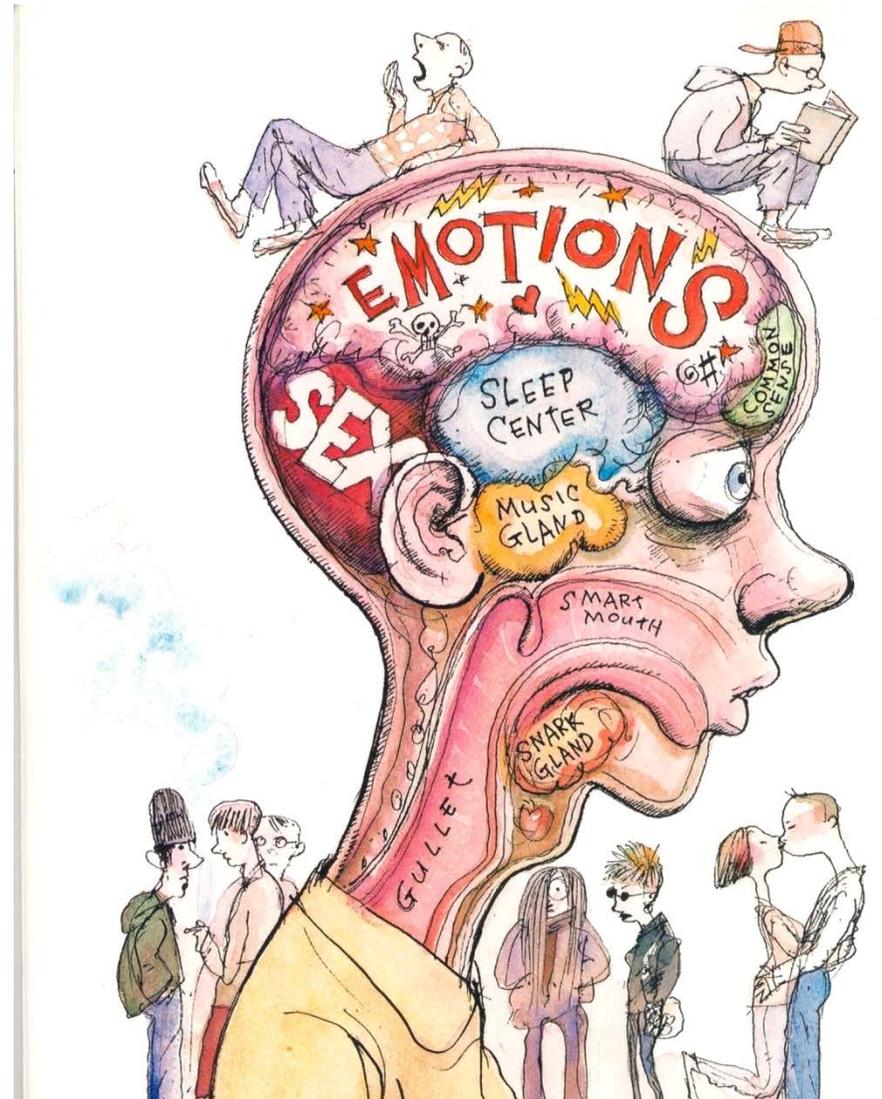


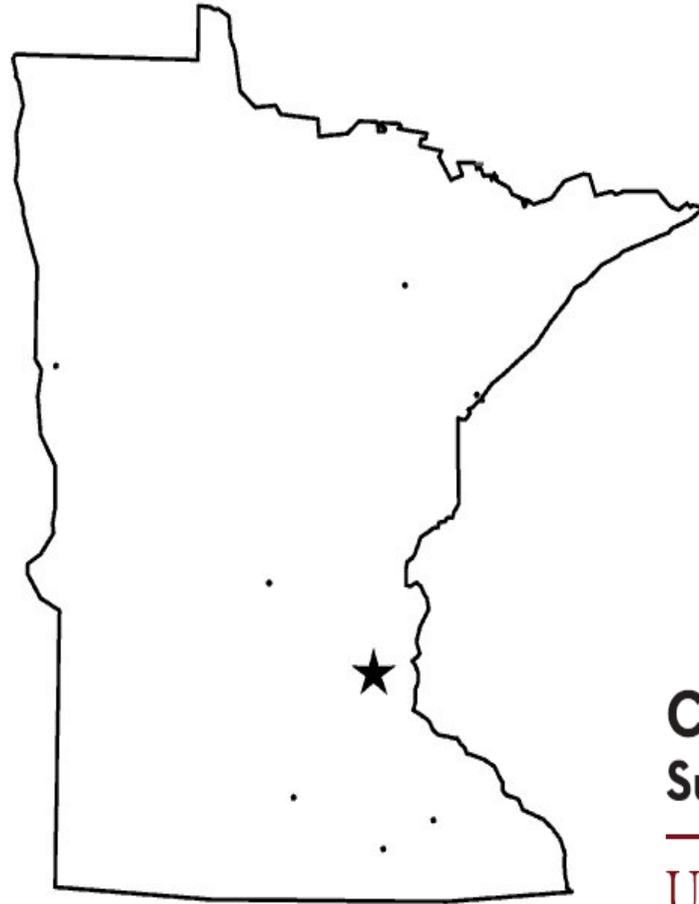
This is Your Brain on Adolescence

Navigating the Teen Years

Ken Winters, Ph.D.
Department of Psychiatry
University of Minnesota Medical School
winte001@umn.edu

Kentucky Systems of Care
Conference
June 26, 2014





**CENTER *for* ADOLESCENT
Substance Abuse Research**

UNIVERSITY OF MINNESOTA

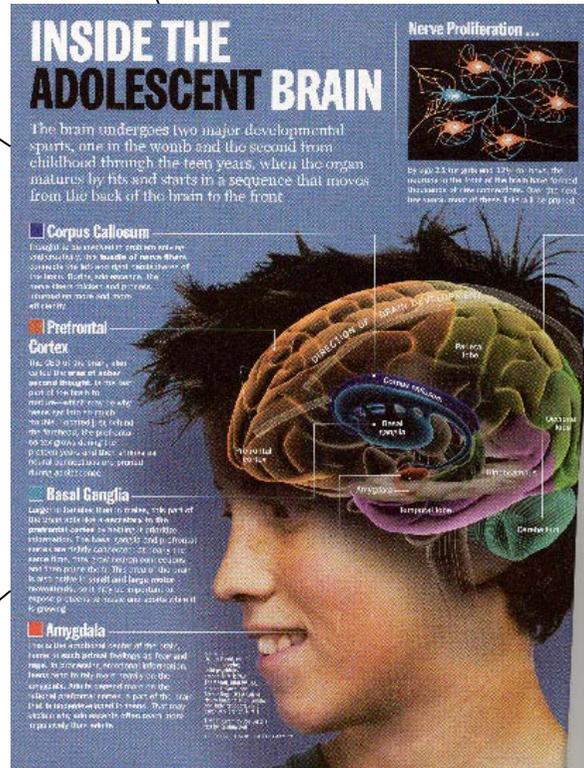
Driven to DiscoverSM

www.psychiatry.umn.edu/research/casar/home.html

1. Addiction as brain disease

4. Summary & applications

2. Brain development



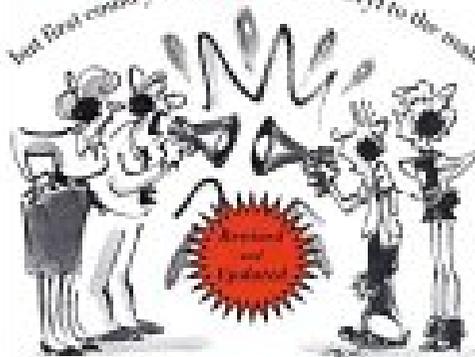
3. Developing brain & drug risk

When talks get too technical, the audience can look like this!



Get Out of My Life,

but first could you drive me and Cheryl to the mall?



A PARENT'S GUIDE TO THE NEW TEENAGER

Anthony E. Wolf, Ph.D.

NATIONAL BESTSELLER

"There's nothing else like this: immensely informative, witty, and useful. I highly recommend it!" —David Bellwood, 1
author of *Brainwashed* and *The Unwritten Rules of Child Rearing*

Why Do They Act That Way?

KEEP
OUT

A Survival Guide
to the Adolescent Brain
for You and Your Teen

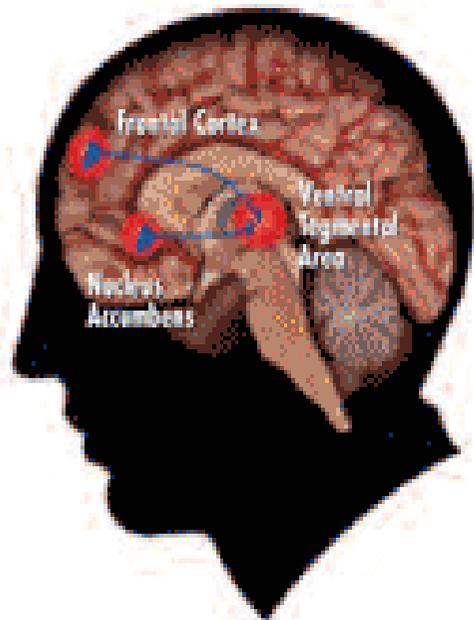
DAVID WALSH, Ph.D.

1. Addiction as brain disease



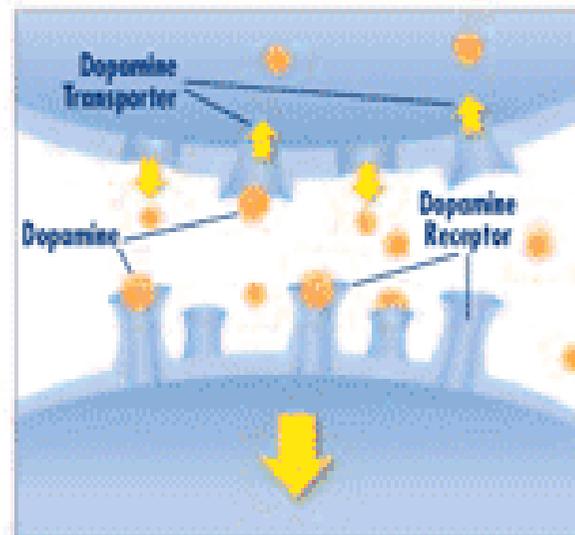
ALL DRUGS OF ABUSE TARGET THE BRAIN'S PLEASURE CENTER

Brain reward (dopamine) pathways

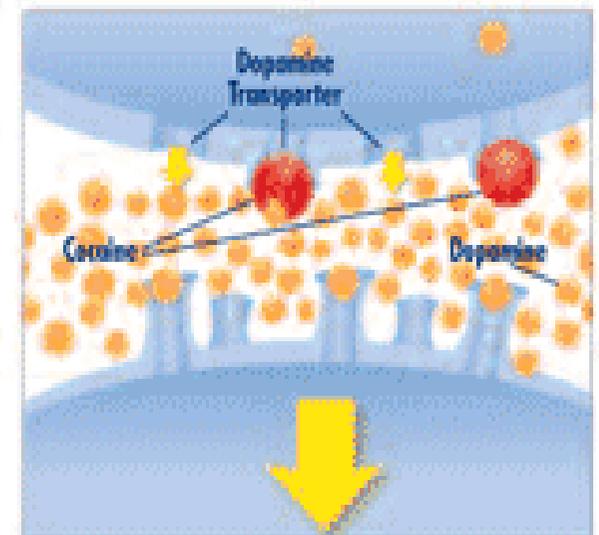


These brain circuits are important for natural rewards such as food, music, and art.

All drugs of abuse increase dopamine



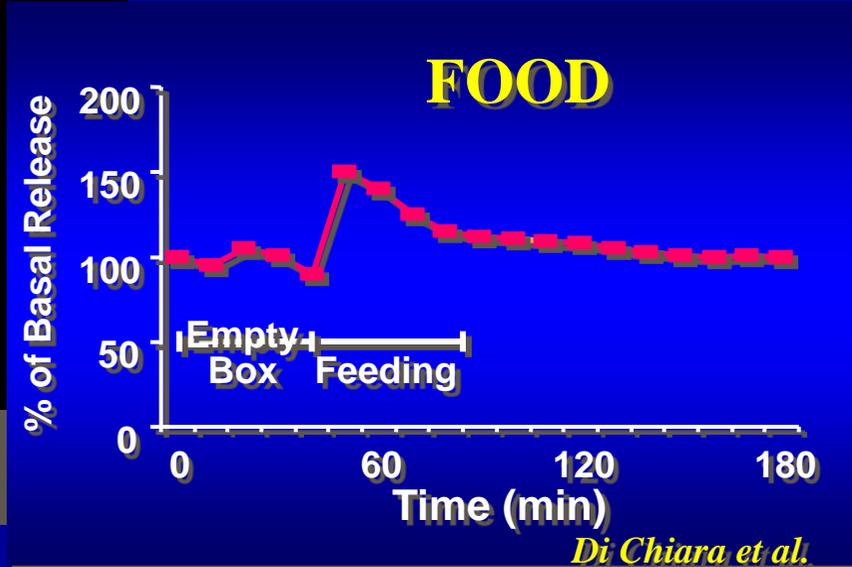
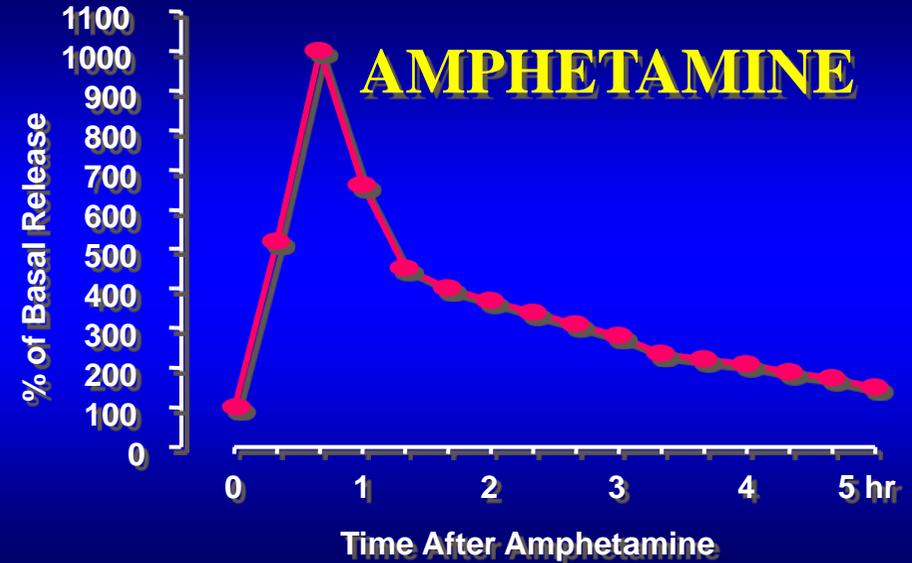
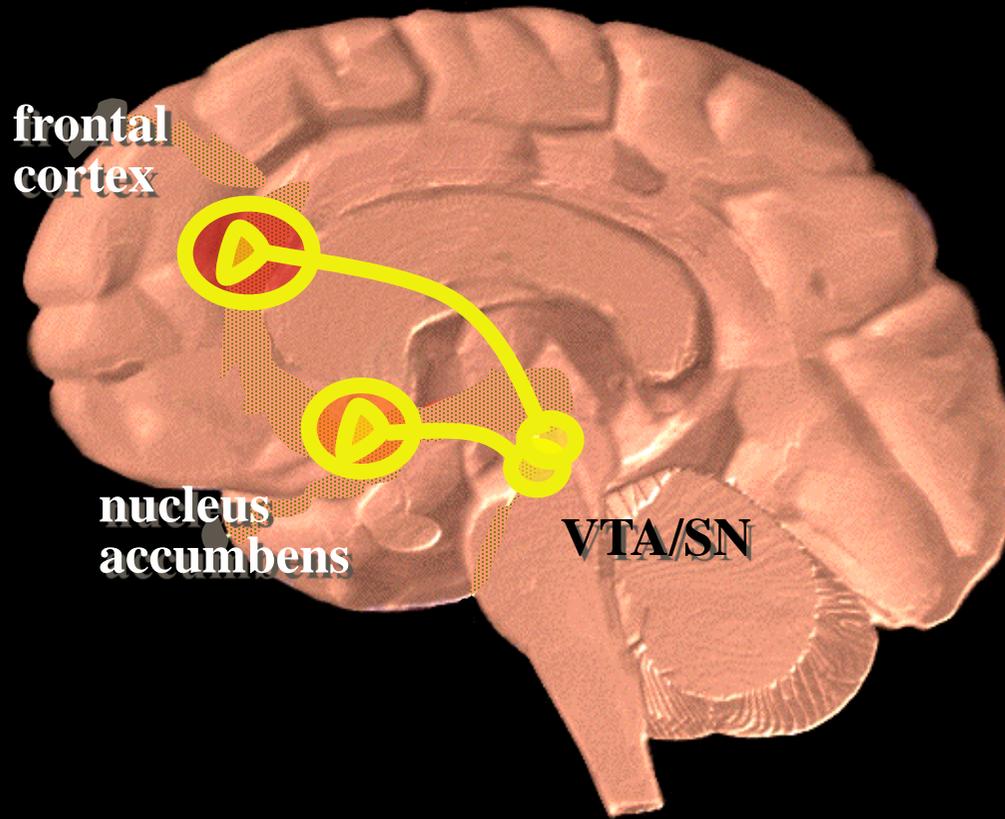
FOOD



COCAINE

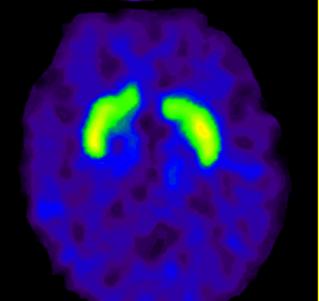
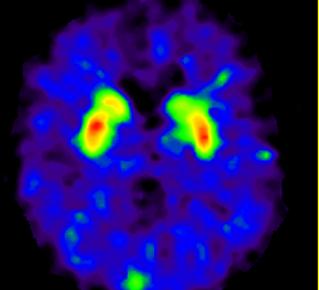
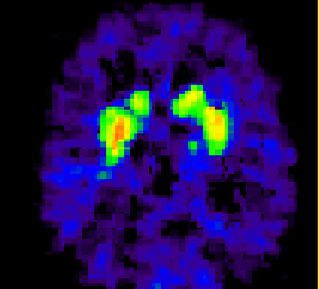
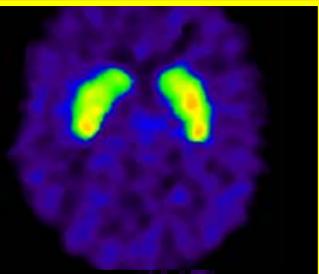
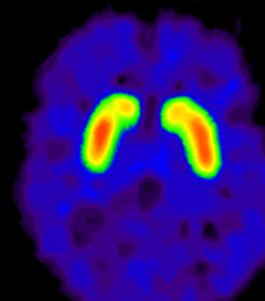
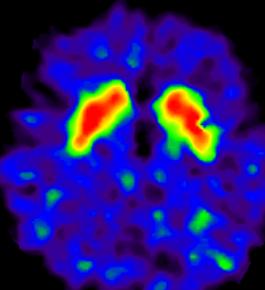
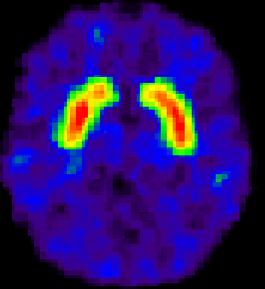
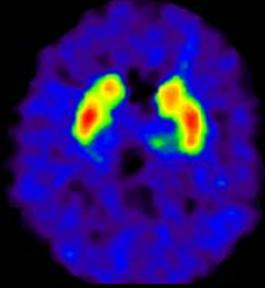
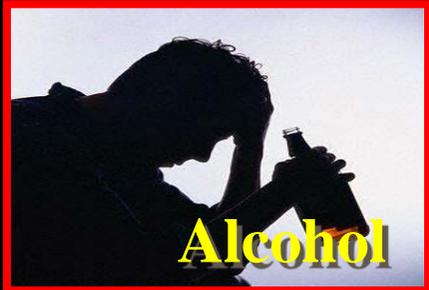
Typically, dopamine increases in response to natural rewards such as food. When cocaine is taken, dopamine increases are exaggerated, and communication is altered.

Dopamine Neurotransmission



Di Chiara et al.

Dopamine D2 Receptors are Lower in Addiction

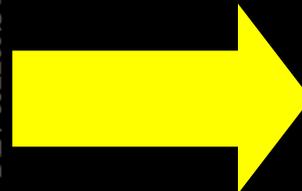


control

addicted

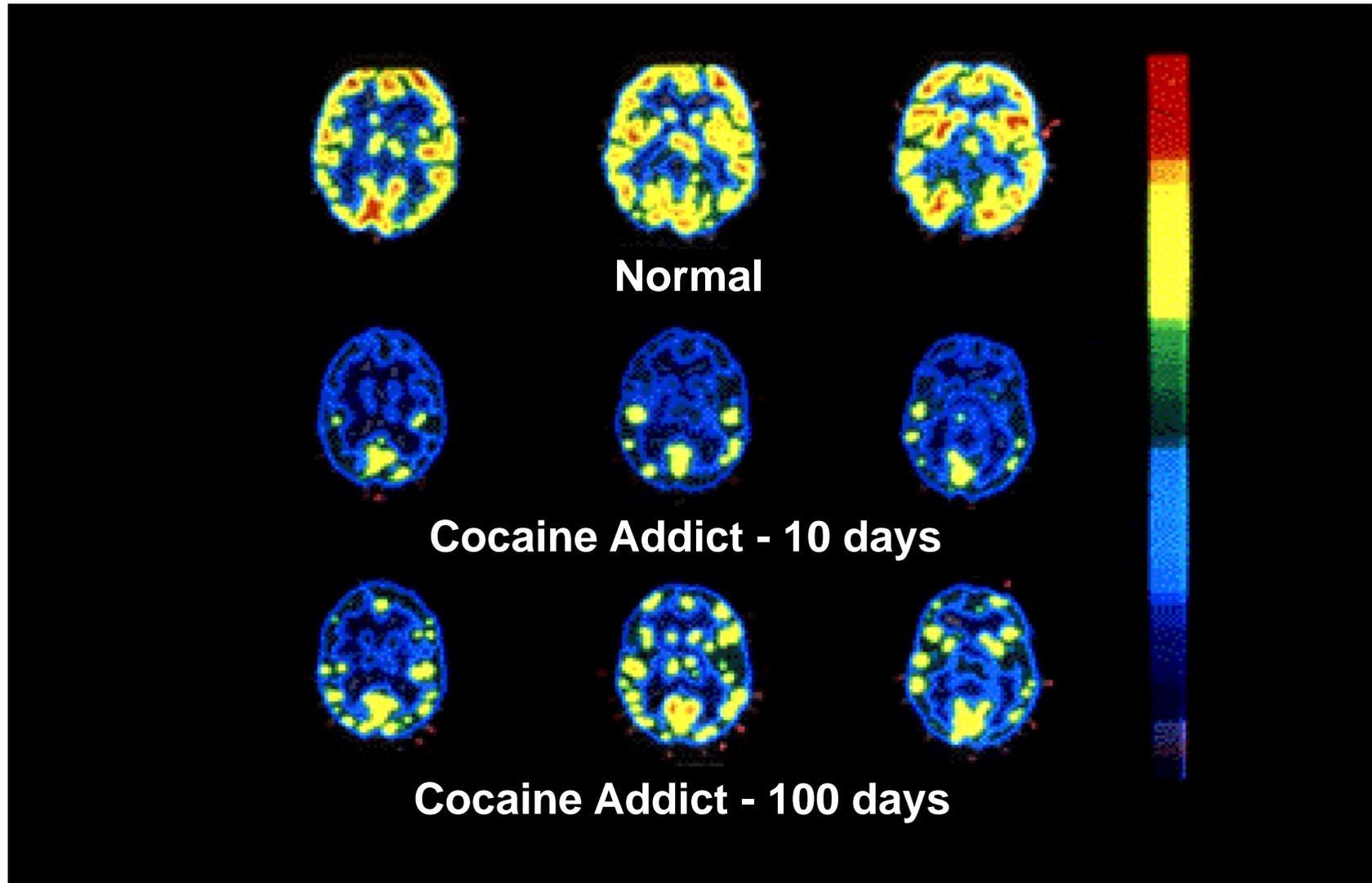


DA D2 Receptor Availability



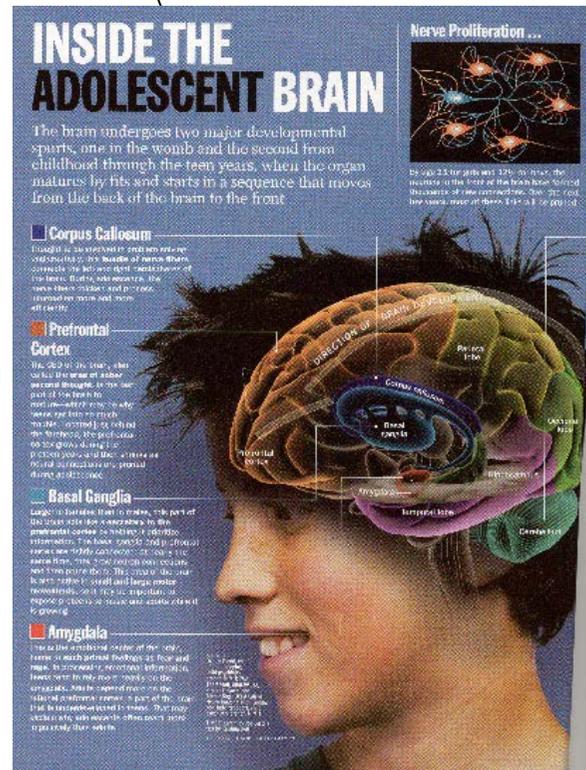
What about recovery?

Your Brain After Cocaine



Yellow = normal brain functioning

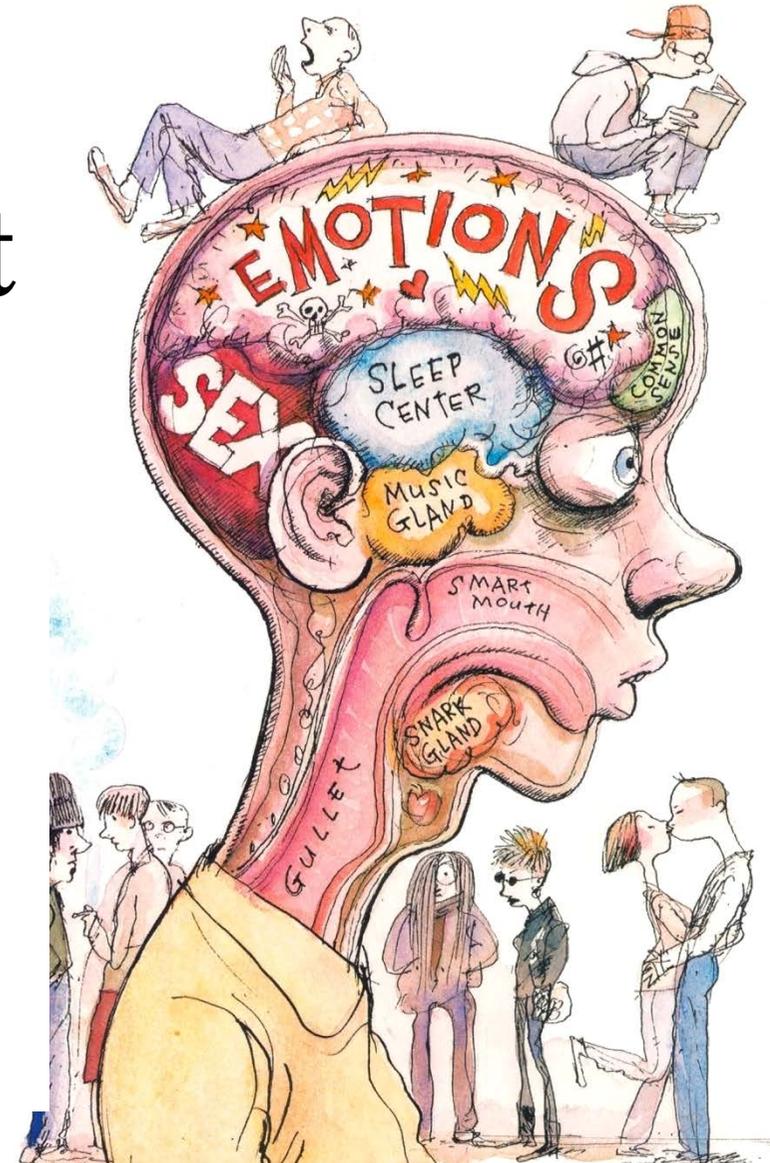
1. Addiction as brain disease



2. Brain development

Important ages of majority and privileges

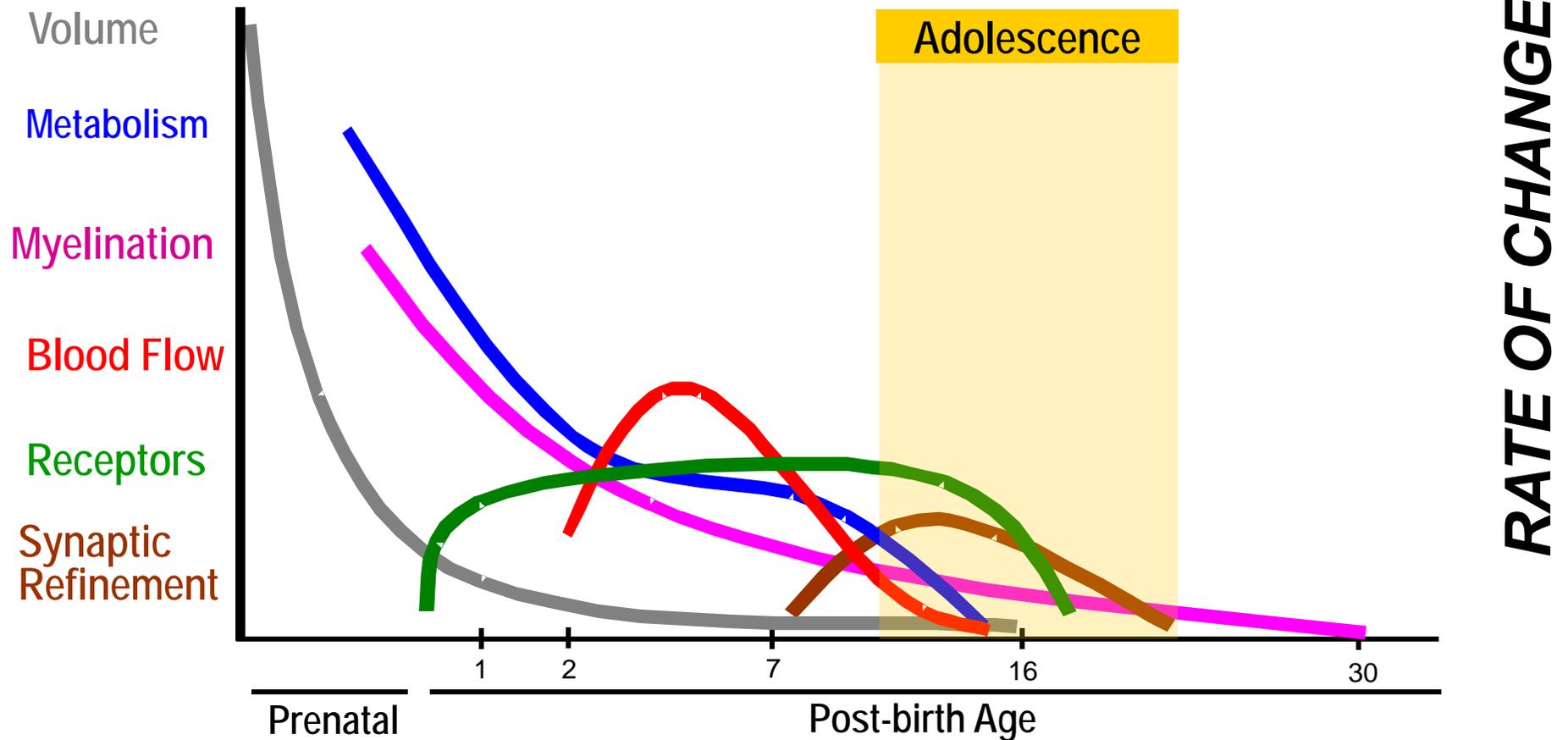
**What one “privilege”
in our culture does not
become fully available
until the age of 25?**



An Immature Brain = Less Brakes on the "Go" System



Brain Development



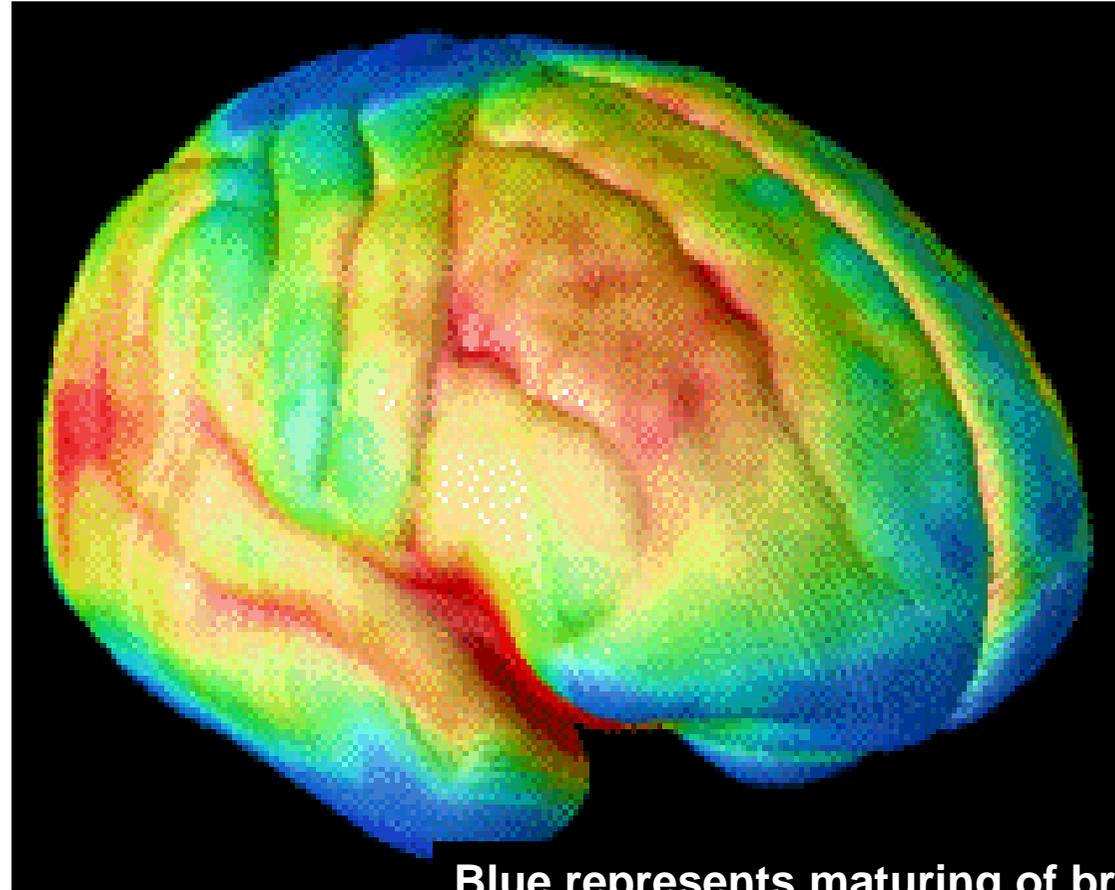
Tapert & Schweinsburg (2005)

Maturation Occurs from Back to Front of the Brain

Images of Brain Development in Healthy Youth (Ages 5 - 20)

Earlier:
Motor and Sensation
Emotion
Motivation

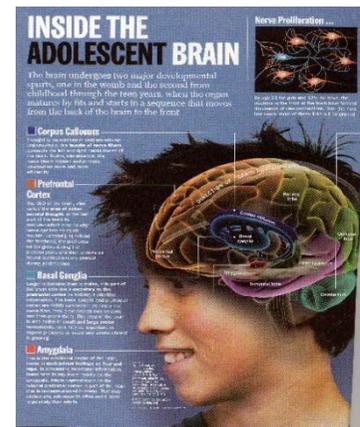
Later:
Judgment



Blue represents maturing of brain areas

Implications of Brain Development for Adolescent Behavior

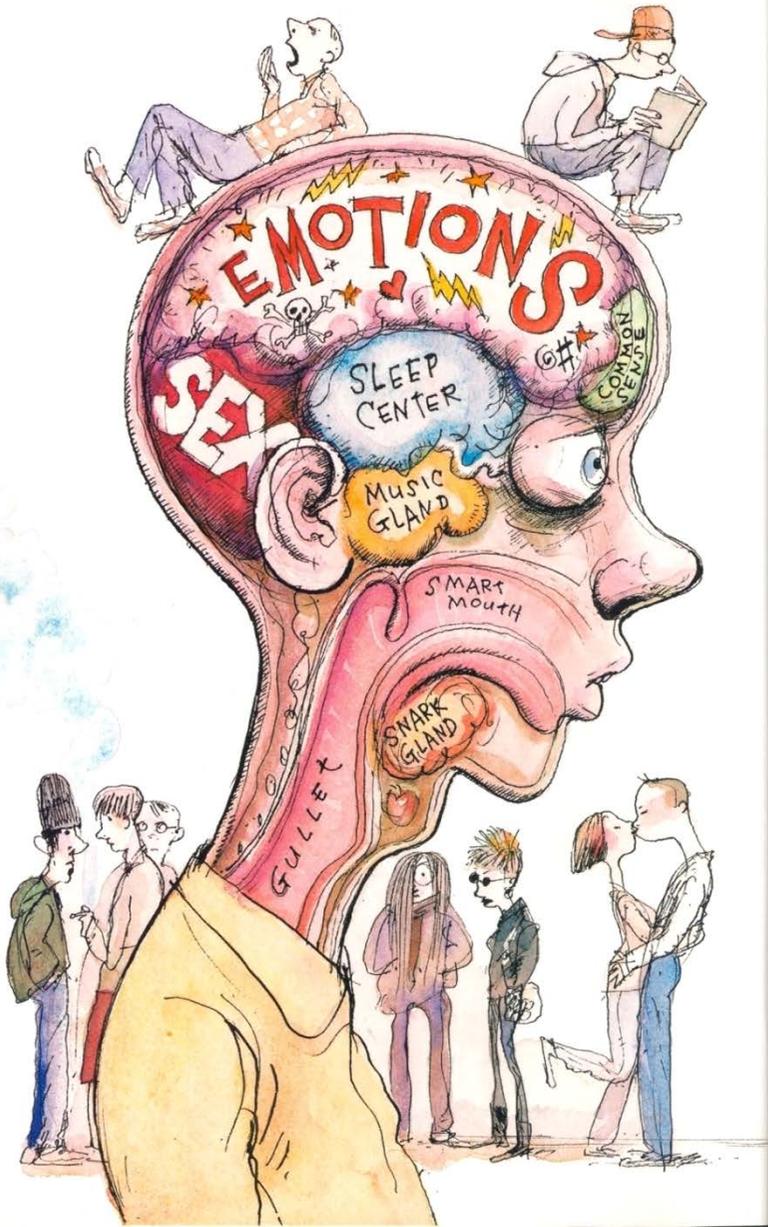
- **Preference for**
 1. physical activity
 2. high excitement and rewarding activities
 3. activities with peers that trigger high intensity/arousal
 4. novelty
- **Less than optimal..**
 5. control of emotional arousal
 6. consideration of negative conseq.
- **Greater tendency to...**
 7. be attentive to social information
 8. take risks and show impulsiveness



Risk-Taking

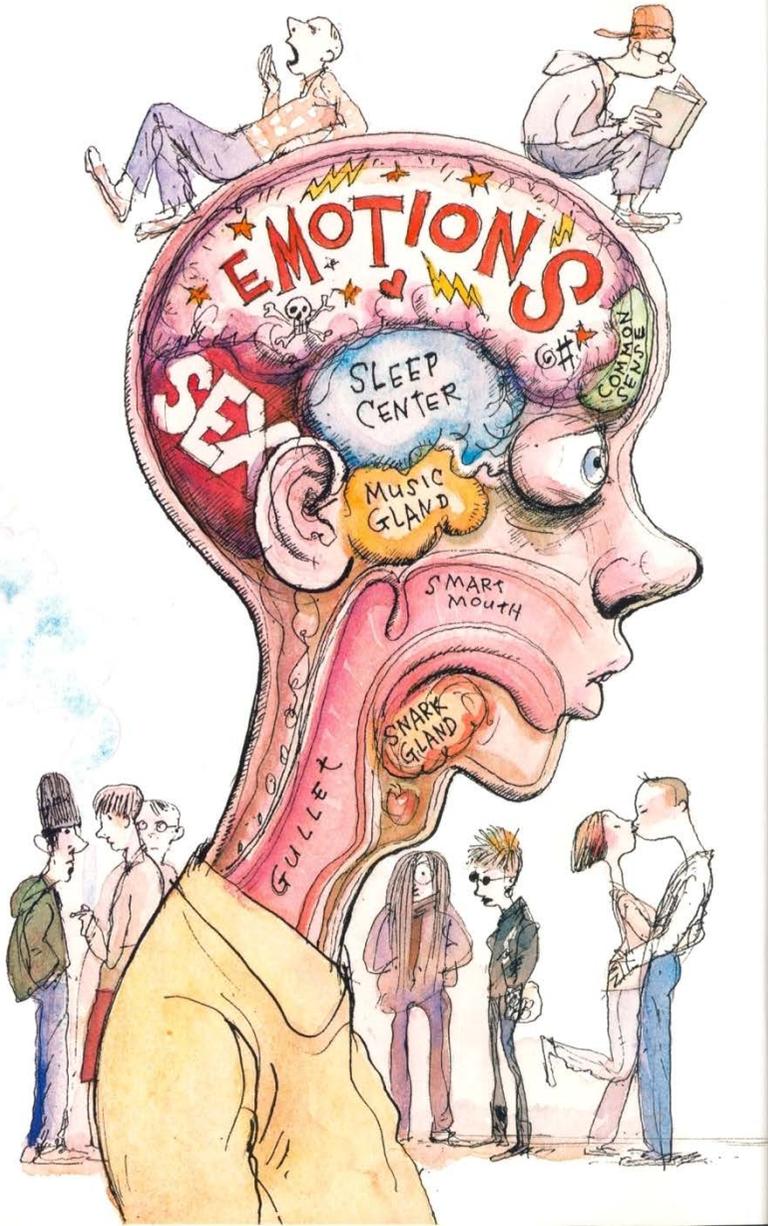
- **Based on science of brain development, a modern view of risk taking in adolescence is...**
 - **normative; important to development**
 - **evolutionarily adaptive**
 - **is due primarily to emotional and contextual, not cognitive, factors**
 - **significant individual differences**

A Developing Brain \neq Low Brain Power



Source: US News &
World Report, 2005

A Developing Brain ≠ Risky Judgment is Pervasive



Source: US News &
World Report, 2005

1. Addiction as brain disease



2. Brain development

3. Developing brain & drug risk

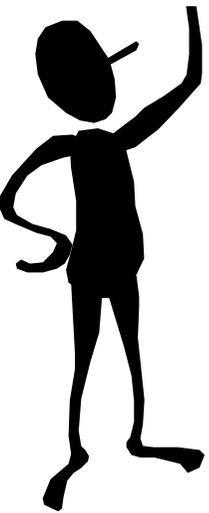
Implications of Brain Development for Drug Abuse Vulnerability



Adolescents may be more susceptible than adults to drugs

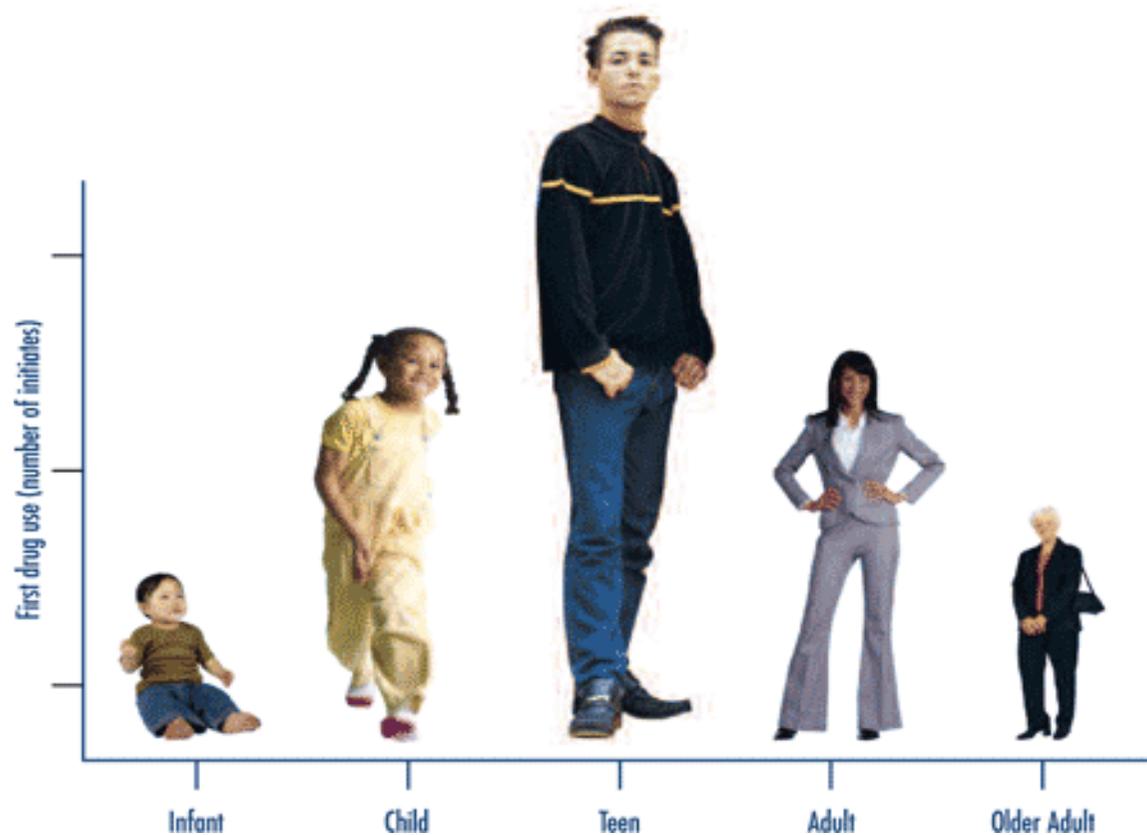
(acknowledgement to Linda Spear, Ph.D.)

**Unethical to give human adolescents alcohol in the laboratory;
much of the best evidence comes from adolescent rat studies.**

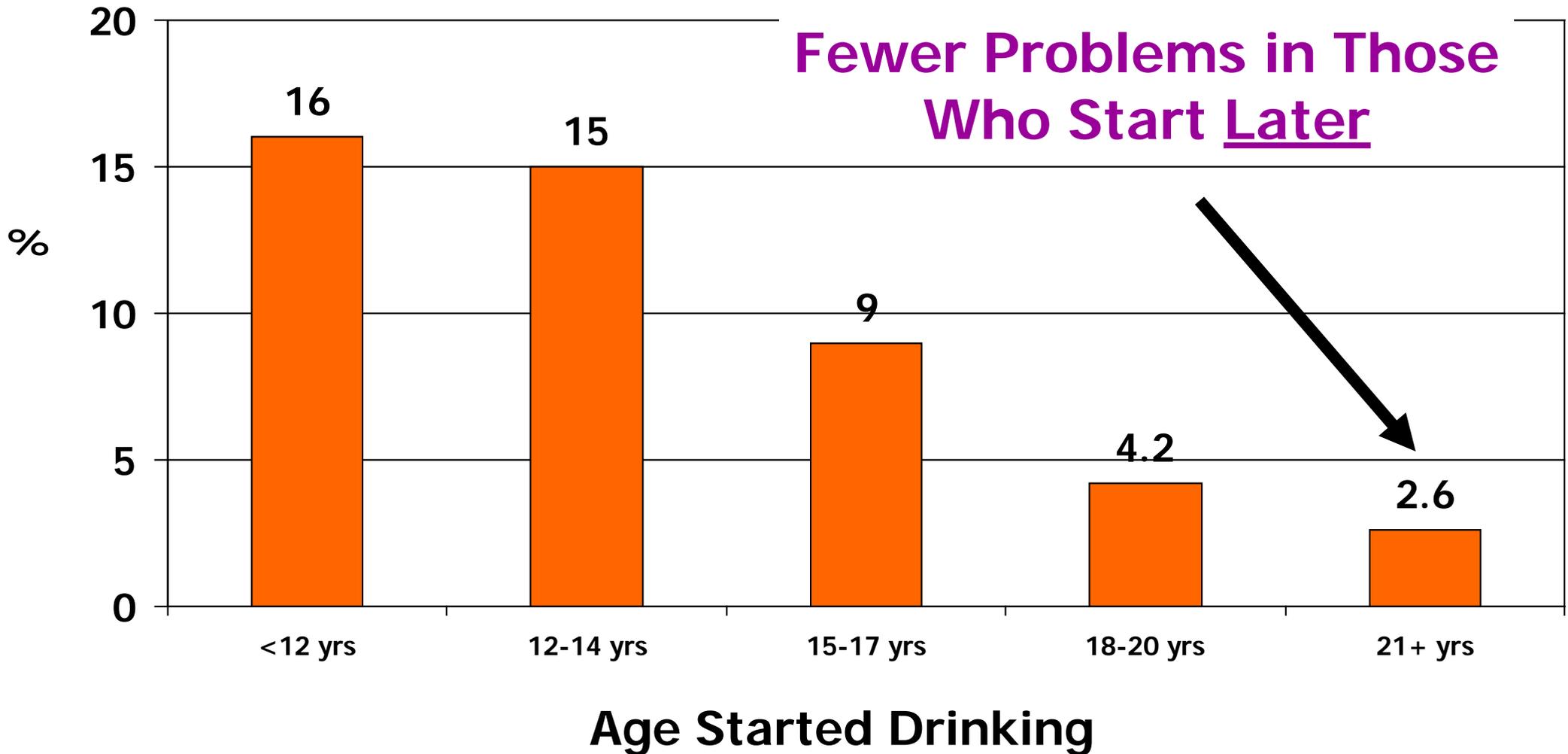


Evidence from epidemiological studies

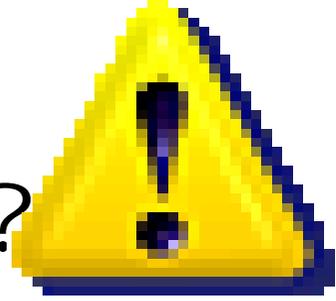
Drug use starts early and peaks in the teen years



Percentages of Past Year Alcohol Use Disorder
(Abuse or Dependence) Among Adults Aged 21 or
Older, by Age of First Use (**SAMHSA, 2005**)

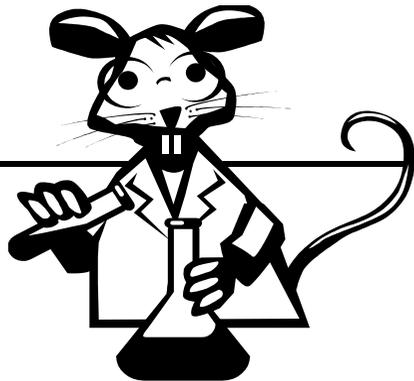


Adolescents may have different sensitivity to alcohol than adults?

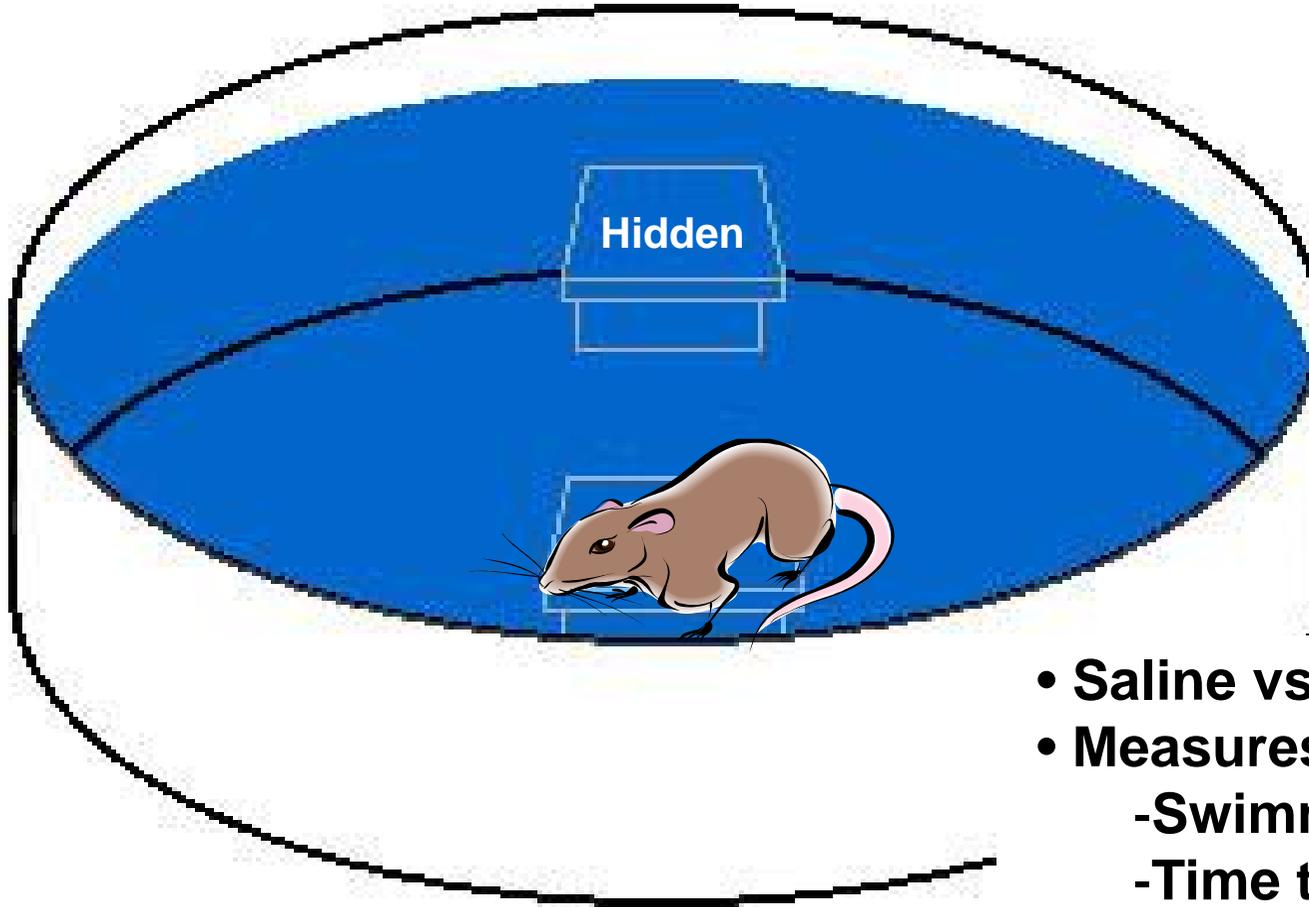
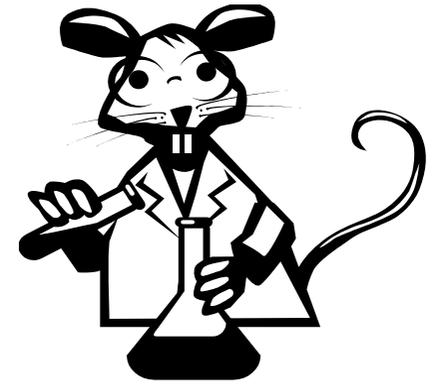


Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.

Adolescent rats are more sensitive to the social disinhibition effects of alcohol.

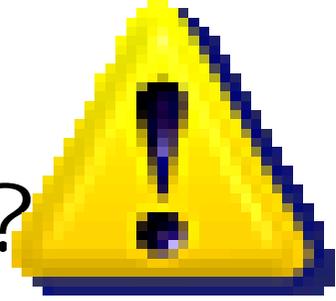


The Water Maze Test



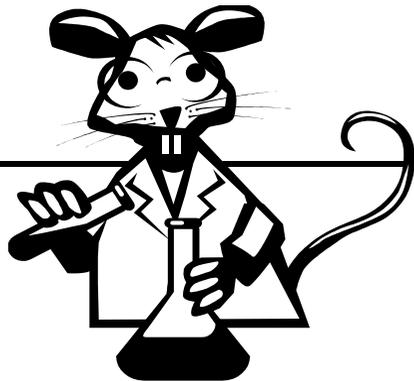
- Saline vs alcohol
- Measures
 - Swimming speed
 - Time to find platform

Adolescents may have different sensitivity to alcohol than adults?



Adolescent rats are less sensitive to the sedative and motor impairment effects of intoxication.

Adolescent rats are more sensitive to the social disinhibition effects of alcohol.

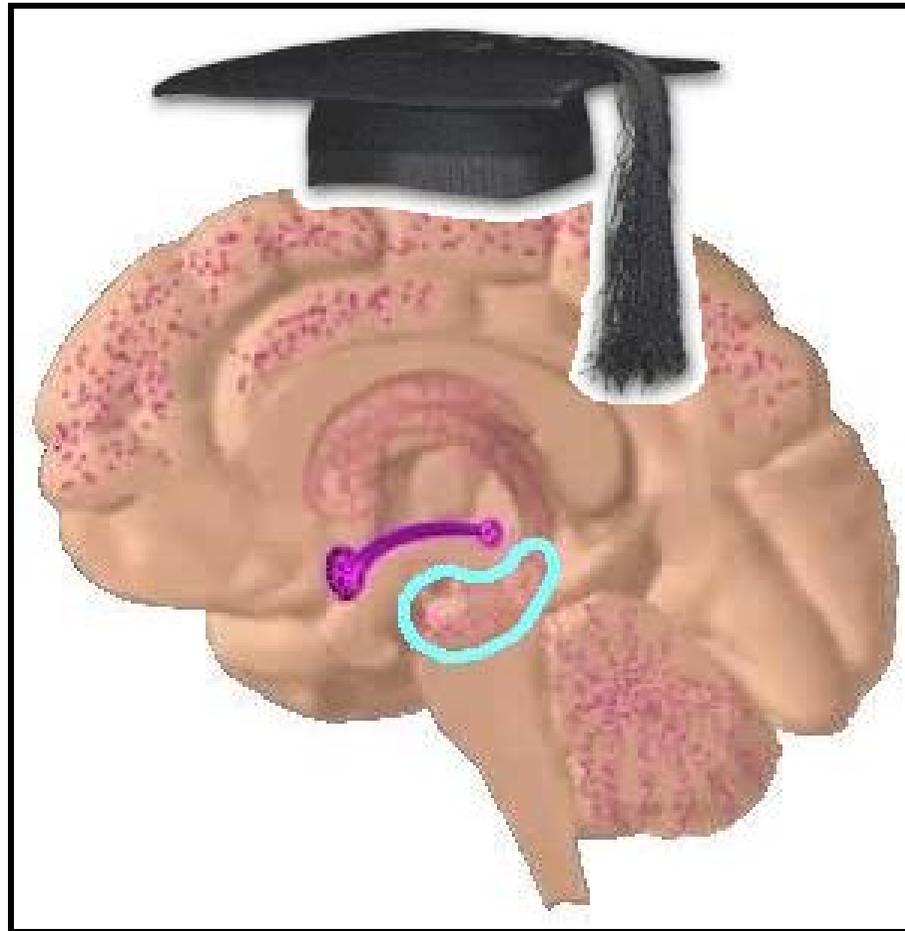


Wanna look
for some cheese
with me?

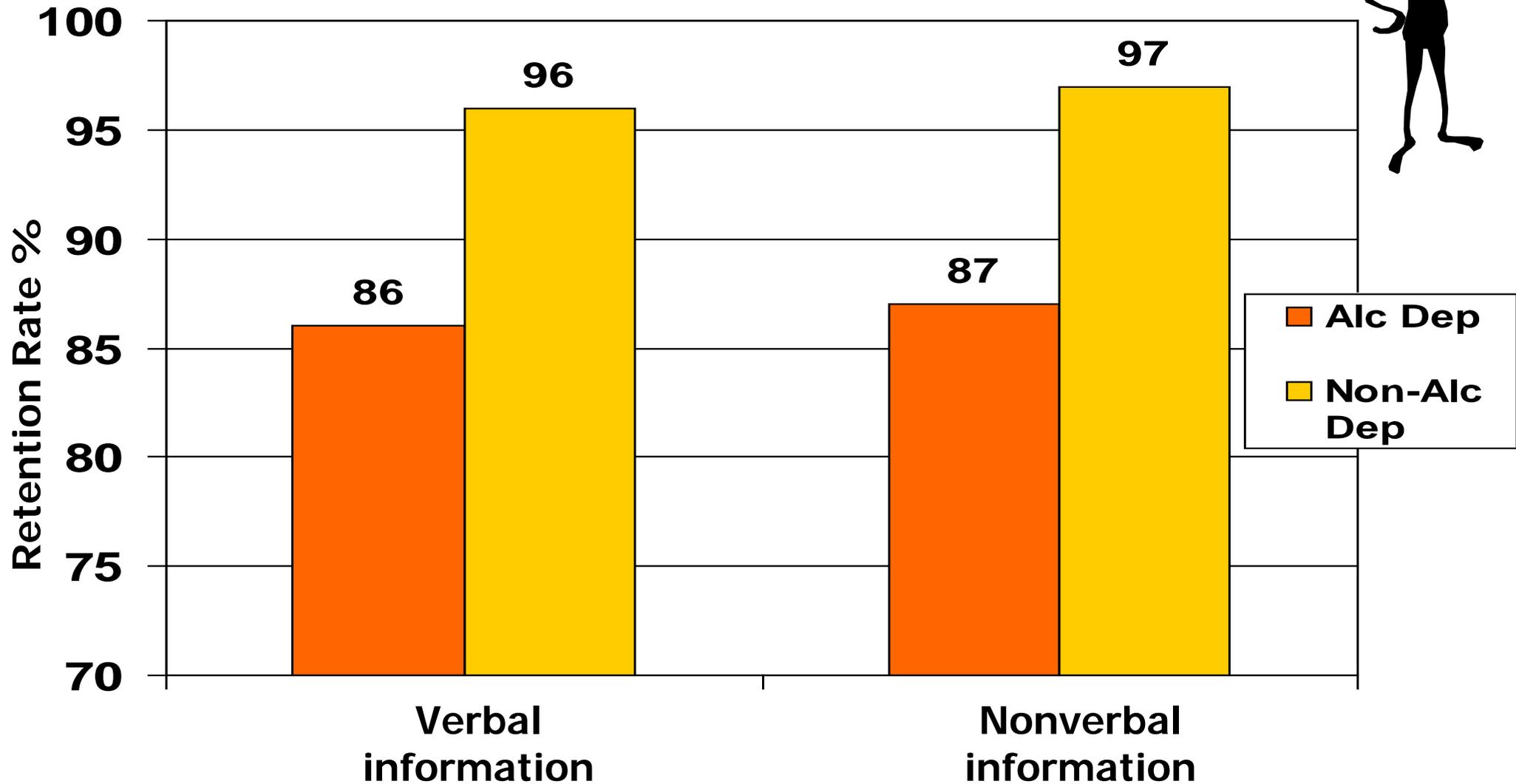
Sure!



Human Data: Drug's Effects on Memory

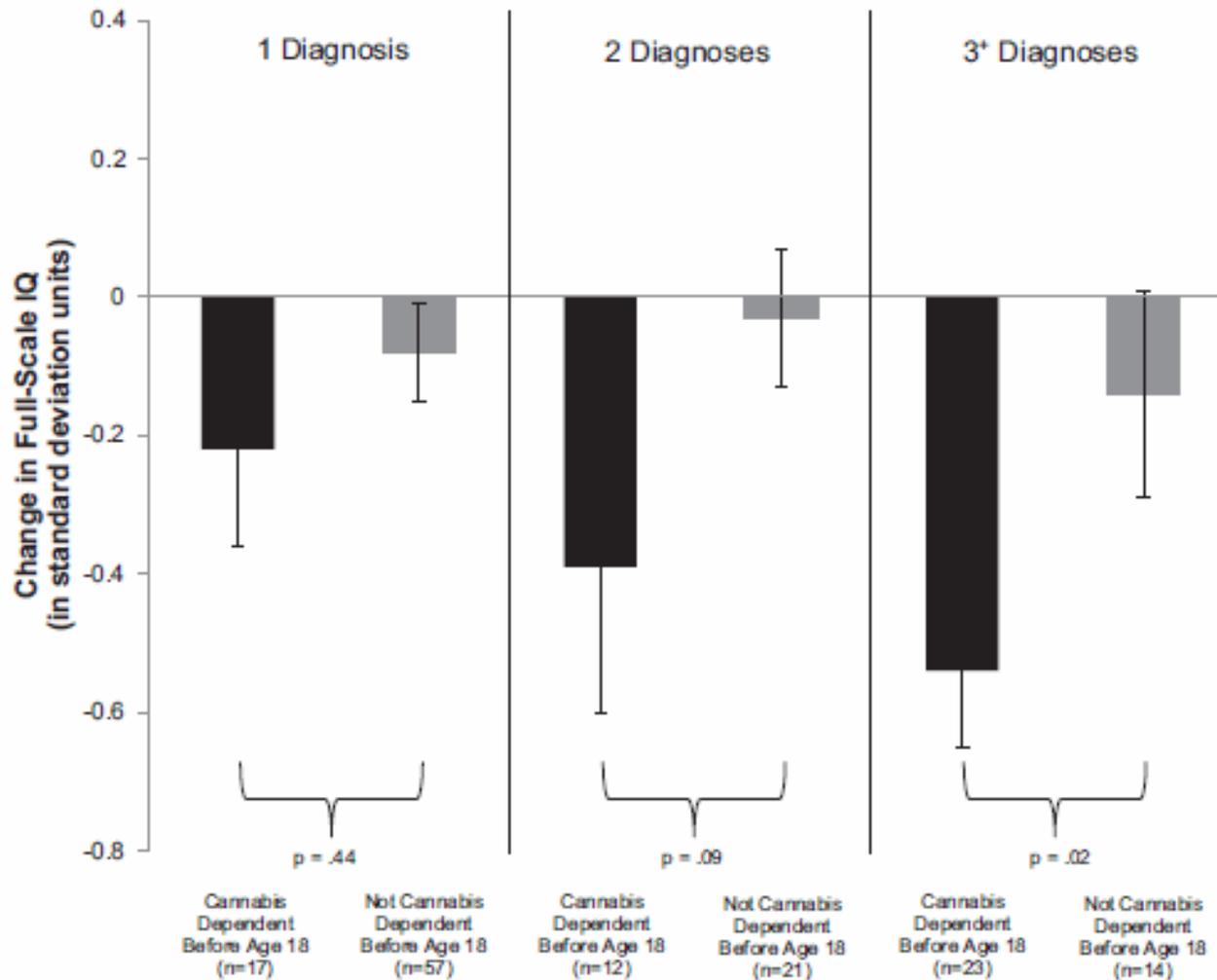


Human Data: Alcohol's Effects



Source: Brown et al., 2000

Marijuana: IQ Changes Among Diagnosed Users



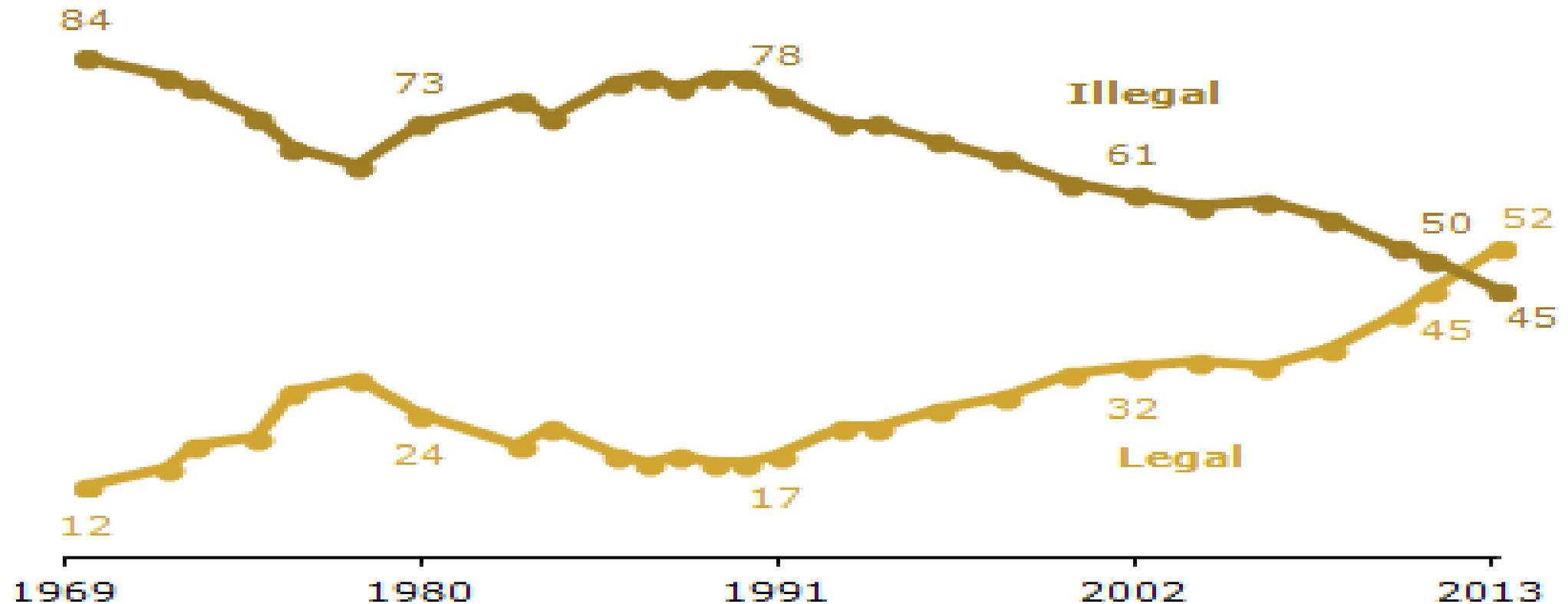
Major New Study Shows Heavy Marijuana Use Lowers IQ

Fig. 2. Adolescent vulnerability. Shown is change in full-scale IQ (in SD units) from childhood to adulthood among study members with 1, 2, or 3+ diagnoses of cannabis dependence as a function of age of onset of cannabis dependence. Individuals with adolescent-onset cannabis dependence (black bars) experienced greater IQ decline than individuals with adult-onset cannabis dependence (gray bars). IQ decline of approximately -0.55 SD units among individuals with adolescent-onset cannabis dependence in the 3+ group represents a decline of 8 IQ points. Error bars = SEs.

Support for Marijuana Legalization in the United States Has Reached Unprecedented Levels

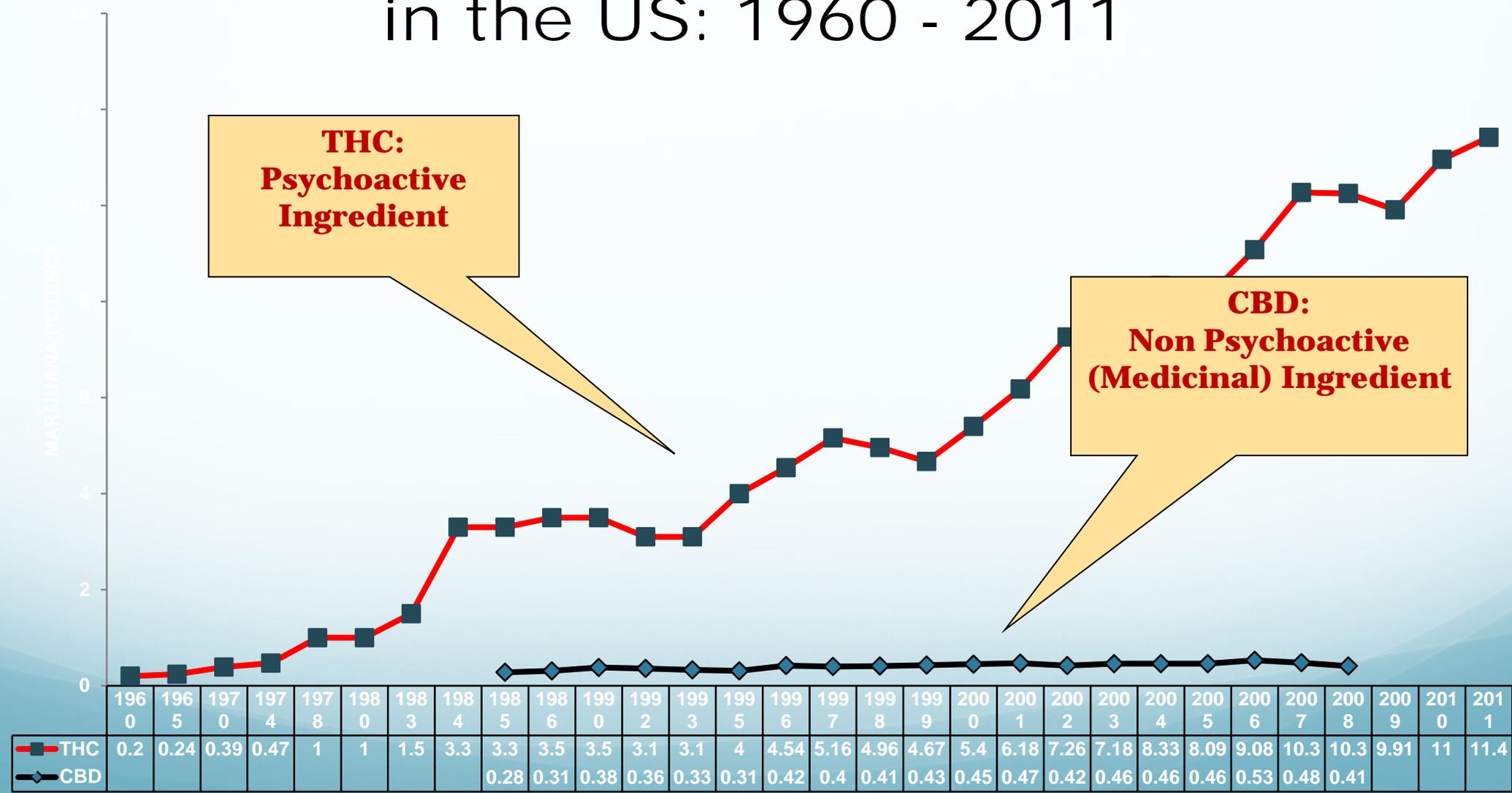
Views of Legalizing Marijuana: 1969-2013

% saying marijuana should be ...



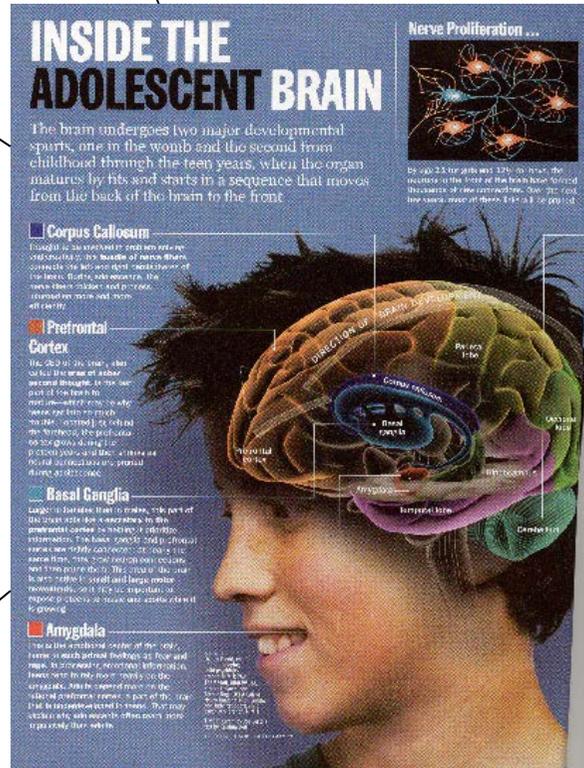
PEW RESEARCH CENTER March 13-17, 2013.
1973-2008 data from General Social Survey; 1969 and 1972 data from Gallup.

Average THC and Cannabidiol (CBD) Levels in the US: 1960 - 2011



1. Addiction as brain disease

4. Summary & applications

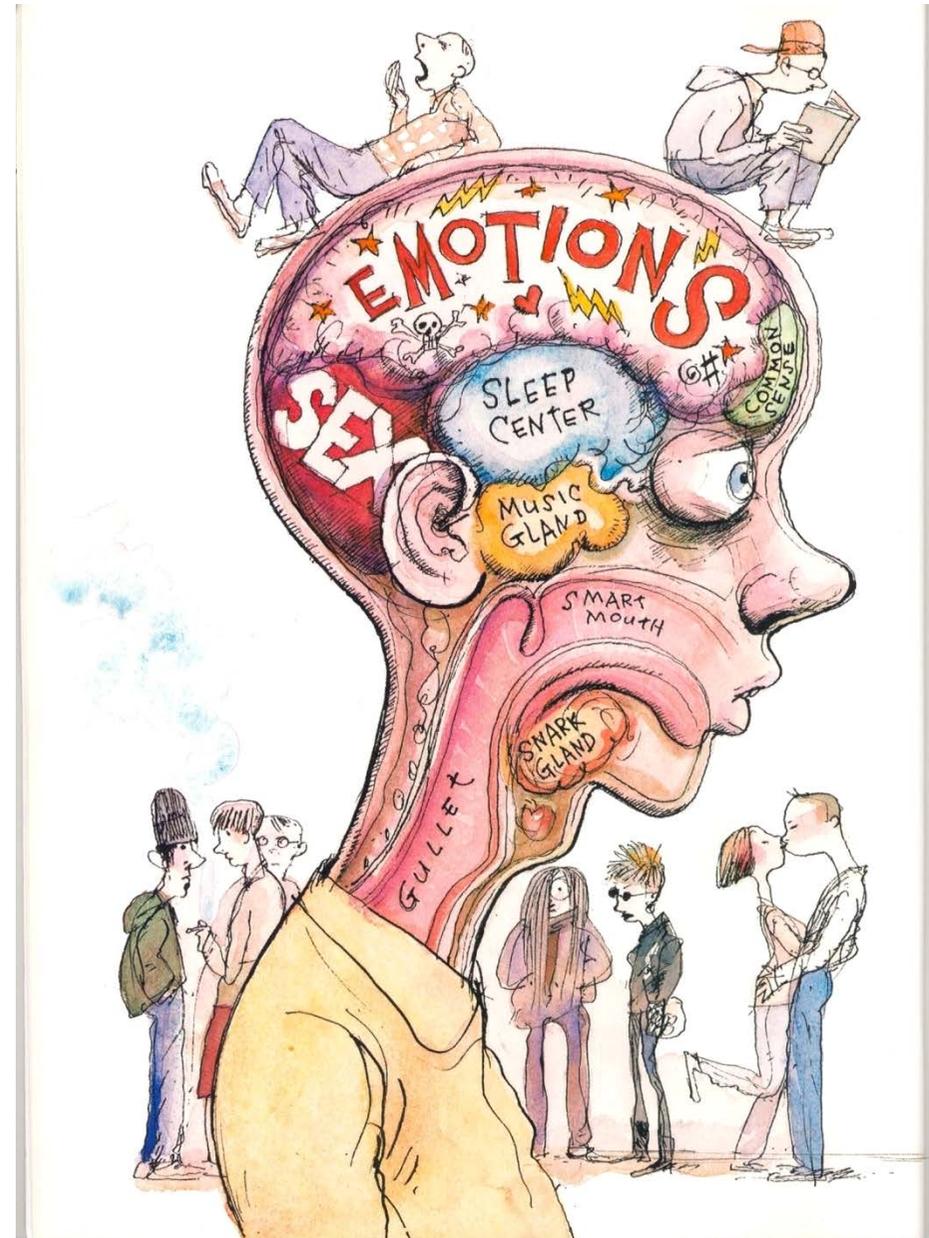


2. Brain development

3. Developing brain & alcohol risk

Review

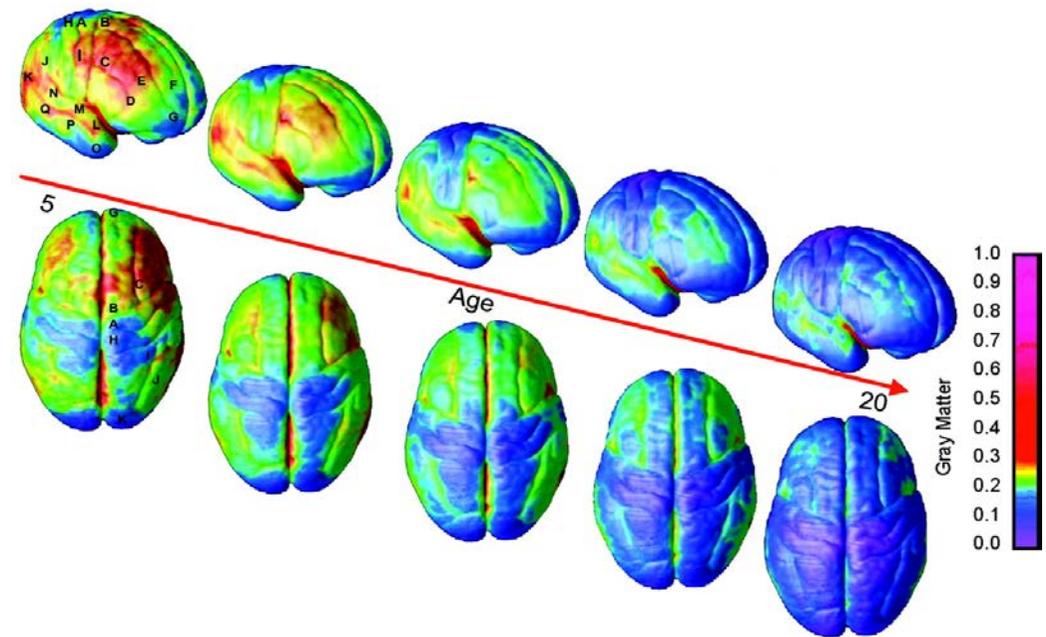
- Adolescence is an extended period of transition from reliance on adults to independence
- Normal adolescence is characterized by....
 - increase in conflicts with family members
 - desire to be with one's friends
 - resistance to messages from authority
 - irritability
 - proclamations of sheer boredom
 - risk taking
 - reward incentive-biased decision making



Review

- The brain undergoes a considerable amount of development during the teen years.
- The last area to mature is the prefrontal cortex region; involved in planning, decision making and impulse control.

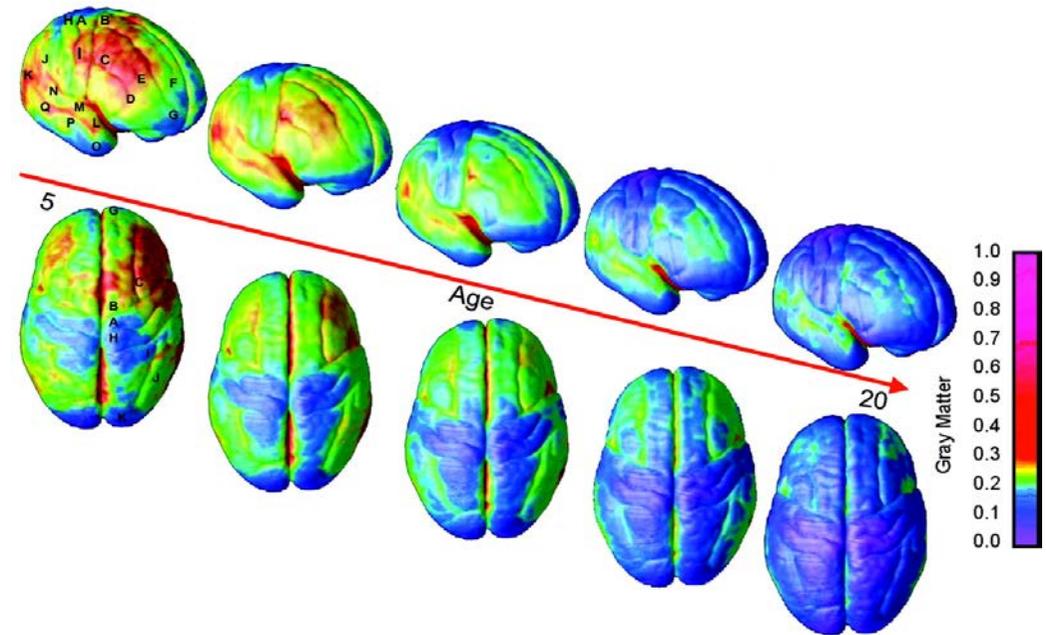
Gray Matter Maturation, Age 4-21
Gogtay et al., 2004



Review

reward incentives >
perception of
consequences

Gray Matter Maturation, Age 4-21
Gogtay et al., 2004



Brain Development: Reinforcing Need for Prevention and Treatment

- Youth is a particularly vulnerable period for developing a substance use disorder.**
- Prevention and treatment programs are vital.**

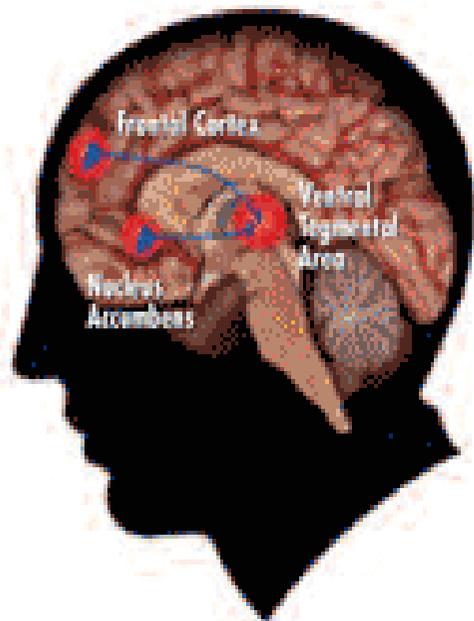
Brain Development: Opportunities for Prevention and Treatment

- Discuss with teenagers the science of the neurobiology of addiction



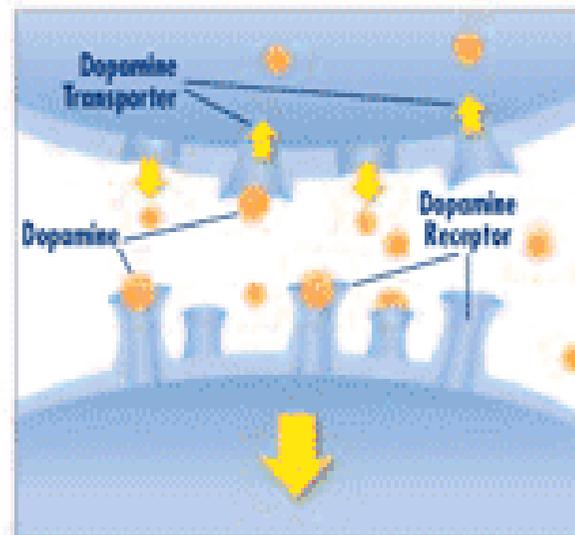
ALL DRUGS OF ABUSE TARGET THE BRAIN'S PLEASURE CENTER

Brain reward (dopamine) pathways

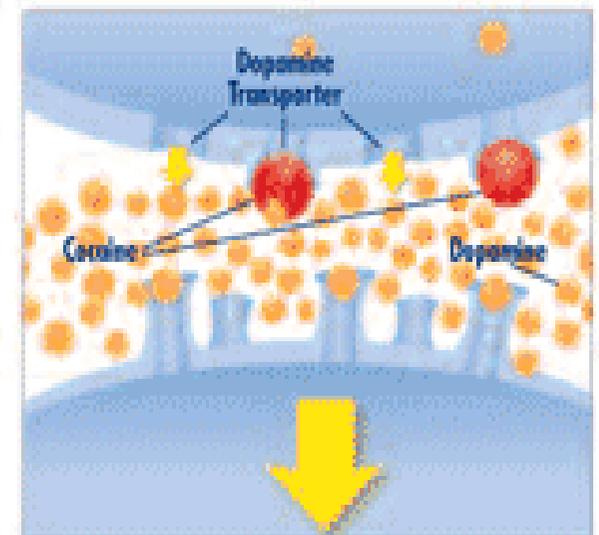


These brain circuits are important for natural rewards such as food, music, and art.

All drugs of abuse increase dopamine



FOOD



COCAINE

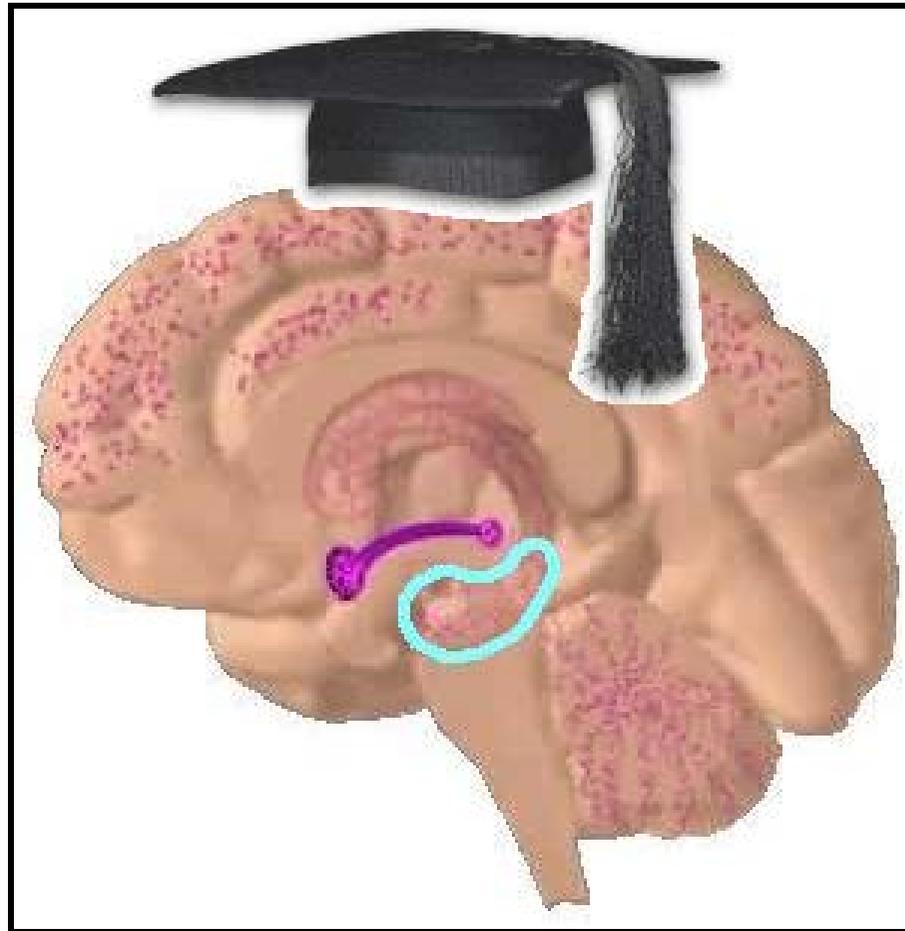
Typically, dopamine increases in response to natural rewards such as food. When cocaine is taken, dopamine increases are exaggerated, and communication is altered.

Brain Development: Opportunities for Prevention and Treatment

- Discuss the implications of using substances when the brain is still developing.



Human Data: Alcohol's Effects on Memory



Brain Development: Implications for Prevention and Treatment

- Teach important skills associated with self-control
 - impulse control
 - “second” thought processes
 - social decision making
 - dealing with risk situations
 - taking healthy risks

Teen-Friendly Treatment Strategies

- **Apply two major treatment approaches seem accommodating to the teen brain:**
 - **Cognitive – Behavioral Therapy (CBT)**
 - **Motivational Interviewing**



Characteristics of CBT

- **Focus on immediate, relevant and specific problems**
- **Solutions are realistic, concrete, specific**

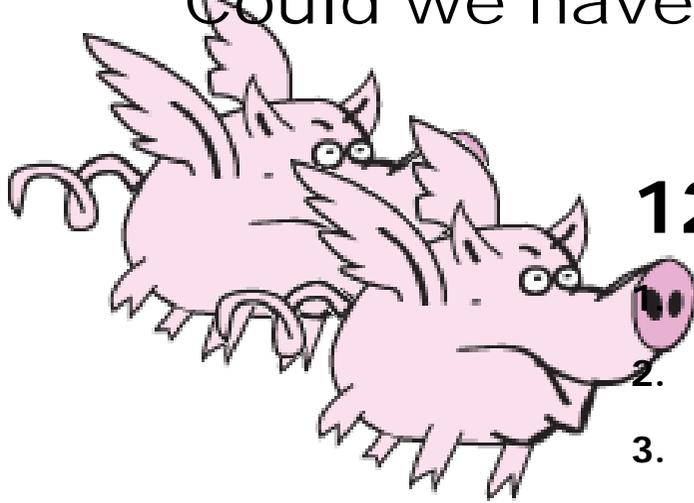


Characteristics of Motivational Interviewing

- **De-emphasize labels**
- **Emphasis on personal choice and responsibility**
- **Therapist focuses on eliciting the client's own concerns**
- **Resistance is met with reflection and non-argumentation**
- **Treatment goals are negotiated; client's involvement is seen as vital**



Could we have some day a new 12-Step Program
for adolescents?



12-Steps of Self-Regulation

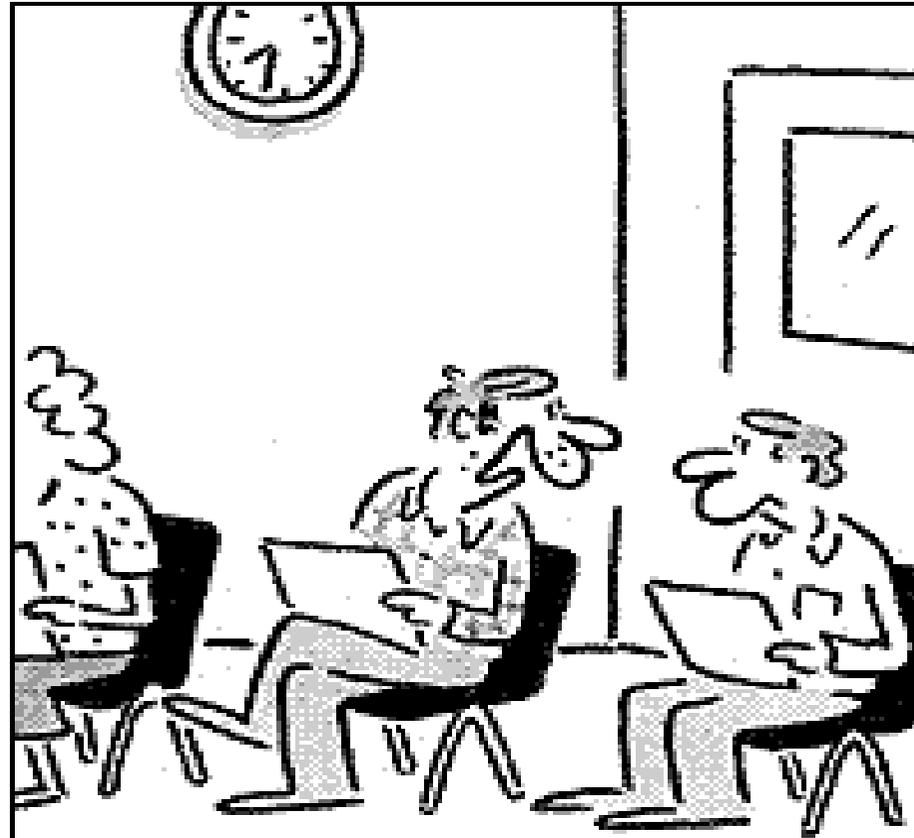
1. impulse control
2. "second thought" processes
3. social decision making
4. dealing with risk situations
5. taking healthy risks
6. attention regulation
7. anger control
8. modulating reward incentives
9. choosing options
10. considering consequences
11. minimizing arousal
12. dealing with peer influences

Classroom Resources

- There are now some age-appropriate resources to educate youth about their developing brain.
 - Resource from BSCS
Drug Abuse, Addiction and the Adolescent Brain
www.BSCS.org
 - Hazelden has published an 8-lesson multi media resource: *Drugs and the Developing Brain*
www.hazelden.org



Parent Resources



'I attend as many parenting classes as I can - anything to get away from my children'



Prevention Smart Parents

www.prevention-smart.org



Partnership[™]
for Drug-Free Kids

Where families find answers

**Prevent_Intervene_Get
Treatment_Recover**

www.drugfree.org

Parents Resource Center beta

Support, tools & tips from experts and parents like you

The Parents Resource Center provides advice and stories from parents and professionals about drug prevention, intervention and raising healthy teens.

Drug Guide ▾

The Partnership
for a Drug-Free
America™**UNDERSTANDING TEENS****A PARENT'S GUIDE TO THE
TEEN BRAIN**

Learn the mystery behind the developing teen brain, and what you can do to help your child avoid trouble.

[Visit A Parent's Guide to the Teen Brain](#)**PARENTING****The Parent Toolkit**

Powerful tools and practical advice for parents to keep their kids healthy and safe.

[Visit The Parent Toolkit](#)**PARENT BLOG****Decoder** FEATURED POSTSBreaking down teen culture, substance abuse, and parenting. [View Blog](#)**Glamorizing Teen Pregnancy?**

By Jessica Hoffman

"I'm baffled as to how Juno can now be criticized for "glamorizing" unplanned pregnancy and for spurring the Gloucester, MA pregnancy phenomenon."

**My Favorite Player**

By James Ponti

Texas Ranger and recovering addict Josh Hamilton is "making a brave attempt to right his life, conquer his demons and play his way back into the major leagues."

**What's New**

WATCH VIDEO

One of the most important roles a parent can play is air traffic controller. Just like an air traffic controller is the most trusted person the pilot relies on, the parent has to play a similar role and be their child's most trusted supporter and help guide them.

— Amelia Arria, Ph.D., senior research scientist, Treatment Research Institute

[Read more about guiding your child](#)**eNEWSLETTER**

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THANK YOU!

winte001@umn.edu