

Understanding Addiction

Neurobiology, Triggers, and Healing

Hannah Hammond, LCSW



Objectives

- Describe the Disease Model of addiction by describing the defect in the reward pathway in the brain of the addict.
- I can articulate why stress management is vital to the relapse prevention process.
- I can identify at least three core issues underlying addiction.



Yellow Lab

Black Lab

Chocolate Lab

Meth Lab

Get More Funny Stuff @ funnyasducl.net

The Medical Model of Disease

Disease:	<u>Cystic Fibrosis</u>	<u>Hepatitis</u>	<u>Drug Addiction</u>
Cause:	Genetic mutation (inherited)	Hepatitis Virus	Drug use (cocaine, heroin, alcohol, etc.)
Affected Organ:			
Symptoms:	<ul style="list-style-type: none">• Excessive mucus• Difficulty breathing (wheezing, coughing)• Increased risk of infection	<ul style="list-style-type: none">• Poor appetite and general malaise• Yellow discoloration of skin• Severe damage to liver (fibrosis, cirrhosis)	<ul style="list-style-type: none">• Altered mood or state of mind (drug-specific)• Intense drug craving• Compulsive drug seeking (at the expense of normal activities)• Depressed mood or loss of pleasure (during drug abstinence)

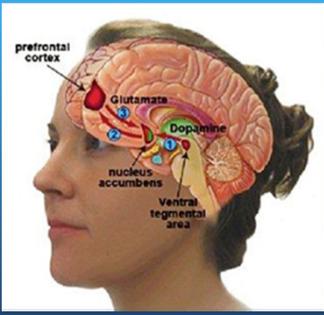
Dopamine:
what is it and what does it do?

<https://www.youtube.com/watch?v=pUkrPNxLau0>

Dopamine:
what is it and what does it do?

- Motivation, energy, drive.
- Drugs affect the Dopamine levels in the brain, specifically in the midbrain (limbic system)
- Cross addiction of sex and food happen often because of how Dopamine affects the reward system

Addiction Cycle



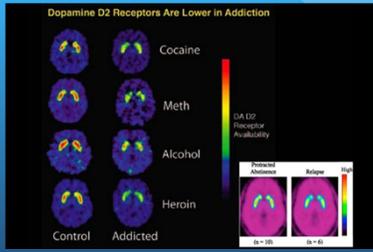
- VTA is stimulated
- VTA releases Dopamine in larger-than-normal amounts
- Dopamine flooding to NA
- NA releases Glutamate to Prefrontal Cortex
- Prefrontal Cortex gets a solid memory
- Excess Glutamate returns to NA

Reward/Pleasure Center

<https://www.youtube.com/watch?v=Mnd2-al4LCU>

Reward/Pleasure Center

Dopamine D2 Receptors Are Lower in Addiction



- Decrease in Dopamine D2 Receptors: the capacity to control strong urges is compromised.

Reward/Pleasure Center

- Conditioned Stimuli results in increased Dopamine as a predictor of reward.
- Food and sex are common cross-addictions.

NEUROTRANSMITTERS IMPLICATED IN THE MOTIVATIONAL EFFECTS OF WITHDRAWAL FROM DRUGS OF ABUSE	
Neurotransmitter	Functional effect
↓ Dopamine	“dysphoria”
↓ Serotonin	“dysphoria”
↓ γ-aminobutyric acid	anxiety, panic attacks
↓ Neuropeptide Y	anti-stress
↑ Dynorphin	“dysphoria”
↑ Corticotropin-releasing factor	stress
↑ Norepinephrine	stress

Arguments Against BDMA

- Those who use drugs recreationally respond to small, positive reinforcements.
- Addiction is most commonly found in Mild or Moderate form, not severe form. People with this kind of addiction are most likely to recover without treatment.
- “The promised treatment benefits associated with the BDMA have not materialized.” (Hall, Carter, & Forlini, 2015)
- Current research on BDMA is costly and not yielding results.

The Psychology of Stress

<https://www.youtube.com/watch?v=bEcdGk4DQ5g>

The Psychology of Stress

- The body is made to tolerate and handle short amounts of stress.
- Humans have increased their exposure to stress through anticipation
- Prolonged exposure to the stress response is challenging on the body from a physiological standpoint, thus creating a mental, emotional, and cognitive challenge.
- The way humans perceive daily life events is stressful

Stress situation

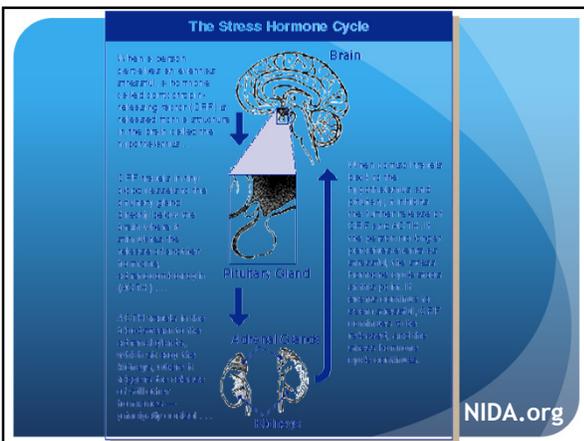
It was late at night in the spring. I was at my sister's place. I remember her saying, 'You are so smart... why are you wasting your life?' I remember she said, 'I have been around drugs, I should have been the drug user, but I didn't, and why did you turn out a loser?' She didn't know how it was making me feel. I felt I had to leave. I could not handle those emotions in that period of my life. I was withdrawing. I was trying to leave. I told her, 'I don't want to talk about this; I can't talk about this in this condition.' I was sad; I was very sad. I was sad because I had no answers for her... You know... I didn't know what to tell her. I went and got the telephone and I called for a ride. I remember I had dropped the cordless phone and um... she yelled at me. 'You bitch, you're a crackhead; you can't buy me another phone.'

I'll never forget that statement... and um... I ran out of the house. I was very, very distraught, I was crying, and I wanted to use so badly. As a matter of fact, there was a bar right around the corner. It had to be around 1 AM, because I remember I went to that bar and I would say it was a little after 1 AM when I drank till it closed at about 2 AM. I felt disgusted... just thinking of it... I can remember... I almost felt like nauseous... anxious... very anxious... I had to... it's a terrible feeling... I don't even like to think about it... but I had to have a drink. Like I said, all I can remember is feeling nauseous, like an upset stomach. I would have to say I felt tense, like in my shoulders and all over. My heart was racing, and I felt like I was burning up. I just had to get out of there, and all I could think of was having a drink." (Sinha, 2007)

The Hedonic System

- The body has a hedonic set point or pleasure threshold.
- Stress can change the hedonic set point: anhedonia or lack of pleasure. The brain becomes "deaf" to pleasure and can only register or sense very "loud" pleasures- those pleasures that cause large fluctuations in the dopamine levels (drugs, sex, sky diving, roller coasters, etc).
- Drug use is a stressor: stimulants will activate the stress response both through use and withdrawal; depressants will activate the stress response during withdrawal. (Koob, 2011)
- The brain interprets these "loud" experiences as salient (dopamine/glutamate relationship) and the brain registers that the behaviors used to get this "loud" pleasure are of utmost import. The brain wants to use these "loud" pleasures until the stress is gone. Opiates have a very rapid response.

Kevin, T. McCauley, MD



Hypothalamo-Pituitary Axis

HPA Axis

Opioid peptides inhibit this response.

Hypothalamo-Pituitary Axis

- Heroin, morphine, and other opiates give the brain a similar reaction as opioid peptides, thus increasing their appeal when the addict is under stress. Taking these substances reduces the anticipation or real perception of stress. (Koob & Simon, 2009)
- Cocaine will induce stress into the system.
- When the cocaine wears off, the brain registers withdrawal, which is stressful.
- Both situations increase an addict's sensitivity to stress, decreasing his/her stress tolerance.

Hypothalamo-Pituitary Axis

- Nonaddicts: Increase in ACTH
- Active opiate addicts: no change in ACTH
- Abstinent addict with no methadone: double ACTH from control group
- Addict on partial agonist methadone: Increase in ACTH, similar to nonaddict response.

HPA Axis

•Kreek et al., 1984

Rats and stress

- Mantsch et al., 1998
- Goeders and Guerin, 1996

Stress impacts HPA axis response which will increase drug self-administration when there is already exposure.

Example: combat veterans with PTSD report a higher lifetime use of alcohol, cocaine, and heroin than veterans screening negative for PTSD (Saxon et al., 2001)

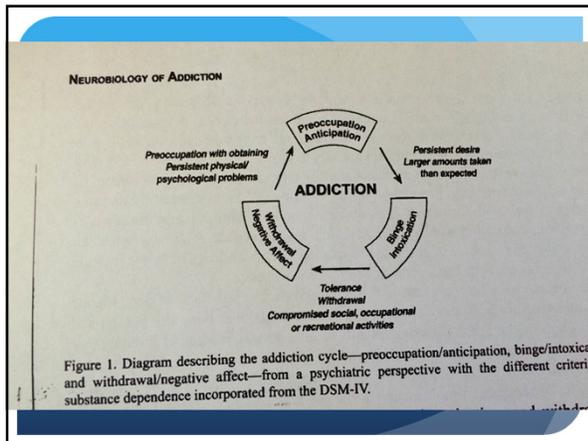
Rat #1- received a shock when self-administering cocaine and food.
(response-contingent shock)
Result- conflict between obtaining food/cocaine and avoiding shock

Rat #2- received a shock, dose of cocaine, and food contingent on Rat #1's self-administration.
(non-contingent shock)
Result- stronger satiety to the drug administered, more quickly developed addiction to the drug.

Rat #3- given food without shock and without drug administration.

Goeders, 2003

As tolerance increases, withdrawal episodes also increase. This induces stress, reintroducing the stress-hormone cycle to the body, giving the addict another reason to use substances.

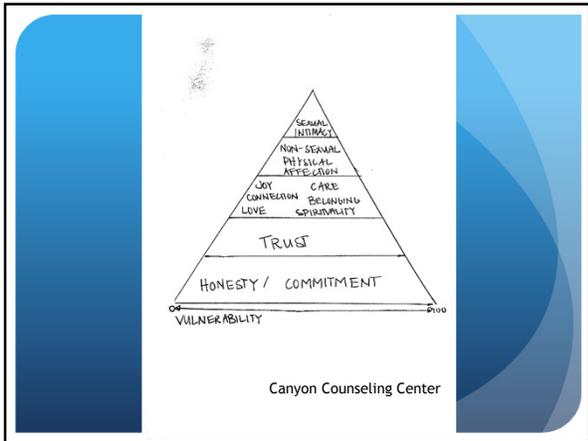


Common Stressors in Addiction

- Goeders, 2010
- Sexual harassment
- Sexual abuse
- Unhappy marriage (or other relationship)
- Dissatisfaction with work
- Social Stressors
 - peer pressure
 - transition to high school
 - Transition to college

Common Stressors in Relapse

- Hungry
- Angry
- Lonely
- Tired



Questions?

Citations

- Carroll, K. M. (1998). *A cognitive-behavioral approach: Treating cocaine addiction*. Bethesda, MD: National Institute on Drug Abuse {NIH publication no. 98-4308}
- Goeders, N. E., (2010, December). The impact of stress on addiction. *European Neuropsychopharmacology*, 13(6), 435-441
- Hall, W., Carter, A., & Forlini, C. (2015, April). The brain disease model of addiction: Is it supported by the evidence and has it delivered on its promises? *The Lancet Psychiatry*, 2(4), 292
- Hildebrandt, T. & Grief, R. (2013, September). Stress and addiction. *Psychoneuroendocrinology*, 38(9), 1923-1927
- I-han, C., & Narasimhan., (2005). Neurobiology of addiction. *Nature and Neuroscience*, 8, 1427

Citations

- Koob, G. F., Neurobiology of Addiction. (2011) *Journal of Lifelong Learning and Psychiatry*, 9(1), 55-65
- Kosten, T. R. (2011, June 1). Stress and addiction. *The American Journal of Psychiatry*, 168(6), 566-568.
- Kreek, M. J., et al. ACTH, cortisol, and b-endorphin response to metyrapone testing during chronic methadone maintenance treatment in humans. *Neuropeptides* 5:277-278, 1984
- Monti, P. Abrams, D., Kadden, R., & Cooney, N. (1989). *Treating alcohol dependence: A coping skills training guide*. New York: Guilford Press
- Sinha, R. (2013). *Principles of addiction: Comprehensive addictive behaviors and disorders* (Vol. 1). San Diego, CA: Elsevier

Citations

- Sinha, R. (2007, October). The role of stress in addiction relapse. *Current Psychiatry Reports*, 9(5), 388-395
- Sinha, R., Garcia, M., Kemp, K., et al. (2005). Alcohol craving and subjective emotional state during stress and alcohol cue exposure in alcoholics and social drinkers. *Alcohol Clin Exp Res*. 29:150A
- Sinha, R., Lacadie, C., Skudlarski, P., et al. (2005) Neural activity associated with stress-induced cocaine craving: a functional magnetic imaging study. *Psychopharmacology (Berl)* 183, 171-180
- Sinha, R., Talih, M., Malison, R., et al. (2003). Hypothalamic-pituitary-adrenal axis and sympatho-adreno-medullary responses during stress-induced and drug cue-induced cocaine craving states. *Psychopharmacology (Berl)*, 170, 62-72
- Ungless, M. A., Argilli, E., & Bonci, A. (2010, November). Effects of stress and aversion on dopamine neurons: Implications for addiction. *Neuroscience and Biobehavioral Reviews*, 35(2), 151-156. doi:10.1016/j.neubiorev.2010.04.006
