Understanding Drugs and the Brain

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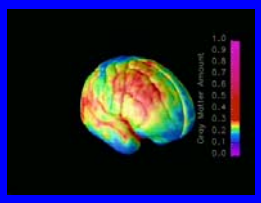
DukeLEARN
Linking Education and Research in Neuroscience



Four principles for understanding drugs

The adolescent brain is in a critical development stage and its special biological characteristics influence adolescent behavior and response to drugs

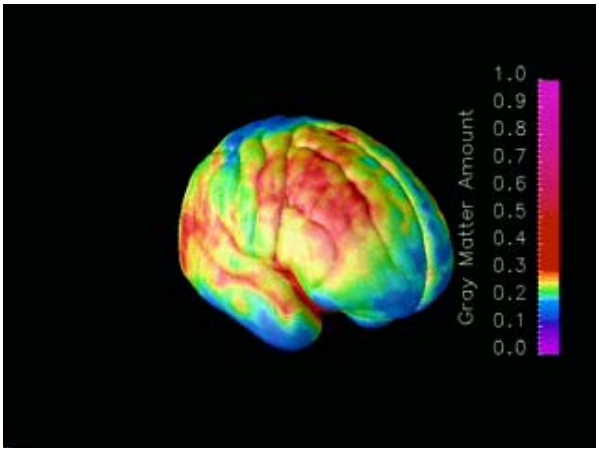
Understand the T.R.U.T.H. about every drug.

Understand drug tolerance and withdrawal vs. drug addiction.

Parent/community education is a critical component of prevention and reduction of abuse.

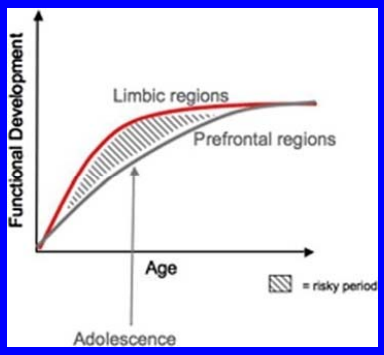
We don't know what it is we don't know.

** Mary Matalin, 1998*



"Brain Challenged?"

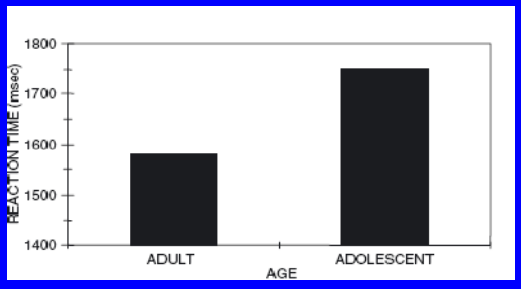
- The late-developing prefrontal cortex is the coordinating center of the brain:
  - Organizes complex tasks
  - Plans in advance for actions
  - Interprets complex cues
  - Inhibits inappropriate behavior
  - Execute rapid decision making
- This area is not fully developed in adolescents. Does this help explain their behavior?



There are more differences than just brain structure

- **Signaling differences**
  - **Different learning chemistry**
  - **Different responses to drugs**
  - **More sensitive to addictive processes**

- **This constellation of differences probably makes adolescents vulnerable to initiating and maintaining alcohol and other drug use.**



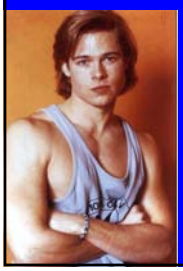
Addiction

Addiction Comes from a Normal Brain Activity—Stimulation of the Brain Reward System

This system is what gives us :

- ---the buzz from sex
- ---the anticipation of good food
- ---the joy of cooperation
- ---the euphoria of winning

Dopamine is released by life sustaining activities…food, sex, and in humans, most pleasureable activities



When we anticipate a reward the brain gives us the tools to get it…

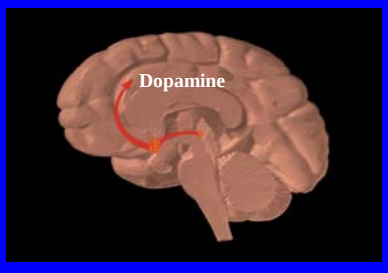
Attention, Focus, Power, Suppression of Fear, Euphoria

When we get the reward we get pleasure and the brain encodes cues to get the reward again.

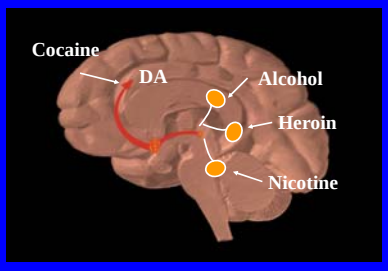
The brain chemical dopamine is released by the reward system, and…..

- ALL addicting drugs release this brain chemical.
- Many release much more than natural stimuli.

Neural Basis of Addiction



All Addictive Drugs Activate this Circuit



Repeated Stimulation Changes The Brain: The Addiction Cycle

Every drug has two effects…

The one you know about and the one you don't….

Two major effects of alcohol

- Inhibitory: sedation, motor control, and anxiety reduction
- Excitatory: Activation of neuronal circuits that underlie the buzz and addiction

Alcohol and the T.R.U.T.H.

Toxicity/Sedation
Reinforcement/Addiction/Tolerance/ Withdrawal
Understand why someone is using alcohol
Time

Alcohol, Sedation and Teens and Alcoholics

Kids/alcoholics are more vulnerable because…

- They are less sedated
- They can stay awake to drink more
- Heavy use as a kid may "lock in" this state into adulthood—possibly promoting excess use and addiction.

Alcohol and Driving

The most important effect of alcohol that you never heard about--

An error detector (the OOPS response) in the cingulate gyrus is suppressed at 0.04 BAC

Alcohol and loss of behavioral control

- The frontal cortex coordinates decision making
- Alcohol impairs the function of that area more than others
- Thus the drunk person has the capability to act, but not the wisdom of control
- This is more true for teenagers, who are already "brain challenged"

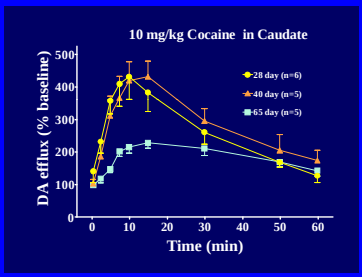
Alcohol and the buzz….the heart of addiction

- Everyone knows that alcohol is addictive.
- Adolescents appear to be more vulnerable to addiction than adults.

Alcohol and the buzz….

- The buzz is caused by activation of the reward system in the brain.
- This is the system that makes us do what is good for preserving the species.

So, do adolescents respond better to addictive drugs?



In Summary

- The adolescent brain is different
  - Structure is still in development, especially in the highest centers: Emotion leads Reason
  - The reward system is different, maybe lower at baseline, but more reactive.
  - The response to addictive agents is different
- All of these come together to make kids more vulnerable to alcohol and other drug problems.

Marijuana

- Toxicity
  - Long-term toxicity similar to tobacco use
  - Possible interactions with the immune system

Marijuana

- Reinforcement—addicting?
  - Clearly some people become dependent
  - Because of anxiety-reducing effects, users tend to not deal with their problems, their problems get worse, they smoke more, and they get into real trouble.

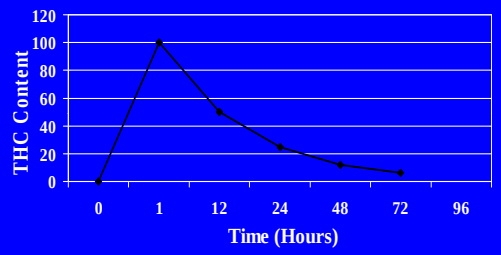
Marijuana

- Understanding how it works
  - Reduces anxiety
  - Produces euphoria in some people
  - Impairs all kinds of learning by the brain
    - Academics
    - Music
    - Athletics
    - Social skills

Marijuana

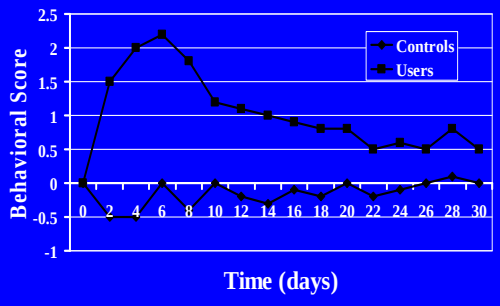
- Time
  - Stays in the body for weeks—8 days to eliminate 90% of one dose
  - Stored in fat
  - Metabolized into active compounds
  - The brain adapts to its presence

THC: Slow Removal from Body



Half life = 12-18 hours

Marijuana Withdrawal



From Pope et al,

A Major Problem With Marijuana

- The adolescent brain is not mature
- For proper development, the brain needs learning mechanisms to work properly
- Marijuana is persistent and impairs learning
- Thus regular marijuana use ***MAY*** impair proper brain maturation

What Kids Need to Be Effective

- Supervision by parents
- High quality sleep, nutrition and exercise
- Effective education about stress
- Appropriate rewarding stimulation
- The three F's…..

U.S.News

Home > Health > On Parenting > 7 Ways to Learn More Without More Study

On Parenting By Nancy Shute

7 Ways to Learn More Without More Study

1. Get to bed and go to sleep.
2. Start studying a few days in advance of a test.
3. Feed your head.
4. Body exercise is brain exercise.
5. Learn now what you want to remember for the rest of your life.
6. Harness the power of risk-taking.
7. Learn what you love.

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Questions?

- Cocaine
- Methamphetamine
- Ecstasy
- PCP