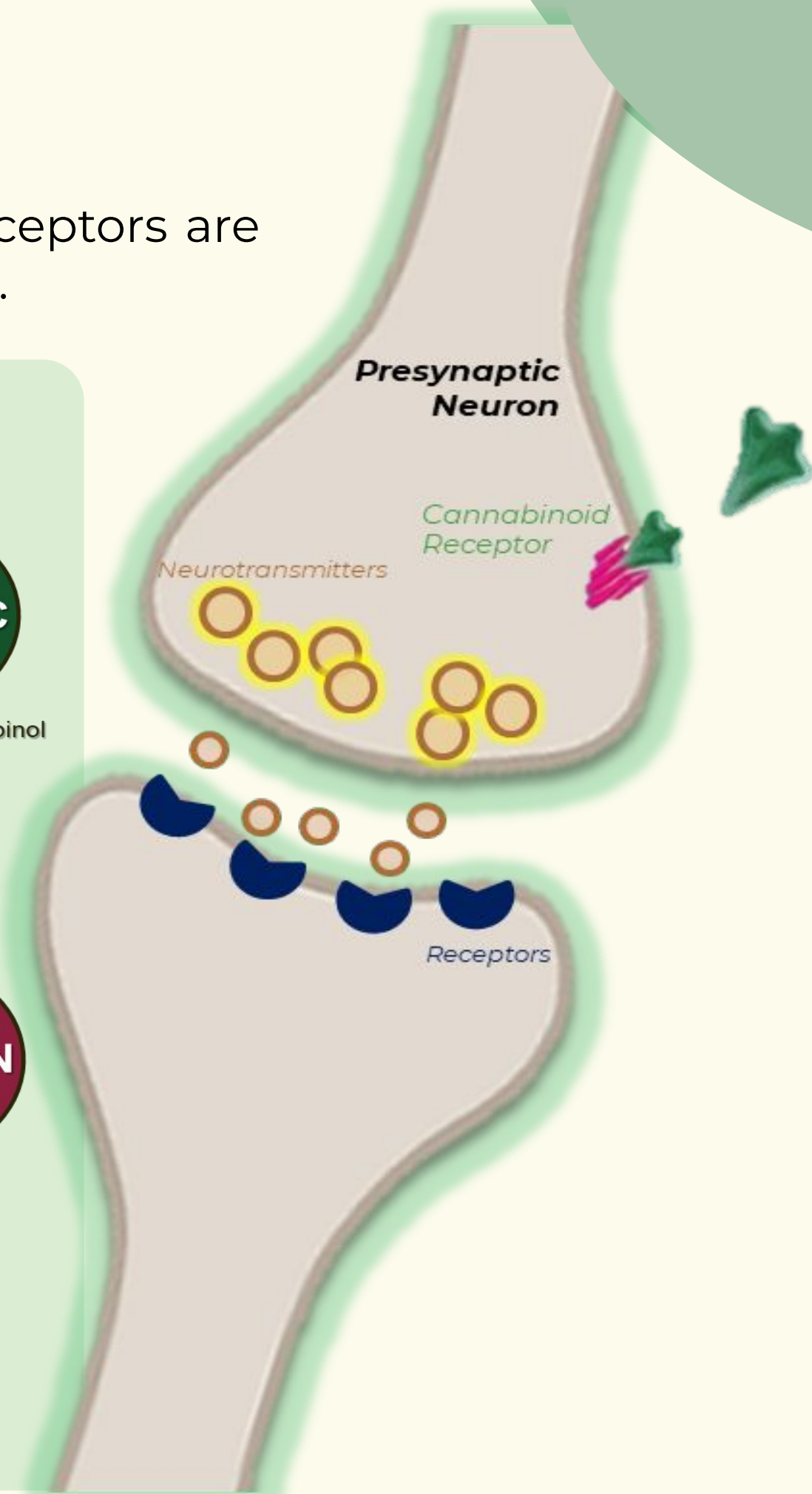
THC
Tetrahydrocannabinol

CB_2 receptors are mostly in the peripheral organs, especially immune-associated cells.

CB₂

- Immune System
- Skin
- Liver Bone Marrow
- Pancreas
- Spleen
- Bones

CBN
Cannabinol

CBD does not directly fit into CB_1 or CB_2 receptors, but can still initiate strong effects on the ECS.

CBD
Cannabidiol

Hua et al., *Cell, 2016*

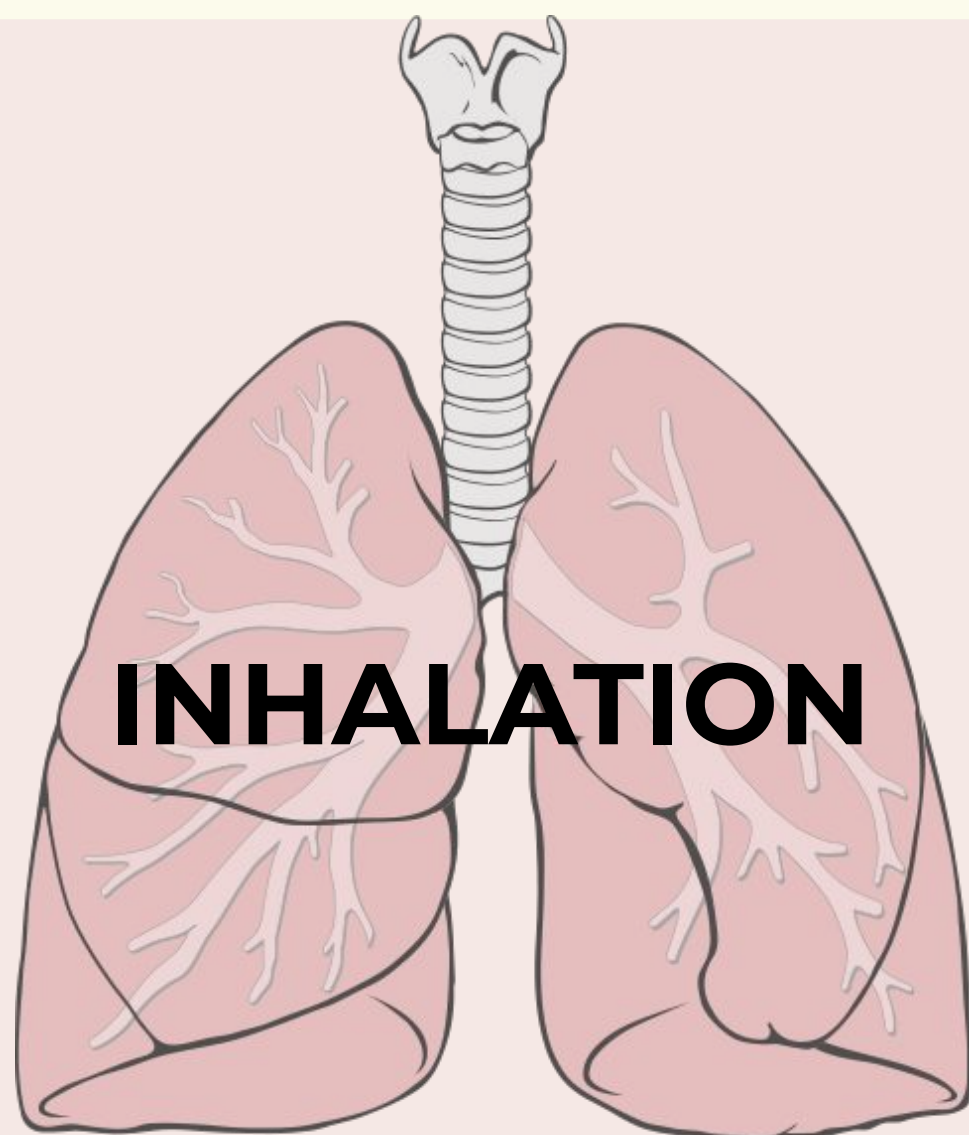**Presynaptic Neuron**

Cannabinoid Receptor

Neurotransmitters

Receptors

06: METABOLISM OF CANNABIS

1

INHALATION

- Rapidly absorbed into the **lungs**
- **30% THC** destroyed by pyrolysis
- **90 %** in blood plasma
- In plasma within seconds of inhalation, **peak [plasma] = 3-10 min**
- [THC] in plasma = 1-4 ng/mL after 3-4 hrs

2

ORAL

- Systemic absorption **slow**
- Extensive **liver** metabolism
- Rapidly penetrates into **fat tissues**
- Low [plasma] levels

METABOLITES OF THC

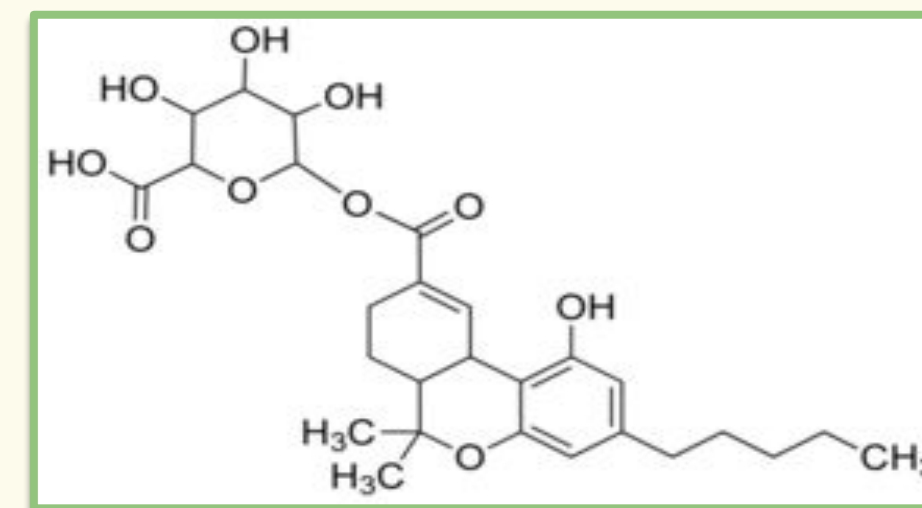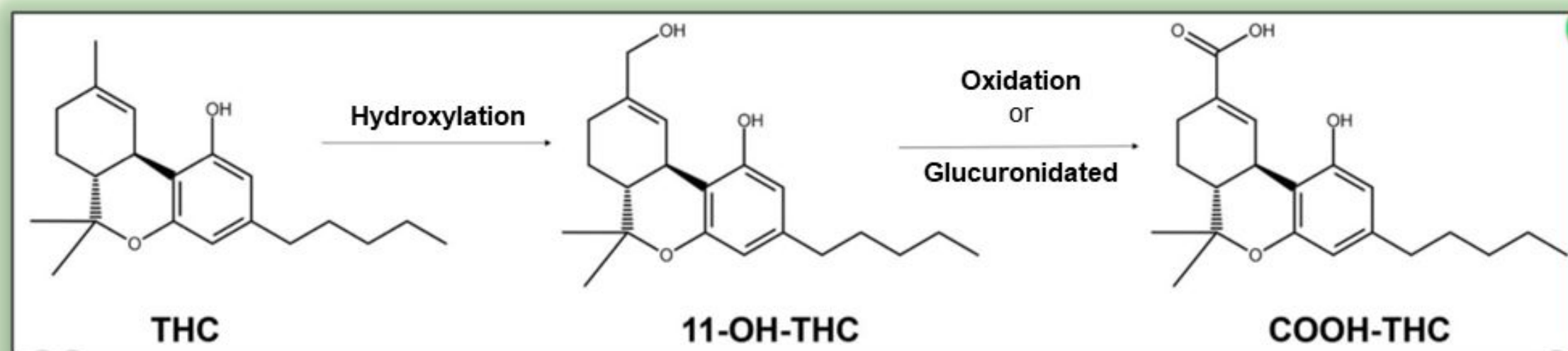| Δ⁹-THC | → | 11-OH-THC | → | THC-COOH | → | Glucuronide |

THC-COOH-Gluc

DID YOU KNOW?

- THC is a **lipophilic** compound
- THC rapidly spreads **from blood to fat deposits and organs**
- *THC lasting up to 30 days after use in chronic users*

METABOLISM OF THC: PHASE I

INFREQUENT USER

- Half-life = **1.3 days** in plasma serum
- Average plasma clearance rate = **36 L/hr**

1.3 days

FREQUENT USER

- Half-life = **5-13 days** in plasma serum
- Average plasma clearance rate = **60 L/hr**
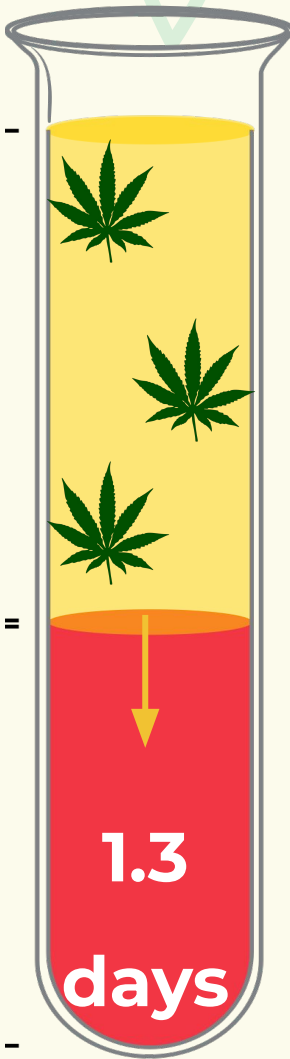
5-13 days

THC
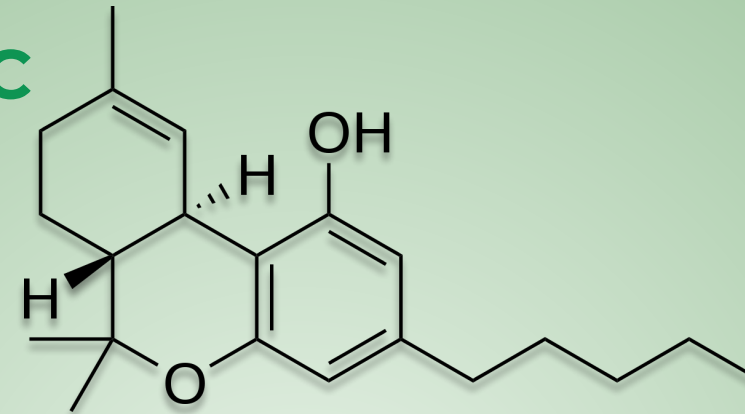
PHASE 1 Metabolism

P450 enzyme

Excreted cannabis (80-90%) = excreted in **5 days**

Oxidation

Glu

11-OH-THC

COOH-THC
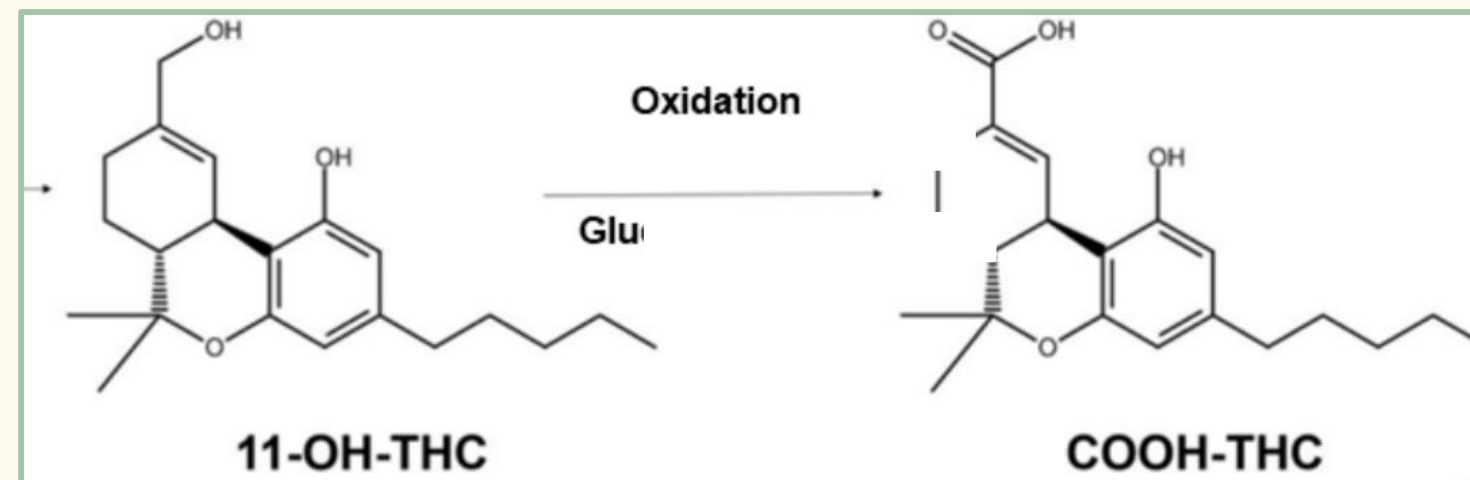
Hydroxylated & carboxylated metabolites

06

Glucuronidation of drug enhances its water solubility - increase in elimination rate

PHASE 2 Metabolism

THC-COOH

UGTs

(1A1, 1A3, 1A6, 1A7, 1A8, 1A9, 2B4, 2B7, 2B17)

Inactive excretion products

→ **Urine**

→ **Bile**

THC-COOH-Gluc
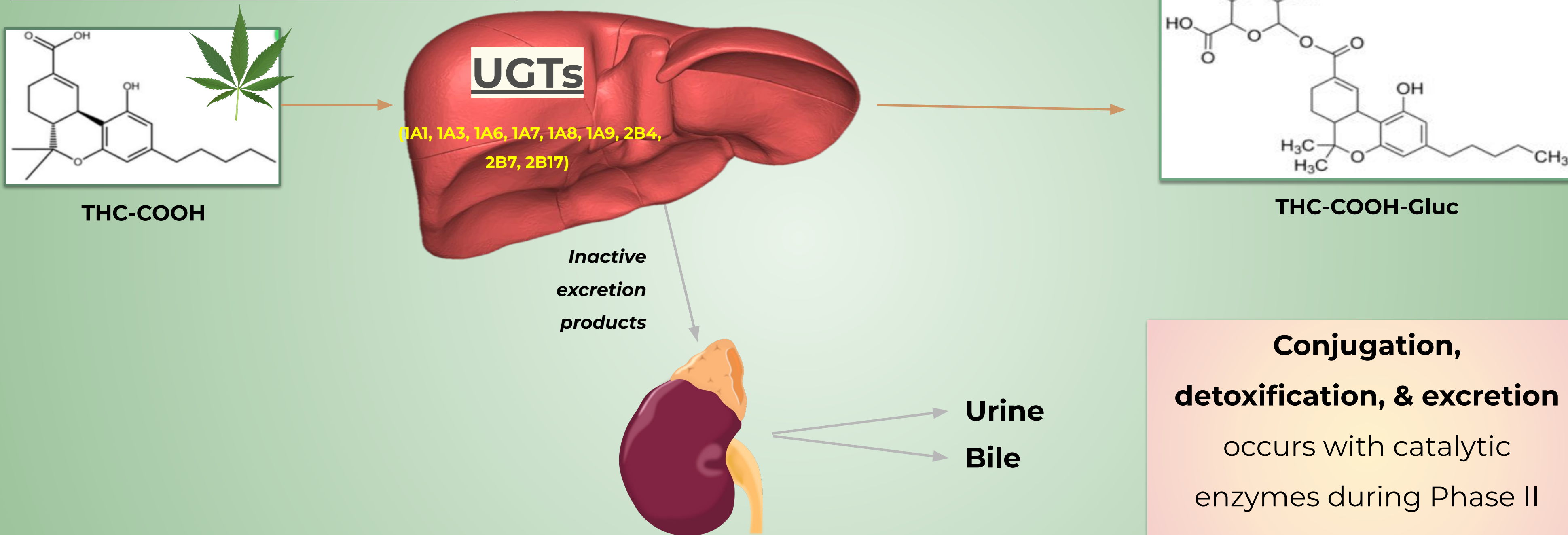
Conjugation, detoxification, & excretion occurs with catalytic enzymes during Phase II Metabolism.

Did you know?

18 gluc-metabolites exist in urine

Large portion of CBD is excreted intact

CBD
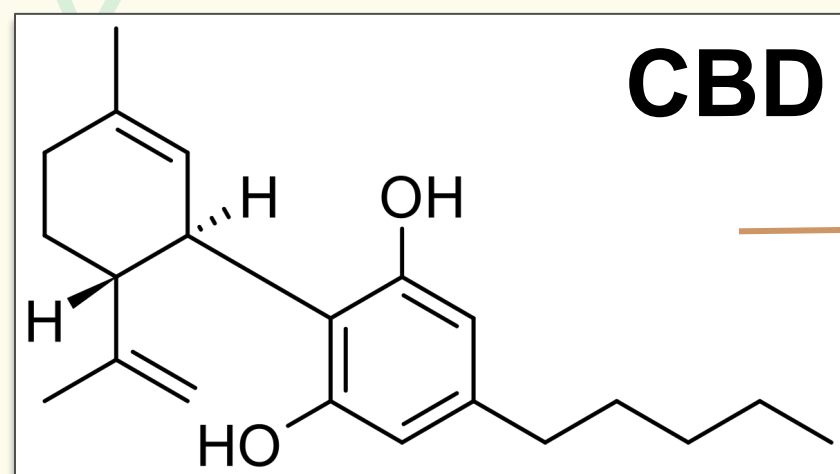
Ujváry I, Hanuš L. *Cannabis Cannabinoid Res.* 2016;1(1)

HIGH   **Relative Amounts**   **LOW**

7-COOH   4"-OH-7-COOH   CBD-glucuronide
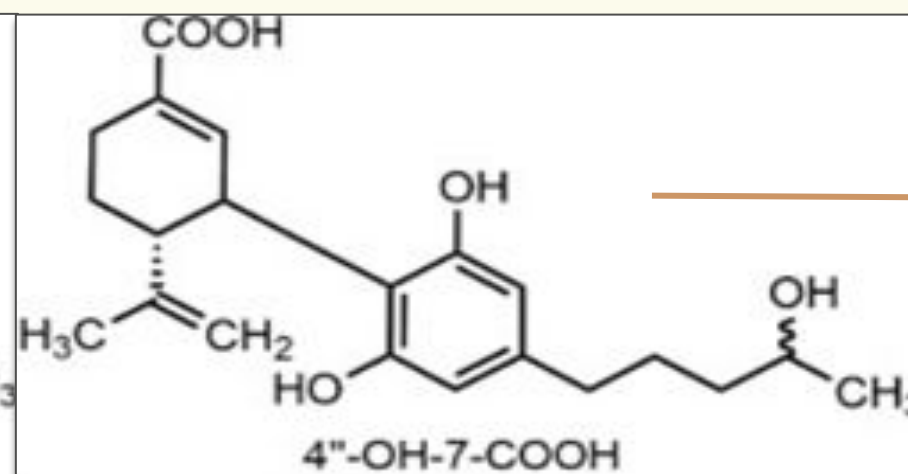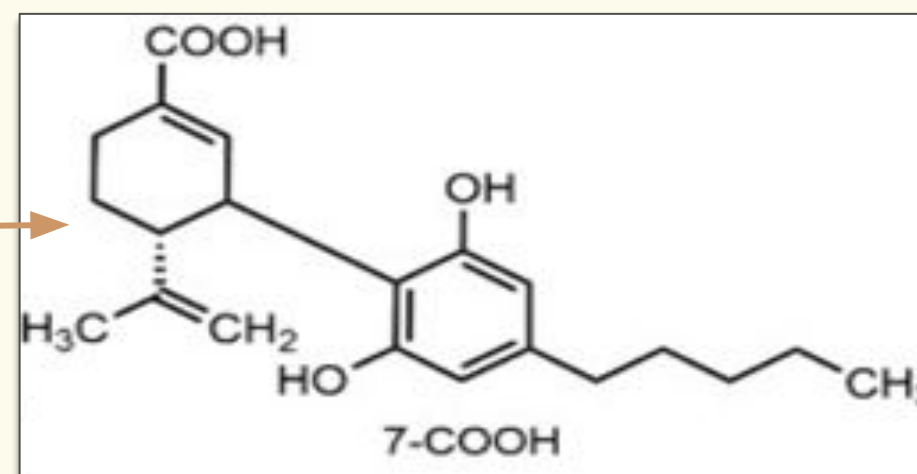
Hydroxylation products **(Phase 1)**   Glucuronide product **(Phase 2)**
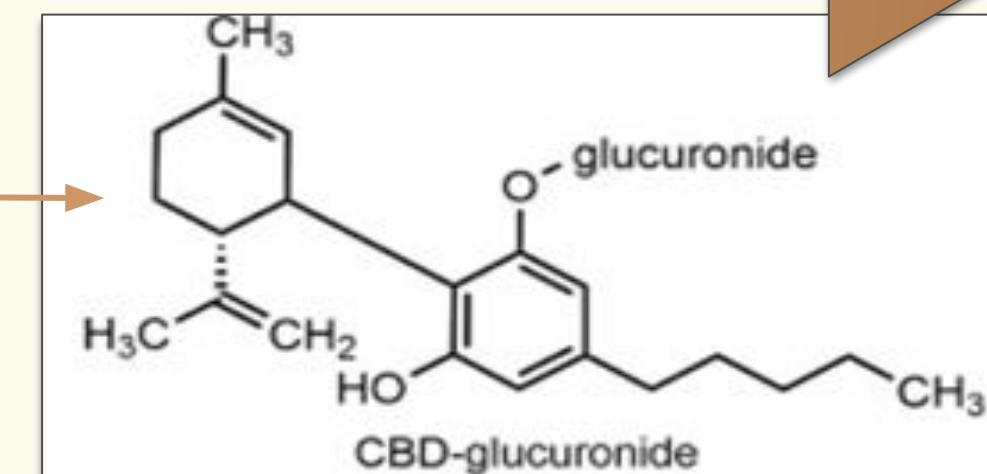
- **Oral Administration:** 1.09 and 1.97 hr
- **Oromucosal Spray Administration:** 1.44 – 10.86 hr
- **Inhalation**: 1.1 and 2.4 hr
- **I.V. Infusion**: 24 hr
- **Chronic Oral Intake:** 2-5 days
- **Smoking:** 30 hr

Volume of Distribution (CBD)
- I.V. = 3,000 L
- Oromucosal spray = 30,000 L

Bioavailability (CBD)
- Oral: ~20%
- Inhaled: ~30%
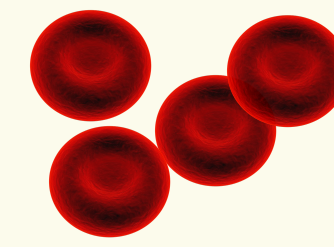
Cannabinoids do **not** distribute well into **erythrocytes**, thus increasing cannabinoid plasma concentration to twice the blood cannabinoid concentration. Most THC and CBD cannabinoids have been detected in the blood plasma!

When THC and alcohol were both consumed, alcohol concentrations **could not** be accurately measured.

DID YOU KNOW?
THC-glucuronide, CBD, and CBN may be present up to 4 hr!

Blood **THC**   13.1 μg/L

+

Blood **Alcohol**   0.08%

= Same Impairment Level

Alcohol is absorbed mostly from the small intestine, resulting in the highest level of ethanol concentration in the blood which was found to be **delayed** due to the cannabis.
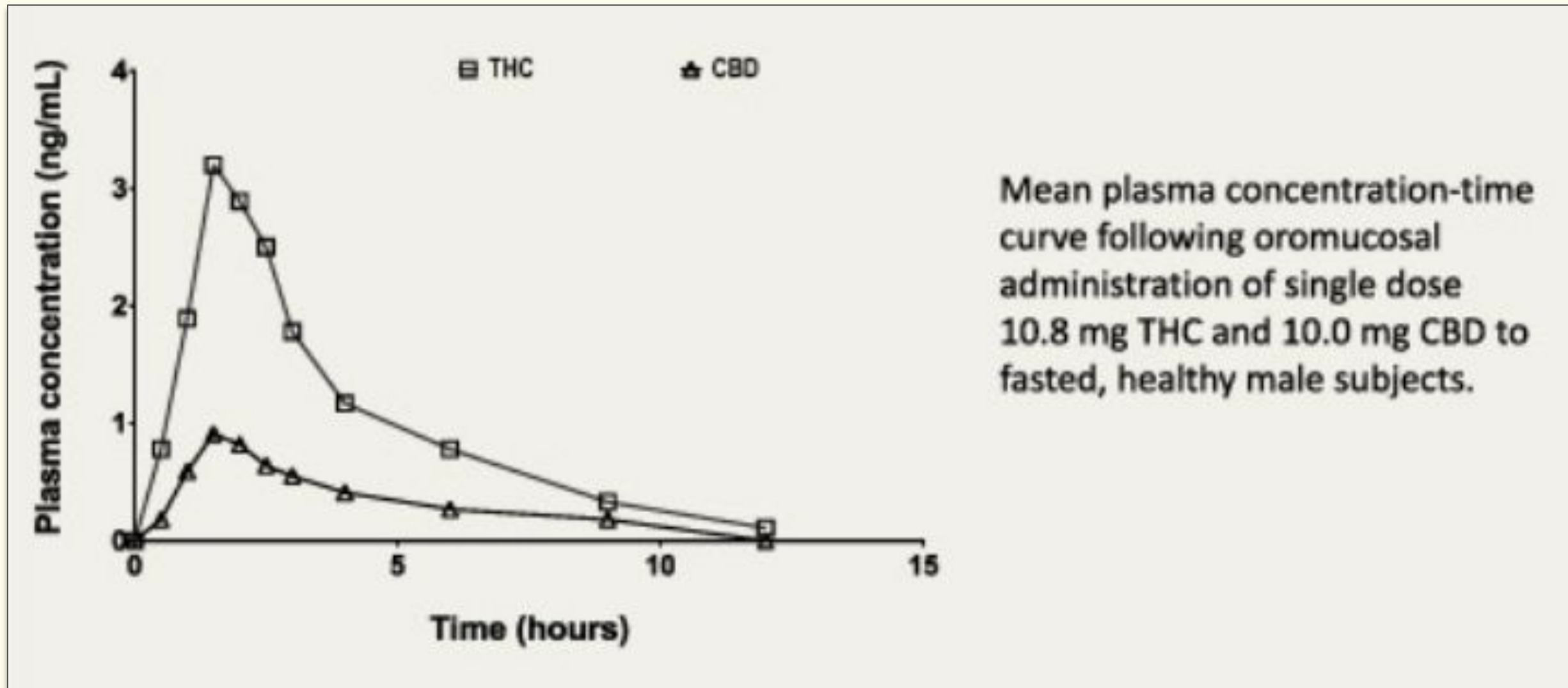
THC and CBD are found in blood plasma

Greater concentration of THC than CBD

Both compounds peak at ~ 2 min

Both compounds eliminated by 12 hours

Lucas, C.J. et al., *British Journal of Clinical Pharmacology,* 84 **(2018).**

CANNABIS FOUND IN **BLOOD**: *CASE STUDY*

Study of **frequent users of cannabis smokers**.

Whole blood detection rates for THC and its metabolites (**Phase 1**) were analyzed over 30 days of abstinence.
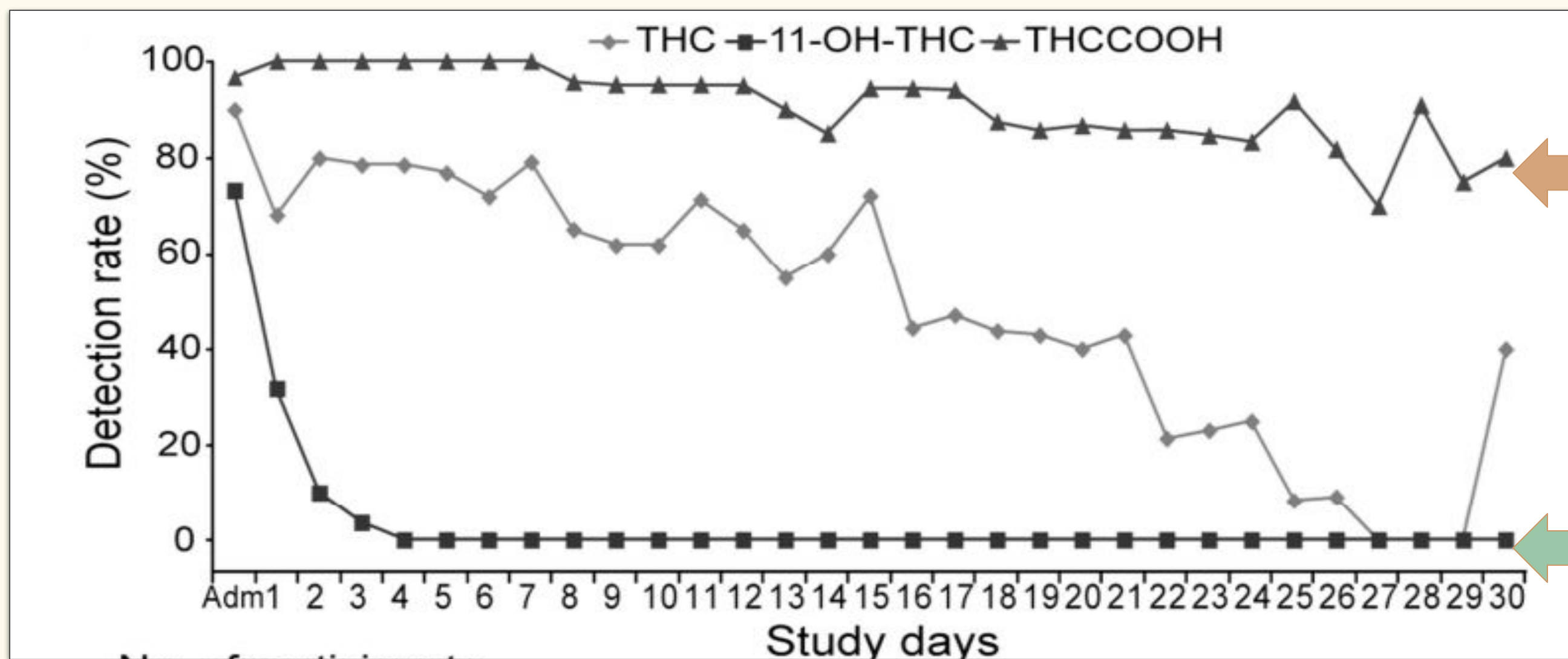
THC-COOH metabolite persists over time

11OH-THC metabolite eliminated within 4 days

- **THC-COOH-glucuronide**

- Enzymatic hydrolysis step to liberate THC-COOH is analyzed *via* immunoassays, GC-MS, LC-MS/MS, HR-MS

- Characterization of the time course of THC-COOH elimination in urine following variable cannabis exposure to provide data for improved interpretation of urine cannabinoid tests
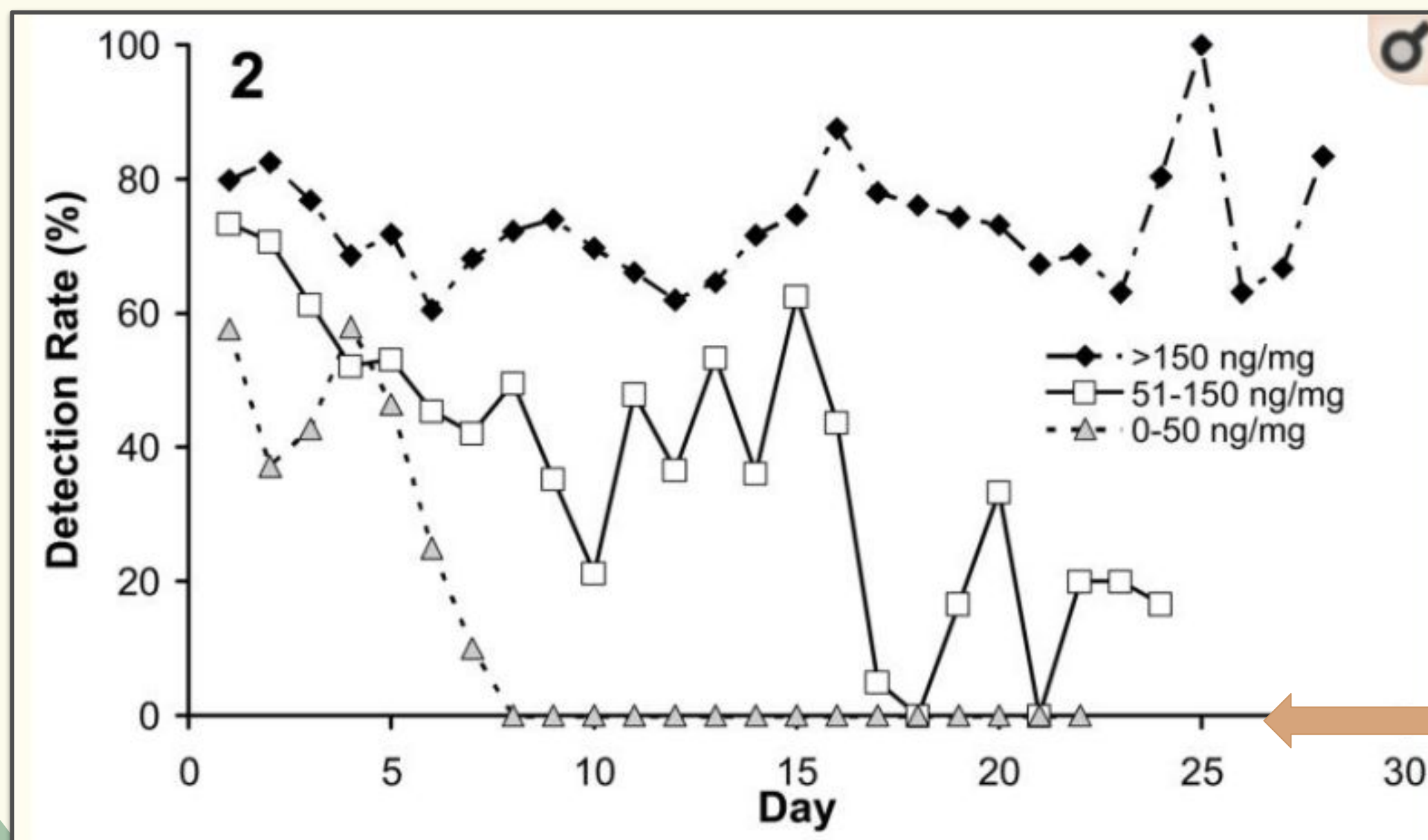
After HIGH exposure (>150 ng/mg), THC-COOH persisted for 28 days

Creatinine-Normalized THC-COOH Concentrations

After LOW exposure (0-50 ng/mg), THC-COOH was cleared by day 8

OTHER BIOLOGICAL FLUIDS WITH CANNABIS

Oral Fluid (OF):

- Non-invasive, applicable for workplace and drug treatment plans
- 2 µg/L THC in OF considered to be a marker of cannabis intake with the last 24 hr
- [CBD] positive in OF at 0.3 µg/L for up to 20 hr in both frequent and infrequent users

Hair Markers:

- Non-invasive, long detection times for drug intake (basic drugs transfer into hair and remain for years)
- Cannabinoids are acidic, so do not transfer to hair well ☐ still quantifiable in pg/mg (THC, 11-OH-THC, THC-COOH, CBN, and CBD)

Sweat Markers:

- Sweat patches worn for one week, monitor drug intake from 3 days before application until removal
- Good method for evaluating THC levels within a week

Breath Markers:

- THC can be collected via roadside test (breathalyzer) and transported to lab for LC-MS/MS from a filter
- THC ≥50 pg/filter was detected up to 4 hr after smoking (shorter for infrequent users)
- No THC-COOH has been detected in breath ☐ need to develop selective on-site instruments for metabolites

ON-SITE CANNABIS TESTING

Handheld Devices (DrugWipe, Securetec)

○ **Oral Fluid sample**

○ **95-97% reliable**

○ **5 ng/L limit of detection for THC**

○ **5 min testing time for THC**

Saliva drug screener

A LESS invasive method of sample collecting compared to blood and urine tests.

The LOWEST sampling volume required.

Potential application and uses by law enforcement, border control, rehabilitation clinics and prison systems worldwide.

Handheld Devices (DrugWipe, Securetec)

How does it work?

- Collect sample
- Break the ampoule and release the liquid
- Liquid moves drug particles that are bound to the antibodies on the test strip migrate to the test line
- A sequence of red lines appears on the readout window, depending on the results.

Detects 5 ng/mL THC ...in just 5 minutes.

Sample collector

Sampling pads

Cover

Ampoule

Read out window

Test cassette
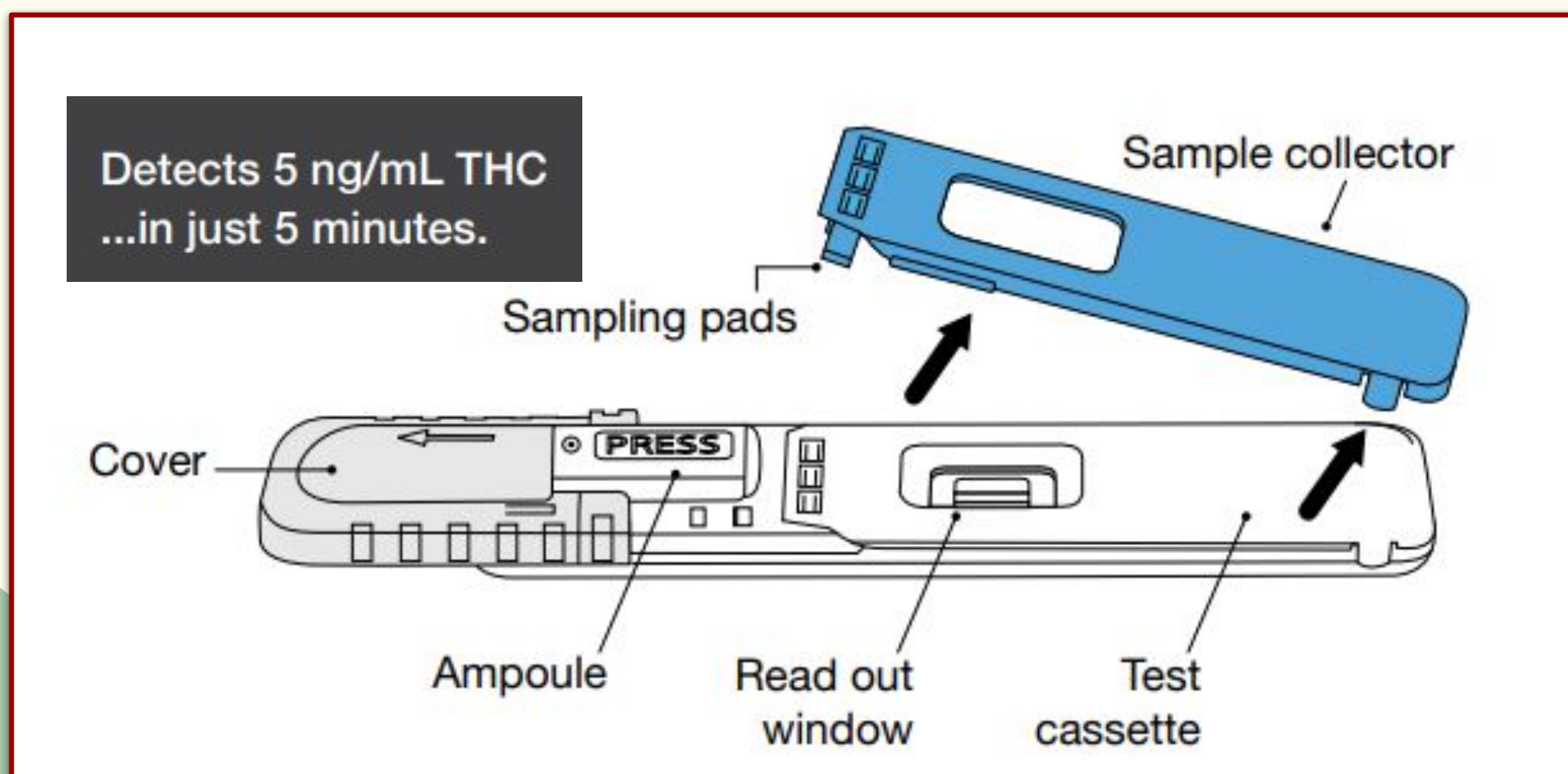
What drugs does it detect?

Cannabis, amphetamine, methamphetamines, cocaine, opiates, ketamine and benzodiazepines.

ACS
ALCOHOL COUNTERMEASURE SYSTEMS

Let's consider a forensic case based on cannabis!

08:
FROM THE CRIME
SCENE
TO THE LAB:
*CANNABIS CASE
FILES*

CAN-LII CASE TIMELINE FROM ARREST TO DRE:

R. v. D.A.H.

June 12, 2015

11:30 AM

D.A.H. struck a tree

Hit the tree on the left side of the vehicle. Airbags deployed, no one else hurt.

12:03 PM

Officer dispatched

Constable Thomas Mondoux dispatched, arrests D.A.H. for driving under the influence.

12:05 PM

Officer makes arrest at scene of the crime

Constable Thomas Mondoux issued a Drug Recognition Evaluation (DRE) on grounds that the defendant's ability to operate a motor vehicle was impaired by drug.

2:00 PM

Constable Lisa Grison conducts DRE

DRE completed at 2:00pm. Notably, physiological effects observed (cannabis), matching the observation from Constable Mondoux.

4:15 PM

Biological Sample Collection

Urine sample was collected at the hospital from the accused. Sample was sent to the CFS for toxicological analysis.

WHAT ARE DRE ROLLING LOGS?

- A ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯ is a police officer who is trained and certified by the International Association of Chiefs of Police (IACP) to correctly identify drug-impaired persons.
- In Canada, all DRE officers are trained by the Royal Canadian Mounted Police (RCMP).

- DREs are trained on a **12-step protocol** called the Drug Influence Evaluation to determine:

    - **[1] If the driver is actually impaired and,**

    - **[2] The classification of the drug causing the incident.**
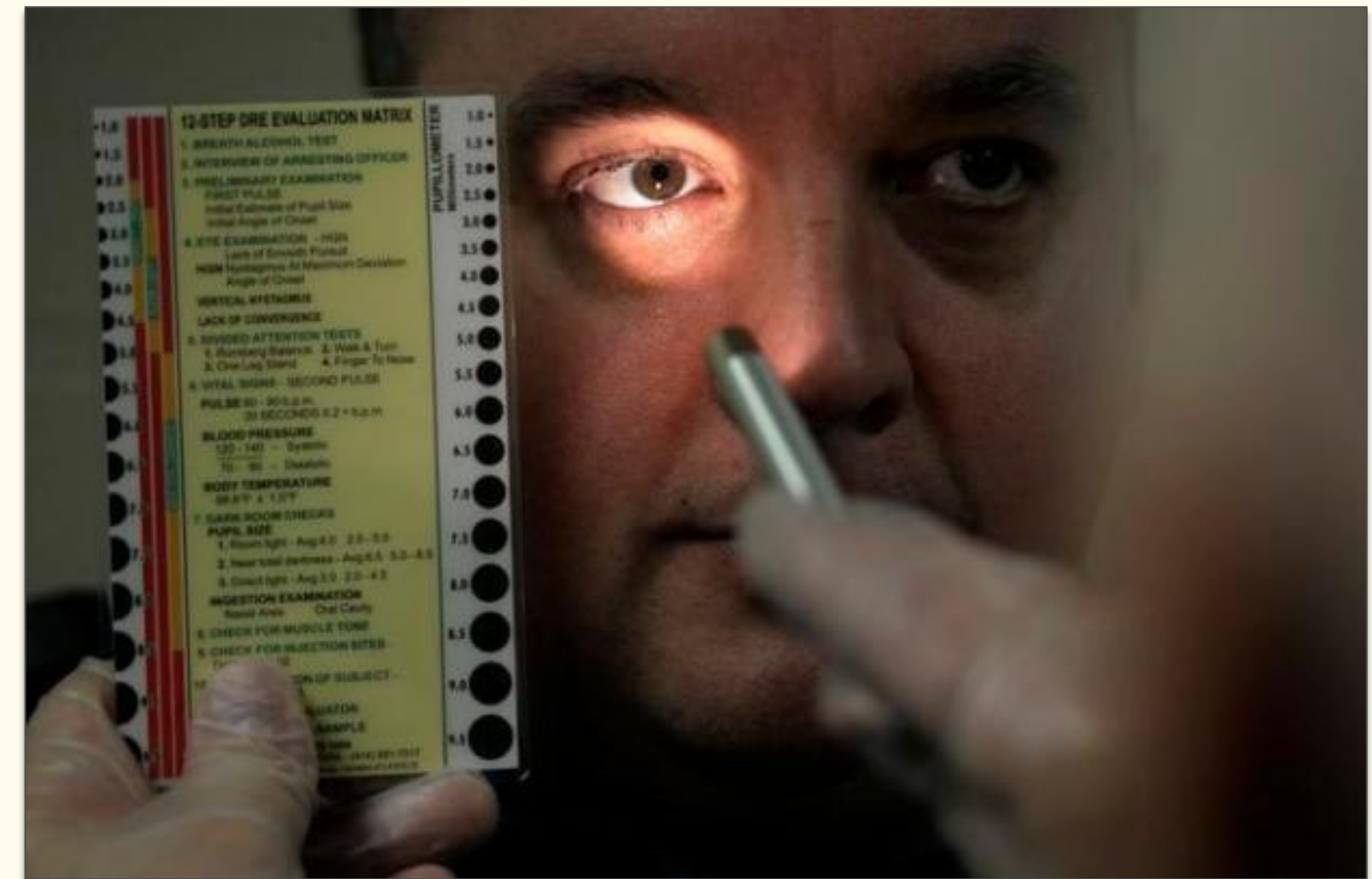
DRE ROLLING LOGS

1. Breath Alcohol Test
2. Interview of the Arresting Officer
3. Preliminary Examination and First Pulse
4. Eye Examinations
5. Divided Attention Psychophysical Tests
6. Vital Signs and Second Pulse
7. Dark Room Examinations
8. Examination for Muscle Tone
9. Check for Injection Sites and Third Pulse
10. Subject's Statements and Other Observations
11. Analysis and Opinions of the Evaluator
12. **After completing the evaluation, the DRE normally requests a urine, blood marker, and/or OF sample from the subject for a toxicology lab analysis**

INDICATORS CONSISTENT WITH DRUG CATEGORIES

	CNS Depressants	CNS Stimulants	Hallucinogens	Dissociative Anesthetics	Narcotic Analgesics	Inhalants	Cannabis
HGN	Present	None	None	Present	None	Present	None
Vertical Gaze Nystagmus	Present (High Dose]	None	None	Present	None	Present (High Dose]	None
Lack of Convergence	Present	None	None	Present	None	Present	Present
Pupil Size	Normal (1)	Dilated	Dilated	Normal	Constricted	Normal (4)	Dilated (6)
Reaction to Light	Slow	Slow	Normal (3)	Normal	Little or None Visible	Slow	Normal
Pulse Rate	Down (2)	Up	Up	Up	Down	Up	Up
Blood Pressure	Down	Up	Up	Up	Down	Up/Down (5)	Up
Body Temperature	Normal	Up	Up	Up	Down	Up/Down/ Normal	Normal
Muscle Tone	Flaccid	Rigid	Rigid	Rigid	Flaccid	Normal or Flaccid	Normal

CLICK LINK FOR DRE EXAMPLES

CAN-LII CASE **TOXICOLOGICAL ANALYSIS:**

DRE LOG

4:15 pm
Urine sample collected

2:00 pm
DRE log completed

Urine sample sent to

Centre of Forensic Sciences

Dr. Daryl Mayers:

-testified as an expert witness for this cannabis-specific case.

-Is an experienced **forensic toxicologist** employed by the **Centre of Forensic Sciences (CFS)** since 1992.

-holds a doctorate in forensic toxicology, as well as other degrees

1. At 4:15 PM, **urine sample** was collected from suspect by Cst. Grison

2. Urine sample sent to CFS

3. Dr. Mayers analyzed urine and found **THC** and **Carboxy-THC** (inactive metabolite, principal psychoactive ingredient in cannabis).
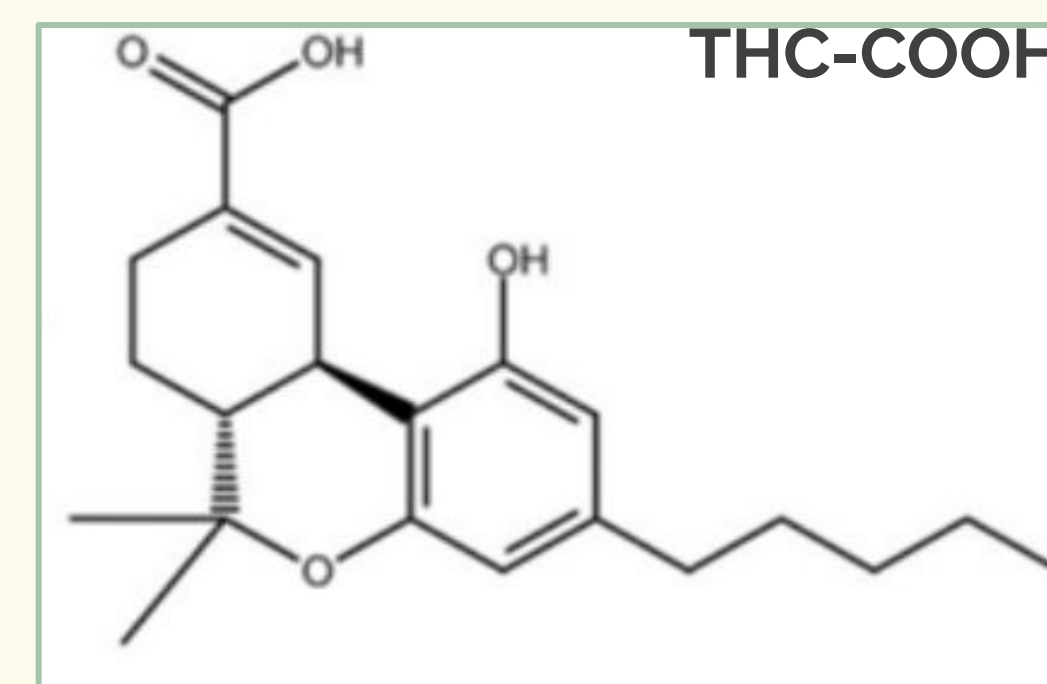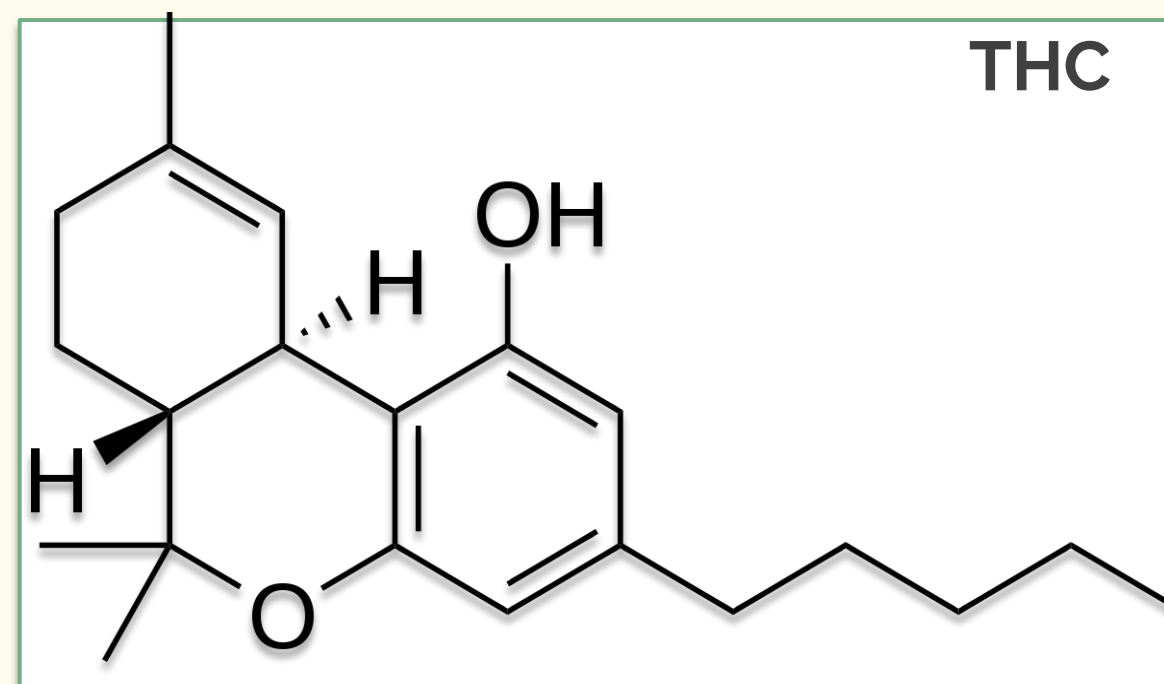
Dr. Daryl Mayers testimony:

1. Since the metabolite may be found in the urine weeks after ingestion of cannabis, and THC was found mixed in, it was noted that the suspect probably ingested cannabis within the **last several hours.**

2. While THC acts immediately on the body, the **metabolite** demonstrates a much longer time course due to **slow release and metabolism** in tissues.

3. Dr. Mayers stated THC **can affect one's mental ability,** including the ability to operate a vehicle, 3-4 hours after ingestion.

4. He also stated it is difficult to be definitive about its effects without THC concentrations from blood.

5. His final remark: it is **unlikely** that a person would be impaired by cannabis **after the 4-hour window,** even though urine detection is still possible.

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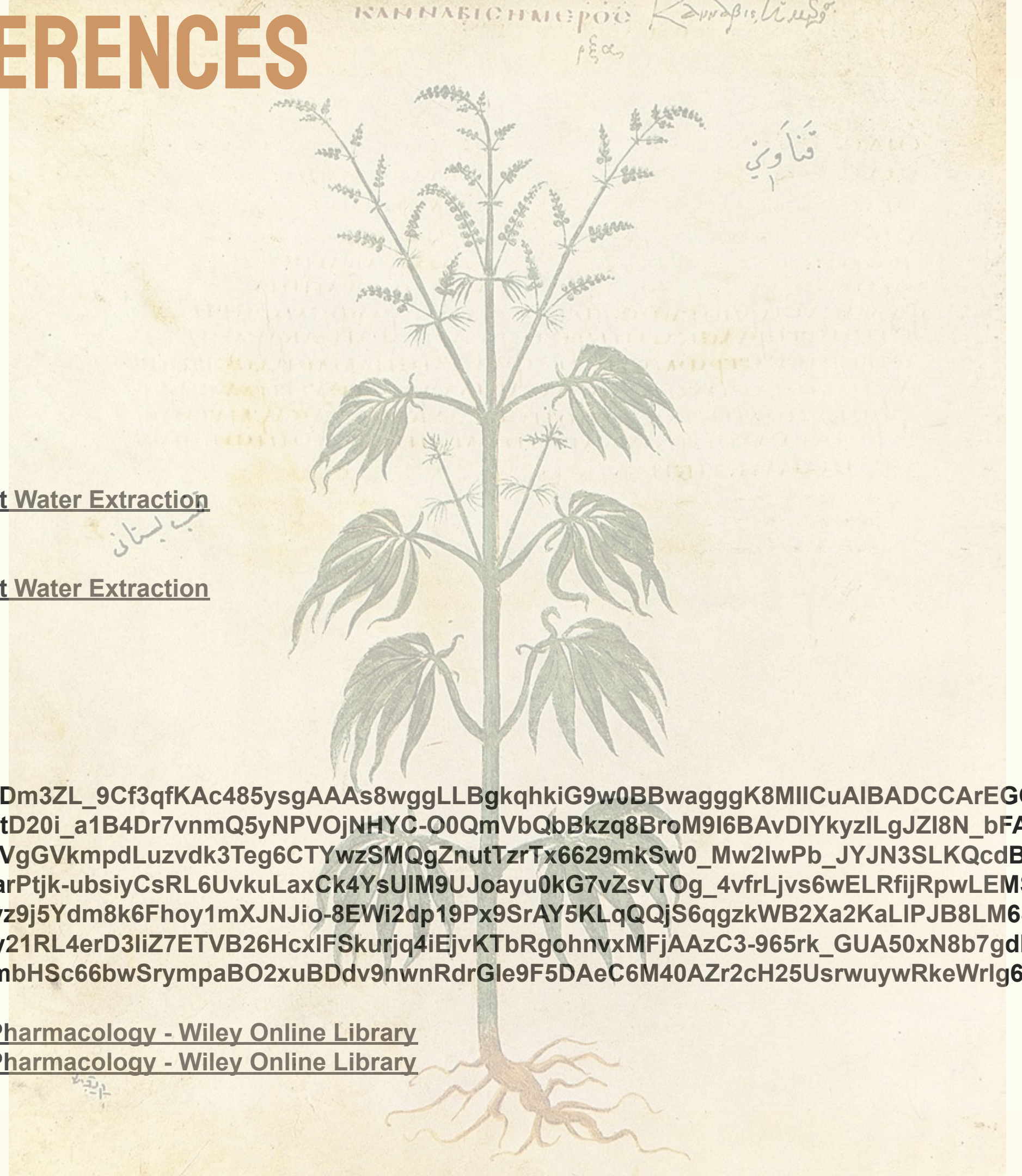
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