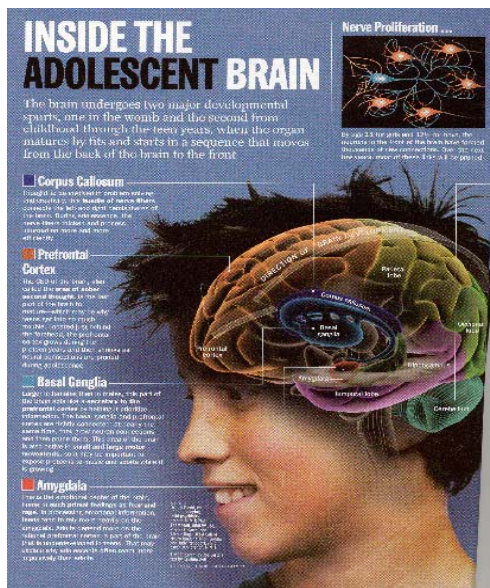


# Youth Drug Abuse and Addiction

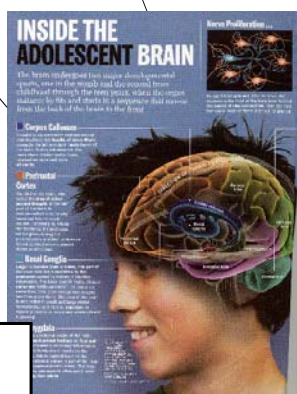
Ken Winters, Ph.D.  
Dept. of Psychiatry,  
U. of Minnesota  
winte001@umn.edu

Summit on Prescription  
Drug Abuse in Georgia  
March 2, 2011



## 1. Epidemiology of Rx Abuse by Youth

## 4. Summary

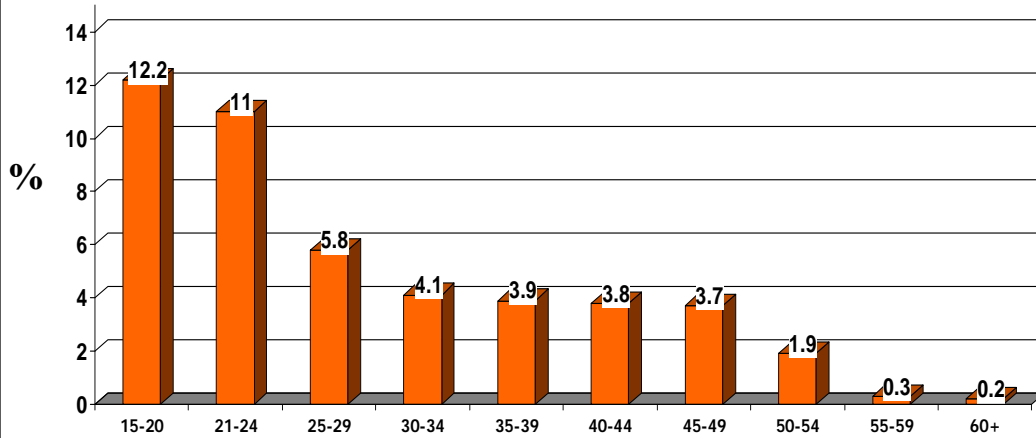


## 2. Adolescent brain development

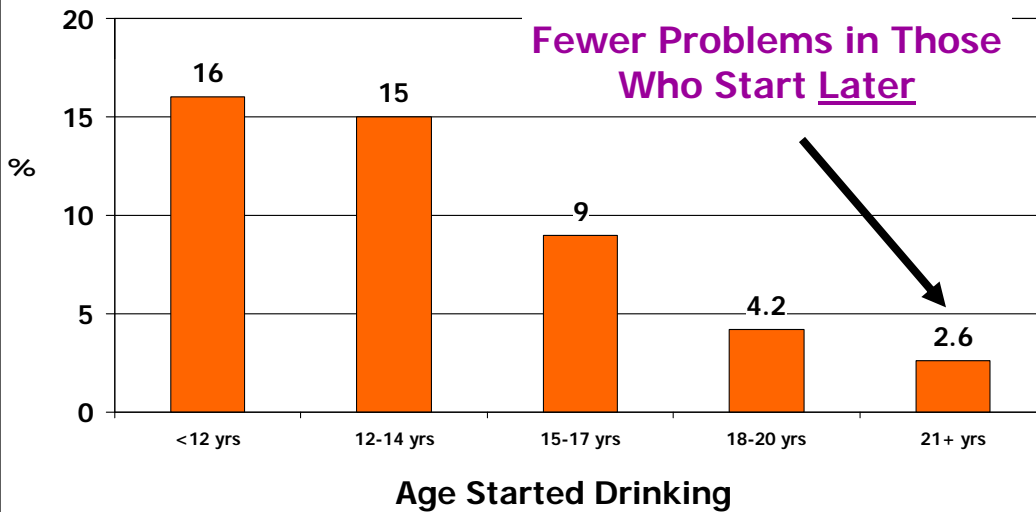
## 3. Implications for community response

## Prevalence of Past-Year DSM-IV Alcohol Dependence: United States, 2001-2002

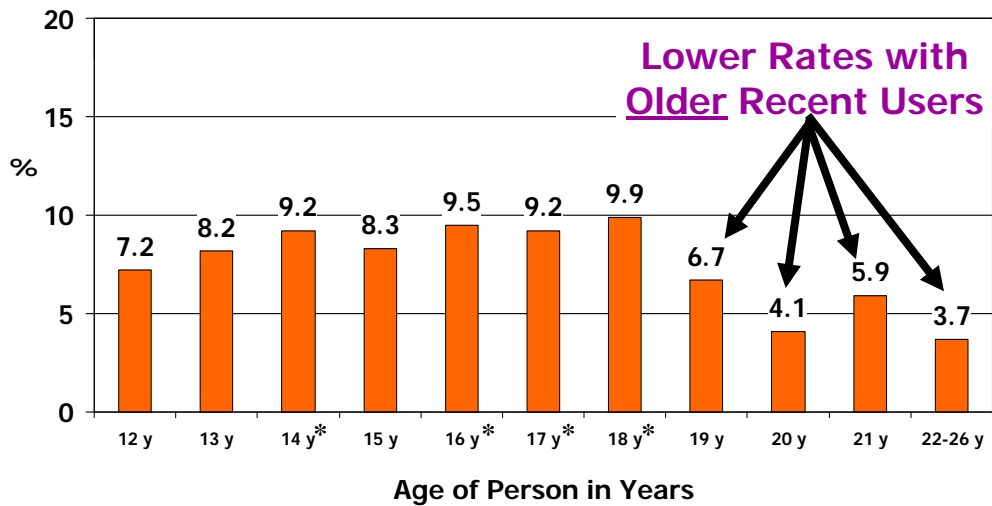
(Grant, B.F., et al., *Drug and Alcohol Dependence*, 74, 223-234, 2004)



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

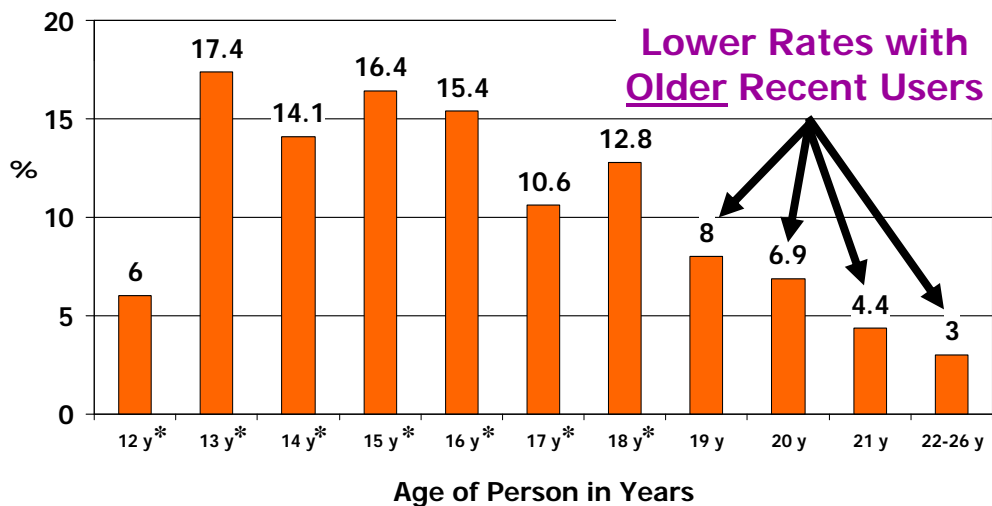


Percentages of past year alcohol use disorder among those with a recent onset (prior 2 years;  $n = 4074$ ) of alcohol use (Winters & Lee, 2007)



\*  $p \leq .05$ ; compared to 22-26y group

Percentages of past year cannabis use disorder among those with a recent onset (prior 2 Years;  $n = 2176$ ) of cannabis use (Winters & Lee, 2007)



\*  $p \leq .05$ ; compared to 22-26y group

**2009 Monitoring the Future Study**  
*Prevalence of Past Year Drug Use Among 12<sup>th</sup> Graders*

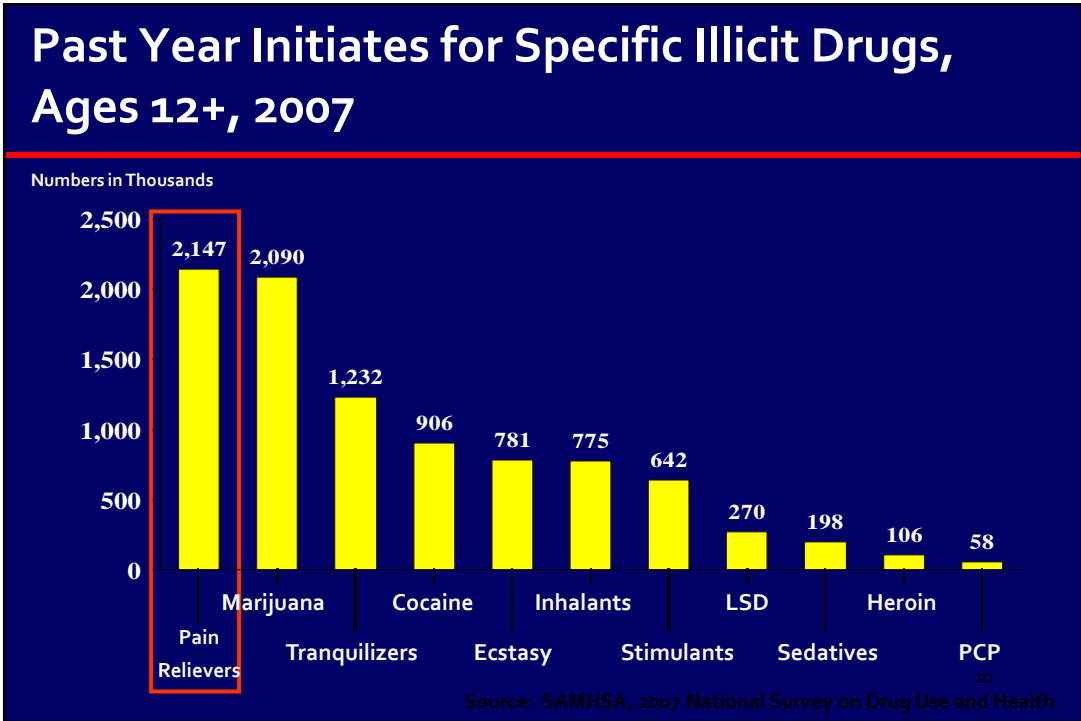
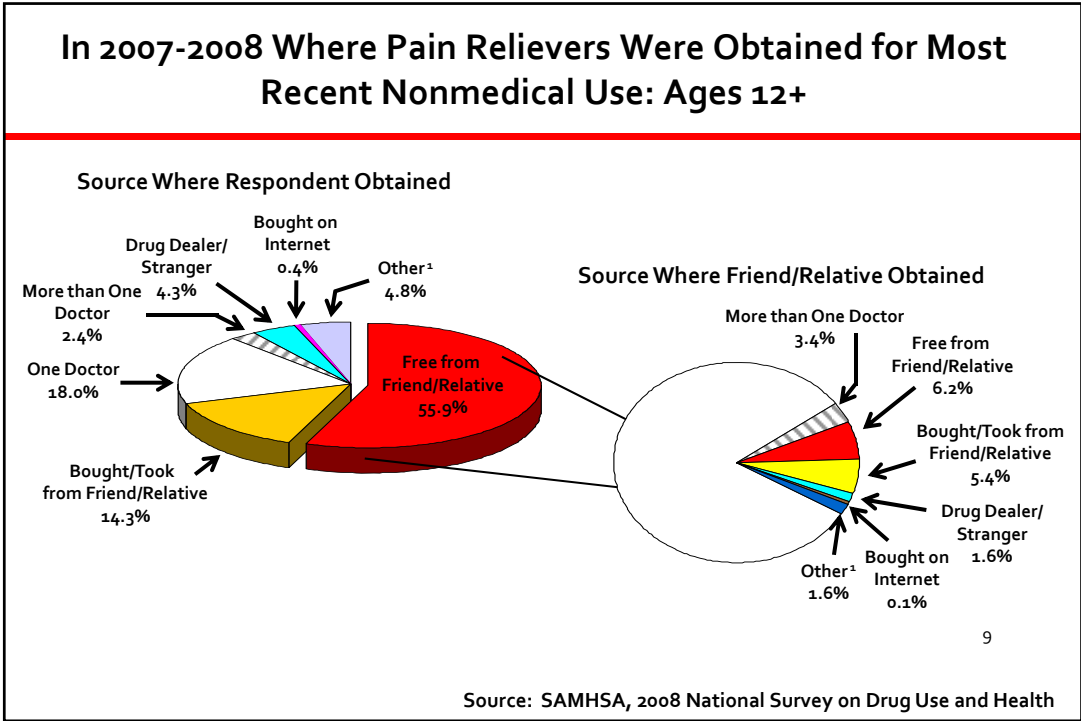
Drug	Prev. (%)	Drug	Prev. (%)
Alcohol	66.2	MDMA (Ecstasy)	4.3
Marijuana/Hashish	32.8	Cocaine (any form)	3.4
Vicodin*	9.7	Inhalants	3.4
Amphetamines*	6.6	Cocaine Powder	3.0
Tranquilizers*	6.3	Ritalin*	2.1
Cough Medicine*	5.9	LSD	1.9
Salvia	5.7	Provigil*	1.8
Adderall*	5.4	Ketamine	1.7
Sedatives*	5.2	Steroids	1.5
OxyContin*	4.9	Crack	1.3
Hallucinogens	4.7	Methamphetamine	1.2

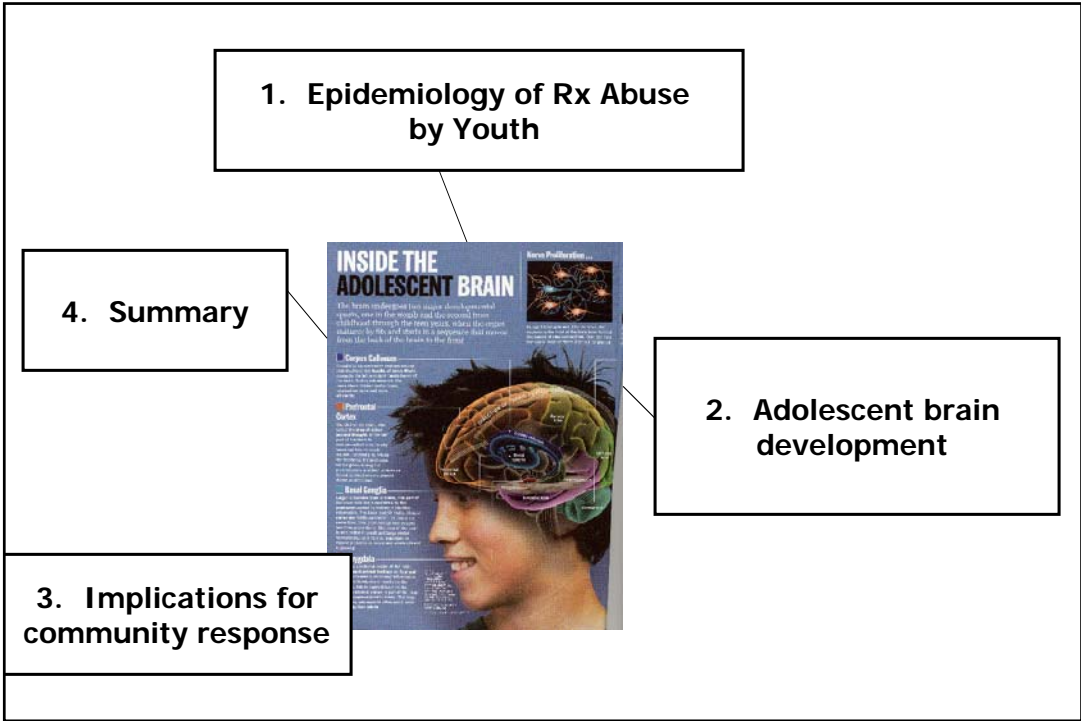
\* Nonmedical use, or not prescribed by a doctor

**2009 Monitoring the Future Study**  
*Source of Prescription Drugs\* Among 12<sup>th</sup> Graders who Used in Last Year*

Source	Range of Prev. (%)
Internet	0.1 – 3.4
Took from friend/relative without asking	10.2 – 18.6
Given for free from friend/relative	51.5 – 64.3
Bought from friend/relative	33.6 – 48.8
Bought from dealer/stranger	13.0 – 21.8
<b>Legitimate Prescrip.</b>	<b>15.3 – 30.3</b>

\* Amphetamines, tranquilizers and narcotics other than heroin






## 2-Minute Drill: Adolescent Brain Development

- **Adolescence is a period of profound brain maturation.**
  - We now know... maturation is not complete until about **age 25!!!**
- **Different systems mature at different points in time and at different rates**
- **Most important areas**
  - prefrontal cortex
  - limbic system

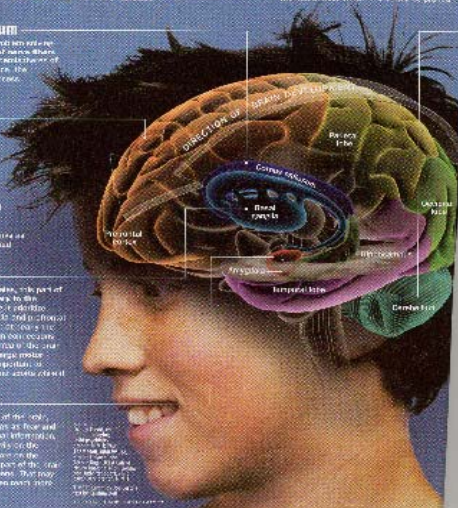
## INSIDE THE ADOLESCENT BRAIN

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.

**Nerve Proliferation ...**



By age 25, the average adult brain has 100 billion neurons. The number of neurons in the brain is fixed at birth, but the connections between them continue to grow and change throughout life.



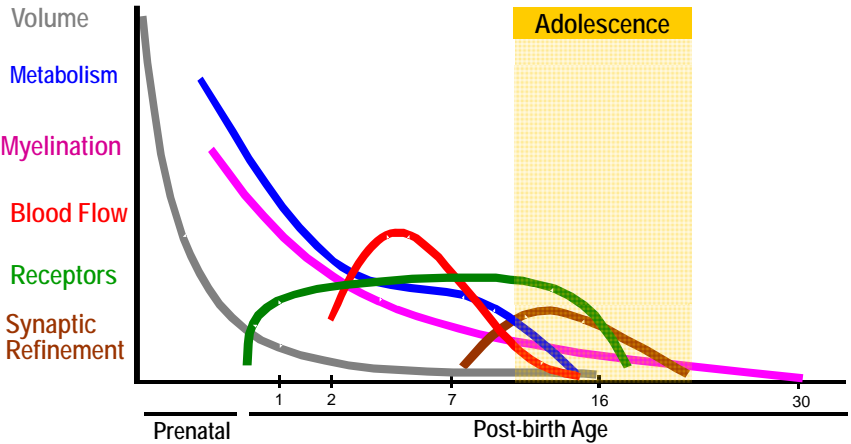
**Corpus Callosum**  
Thought is the result of electrical impulses traveling through the brain. The corpus callosum is a thick band of nerve fibers that connects the two hemispheres of the brain, allowing them to communicate with each other.

**Prefrontal Cortex**  
The part of the brain that is responsible for planning, decision-making, and impulse control. It is the last part of the brain to mature, and its development continues through adolescence and into early adulthood.

**Basal Ganglia**  
A group of structures in the brain that are involved in movement, learning, and emotion. They help to coordinate and control voluntary movements and are also involved in the brain's reward system.

**Amygdala**  
A small, almond-shaped structure in the brain that is involved in processing emotions, particularly fear and anxiety. It is one of the most primitive parts of the brain and is highly active during adolescence.

## Brain Development



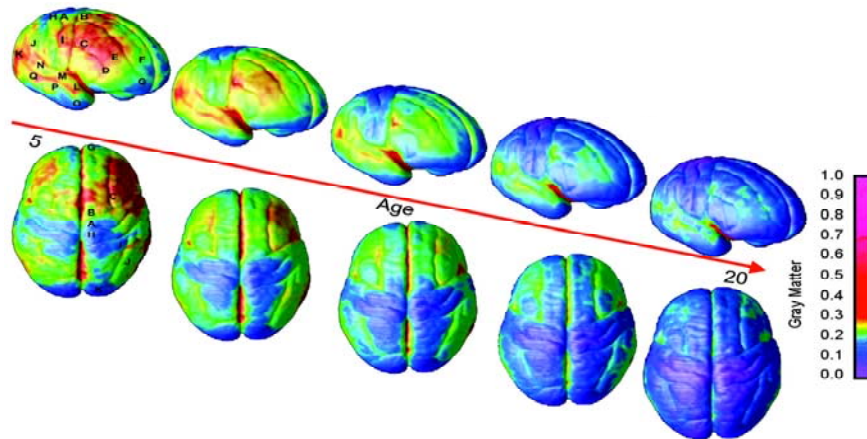
RATE OF CHANGE →

Tapert & Schweinsburg (2005)

7

# Brain Development

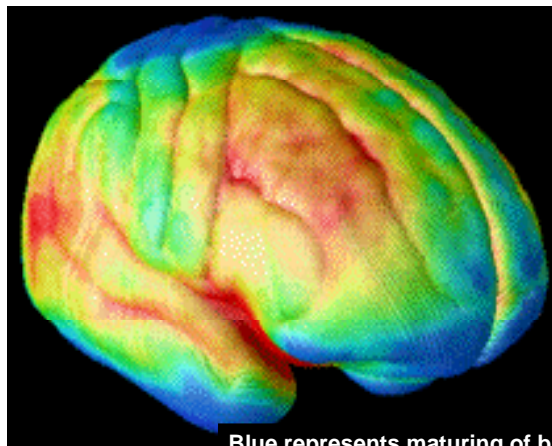
Gray Matter Maturation, Age 4-20  
Gogtay et al., 2004



Maturation Occurs from Back to Front of the Brain  
Images of Brain Development in Healthy Youth  
(Ages 5 - 20)

Earlier:  
limbic regions

Later:  
prefrontal cortex



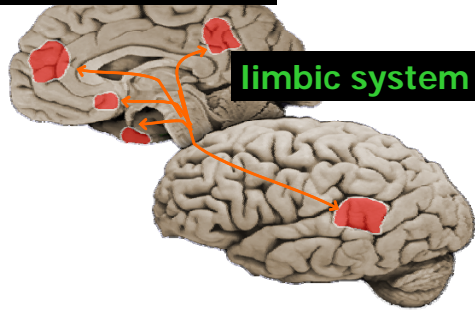
Blue represents maturing of brain areas

Source: PHAS USA 2004 May 25; 101(21): 8174-8179. Epub 2004 May 17.



## A Tale of Two Systems: Incentive Processing System

**prefrontal cortex**



These two systems are involved in how we value and predict potential rewards and punishments, and process emotional and social information.

### • Key Nodes

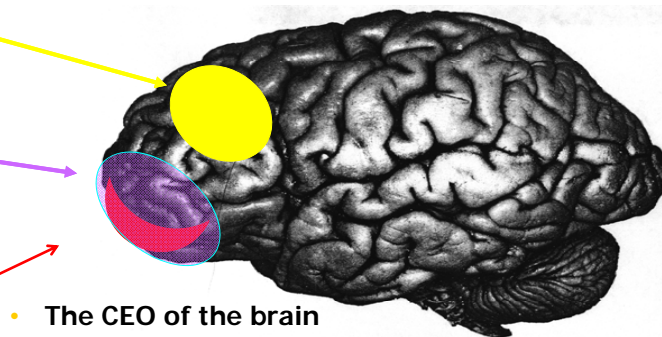
- **Ventral striatum**
- **Orbitofrontal cortex**
- **Posterior cingulate cortex**
- **Amygdala**
- **Nucleus accumbens**

## Prefrontal Area

**Dorsolateral**  
(reasoning and self-control)

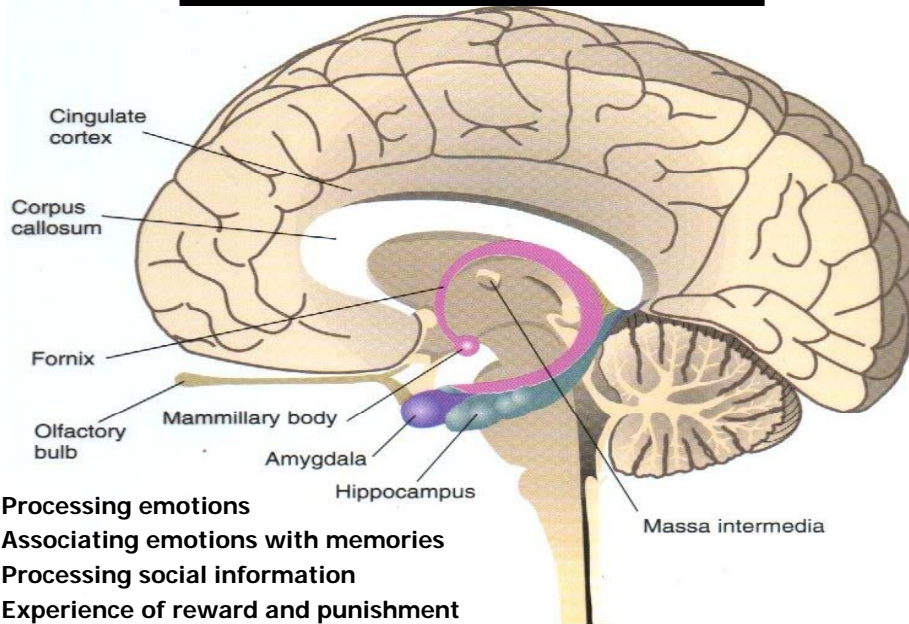
**Ventromedial**  
(gut-level decisions)

**Orbitofrontal**  
(evaluating risk and reward)



- The CEO of the brain
- Deliberative thinking
- Logical reasoning
- Planning ahead
- Weighing costs and benefits
- Regulating impulses

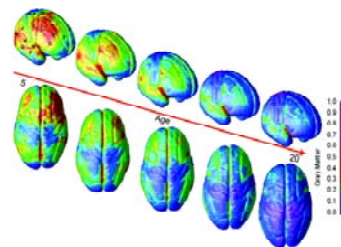
## The Limbic System



## Timing is Everything

- The excitation of the **incentive processing system** occurs early in adolescence, around puberty, and peaks during mid-adolescence.
- The maturation of the **cognitive control system** is gradual and not complete until late adolescence or early adulthood.
- The “accelerator” is activated before a good braking system is in place.
- The result?

Gray Matter Maturation  
(Gogtay et al., 2004)





Starting the engine without a skilled driver behind the wheel

To Review: A Reward-Biased Incentive System May Reveal These Tendencies (Dahl, 2004)

- **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**



## Standard View

- Adolescents underestimate risk
- Adolescents believe they are invulnerable
- Adolescents engage deficient cognitive processes in making decisions
- Adolescents are unaware of the dangers of their risky behavior



## Alternative View

- Risk taking in adolescence ...
  - is normative; important to development
  - has evolutionary significance
  - is due primarily to emotional and contextual factors
  - is perceived in similar ways as by adults
- Recent research on adolescent brain development provides a useful framework.

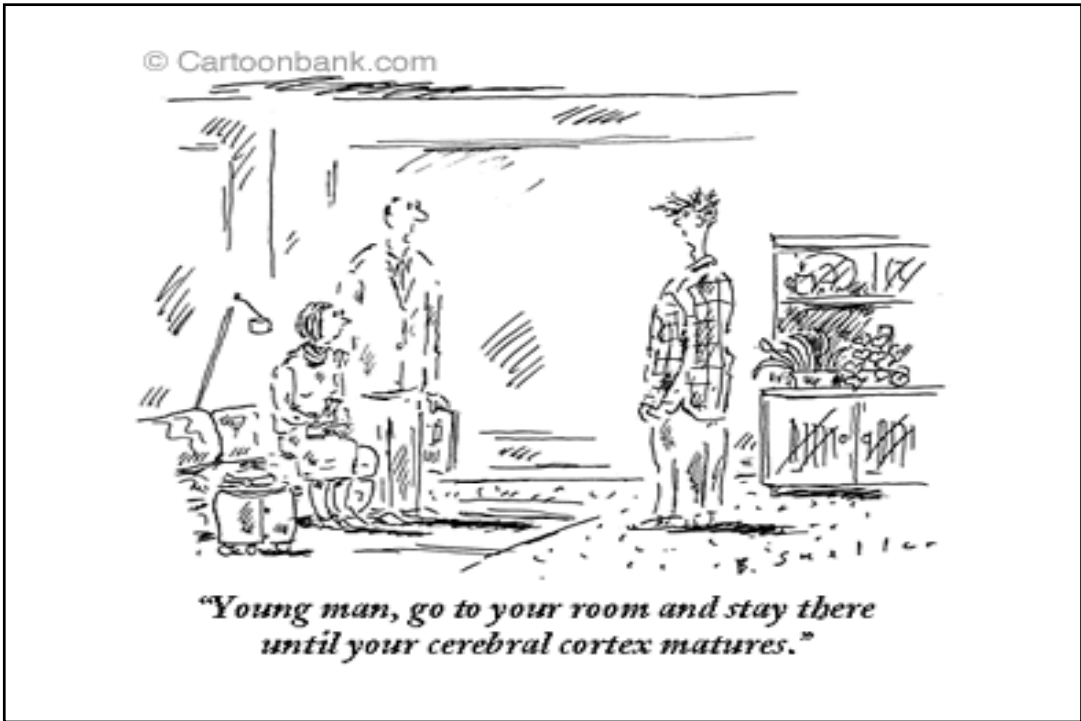


**1. Epidemiology of Rx Abuse by Youth**

**4. Summary**

**2. Adolescent brain development**

**3. Implications for community response**



## Implications for Interventions

---

- **Harm perception**
- **Social/Environmental**
- **Self-regulation skills**



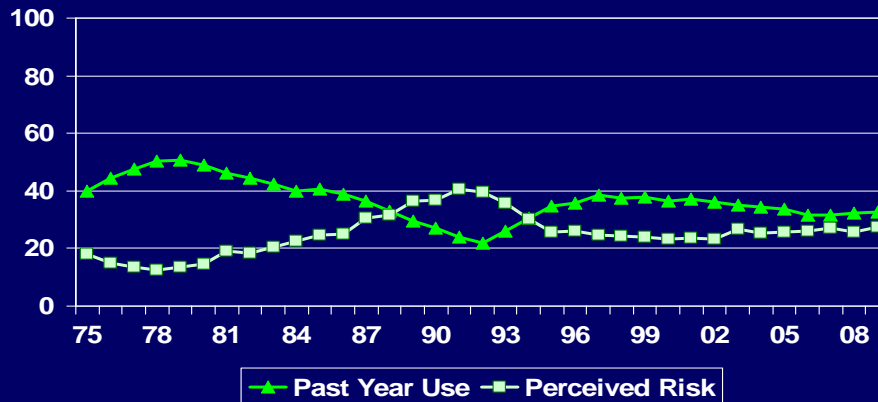
## Implications for Interventions

---

- **Harm perception**
- Social/Environmental
- Self-regulation skills



## 12<sup>th</sup> Graders' Past Year Marijuana Use vs. Perceived Risk of Occasional Marijuana Use



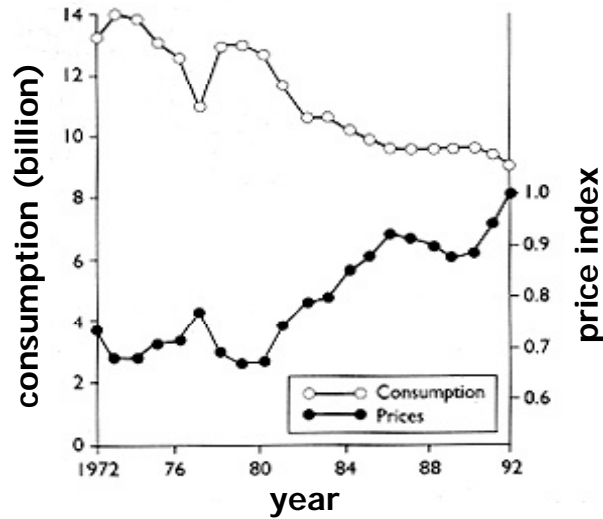
SOURCE: University of Michigan, 2009 Monitoring the Future Study

## Implications for Interventions

- Harm perception
- **Social/Environmental**
- Self-regulation skills

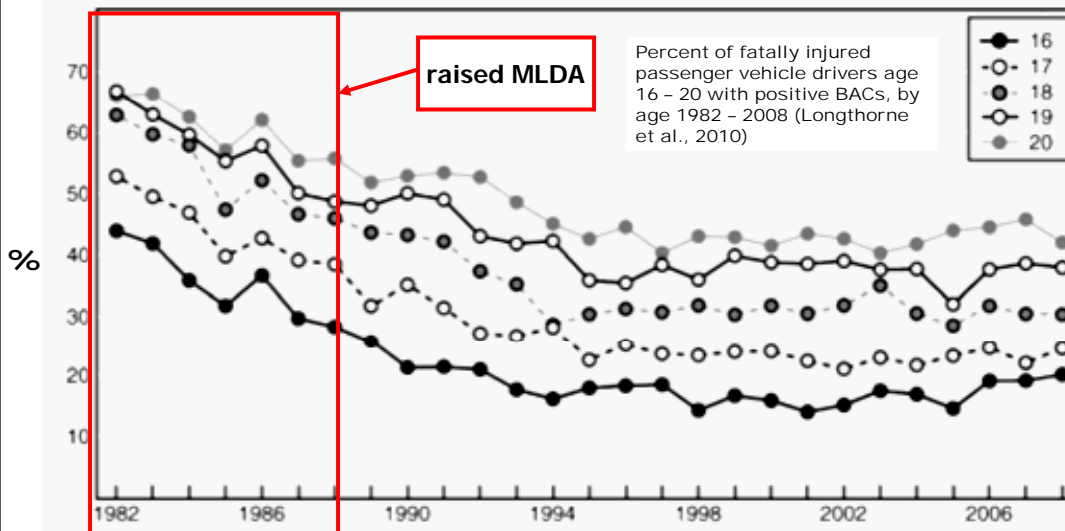


### Smoking and Price: Relation Between Cigarette Consumption and Adjusted Price During 1972-92



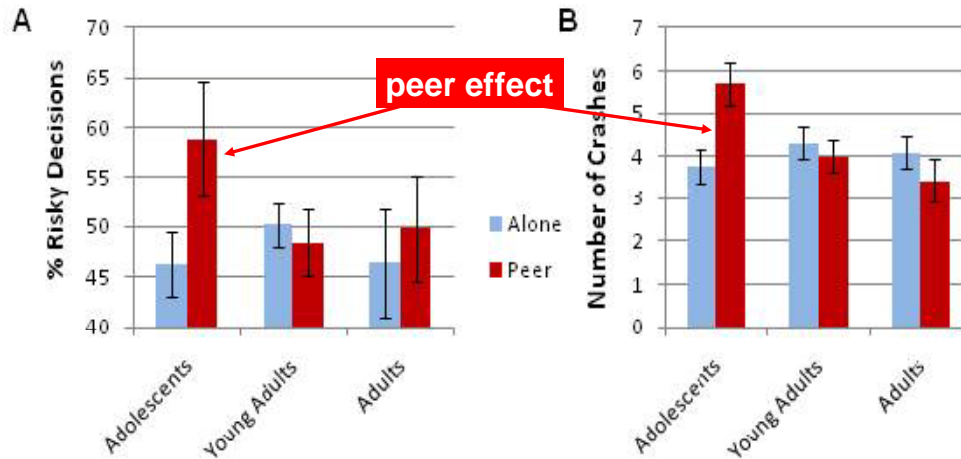
Townsend J et al. BMJ 1994;309:923-927

### Minimum Legal Drinking Age (MLDA) and Vehicle Fatalities Among Young Drivers (16 - 20)





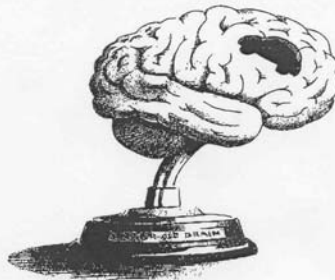
## Impact of Peer Presence on Risky Driving in Simulated Context



Chein et al., in press

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

BECAUSE THEY ARE.



Allstate ad, *NY Times*,  
May, 2007

EVEN BRIGHT, MATURE TEENAGERS SOMETIMES DO THINGS THAT ARE "STUPID."

But when that happens, it's not really their fault. It's because their brain hasn't finished developing. The underdeveloped area is called the dorsal lateral prefrontal cortex. It plays a critical 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 17-year-olds and five times higher

crash rates. These laws restrict the more dangerous kinds of driving teens do, such as nighttime driving and driving with teen passengers. Since North Carolina implemented one of the most comprehensive GDL laws in the country, it has seen a 25% decline in crashes involving 16-year-olds.

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

Let's help our teenagers not miss out on tomorrow just

## Implications for Interventions

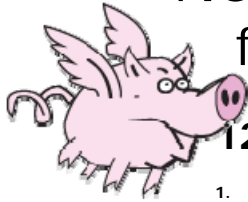
- Harm perception
- Social/Environmental
- **Self-regulation skills**



## Self-Regulation

- Teaching important skills that may be a “weakness” for the adolescent brain
  - impulse control
  - “second” thought processes
  - social decision making
  - dealing with risk situations
  - taking healthy risks

# 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

### 1. Epidemiology of Rx Abuse by Youth

### 4. Summary

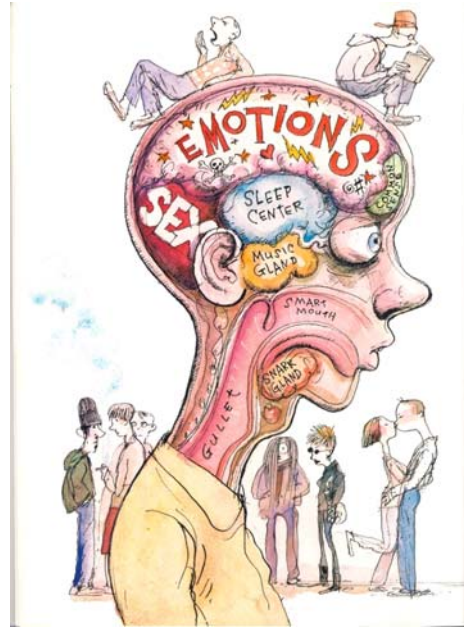


### 2. Adolescent brain development

### 3. Implications for community responses

## Summary

- 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



## Implications for Interventions

- **Harm perception**
- **Social/Environmental**
- **Self-regulation skills**





**THANK YOU!**

**winte001@umn.edu**