The Science of Addiction:

Why it's a bad idea to turn to drugs in times of stress

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Why do people take drugs?

To Feel Good

To have novel: feelings sensations experiences AND to share them

$\mathsf{Cocaine} \rightarrow$

'High', followed by feelings of power, self-confidence, increased energy

Heroin → Euphoria, followed by feelings of relaxation & satisfaction

Why do people take drugs?

To Feel Good

To have novel: feelings sensations experiences AND to share them

To Feel Better

To lessen: anxiety worries fears depression hopelessness distress

To help deal with STRESS !!!!

Stress at work Too much to do, too little time

Social Services Profession: Compassion Fatigue

The cumulative physical, emotional & psychological effect of exposure to traumatic stories/events when working in a helping capacity, combined with the strain and stress of everyday life

Variety of drugs

Legal Compounds (alcohol, cigarettes)



NIAAA

Likely soon to be legal



Marijuana

Illicit drugs



Cocaine



Prescription Drugs

Opioids—usually prescribed to treat pain e.g., OxyContin, Percocet

Depressants; used to treat anxiety & sleep disorders e.g, benzodiazepines, such as diazepam (Valium), alprazolam (Xanax)

Stimulants—most often prescribed to treat attention deficit hyperactivity disorder (ADHD). e.g., dextroamphetamine (Adderall) and methylphenidate (Ritalin)

Substance Use Disorder: DSM-5

- Increased drug taking
- Unsuccessful efforts to cut down
- A great deal of time spent
 - obtaining the drug using the drug recovering from drug use
- Hazardous use
- Social, occupational or recreational activities reduced due to drug use
- Continued use despite physical/psychological problem made worse by drug
- Craving or strong desire to use
- Tolerance
- Withdrawal

Mild (2-3 symptoms) Moderate (4-5 symptoms) Severe (6 or more symptoms)

Why don't people just stop taking drugs?

Do drug abusers lack willpower or self-control?

Can't they just stop using drugs simply by choosing to change their behavior?

In reality, drug addiction is a complex disease, and quitting takes more than good intentions or a strong will.

WHY???

Drugs change the biology of the brain

Decreased Brain Metabolism in *Drug Abuser*

Decreased Heart Metabolism in Heart Disease Patient



Healthy Brain



Diseased Brain/ Cocaine Abuser



Healthy Heart



Diseased Heart

Positron emission tomography (PET)

National Institute on Drug Abuse (NIDA) NIH Pub No. 14-5605



Brain Circuits Affected by Drugs



Prefrontal Cortex (PFC)

Orbitofrontal Cortex (OFC)

Nucleus Accumbens

Striatum

Amygdala

Hippocampus

Ventral Tegmental Area (Dopamine)

"Bringing the the Full Power of Science to Bear on Drug Abuse & Addiction" PPT from NIDA webpage

Normal communication in the brain

The brain consists of billions of neurons, or nerve cells. Networks of neurons pass messages back and forth among different structures within the brain. Neural networks coordinate and regulate everything we feel, think, and do.

- Neuron to Neuron
- Neurotransmitters The Brain's Chemical Messengers (e.g., Dopamine)



From Drugs, Brains and Behavior The Science of Addiction NIDA; NIH Pub No. 14-5605

- Receptors The Brain's Chemical Receivers
- Transporters The Brain's Chemical Recyclers

Natural Rewards Activate Brain Reward Pathways

AND natural rewards increase dopamine in the brain's pleasure centers



From Drugs, Brains and Behavior The Science of Addiction NIDA; NIH Pub No. 14-5605

Drugs of Abuse also Activate Brain Reward Pathways

Further, virtually all drugs of abuse increase brain dopamine levels



From Drugs, Brains and Behavior The Science of Addiction NIDA; NIH Pub No. 14-5605

Drugs can be 'Imposters' of Brain Messages

Regulation of mood, appetite, memory, & pain

"Bringing the the Full Power of Science to Bear on Drug Abuse & Addiction" PPT from NIDA webpage

Scientific Evidence has Shown.....

Prolonged Drug Use Changes the Brain In Fundamental and Long-Lasting Ways



AND...

These Changes in Brain Can Be Both *Structural* and *Functional*



Structurally...

Drugs alter:

Shape
Size
Receptor numbers
Transporter numbers

in the brain reward pathway





Dopamine D2 Receptors are Decreased by Addiction



Cocaine: NIH Publication Number 10-4166

Positron emission tomography (PET) images

Functionally...

Dopamine D2 Receptors are Decreased by Addiction



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What about Marijuana?

Strong push to legalize marijuana throughout the U.S.

Medical marijuana legalized: e.g., California, Nevada, Arizona, New Mexico, New York, New Jersey, etc.

Recreational Marijuana Use: Oregon, Colorado, Alaska, Washington & Washington DC

Is Marijuana Addictive?

> Contrary to common belief, *marijuana is addictive*.

~ 9% of users become addicted; this # increases among those who start young (to about 17%, or 1 in 6) and among daily users (to 25-50%).

Does marijuana alter the brain?

Brain Changes are Associated with Causal Marijuana use in Young Adults

- Magnetic resonance imaging (MRI)
- Compared brains of 18-25 year olds who reported smoking marijuana at least once/week (n=20) with those with little to no history of marijuana use (n=20).
- Psychiatric evaluations- not drug dependent
- Two brain regions (Nucleus Accumbens & Amygdala) were larger & altered in shape & structure in marijuana users

Gilman et al., J. Neurosci, 34(16):5529-38, 2014

Marijuana Long-Term Effects on Adult Brains

- MRI Study: 48 marijuana users & 62 controls Used marijuana at least 4x/week over past 6 months
- Chronic marijuana users had lower IQ compared to controls
- Chronic marijuana users have smaller brain volume in the orbitofrontal cortex (but also increases brain connectivity)
- However, no direct correlation between IQ deficits and OFC volume decrease

These findings suggest that chronic marijuana use results in complex neuroadaptive processes.

Filbey et al., PNAS, 111(47): 16913-16918, 2014

Vulnerability



Why do some people become addicted to drugs while others do not?

No single factor determines whether a person will become addicted to drugs



RISK FACTORS

Biology/Genes

Development

Environment

Drug Use Addiction

What Environmental Factors Contribute to Addiction?

Stress

- Early physical or sexual abuse
- Witnessing violence
- Peers who use drugs
- Drug availability
- Drug use considered the 'norm'



COMORBIDITY

Drug users have a higher risk of developing mental disorders

> Psychosis

Depression

>Anxiety

Panic attacks



The good news is.....

"Drug addiction is a brain disease that can be treated"

Nora Volkow Director National Institute on Drug Abuse (NIDA)



But, drug addiction is a chronic illness with relapse rates similar to those of hypertension, diabetes, and asthma.

Full recovery is a challenge but it is possible ...



Density of Dopamine Transporters in Striatum

NIDA; NIH Pub No. 14-5605

Why is it a bad idea to turn to drugs in times of stress?

- Drugs change the biology of the brain
- Changes are structural, functional & long lasting
- Chronic, relapsing disease
- > Initial 'benefit' \rightarrow feel good/feel better....

With repeated drug use those feelings subside \rightarrow person continues to take drug to feel 'normal'

How can I deal with stress??

Mindfulness

What is mindfulness?

"Paying attention in a particular way; on purpose, in the present moment, and non-judgmentally." Jon Kabat-Zinn, Ph.D.

Attention to thoughts, emotions and feelings in the present moment

Attitude of acceptance/non-reactivity and non-judgment

Automatic Pilot

- Life on 'automatic pilot' not fully aware of what we are doing
- ➢ On automatic pilot → you are more likely to have your 'buttons pushed' → STRESS!!
- ➢ Old habits of thinking → unhelpful and may lead to worsening mood

Is it possible to break out of this vicious cycle?

From Chaos to Calm

> Autonomic nervous system: Sympathetic & Parasympathetic systems

- Stress → activates sympathetic nervous system; "Fight or flight" response--Excessive release of stress hormones (adrenaline); revs up the body to survive a threat to life or limb
- We can *learn* to activate the parasympathetic system; "Rest-and-digest response" Automatically responds to our sense of equilibrium.

Eg., vacation, hearty laugh, deep sleep

Mindfulness Approaches

- ➤ Thought awareness pleasant moments → and your reaction to them unpleasant moments
- Mindful eating
- > Mindful yoga
- > Mindful breathing
- Meditation Sitting meditation Walking meditation

Benefits of Mindfulness Approaches

> Decreases stress

- Decreases depression and anxiety
- Decreases blood pressure and heart rate
- Slows or controls chronic diseases
- Increases immune functioning
- > Increases focus, attention and awareness

What conditions or illnesses can it help treat?

Chronic Pain Heart Disease **Stress Disorders** Personal Well-Being Hypertension Diabetes Fibromyalgia Gastrointestinal Disorders

Hot Flashes Sleep Disturbances Cancer Anxiety Major Depression Mood Disorders HIV Asthma

> U Mass Medical School Center for Mindfulness

Neurobiology of Mindfulness

Mindfulness training can strengthen connectivity between the prefrontal cortex & limbic system (Chiesa et al.,, Clin. Psyc Rev 33: 82–96, 2013).

- Increase activity in prefrontal cortex
 - Increased executive control, decision making etc.
- Dampen automatic amygdala activation
 - stress response
 - anxiety and other emotional states



Mindfulness & Stress

"How you see things and how you handle them makes all the difference in terms of how much stress you will experience"

> Jon Kabat–Zinn, Ph.D. "Full Catastrophe Living"

Resources

See handout (on meeting website)

Help with Alcohol or Drug Problems: North Carolina Lawyer Assistance Program http://www.nclap.org