

The Teen Brain on Drugs, and What to do About It

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Presentation outline:

- I. The teen brain: Key neuroscience discoveries
- II. Teens, AOD involvement, and juvenile justice: Overview
- III. Effective AOD interventions
- IV. Neuroscience implications for best practices with AOD-involved teenagers

I. The Teen Brain: Key Neuroscience Discoveries

INSIDE THE ADOLESCENT BRAIN

The brain undergoes two major developmental spurts, one in the womb and the second from childhood through the teen years, when the organ matures by fits and starts in a sequence that moves from the back of the brain to the front.

Corpus Callosum

Thought as an interlink to join the two hemispheres of the brain, the corpus callosum connects the two sides of the brain. It's made of thick bundles of nerve fibers, and its growth and maturation depend on myelin and occur all neatly.

Prefrontal Cortex

The CEO of the brain, also called the area of higher-level thought, is the last part of the brain to mature—often not until age 25. It's the seat of executive functions, such as planning, decision-making, and impulse control. It's also the seat of social and emotional development.

Basal Ganglia

Large, ball-shaped brain structures, the basal ganglia are involved in movement, learning, and habit formation. They have a role in the brain's reward system, which is involved in the brain's ability to learn from experience. The basal ganglia are also involved in the brain's ability to learn from experience.

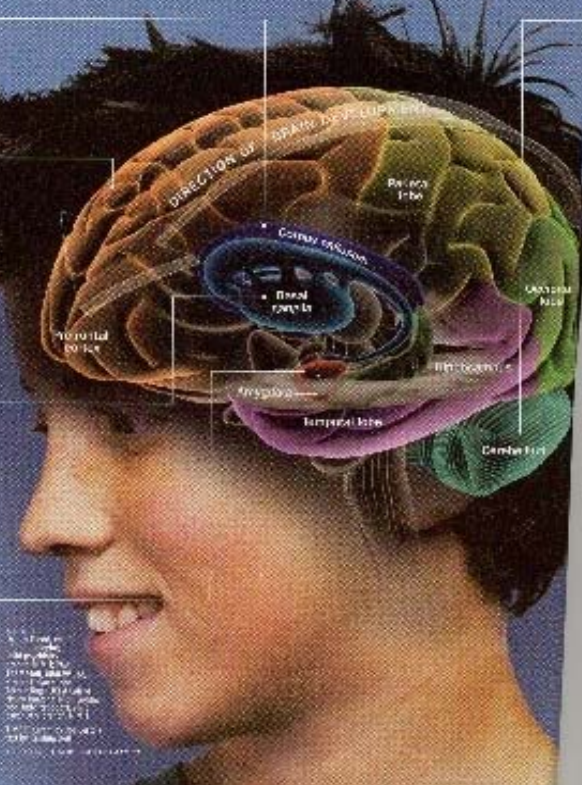
Amygdala

Known as the emotional center of the brain, the amygdala is involved in processing information about emotions. It's also involved in the brain's ability to learn from experience.

Nerve Proliferation ...



By age 25, the brain has 17% more nerve cells in the front of the brain than it did at birth. The rest of the brain has lost the same amount of cells that it gained.



Source: *Brain Development in Adolescence*, by Dr. Jay Giedd, Harvard Medical School.

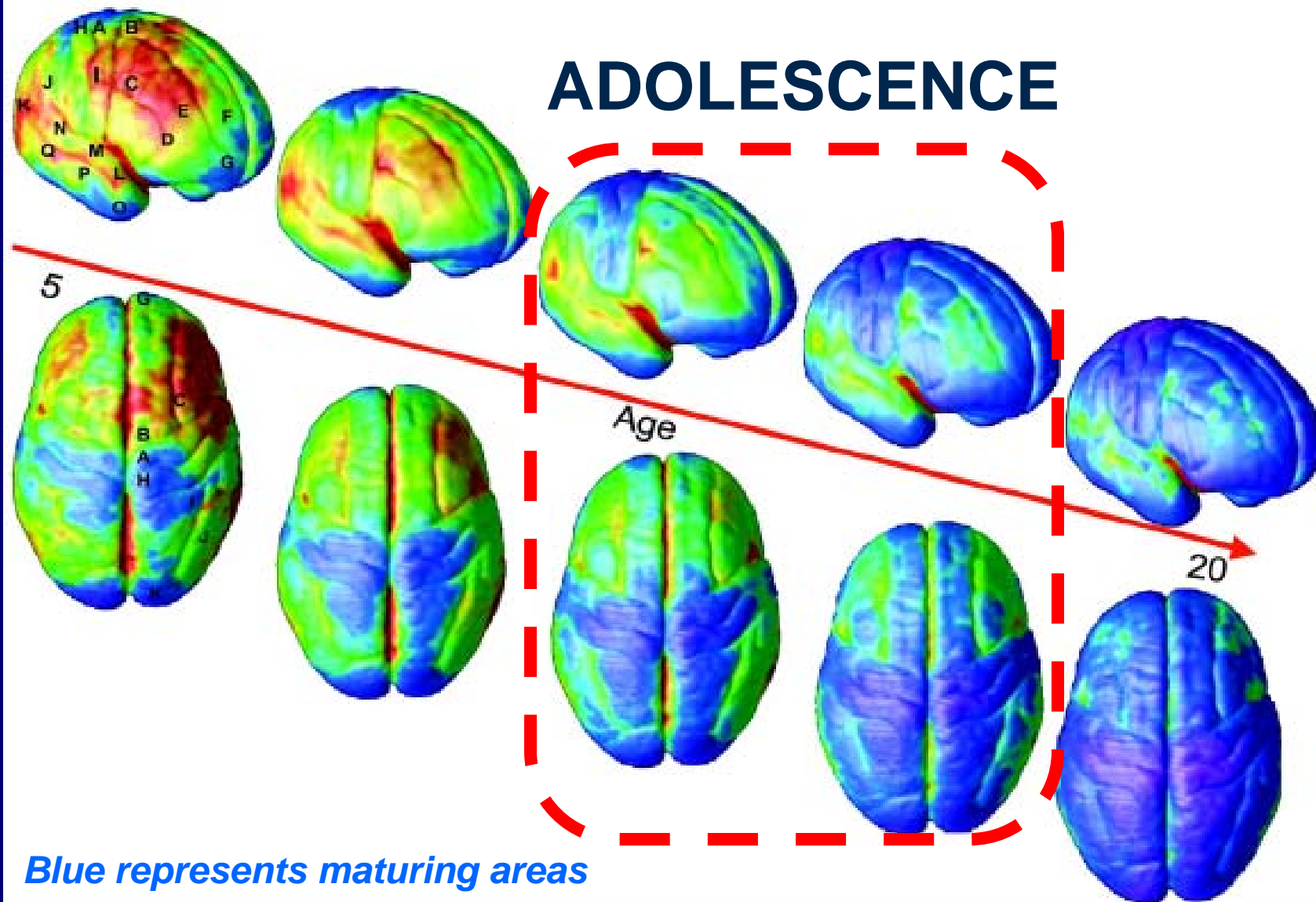
Imaging technology provides windows into the developing brain



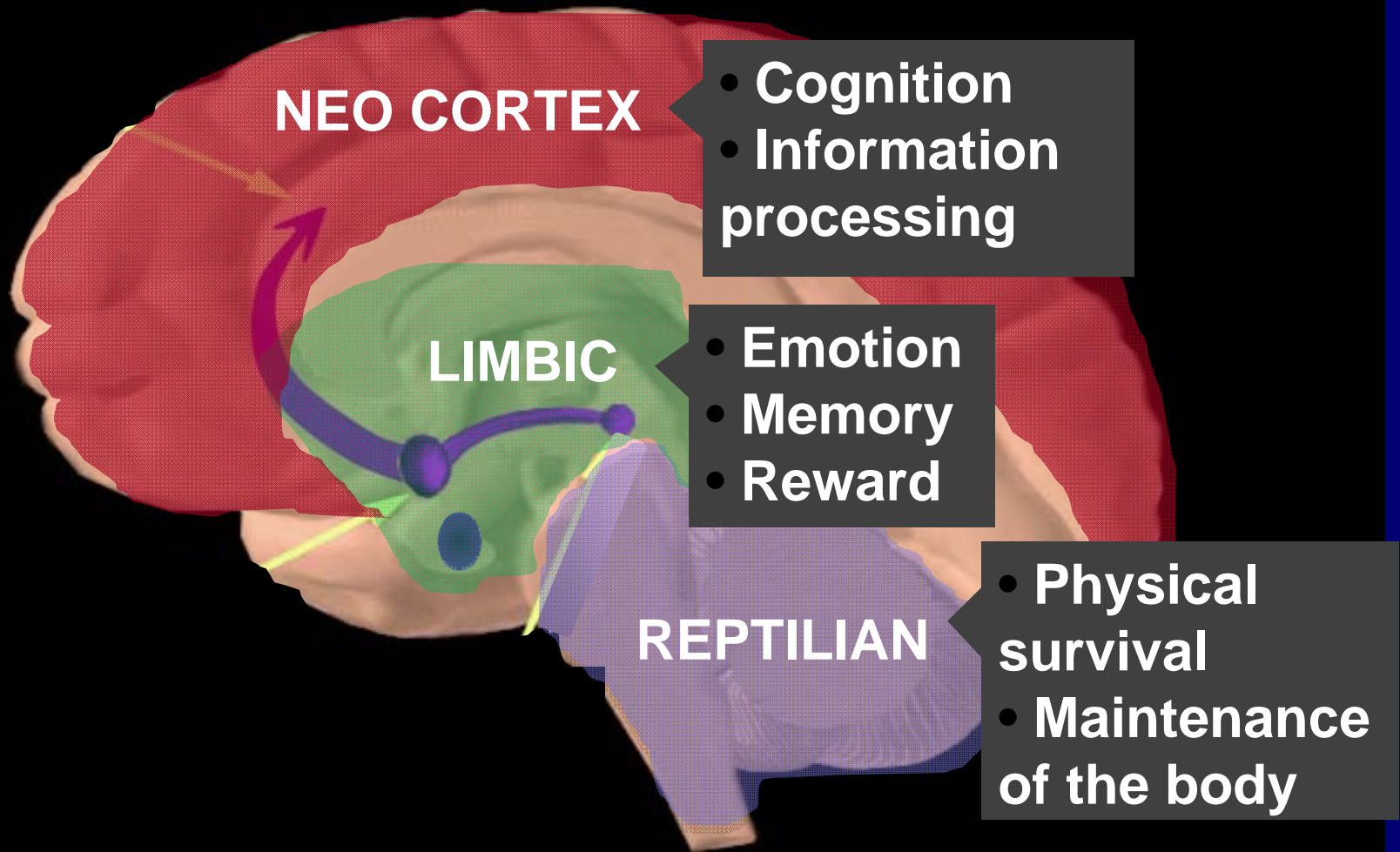
Key findings:

- Profound and unique brain maturation with the onset of adolescence
- Remodeling of basic structure

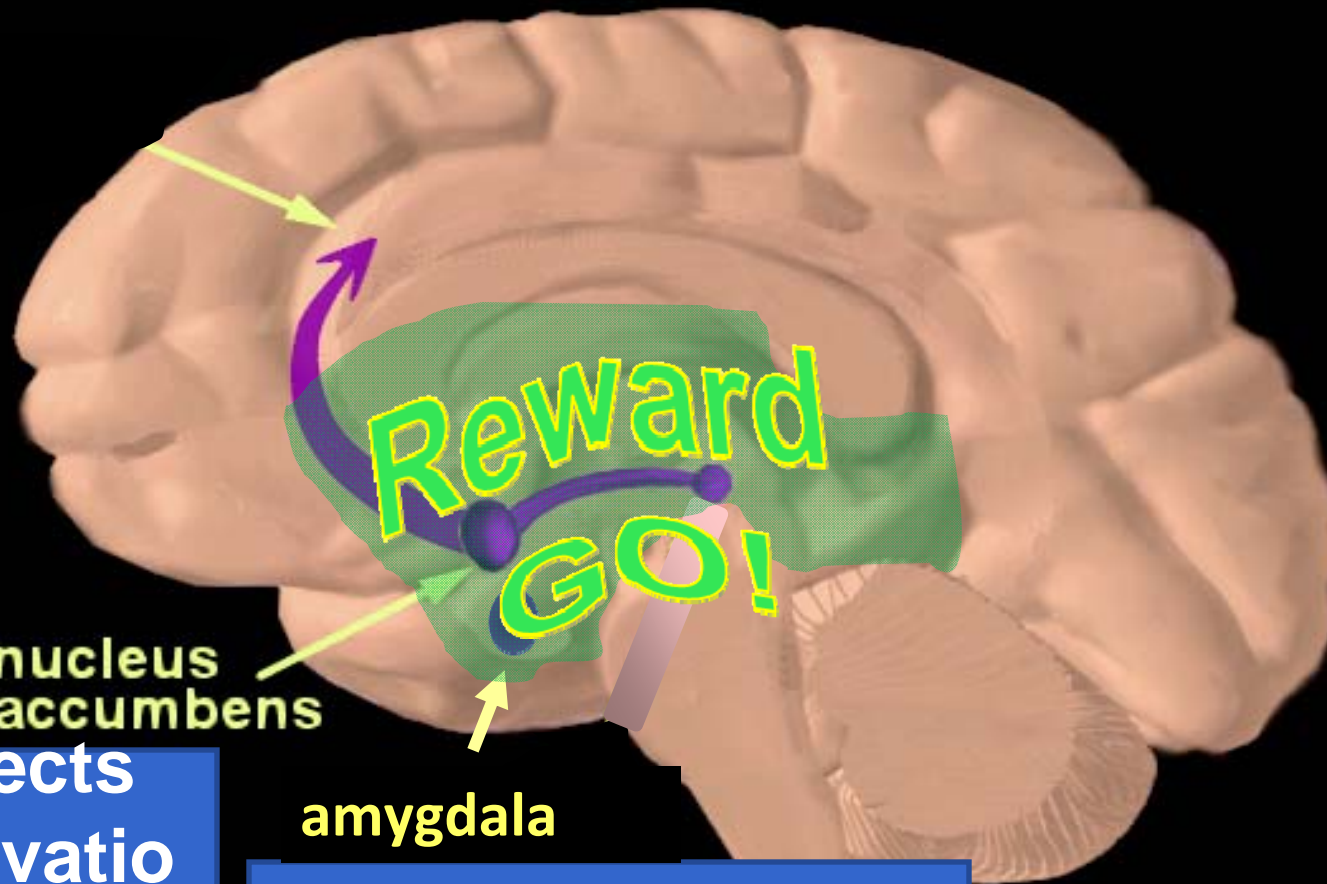
Human Brain Development



3-Brains-in-One



Limbic System: Key Structures



Directs
motivation

amygdala

Regulates emotion

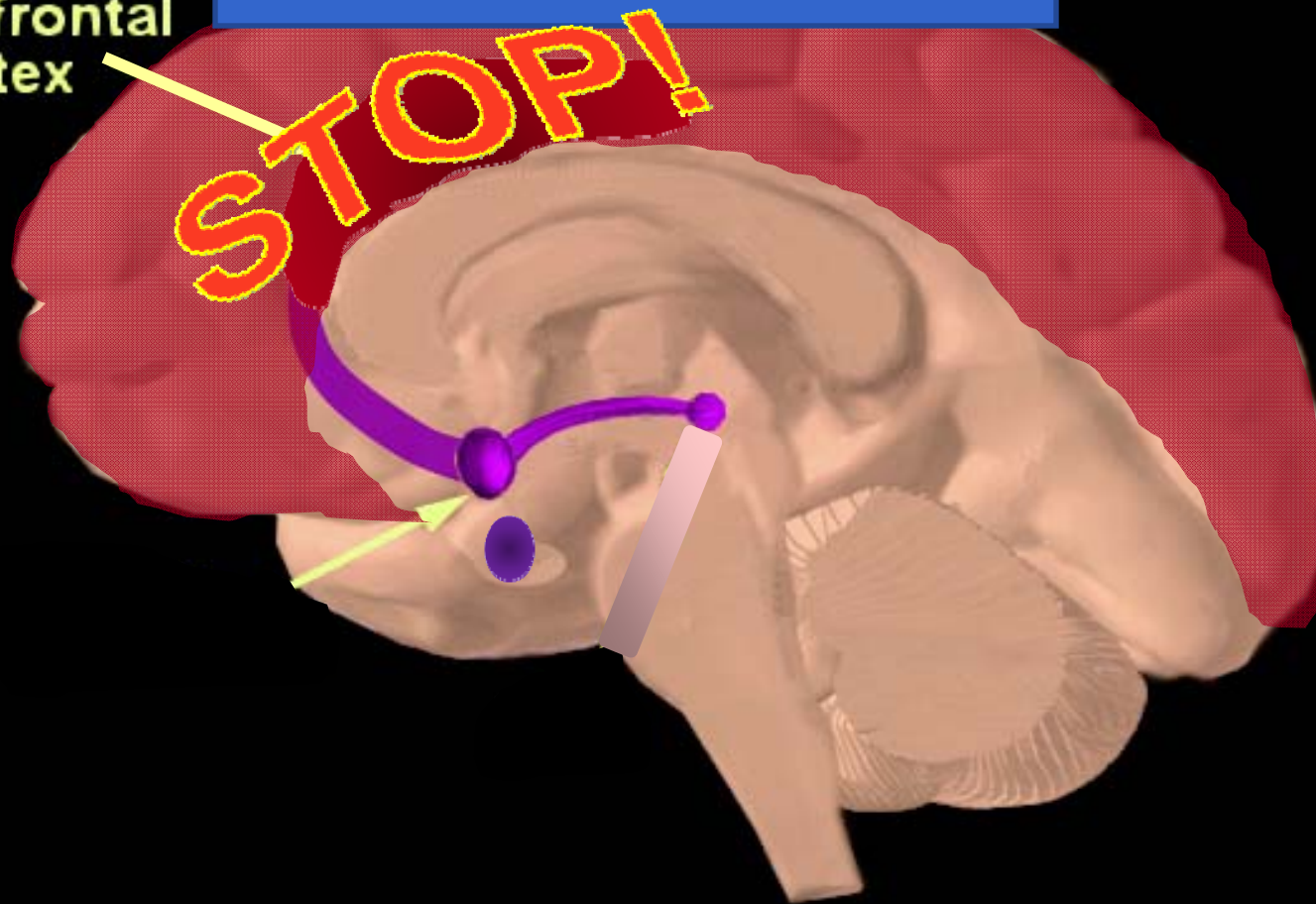
Limbic system during adolescence:

- Very active
- Relationships and reward (**GO!**) highly salient
- Still developing:
 - Motivation
 - Emotional regulation

Neocortex: Key Structure

CEO: judgment, decision making, planning ahead

prefrontal cortex



Neocortex during adolescence:

- Critical thinking and abstract reasoning skills come online
- However, underdeveloped brakes (**STOP!**)
- Prefrontal cortex is the last area to fully develop

Key findings:

- Profound and unique brain maturation with the onset of adolescence
- Remodeling of basic structure
- The brain does not reach full maturity until about age 25!

Why do most 16-year-olds drive like they're *missing a part of their brain?*



BECAUSE THEY ARE.



**EVER ASKED, "WHY ARE TEENAGERS SO OBSCURE ON
THINGS THAT ARE 'TITANIC'?"**

But when that happens, it's not really their fault. It's because their brains haven't finished developing. The underdeveloped area is called the dorsal lateral prefrontal cortex. It plays a crucial role in decision making, problem solving and understanding future consequences of today's actions. Problem is, it won't be fully mature until they're into their 20s.

It's one reason 16-year-old drivers have crash rates three times higher than 16-year-olds and five times higher

than 20-year-olds. These teens commit the most dangerous kinds of driving acts, such as nighttime driving and driving with two passengers. Since North Carolina implemented one of the most comprehensive GDL laws in the country, it has seen a 50% decline in crashes involving 16-year-olds.

To find out what the GDL laws are in your state, visit Allstate.com/teen. Help enforce them — and if they aren't strong enough, ask your legislators to strengthen them.

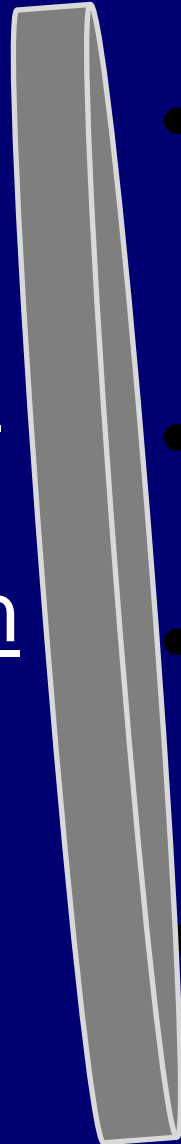
Let's help our teenagers not miss out on insurance but

**Auto insurance ad in
Wall Street Journal
February 2009**

Brains & Behavior:

Two sides of the same coin

- Active limbic brain
- Limits to emotional regulation
- Limits to motivation
- Still-developing prefrontal cortex



- Social connections, strong value on friends
- Moodiness, quick to anger, **hot** emotions
- Propensity for low effort, high excitement activities
- Increased risk taking, decreased planning ahead

***AOD use amplifies the
vulnerabilities.***

II. Young People, AOD Involvement, and Juvenile Justice: Overview

Young people, AOD involvement, and juvenile justice:

- High rates of AOD abuse/dependence

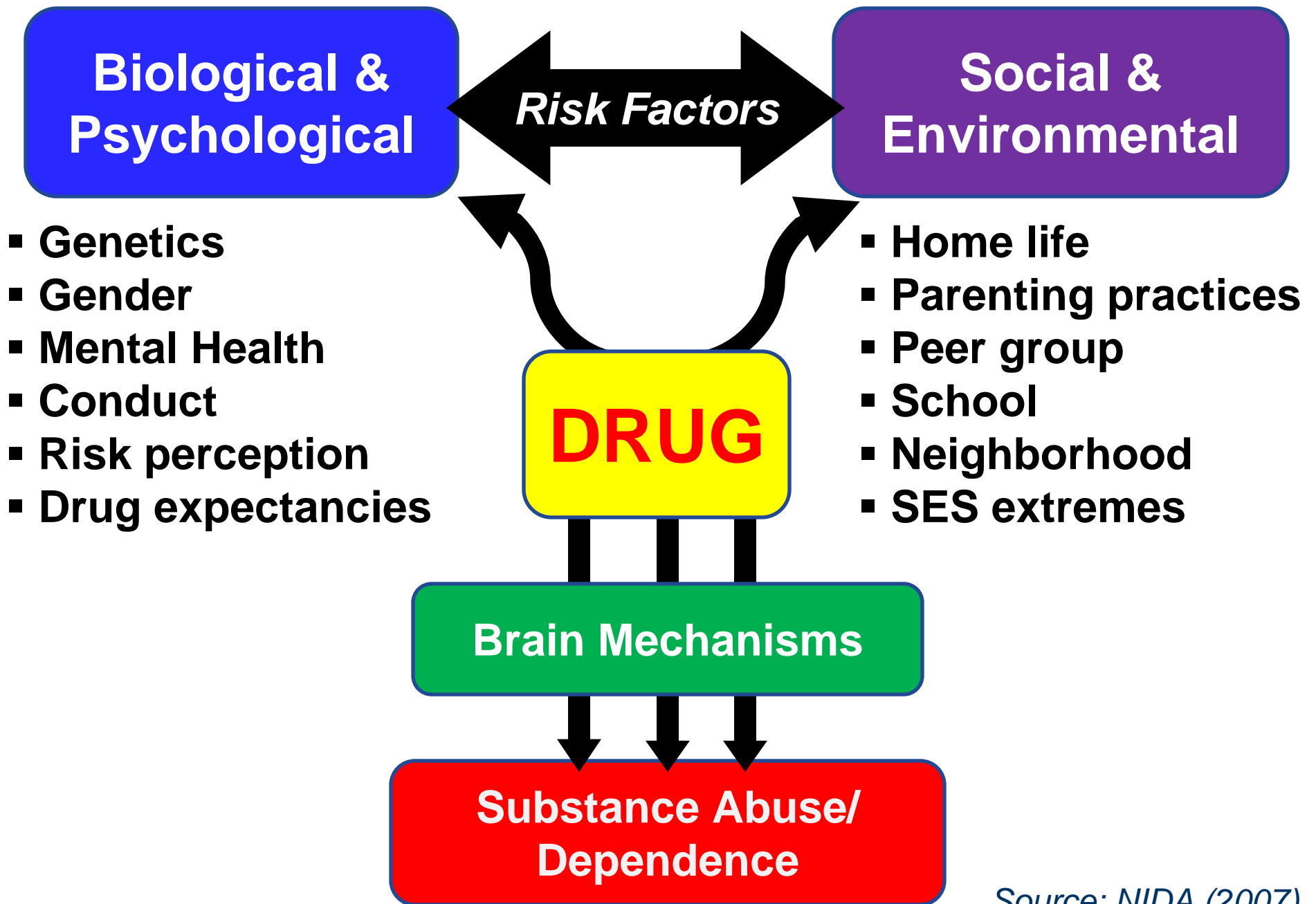
AOD Continuum of Use Severity

Source: Felgus et al. (2009)

Experimental use	Misuse	Abuse	Dependence
<ul style="list-style-type: none">• Use initiation (typically alcohol)• Sporadic or infrequent use	<ul style="list-style-type: none">• Use pattern and tolerance <u>developing</u>• <u>Emerging</u> consequences	<ul style="list-style-type: none">• Use pattern and tolerance <u>established</u>• <u>Recurrent</u> consequences• Activities and peer choices narrow	<ul style="list-style-type: none">• Use is central• Continued use despite severe consequences• Possible withdrawal• Co-occurring problems

Young people, AOD involvement, and juvenile justice:

- High rates of AOD abuse/dependence
- Multiple risk factors exist



Source: NIDA (2007)

Young people, AOD involvement, and juvenile justice:

- High rates of AOD abuse/dependence
- Multiple risk factors exist
- Alcohol and marijuana are most prevalent

Alcohol and teens:

- Binge drinking is the norm
- Greater risk taking
- Decreased health status
- Vulnerability for co-occurring problems
- Risk for cognitive deficits

Source: Clark (2004); Deas et al. (2000); Tapert et al. (2004/2005)

Binge drinking and the teen brain

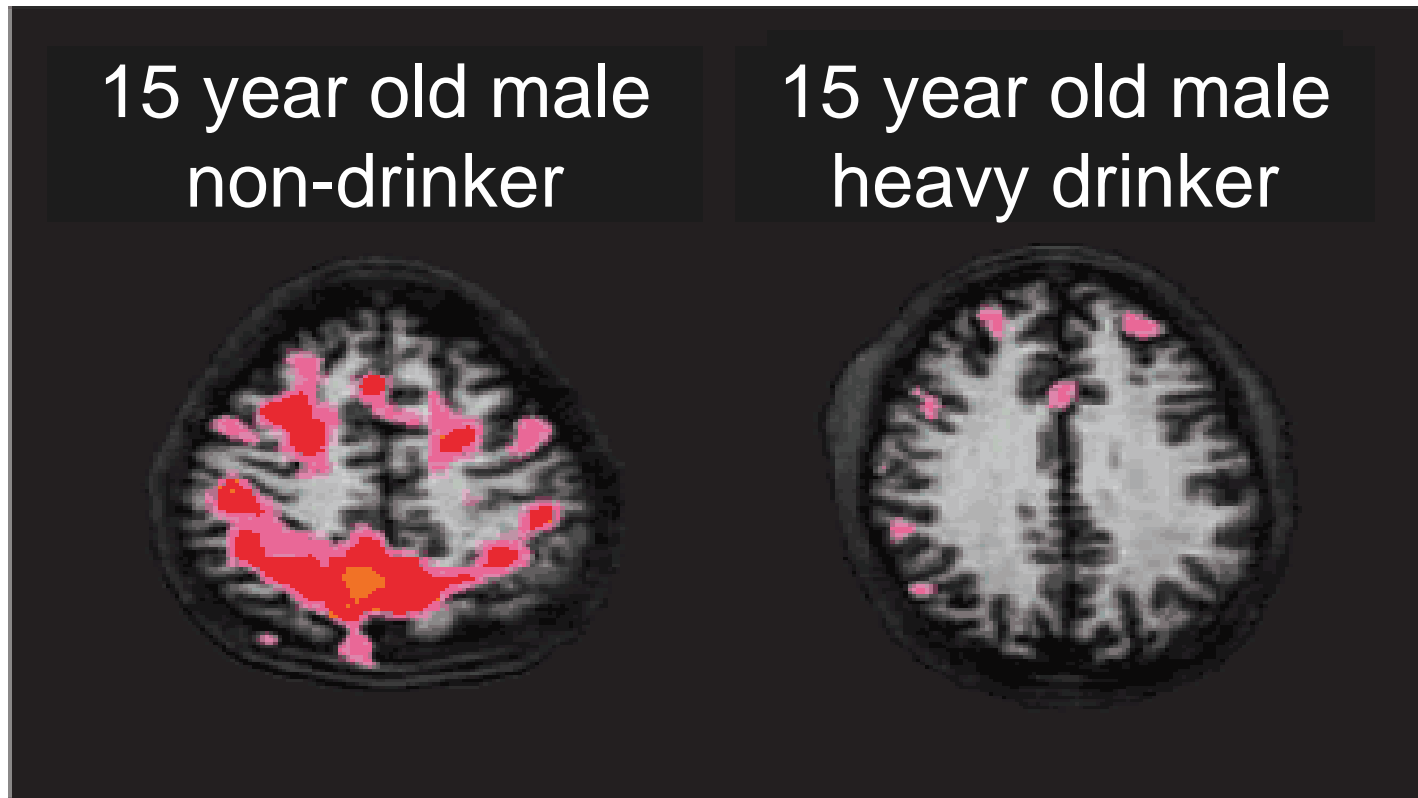
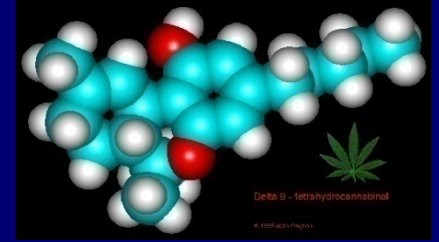


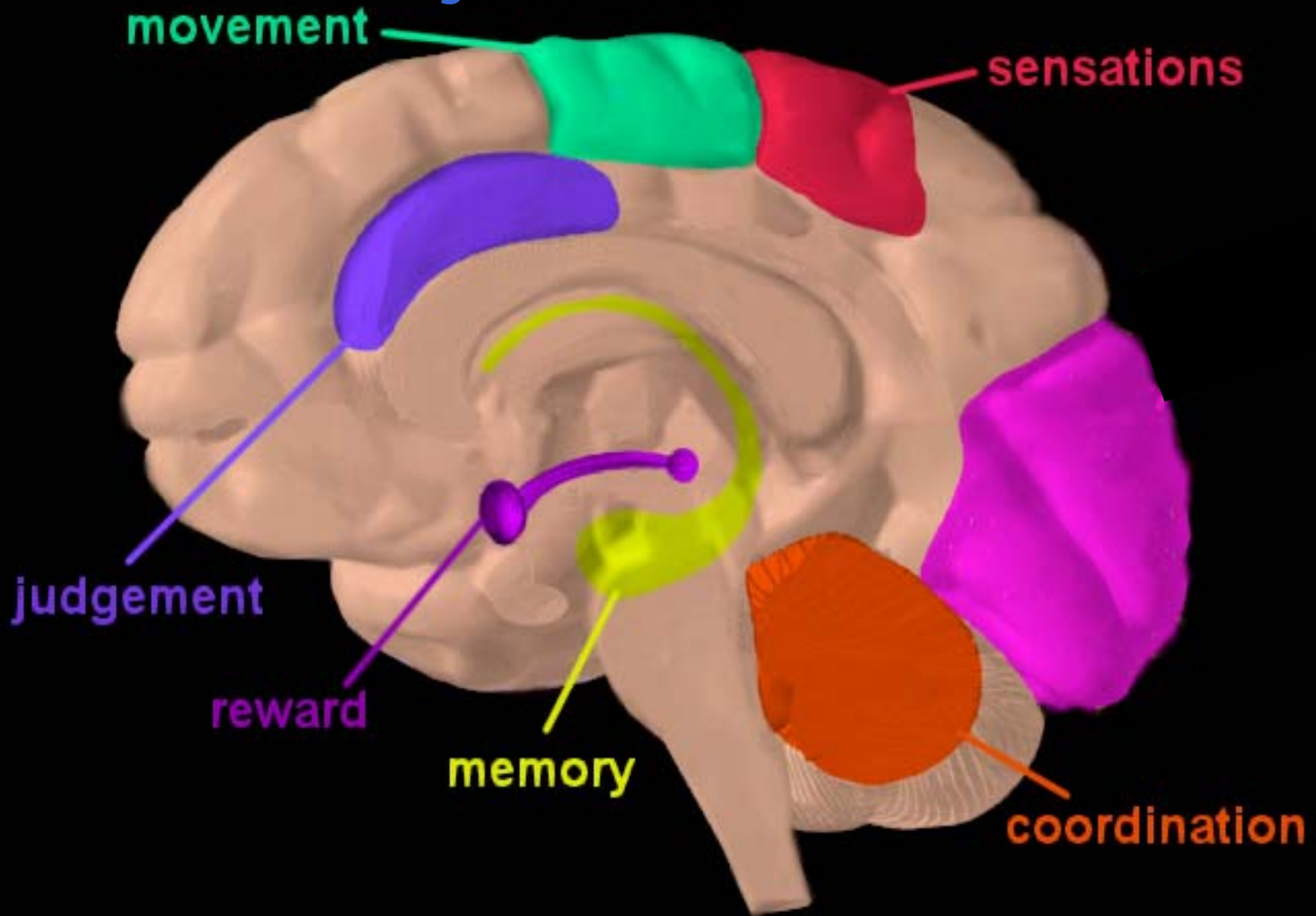
Image from Susan Tapert, PhD, University of California, San Diego.

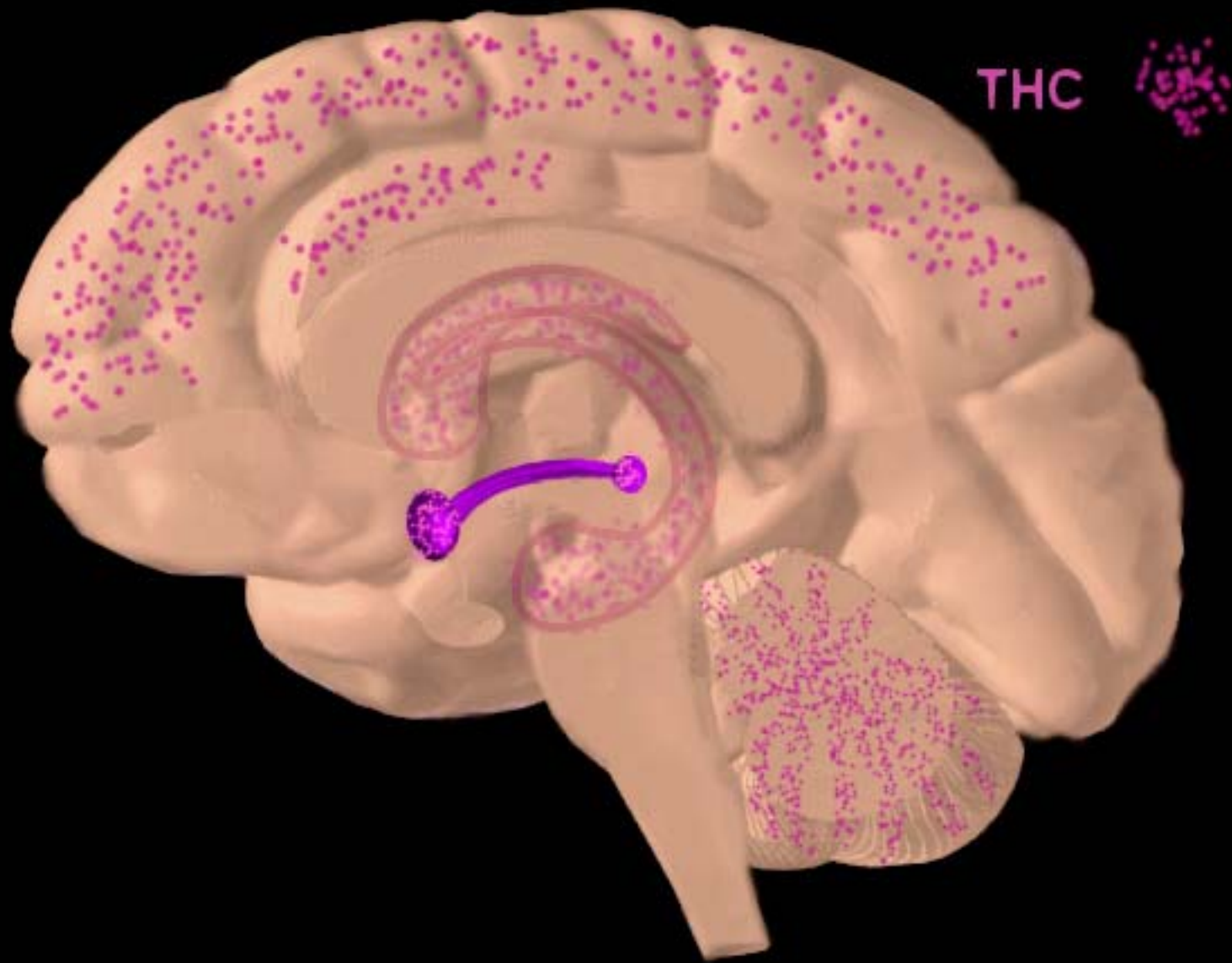
Marijuana and teens:



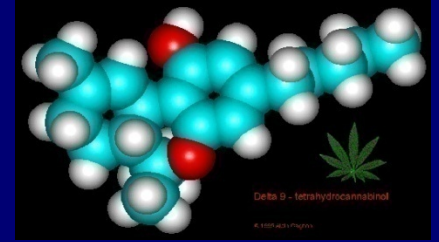
- Substantial increase in THC potency since the 1980s (Univ. of Miss. Marijuana Potency Monitoring Project)

Marijuana affects...





Marijuana and teens:

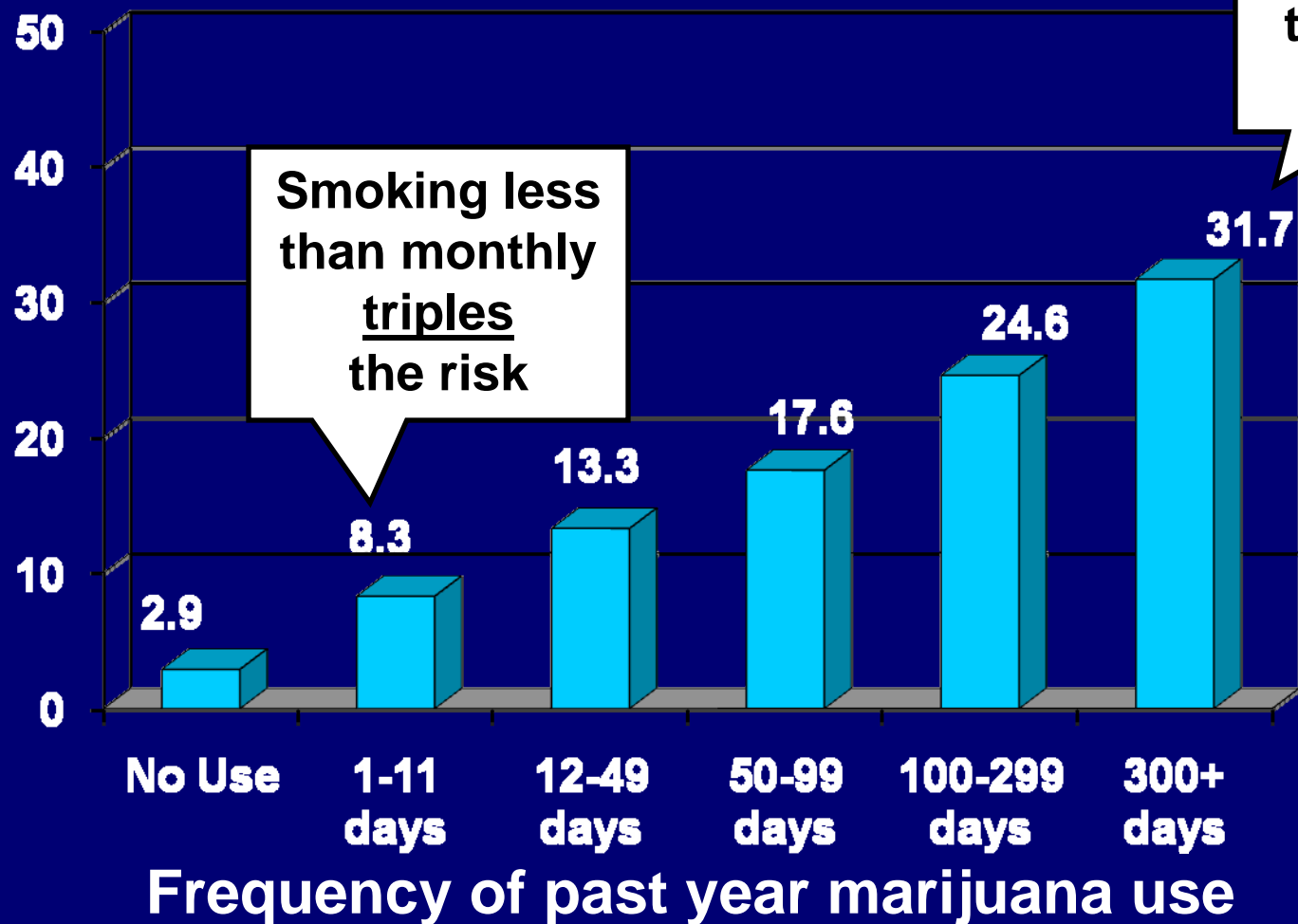


- Substantial increase in THC potency since the 1980s (Univ. of Miss. Marijuana Potency Monitoring Project)
- Rates of cannabis use disorders rising
- Effects associated with:
 - decreased immune system function
 - decreased motivation
 - poor academic achievement
 - delinquency and conduct problems

Source: Dennis et al. (2002); Fergusson & Boden (2008)

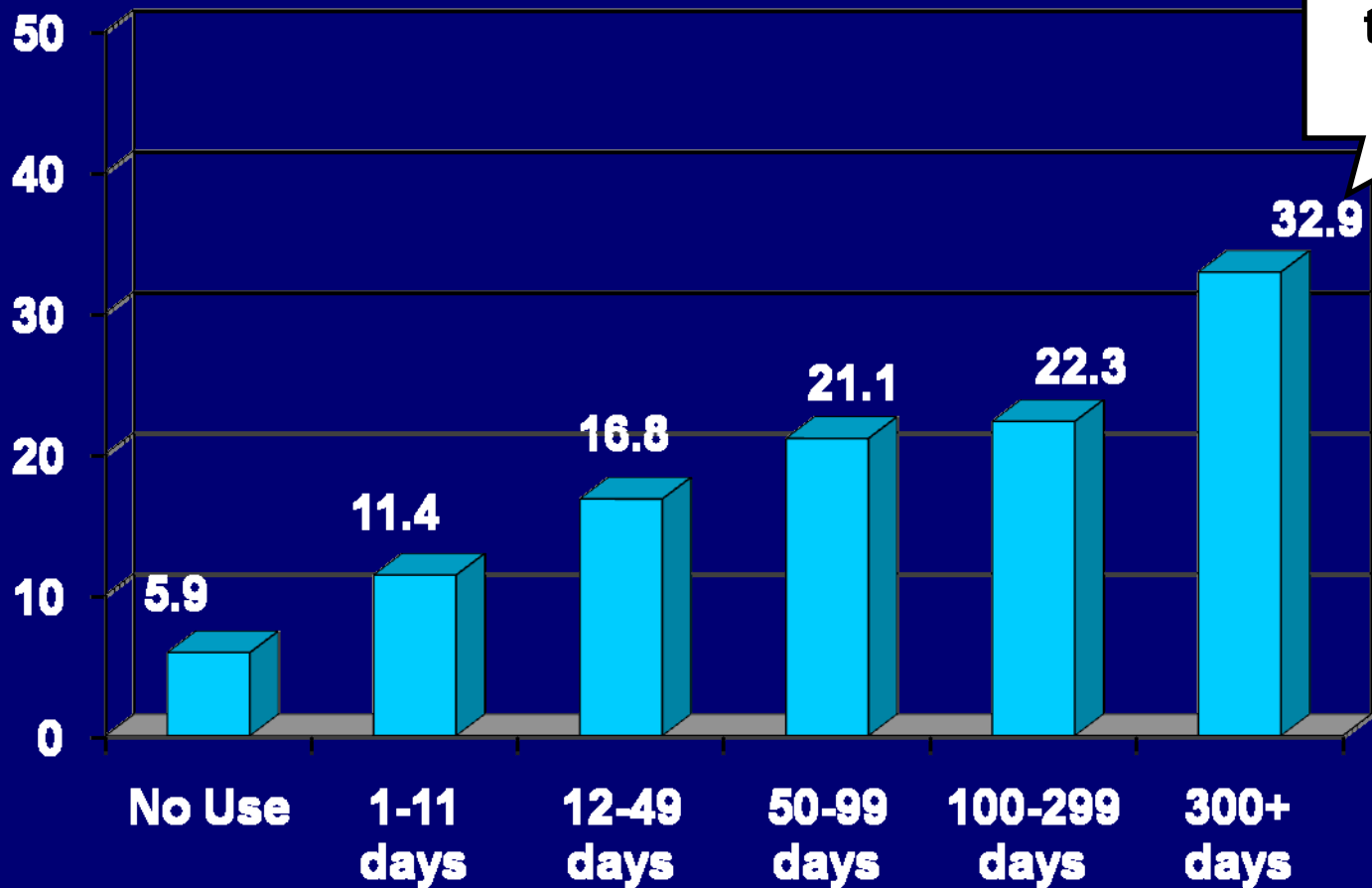
Percentages of those aged 12-17 who stole or tried to steal anything worth \$50 or more

Source: SAMSHA (2003)



Percentages of those 12-17 who attacked someone with intent to seriously hurt

Source: SAMSHA (2003)



Over 5 times the risk

Frequency of past year marijuana use

Cannabis abuse/dependence and teens:

- Hijacks the developing brain
- Tolerance to effects
- Positive expectancies for effects
- Low problem recognition
- Narrowing activities and social relations
- Withdrawal is common when attempting to quit

Cannabis withdrawal prevalence (%) reported by adolescents in outpatient treatment

Source: Vandrey et al. (2005)

Withdrawal Symptom	Moderate – Severe Ratings
Craving	74%
Irritability	50%
Depressed mood	44%
Sleep difficulty	44%
Restlessness	36%
Increased anger	31%
Decreased appetite	27%
Physical symptoms	1% - 18%

The very brain systems developing during adolescence are implicated in addiction.

INHIBITORY CONTROL

PFC

ACG

OFC

SCC

**MOTIVATION/
DRIVE**

NAcc

Amyg

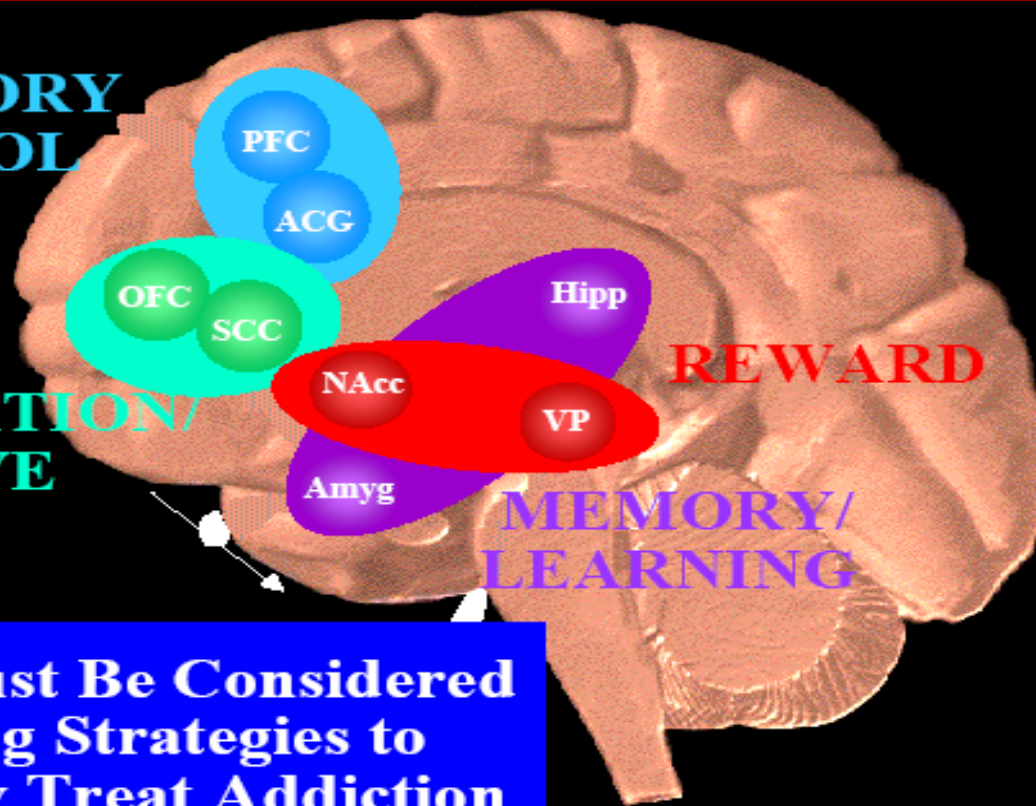
Hipp

VP

REWARD

**MEMORY/
LEARNING**

**All of These Must Be Considered
In Developing Strategies to
Most Effectively Treat Addiction**



Young people, AOD involvement, and juvenile justice:

- High rates of AOD abuse/dependence
- Multiple risk factors exist
- Alcohol and marijuana are most prevalent
- AOD use is a strong predictor of offending
- Entering the system is an opportunity for AOD intervention (*Source: Dennis, 2006; over 40% of adolescent AOD treatment referrals in WI are from juvenile justice*)

Evidence-based AOD interventions

Source: Deas (2008); Tripodi et al. (2010)

- Motivational Interviewing (MI),
Motivation Enhancement Therapy (MET),
Brief Intervention (BI)
 - 1-4 sessions
 - Non-judgmental and empathetic
counseling style
 - Enhance motivation for change
(readiness, ability)

Evidence-based AOD interventions

Source: Deas (2008); Tripodi et al. (2010)

- Motivational Interviewing (MI),
Motivation Enhancement Therapy (MET),
Brief Intervention (BI)
- Cognitive-Behavioral Therapy (CBT),
Behavioral Therapy (BT)
 - Functional behavioral analysis
 - Identify triggers for AOD use
 - Skill building through self-monitoring
and practice

Evidence-based AOD interventions

Source: Deas (2008); Tripodi et al. (2010)

- Motivational Interviewing (MI),
Motivation Enhancement Therapy (MET),
Brief Intervention (BI)
- Cognitive-Behavioral Therapy (CBT),
Behavioral Therapy (BT)
- **Contingency Management**
 - **Monitoring of AOD (e.g., drug testing)**
 - **Immediate response with positive reinforcement or consequence**

Evidence-based AOD interventions

Source: Deas (2008); Tripodi et al. (2010)

- Motivational Interviewing (MI),
Motivation Enhancement Therapy (MET),
Brief Intervention (BI)
- Cognitive-Behavioral Therapy (CBT),
Behavioral Therapy (BT)
- Contingency Management
- **Family-based therapies**
 - **Target family-based risk factors**
 - **Change interactional patterns**
 - **Increase support and accountability**

Ineffective AOD interventions with youth:

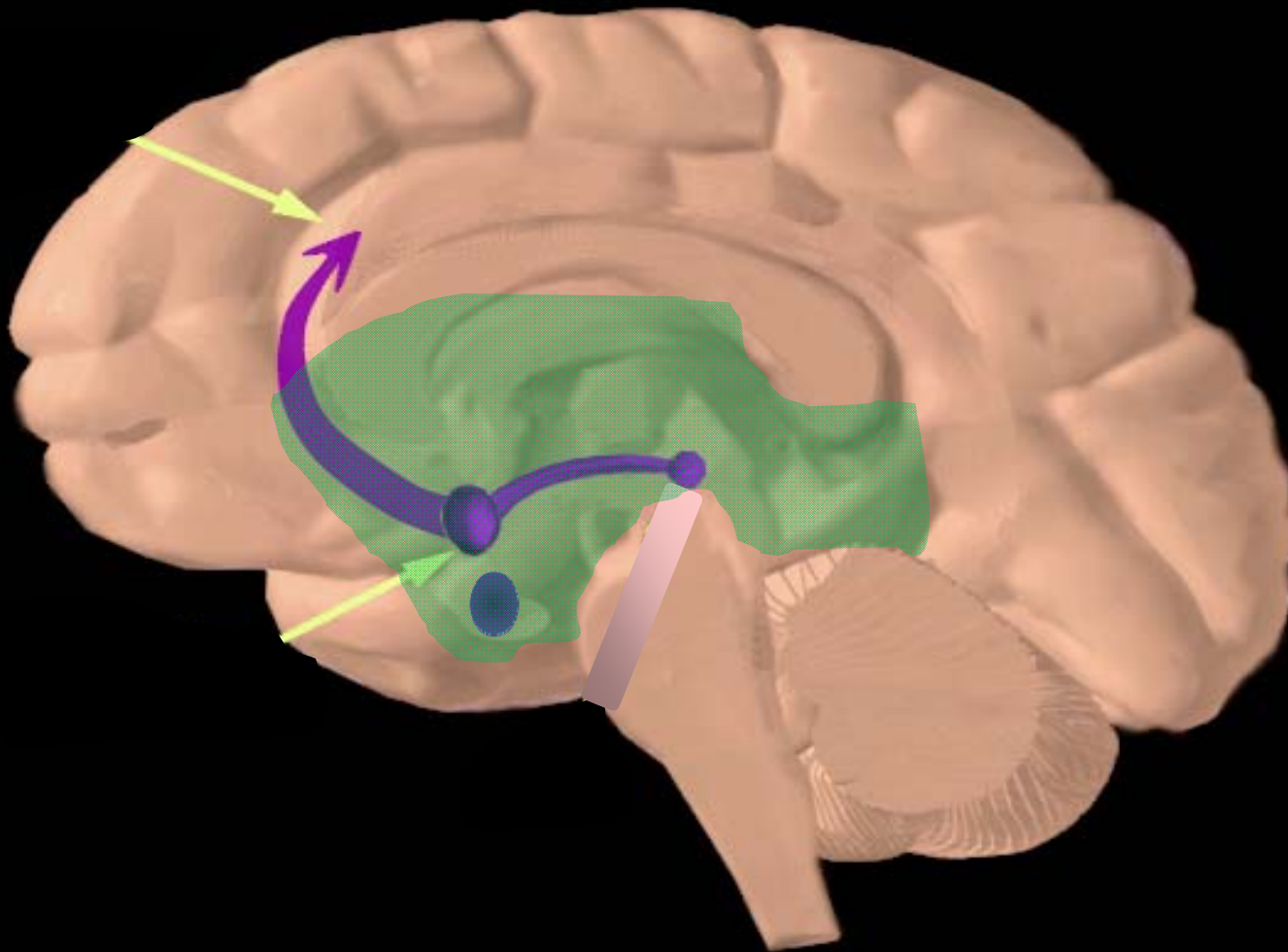
- Confrontation
- Scare tactics (“scared straight”)
- Education, films, lectures
(D.A.R.E.)

Summary: What we know

1. The teen brain is a work in progress
2. The science of addiction highlights teen vulnerability to drugs of abuse
3. Evidence-based AOD interventions exist for teens, but are rarely implemented

IV. 8 Neuroscience Implications for Best Practices with AOD-Involved Adolescents

Best practices related to the limbic teen brain...



1. Relationships matter.

Use a non-judgmental and empathetic communication style

(EBP: Client-centered Rogerian therapy, Motivational Interviewing)

2. Target teen motivation for behavior change.

Readiness

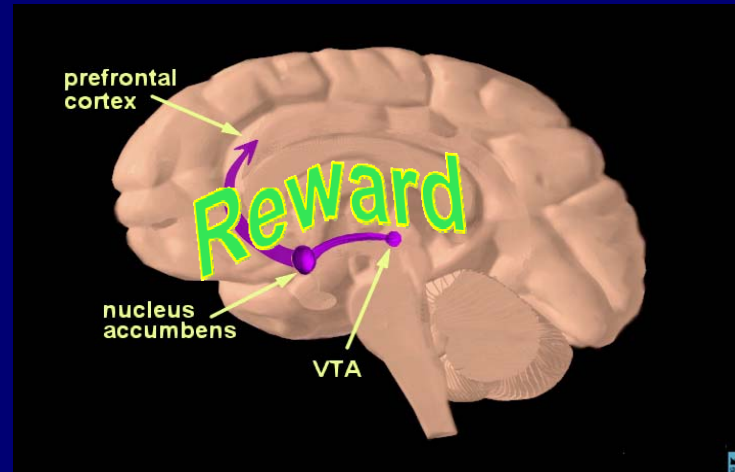
Willingness

Ability

(EBP: Motivational Interviewing, MET, BI)

3. Create and encourage alternative reward opportunities.

*We're in competition for teens' reward circuitry
(and it's not a level playing field)*



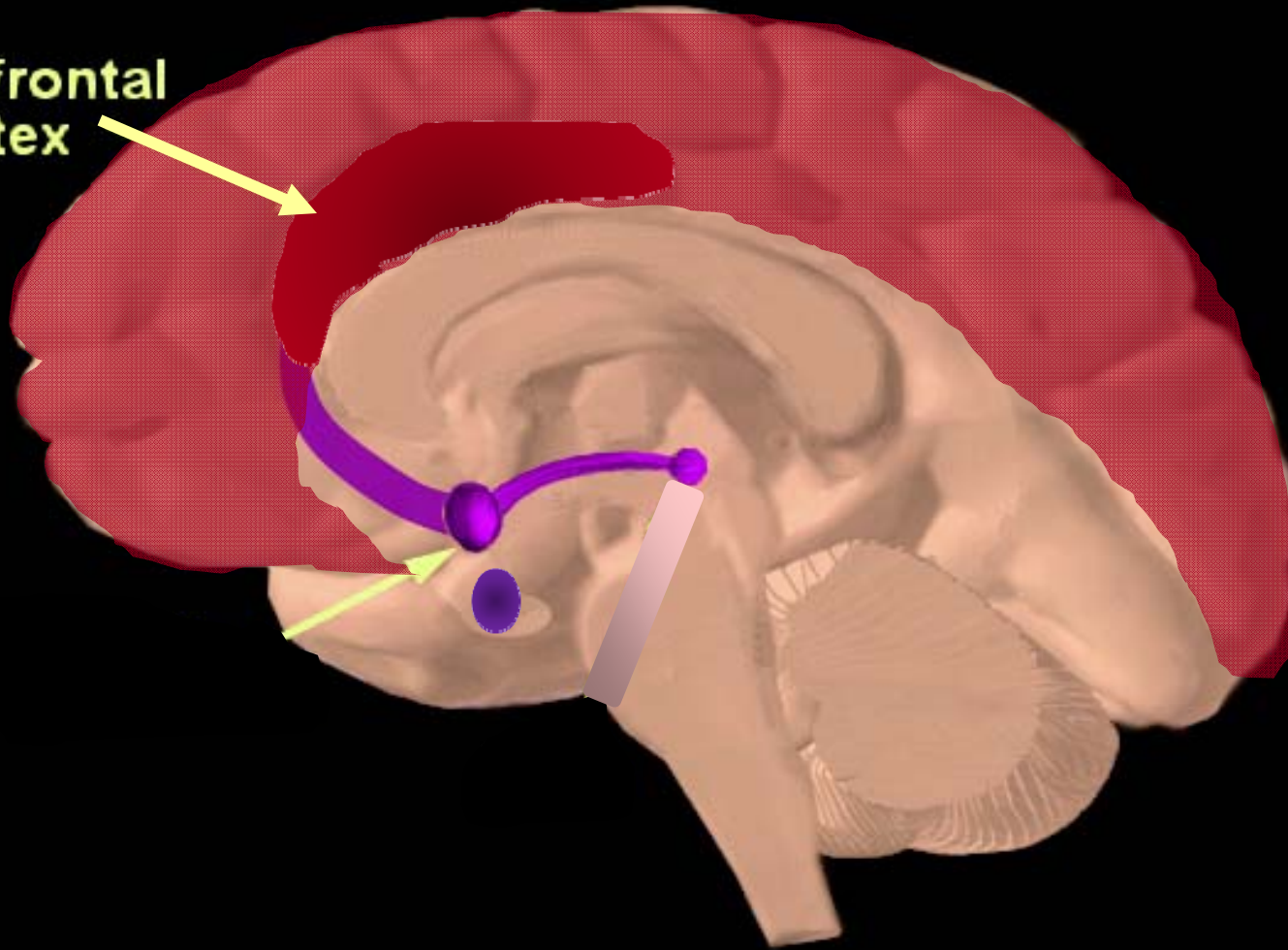
4. Increase teen emotional self-regulation.

Effective coping with stressors is a powerful protective factor

(EBP: CBT, Family-based interventions)

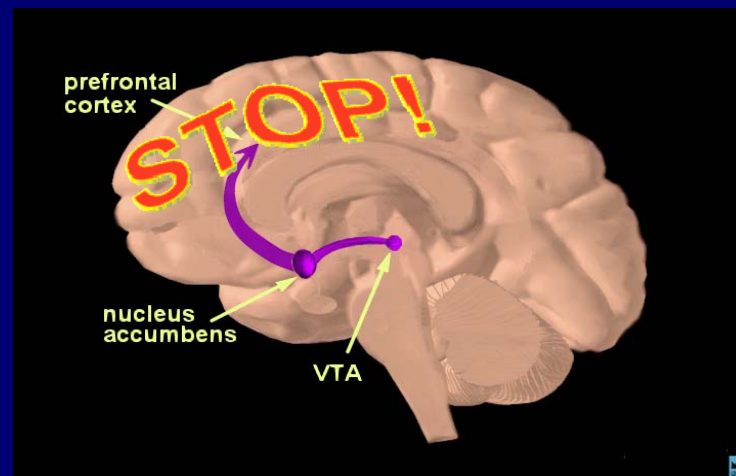
Best practices related to teens' limitations with judgment...

prefrontal cortex



5. Shore up the brakes.

- *functional behavior analysis*
 - *increase self-monitoring*
- *build AOD resistance skills*



(EBP: CBT, BT, Contingency Management)

6. Clear no AOD use rule.

- Clear expectations for behavior
- Enforceable
- Amenable to monitoring in juvenile justice (e.g., drug testing)
- Link to contingencies

7. Accountability for AOD use.

The teen brain learns through experience.

The best consequences are immediate, firm but fair, consistent, and meaningful.

8. Involve and coach the caregivers.

*On what?
All the above!*

(EBP: BI, Family-based interventions)

Conclusions

1. Neuroscience findings underscore the “what” and “why” of effective teen AOD interventions
2. Some best practices are easier to implement than others.
3. However, even small adjustments to practice-as-usual can make a difference
4. Non-specialists play a critical role for addressing teen AOD use in the juvenile justice system

Key References

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Thank you.

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