

The Neuroscience of Addiction

Bob Schuneman
Lawyers Concerned for Lawyers

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mncl.org



1

Copyright Notices

This presentation and the accompanying materials exclusive of images are copyright © 2020-2022 by Lawyers Concerned for Lawyers, Saint Paul, Minnesota. All rights reserved.

Images are copyright by their respective owners and are used here for a non-profit educational purpose understood as fair use within the analytical framework provided by 17 U.S.C. § 107.

LCL gratefully acknowledges the contributions to this presentation and the accompanying materials by the National Institutes for Health (NIH), the Office of the United States Surgeon General, and the National Institute on Drug Abuse (NIDA).

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mncl.org



2

Opening Thoughts

1. I'm not a neuroscientist
2. Neuroscience is an emerging field with more unknowns than knowns
3. Hypotheses are not facts
4. Neurotransmitters perform multiple functions
5. Human behavior is incredibly complex and poorly understood
6. There is substantial overlap between addiction and mental health issues

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mncl.org



3

Definition of Addiction

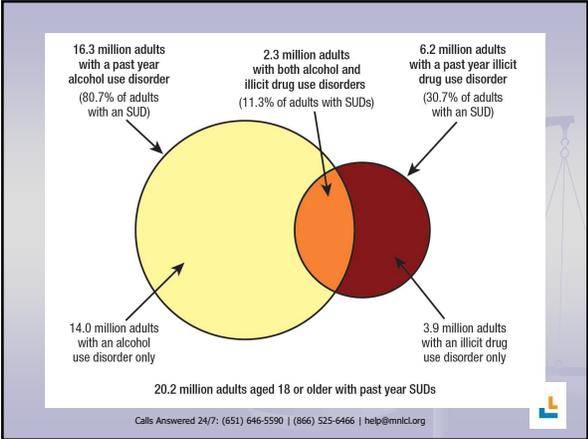
Addiction is a treatable, chronic medical disease involving complex interactions among brain circuits, genetics, the environment, and an individual's life experiences. People with addiction use substances or engage in behaviors that become compulsive and often continue despite harmful consequences.

Prevention efforts and treatment approaches for addiction are generally as successful as those for other chronic diseases.

American Society of Addiction Medicine



4



5

51.5 Million → **1 IN 5** ADULTS IN THE U.S. LIVES WITH A MENTAL HEALTH CONDITION

10.3 Million → **1 IN 25** (10 MILLION) ADULTS IN THE U.S. LIVES WITH A SERIOUS MENTAL ILLNESS

60 MILLION PEOPLE IN THE U.S. FACE THE DAY-TO-DAY REALITY OF LIVING WITH A MENTAL ILLNESS

Columbia River Community Mental Health Center

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mmic.org



6

Other Substances & Behaviors

- > Drugs
- > Gambling
- > **Internet Addiction** →
- > Sexual Compulsivity
- > Eating Disorders
- > Shoplifting Addiction
- > Compulsive Shopping

- i-Escapism**
- > Internet Gaming
 - > Online Pornography
 - > Social Media
 - > YouTube
 - > ... and whatever the next big thing turns out to be!

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



10

Legal Profession and Mental Health

"In the last 12 months..."

- > 28% met the criteria for depression
- > 18% met the criteria for anxiety

In the course of their careers...

- > 11.5% had considered suicide.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



11

Depression

- > A loss of interest in normally pleasurable activities
- > Impaired ability to concentrate, remember and decide
- > It can occur in stages:
 1. Emptiness
 2. Hopelessness/helplessness
 3. Malaise
 4. Suicidal Ideation
- > It's not just a blue mood that can be wished away
- > Time element

In a colleague, look for *changes* in behavior.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



12

Other Mental Health Issues

- Anxiety Disorder
- Bipolar Disorder
- Obsessive Compulsive Disorder
- ADHD
- Unresolved Grief
- Post Traumatic Stress Disorder
- Cognitive Impairment

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



13

Stress and Fear

- Fear is part of survival
- Loss of control
 - Irregular and unpredictable
 - Potential scope
 - Potential duration
- Stigma is fear-based
- Recognize that fear can help us cope

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



14

Trauma

Trauma is the unique individual experience of an event, series of events, or set of circumstances:

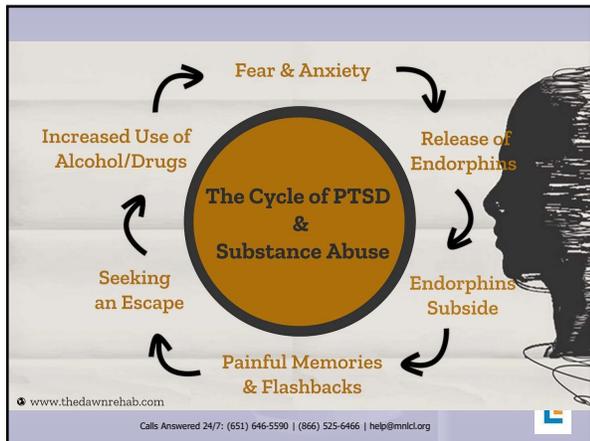
- The individual's ability to integrate their emotional experience is overwhelmed; and
- The experience is physically or emotionally harmful or threatening and has lasting effects on the individual's functioning and physical, social, emotional, or spiritual well-being
- Direct, secondary and vicarious

That the pandemic is traumatic for everyone is a given. How each person experiences it will vary according to many factors unique to themselves.

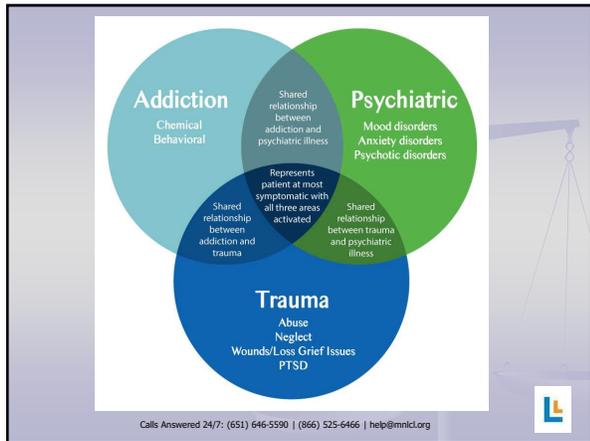
Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



15



16



17

Triggers

Triggers are stimuli that set off a “memory tape” or “flashback” transporting the person back to the emotional state of the original trauma. Triggers are also involved in Substance Use Disorders and have the effect of stimulating cravings.

- Triggers are very personal; different things trigger different people. A person's triggers are activated through one or more of the five senses: sight, sound, touch, smell and taste.
- The survivor may begin to avoid situations and stimuli that she/he thinks triggered the flashback. She/he will react to this flashback, trigger with an emotional intensity similar to that experienced at the time of the trauma.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnlc.org

18

Homeostasis v Allostasis

Homeostasis, any self-regulating process by which biological systems tend to maintain stability while adjusting to conditions that are *optimal for survival*.

If homeostasis is successful, life continues; if unsuccessful, disaster or death ensues. The stability attained is actually a dynamic equilibrium, in which continuous change occurs yet *relatively uniform conditions prevail*.
(Encyclopedia Britannica. <https://www.britannica.com/science/homeostasis>. Emphasis added.)

Allostasis, the process by which, in order to be adaptive, organisms must be able to change the defended levels of one or more regulated parameters as needed to adjust to new or changing environments.

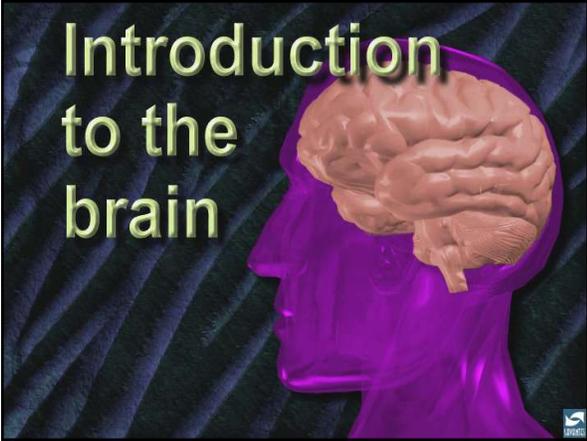
Allostasis explicitly incorporates learning and anticipatory responding, relying on experience or learning from past events.
(Ramsay, Douglas S. and Woods, Stephen C. "Clarifying the Roles of Homeostasis and Allostasis in Physiological Regulation", *Psychol. Rev.*, 2014 April, 121(2):225-247.)

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mmlc.org



19

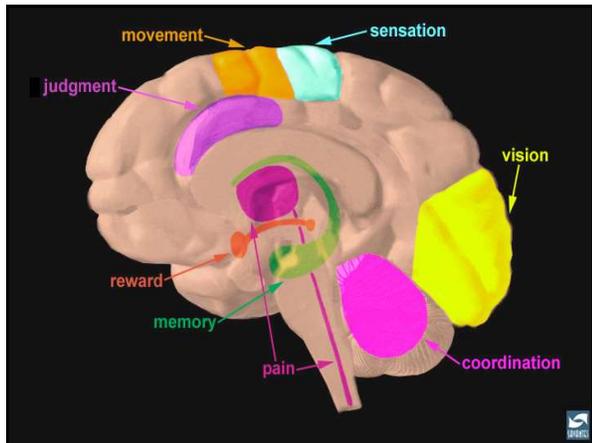
Introduction to the brain



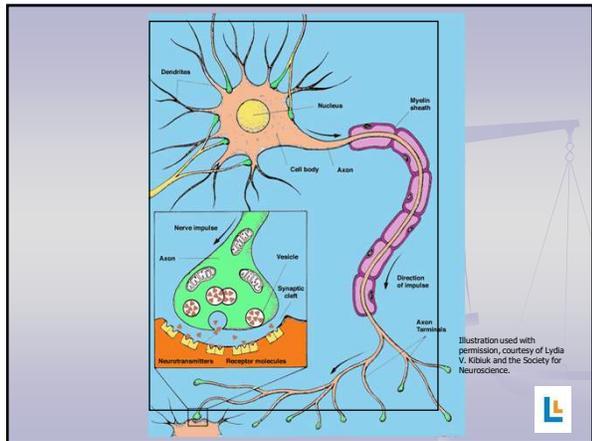

20



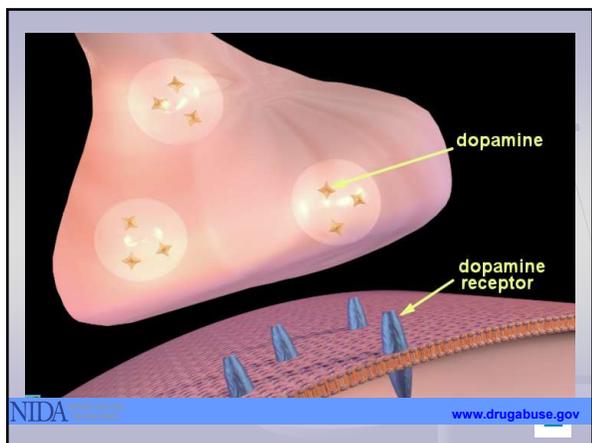

21



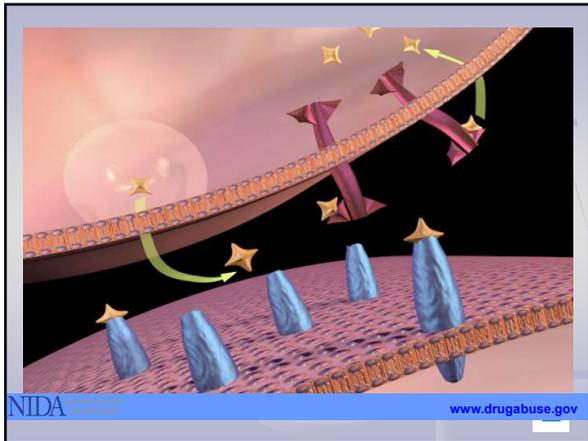
22



23



24



25

KEY NEUROTRANSMITTERS		AND THEIR MAIN FUNCTIONS	
<p>ADRENALINE/EPINEPHRINE</p> <p>Fight or flight Produced in stressful situations. Increases heart rate and blood flow, leading to physical boost and heightened awareness.</p>	<p>GABA</p> <p>calming Calm firing nerves in the central nervous system. High levels improve focus, low levels cause anxiety. Also contributes to motor control and vision.</p>		
<p>NORADRENALINE/NOREPINEPHRINE</p> <p>concentration Affects attention and responding actions in the brain. Contract blood vessels, increasing blood flow.</p>	<p>ACETYLCHOLINE</p> <p>learning Involved in thought, learning, and memory. Activates muscle action in the body. Also associated with attention and awakening.</p>		
<p>DOPAMINE</p> <p>pleasure Feelings of pleasure, also addiction, movement and motivation. People repeat behaviors that lead to dopamine release.</p>	<p>GLUTAMATE</p> <p>memory Most common neurotransmitter. Involved in learning and memory, regulates development and creation of nerve contacts.</p>		
<p>SEROTONIN</p> <p>mood Contributes to well-being and happiness. Helps sleep cycle and digestive system regulation. Affected by exercise.</p>	<p>ENDORPHINS</p> <p>euphoria Released during exercise, excitement and sex. Producing a sense of well-being and pain reduction.</p>		

26

NEUROTRANSMITTERS AND SUDS

Neurotransmitters are chemicals that relay, amplify, and modulate signals within the brain. When we introduce drugs into the system it disrupts these pathways and interferes with the way the body and brain communicate.

SEROTONIN

Affects: regulation of mood and impulsivity, sleep, sexual desire, appetite

Drugs that affect it: cocaine, anti-depressants, stimulants, alcohol, hallucinogens

DOPAMINE

Affects: pleasure/reward, movement, attention, memory

Drugs that affect it: virtually all drugs of use directly or indirectly alter dopamine in the reward pathway

ENDORPHINS & ENDOGENOUS OPIOIDS

Affects: pain relief, sedation, rate of bodily functions, mood, reward/punishment

Drugs that affect it: heroin, opioids, morphine, prescription pain relievers

GLUTAMATE (WIDELY DISTRIBUTED IN BRAIN)

Affects: neuron activity, learning, cognition, memory

Drugs that affect it: alcohol

The HIPPOCAMPUS (GABA AND SEROTONIN)

Affects: learning, memory, and depression

Drugs that affect it: alcohol, marijuana

GABA

Affects: slowed neuron activity, anxiety, memory, anesthesia

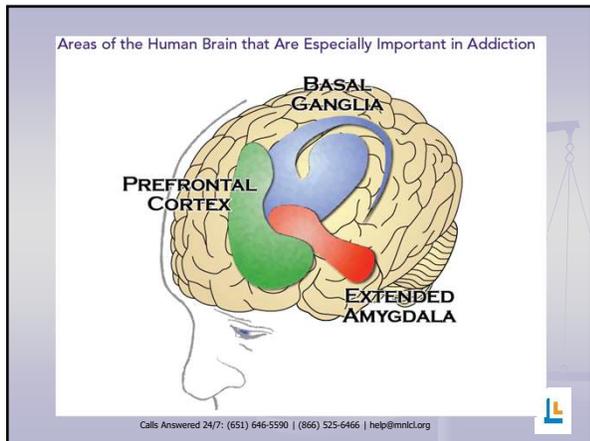
Drugs that affect it: alcohol, depressant drugs, marijuana, benzodiazepines

NOREPINEPHRINE

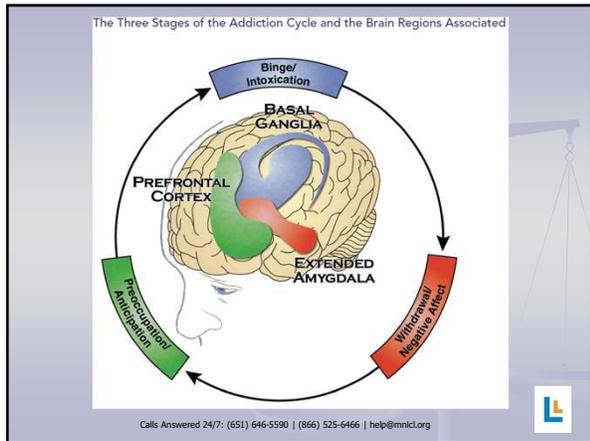
Affects: arousal and alertness, sleep, energy and feelings of pleasure

Drugs that affect it: cocaine and methamphetamine

27



28



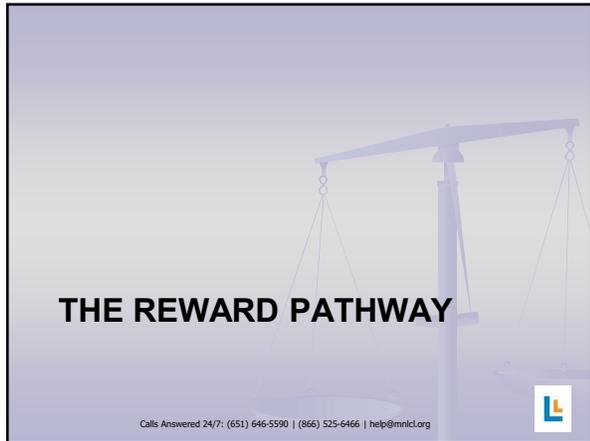
29

Behaviors Central to the Addiction Cycle

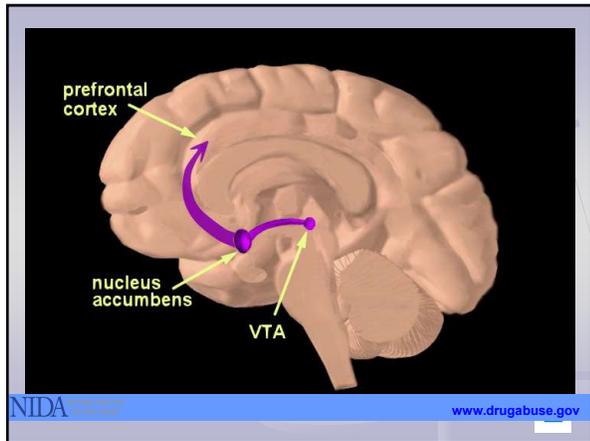
1. **Impulsivity**
2. **Positive reinforcement** - The process by which presentation of a stimulus such as a drug increases the probability of a response like drug taking.
3. **Negative reinforcement** - The process by which removal of a stimulus such as negative feelings or emotions increases the probability of a response like drug taking.
4. **Compulsivity**

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mncl.org

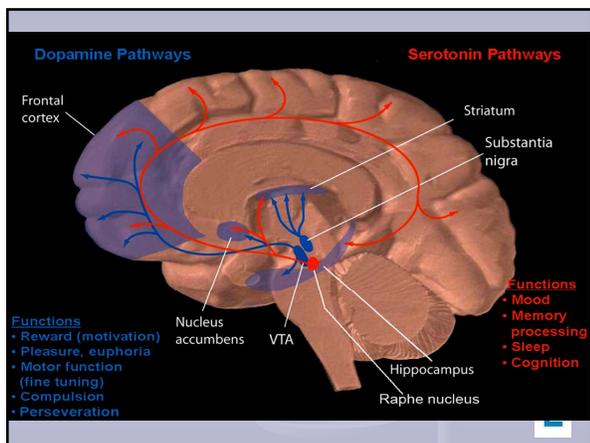
30



31



32



33

perseveration noun

Save Word

per-sev-er-a-tion | \ per-se-və-'rā-shən

Definition of perseverance

: continuation of something (such as repetition of a word) usually to an exceptional degree or beyond a desired point

<https://www.merriam-webster.com/dictionary/perseveration>

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org



34

Like v Want

Dopamine mediates both *reward* (like) and *saliency* (want) pathways.

In addition, a substance or behavior receives greater saliency (importance) than it should.

This is called the *incentive saliency model*.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org



35

"Dopamine is not just about reward anticipation; **it fuels the goal-directed behavior needed to gain that reward**; dopamine 'binds' the value of a reward to the resulting work. It's about the motivation arising from those dopaminergic projections to the PFC that is needed to do the harder thing (i.e., to work). In other words, dopamine is not about the happiness of reward. It's about the happiness of pursuit of reward that has a decent chance of occurring." *Robert Sapolsky*

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org

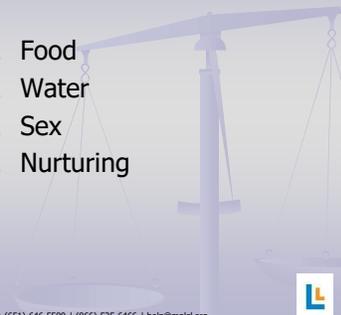


36

Natural Rewards

1. Food
2. Water
3. Sex
4. Nurturing

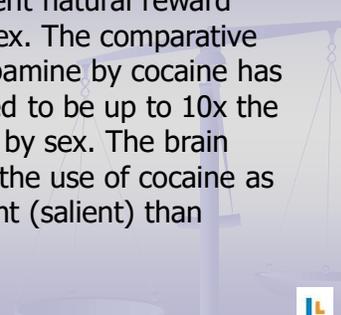
Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



37

The most salient natural reward comes from sex. The comparative release of dopamine by cocaine has been measured to be up to 10x the level released by sex. The brain comes to see the use of cocaine as more important (salient) than anything else.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



38

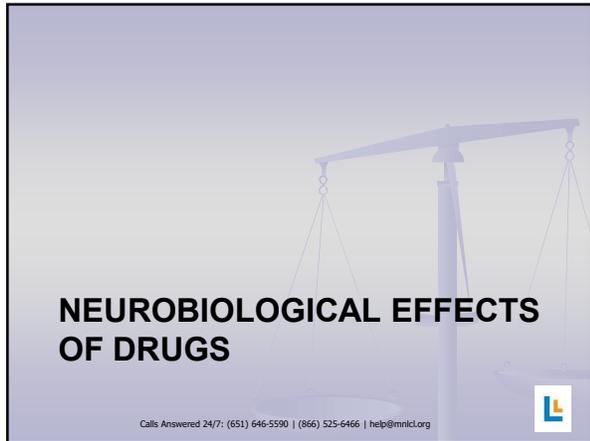
Rewards in the Addicted Brain

1. Drug
2. Food
3. Water
4. Sex
5. Nurturing

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



39



NEUROBIOLOGICAL EFFECTS OF DRUGS

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnici.org



40

HOW DO DIFFERENT SUBSTANCES ACT DIFFERENTLY IN THE BRAIN?



Stimulants
Stimulants excite, or speed up, the brain and its functions. Use of stimulants can cause increased energy, faster breathing, more rapid heart rate, and higher body temperature.



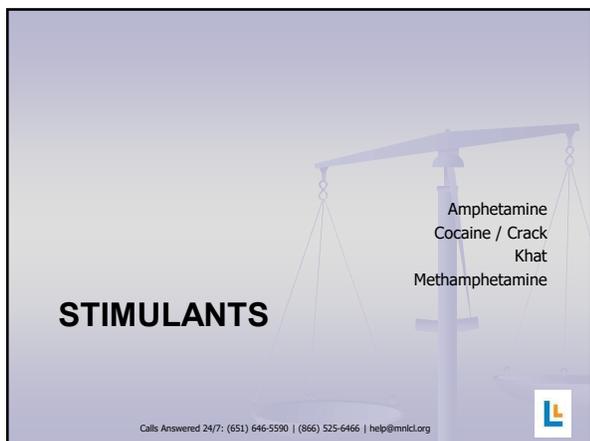
Depressants
Depressants inhibit, or slow down, the brain and body. Use of depressants can cause lowered energy, slowed breathing, slowed heart rate, and lower body temperature.



Hallucinogens
Hallucinogens impair the brain and body's perception of reality. Use of hallucinogens can cause delusional thoughts, bizarre physical motions, and the experience of sights, sounds, tastes, and sensations that are not there.




41



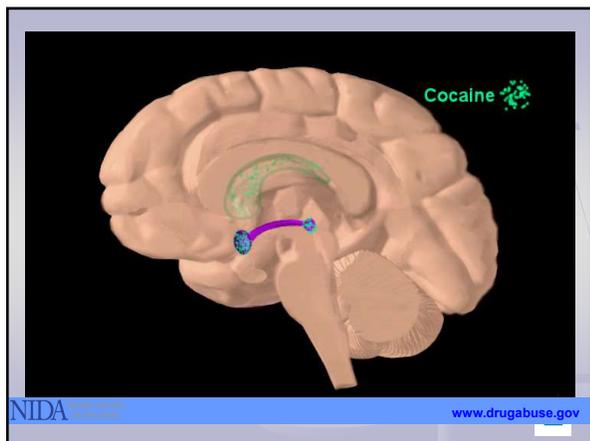
STIMULANTS

Amphetamine
Cocaine / Crack
Khat
Methamphetamine

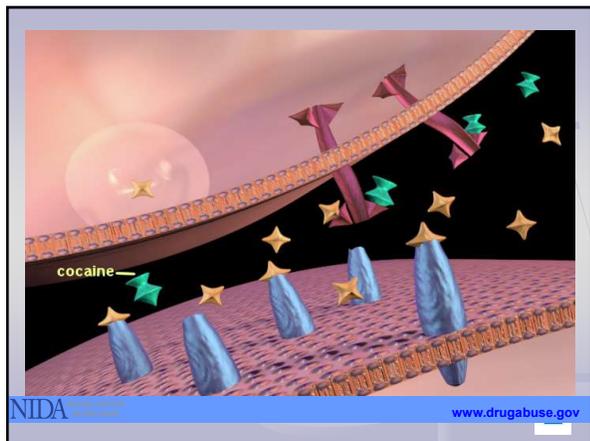
Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnici.org



42



43



44

Receptor downregulation: the decrease in the number of available receptors for a particular neurotransmitter caused by an overabundance of the neurotransmitter in the synaptic cleft.

Tolerance: the response of an organism to desensitize itself to the ongoing presence of a particular brain state caused by a stimulus (drugs, alcohol, behaviors, etc.) such that the organism requires an increased quantity of the stimulus in order to achieve the same or similar effect. The positively reinforcing effects of substances tend to diminish with repeated use.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



45

Resistance

As an organism is exposed to abnormally high amounts of an endogenous or exogenous substance, it raises the response threshold of target cells, thereby diminishing the cells responsiveness to the substance.

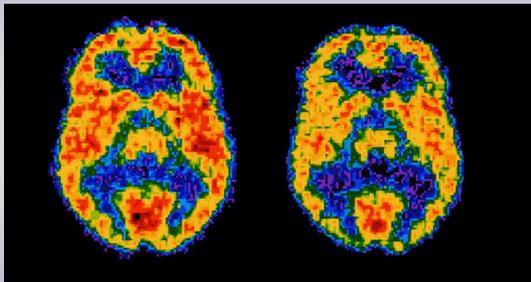
Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



46

control

on cocaine



NIDA

www.drugabuse.gov

47

DEPRESSANTS

- Alcohol
- Barbiturates
- Benzodiazepines
- GHB
- Rohypnol

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



48

How alcohol affects the brain

Drinking alcohol affects the way your brain works—changing everything from the way you act to your ability to walk. Some effects can be long-lasting. Learn about how alcohol affects different parts of the brain.¹

Cerebral Cortex: This is the main area involved in thinking, decision-making, emotions, and the five senses. Alcohol's effects on this area can impair your ability to think clearly and lower your inhibitions. It may make you act without thinking or make you angry for no reason. Alcohol may affect your senses, such as blurring your vision. Long-term alcohol abuse can permanently damage this region.

Hippocampus: Your memory is controlled by the hippocampus. Drinking a lot of alcohol at one time can cause you to blackout, or forget a period of time. Long-term alcohol abuse can permanently damage the hippocampus, making it difficult for a person to learn.

Hypothalamus: Many body processes, such as heart rate and the feeling of hunger or thirst, are controlled in this small area. Alcohol can slow your heart rate and may make you hungrier and thirstier.

Central Nervous System: Alcohol slows down this system, which is made up of the brain, spinal cord, and nerves. That affects how signals flow through your body, making you think, speak, and move more slowly.

Cerebellum: This part of the brain is important for coordinating many of your daily movements, such as walking and grabbing objects. Alcohol can slow your reflexes. It may cause you to lose your balance or make your hands shake.

Medulla: Involuntary processes, such as breathing and maintaining body temperature, are controlled here. Drinking a lot of alcohol at one time can shut down the medulla, leading to a coma.

49

Barbiturates

- GABA ↑
- Dopamine ↑
- Glutamate ↓
- Barbiturates include
 - Butalbital
 - Phenobarbital
 - Pentothal
 - Seconal
 - Nembutal
- Dependence and tolerance develop rapidly

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnictl.org

50

Benzodiazepines

- GABA ↑
- Dopamine ↑
- Glutamate ↓
- Benzodiazepines include
 - Valium
 - Xanax
 - Halcion
 - Ativan
 - Klonopin
 - Restoril
 - Rohypnol (not marketed in US, but available illegally)

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnictl.org

51

GHB

- GABA ↑
- Dopamine ↑
- Glutamate ↓
- Memory impairment
- Visual hallucinations
- Amplifies other depressants (e.g., alcohol)

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

52

OPIATES / NARCOTICS

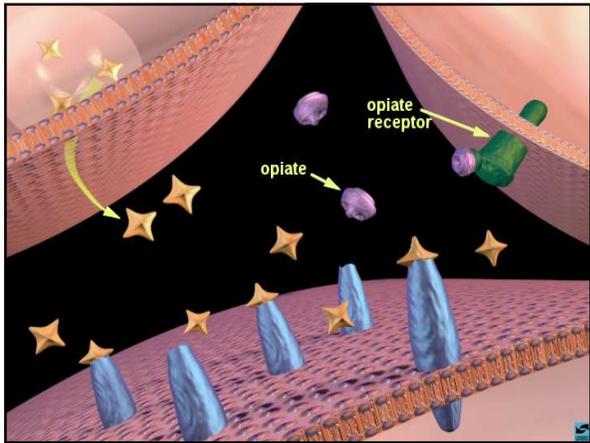
- Fentanyl
- Heroin
- Hydromorphone
- Methadone
- Morphine
- Opium
- Oxycodone

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

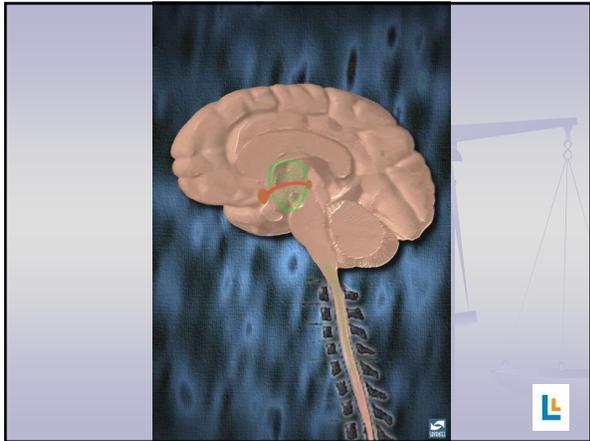
53

Opiates

54



55



56

Endorphin System

- Production slows or stops
- Downregulation of receptors
- Pain perception

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

57

HALLUCINOGENS

Dextromethorphan / DXM
Ecstasy / MDMA
Ketamine
LSD
Peyote & Mescaline
Psilocybin

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mmic.org

58

Serotonin Nerve Pathways in the Brain

Raphe nuclei

59

Acute Effects of Ecstasy

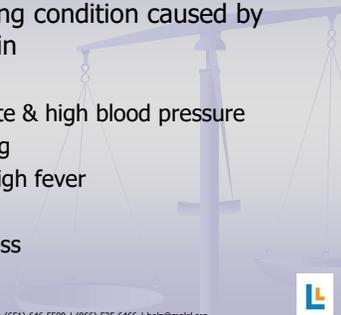
heightened perceptions
stimulation
reduced appetite
elevated mood

60

Serotonin Syndrome

- A life-threatening condition caused by excess serotonin
 - Agitation
 - Rapid heart rate & high blood pressure
 - Heavy sweating
 - Dangerously high fever
 - Seizures
 - Unconsciousness
 - Death

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



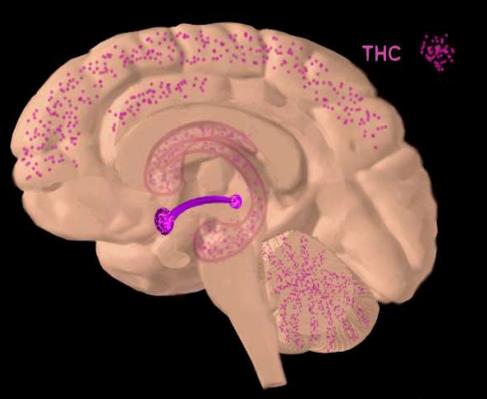
61

CANNABIS

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org



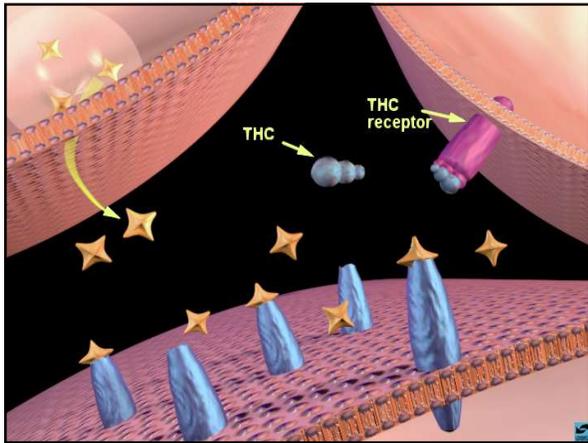
62



THC

The diagram shows a sagittal view of a human brain with numerous purple dots representing THC molecules binding to receptors throughout the brain, particularly in the cerebral cortex and hippocampus.

63



64

Triggers

Triggers are stimuli that set off a "memory tape" or "flashback" transporting the person back to the emotional state of the original trauma. Triggers are also involved in Substance Use Disorders and have the effect of stimulating cravings.

- Triggers are very personal; different things trigger different people. A person's triggers are activated through one or more of the five senses: sight, sound, touch, smell and taste.
- The survivor may begin to avoid situations and stimuli that she/he thinks triggered the flashback. She/he will react to this flashback, trigger with an emotional intensity similar to that experienced at the time of the trauma.



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

65



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

66

What Stigma Means

- ABA Hazelden Study found barriers to seeking help include
 - "not wanting others to find out they needed help"
 - "concerns regarding privacy or confidentiality"
- It's a Diversity and Inclusion Issue



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

67

Stigma

- How we visualize people
- How we talk about mental illnesses
- How we think about mental illnesses
- How we treat people with mental illnesses



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

68

Stigma

- Isolation - No get-well cards
- Shame
- Negative attitudes
- Stereotypes
- Prejudice
- Misunderstanding
- Discrimination
- Indignity
- Hopelessness



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnict.org

69

Double Stigma

- Those subject to implicit or explicit bias, anticipated or actual, experience greater stress
- Stress predicts mental health issues
- Legal profession expectations of majority and other attorneys differ. No second chances.

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org



70

Making a Change

- Be openly supportive of those working to support well-being
- Do not support jokes or comments about colleagues being weak, etc.
- Develop a good understanding of the potential for unconscious bias and be alert
- Think of your language
- Notice and interrupt

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org



71

Changing Our Language

Addict	➡	Person with Substance Use Disorder
Substance Abuse	➡	Substance Use Disorder
Clean	➡	Abstinent
Dirty Screen	➡	Testing Positive
Relapse	➡	Recurrence
Slow Learner	➡	Person with a Learning Disability
Crazy	➡	Person with a Mental Illness

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnicl.org



72

any stigma still connected with
MENTAL ILLNESSES
or
SUBSTANCE ADDICTION
continues to prevent people from choosing
LIFE-SAVING
treatment options

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnmlc.org

73

Lawyers Concerned for Lawyers

- Who we help –
 - Lawyers, Judges, Law students, and Families; Staff on a case-by-case basis
- What we help with –
 - Substance use and mental health, cognitive, stress, burnout
- Communications are **confidential**
- Services or Referrals –
 - Licensed professionals
 - Group support
- Peer support
- Education and public awareness

74

Partnership with The Sand Creek Group

- Up to 4 free counseling sessions
- Resource website
 - www.sandcreekeap.com
 - Click on "Member Portal & App"
When registering use the Company Code "lawyers"
- Contact Sand Creek directly at
612-430-3383 or toll-free: **1-888-243-5744**

Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnmlc.org

75

TO CONTACT LCL

LAWYERS CONCERNED FOR LAWYERS
2250 University Avenue West, # 313N
St. Paul, MN 55114

(651) 646-5590
Toll Free: (866) 525-6466

Website: www.mnlcl.org E-mail help@mnlcl.org
www.facebook.com/mnlcl
LCL You Tube Channel



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnlcl.org

76

**LAWYERS CONCERNED FOR
LAWYERS**

There is Help

 & 

There is Hope



Calls Answered 24/7: (651) 646-5590 | (866) 525-6466 | help@mnlcl.org

77