



Objectives

1. Discuss the statistics and marijuana trends
2. Describe the difference between marijuana forms and the different vehicles used
3. Explain the pharmacology of medical marijuana
4. At the end of the presentation technicians should be able to understand the difference between manufactured marijuana that comes in a pill form compared to edible or inhalant marijuana.
5. Discuss the approved uses for medical marijuana
6. Identify the common adverse reactions and drug interactions with medical marijuana

How many people use marijuana?

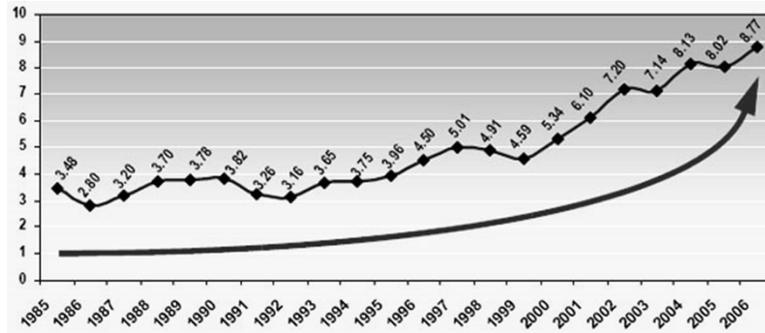
- ▣ Over 94 million Americans use marijuana
- ▣ 1,137,069 legal medical marijuana patients as of October 2014
- ▣ Average 7.7 of patients per 1,000 state residents

Medical Marijuana

- ▣ Legal medical marijuana states
 - Alaska, Arizona, California, Colorado, Connecticut, DC, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont, Washington
- ▣ 13 states pending legislation in 2015
 - Florida, Georgia, Indiana, Kansas, Kentucky, Missouri, Nebraska, North Carolina, Pennsylvania, S. Carolina, Tennessee, Utah, W. Virginia
- ▣ Failed Legislation in 2015
 - North Dakota and Mississippi

Marijuana Trend

- The THC content of marijuana and potency has increased dramatically since the 1980s



National Drug Intelligence Center

What is Marijuana

- Marijuana consists of leaves, stems, seeds, and other pieces of the plant



What is Marijuana

- ▣ All parts of the plant contain the psychoactive ingredients:
 - THC (delta-9-tetrahydrocannabinol)
 - Other cannabinoids
- ▣ There are two different types of plants
 - Male
 - Female
 - Flowers
 - Leaves
 - Trichomes
- ▣ Each plant has its own unique makeup and concentrations of cannabinoids

Marijuana's Main Chemicals...

Psychoactive: mind altering (changes how the brain works)

- 400 mind altering chemicals in marijuana
 - THC: Stimulates appetite and reduces nausea

Non-psychoactive: does not alter brain function

- Cannibidol (CBD): Reduces pain and inflammation, controlling epileptic seizures.

Marijuana Vehicle Overview

- ▣ Ways to consume medical marijuana
 - Inhalant
 - Edibles
 - Baked Goods (cakes, brownies, rice krispies, and granola bars), chocolate bars, gummy bears, beef jerky
 - Drinkable
 - Strawberry lemonade
 - Tinctures & Tonics
 - Topical: balms, salves, lotions, sprays, and ointments made from cannabis oils
 - Tea & Sodas

Marijuana Vehicles

- ▣ Inhalant
 - Smoking
 - Most expedient (immediate effect)
 - Can control dose
 - Harmful to the respiratory system
 - Cancer risk
 - Infection
 - Vapor
 - Less harmful toxins
 - No smoke

Marijuana Vehicles

- ▣ Edibles
 - Slow on/off
 - Easy to over consume
- ▣ Tinctures/oils
 - Made by soaking the flowers in alcohol
 - Strain solids particles
 - Very potent
 - Normal dose is 3 drops
 - Used sublingual, topical, or in food
- ▣ Topical
 - Balms, slaves, lotions, sprays, and ointments
 - Used for analgesia and anti-inflammatory properties

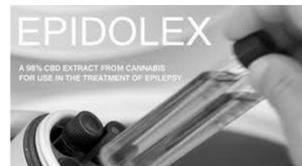
Marijuana Vehicles

- ▣ Tea
 - THC is slightly soluble in boiling water
 - Need to add oil or alcohol to help dissolve THC
- ▣ Sodas
 - 12 oz can has 35-65 mg of THC
 - 5 flavors (Canna Cola, lemon-lime, Doc Weed, Grape Ape, Orange Kush)
- ▣ Hash & Wax
 - Very potent
 - "Ear wax"
 - Flowers from the female plant (trichomes)
 - Can be smoked, eaten, or added to tea

Medical vs Street Marijuana

- ❑ Most marijuana sold in dispensaries as medicine is the same quality and carries the same health risks as marijuana sold on the street
- ❑ Specific marijuana has been bred to treat certain condition like epilepsy or nausea in cancer patients
 - Contains more CBD
 - Lower concentrations of THC
 - No psychoactive effects

Prescription Marijuana



Prescription Marijuana

FDA U.S Approved

- ▣ Marinol (dronabinol) Schedule III
- ▣ Cesamet (nabilone) Schedule II

Future Medication

- ▣ Sativex (nabiximols)
 - Currently in phase III trial
 - Approved in many other countries
 - Canada, Europe, Spain, Germany, Denmark, Sweden, and New Zealand
- ▣ Epidolex - orphan drug designation
 - Dravet syndrome

Prescription Marijuana

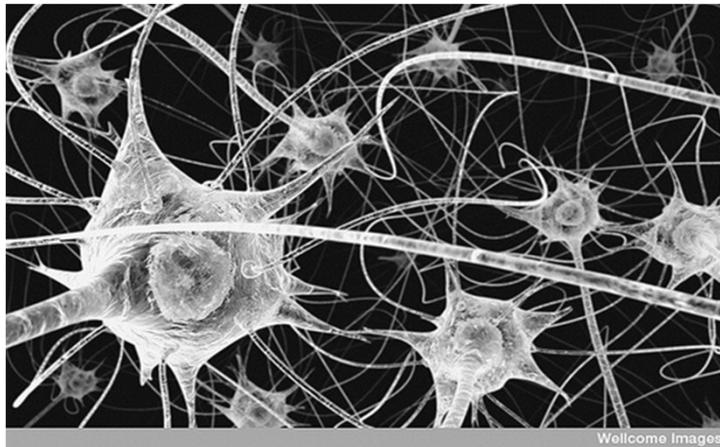
- ▣ Marinol
- ▣ Cesamet
 - Decrease nausea for oncology patients
 - Increase appetite in AIDS patients
 - Synthetic THC
- ▣ Sativex
 - Pain for oncology patients
 - Non-synthetic CBD
- ▣ Epidolex
 - Dravet syndrome
 - Spray formulation
 - Not yet approved anywhere

Prescription Marijuana

- ▣ Marinol -(most common)
 - Cautions
 - Consume marijuana while using Marinol treatment for risk of overdose
 - History of seizure activity
 - Mental health problems (depression, bipolar, or schizophrenia)
 - High or low blood pressure/heart rate
 - Avoid
 - Pregnancy
 - Taking benzodiazapenes
 - True allergy to sesame oil or cannabis

How Does Marijuana Work?

- ▣ *OUR BRAIN*



Natural EC system is finely tuned, THC overwhelms the EC system

The Endocannabinoid System

Brain cells (neurons) communicate with each other by sending chemical messages. The chemicals (neurotransmitters) cross a gap between neighboring neurons before attaching to their specific receptors.

Presynaptic: The neuron sending a message by releasing a chemical when signaled to do so

Postsynaptic: The neuron receiving the message when its receptors are activated by specific chemicals (neurotransmitters)

Neurotransmitters: The chemical messengers that travel from one brain cell to another

Receptors: Activated by neurotransmitters, receptors trigger a set of events that allows a message to be passed along to other neurons

The diagram illustrates the interaction between a presynaptic neuron (sending neuron) and a postsynaptic neuron (receiving neuron). The presynaptic neuron contains neurotransmitters and cannabinoid receptors. It releases neurotransmitters and cannabinoids into the synaptic cleft. The postsynaptic neuron contains receptors and lipid precursors (fat cells). THC is shown as a cannabinoid that binds to the postsynaptic receptors, interfering with the normal functioning of the endocannabinoid system.

Cannabinoids: Natural chemicals (anandamide and 2-AG) that bind to cannabinoid receptors in the brain and the body

THC: The main active ingredient in marijuana; THC, also a cannabinoid, interferes with the normal functioning of the endocannabinoid system

Neurotransmitters

GABA - inhibitory & Dopamine - excitatory

Without THC

GABA interneuron

GABA

Synapse

Cl⁻

Dopaminergic Neuron

With THC

GABA interneuron

Cannabinoid Receptor

THC

GABA

Synapse

Cl⁻

GABA receptor

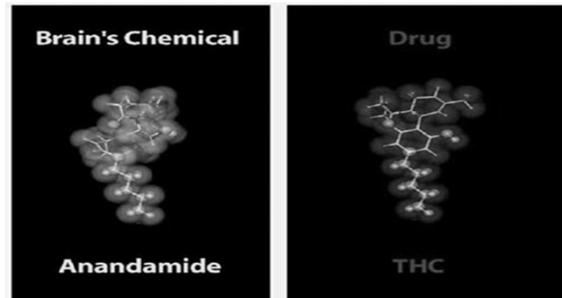
Dopamine

Dopaminergic Neuron

↓

Enhanced feelings of euphoria

The Effects of THC

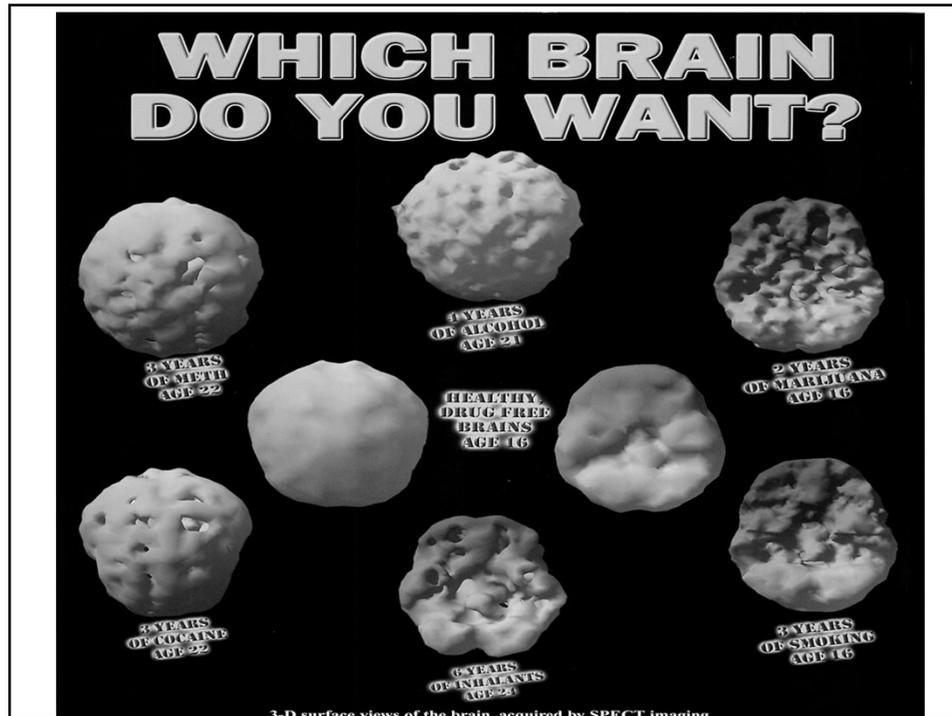


- THC's chemical structure is similar to the brain chemical anandamide. Similarity in structure allows drugs to be recognized by the body and to alter normal brain communication

How does THC affect behavior? *It depends on where the CB receptors are in the brain.*

Brain Structure	Regulates	THC Effect on User
Amygdala	emotions, fear, anxiety	panic/paranoia
Basal Ganglia	planning/starting a movement	slowed reaction time
Brain Stem	information between brain and spinal column	antinausea effects
Cerebellum	motor coordination, balance	impaired coordination
Hippocampus	learning new information	impaired memory
Hypothalamus	eating, sexual behavior	increased appetite
Neocortex	complex thinking, feeling, and movement	altered thinking, judgment, and sensation
Nucleus Accumbens	motivation and reward	euphoria (feeling good)
Spinal Cord	transmission of information between body and brain	altered pain sensitivity

The brain structures illustrated above all contain high numbers of CB receptors



How Marijuana Works

Within a few minutes after inhaling marijuana....

- Heart rate speeds up
 - Increase by 20-50 beats per minute
 - Increased even more with other drugs
- Bronchial passages dilate
- Blood vessels in eyes dilate



Consuming marijuana

- Think this is safer.....think again
- Effects brain just as much
- Lasts longer



How marijuana affects the body

Brain

- ▣ Our brains continue to develop into our early 20s
 - Acts on the brains reward system
 - THC activates the reward system the same way that nearly all drugs of abuse do: by stimulating brain cells to release the chemical dopamine.
 - Acts on the brain memory/learning
 - As people age they loose neurons in the brain which decrease their ability to learn new information
 - Chronic THC exposure may speed up this process
 - Or at younger ages not allow the development to succeed fully
 - Makes other drugs more appealing too
 - Psychosis - it's all linked together!

How marijuana affects the body

- ▣ Heart
 - Risk of HEART ATTACK increased is 4 times during the first hour after marijuana use
 - Naive users may experience a sudden 20-100% rise in heart rate, lasting up to 2-3 hours.
 - Peripheral vasodilatation causes postural hypotension, which may lead to dizziness
 - Cardiac output increases by as much as 30%. In addition, the cardiac oxygen demand is also increased. Tolerance to these effects can develop within a few days of use.
 - Naive users can experience chest pain. In addition, users with preexisting coronary artery disease or cerebrovascular disease may experience myocardial infarctions, congestive heart failure, and strokes

How marijuana affects the body

- ▣ Lungs
 - The amount of tar in a marijuana cigarette is 3 times the amount in a tobacco cigarette when smoked
 - With chronic heavy smoking, users experience increased cough, sputum production, and wheezing
 - One study sites that the rate of decline of respiratory function in an 8-year period was greater among marijuana smokers than among tobacco smokers
 - Several case reports strongly suggest a link between cannabis smoking and cancer of the month, tongue and throat
 - Most illegally obtained marijuana is contaminated with *Aspergillus* species

How marijuana affects the body

- ▣ Immune system
 - Most immune cells are protecting our body from infection
 - Myeloid-derived suppressor cells inhibit the formation of immune cells
 - ▣ Keeps the immune system in check
 - Marijuana increases the actions of myeloid derived suppressor cells
 - Therefore our risk for infection is **increased**

Consequences of Marijuana

- ▣ Acute (during intoxication)
 - Impairs short term memory
 - Impairs attention, judgment, and other cognitive functions
 - Impairs coordination and balance
 - Increases heart rate
 - Psychotic episodes

Consequences of marijuana

- ▣ Persistent (lasting longer than intoxication)
 - Impairs memory and learning skills
 - Sleep impairment

Consequences of Marijuana

- ▣ Long Term
 - Can lead to addiction
 - Increases risk of chronic cough, bronchitis
 - Increases risk of schizophrenia
 - Increases risk of anxiety, depression, and amotivational syndrome

Marijuana-the cause of mental illness

- ▣ There is a significant increased risk of developing a psychotic disorder such as schizophrenia after chronic cannabis use
 - The relationship is dose and age dependent
- ▣ Cannabis can trigger schizophrenia in those who would otherwise have had good prognostic features
- ▣ Increased anandamide levels are seen in schizophrenic patients
- ▣ Schizophrenia- a mental health disease characterized by psychotic episodes:
 - Hallucinations
 - Delusions
 - Disorganized thinking and speech

Marijuana and Mental Illness

- ▣ Is mental illness a risk factor for using marijuana
 - Many studies have shown that people with a mental illness are a higher risk of substance abuse and addiction
 - ▣ More use has been seen in patients with a mental illness than in the general population



Marijuana and Addiction

- ▣ About 9% of people that use marijuana will become addicted
- ▣ The number of addicted people increases in those who start using at younger ages (to about 20-50%)
- ▣ Marijuana addiction is linked to withdrawal syndrome similar to nicotine withdrawal
 - Irritability, sleeping difficulties, craving, increased aggression, and anxiety peak at about 1 week after the last marijuana.

Growing Misperception of Safety

- ▣ The acceptance of medical marijuana and now legalization of marijuana in two states influence how people perceive the harm
 - Research shows that as high school seniors perception of risk goes down the use goes up
- ▣ Consider marijuana like any other drug as we continue research of its effects on brain function

Conclusions

- ▣ Marijuana has been around for centuries
- ▣ Medicinal marijuana has gained significant attention recently
- ▣ There are many differences between the vehicles used to consume medical marijuana
- ▣ Prescription marijuana is available with different active ingredients used for different disease states
- ▣ There are more and more studies following marijuana use and its affects
- ▣ Genetically predisposed patients that struggle with addiction should avoid marijuana

Conclusions

- ▣ Marijuana can harm many parts of our body when used chronically
 - Brain
 - Heart
 - Lungs
 - Immune system
- ▣ Marijuana can be the cause of a mental illness such as schizophrenia

Questions



Resources

- ▣ National Drug Intelligence Center
- ▣ National Institutes of Health
- ▣ National Institute of Drug Abuse
- ▣ Mayo Clinic