

Pennsylvania's 100% Tobacco Free Schools Toolkit *for Student Assistance Programs*



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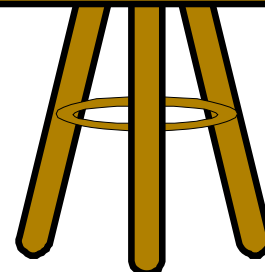
Includes fact sheets; presentations for students, parents and staff, and templates that are available on CD or at www.tobaccofreeallegheny.org

TobaccoFreeAllegheny

This presentation is part of the Tobacco Free Schools Toolkit. The printed booklet that accompanies the presentation is available from Tobacco Free Allegheny.

TobaccoFreeAllegheny

Adolescent Brain Development & Nicotine



Adolescence

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- Period between sexual maturation and the attainment of adult roles and responsibilities
- *Begins* with the domain of physical/biological changes related to puberty, but *ends* in the domain of social roles

Adolescence (cont.)

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Puberty

Romantic motivation
Sexual interest
Emotional intensity
Sleep-cycle changes
Appetite
Risk for affective disorders (girls)
Increase in risk taking, sensation seeking and novelty seeking

Age/Experience

Planning
Logic, reasoning
Inhibitory control
Problem solving
Understanding consequences
Affect regulation
Goal setting and pursuit
Judgment and abstract thinking

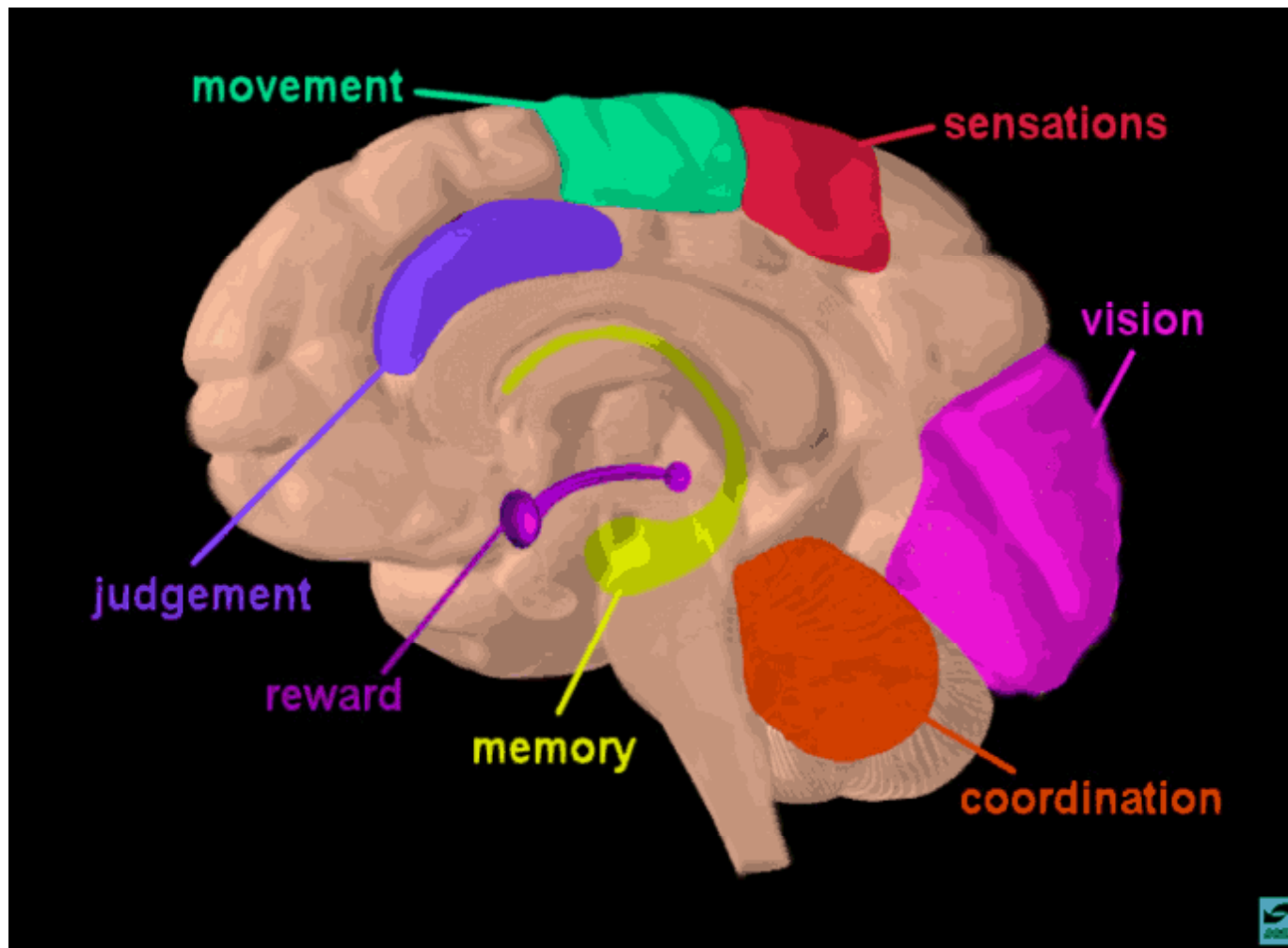
Adolescent Brain Development

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- Adolescence involves the maturation of self-regulation of behavior and emotions and the need to learn how to navigate complex social situations under conditions of strong emotions.

Adolescent Brain Development (cont.)

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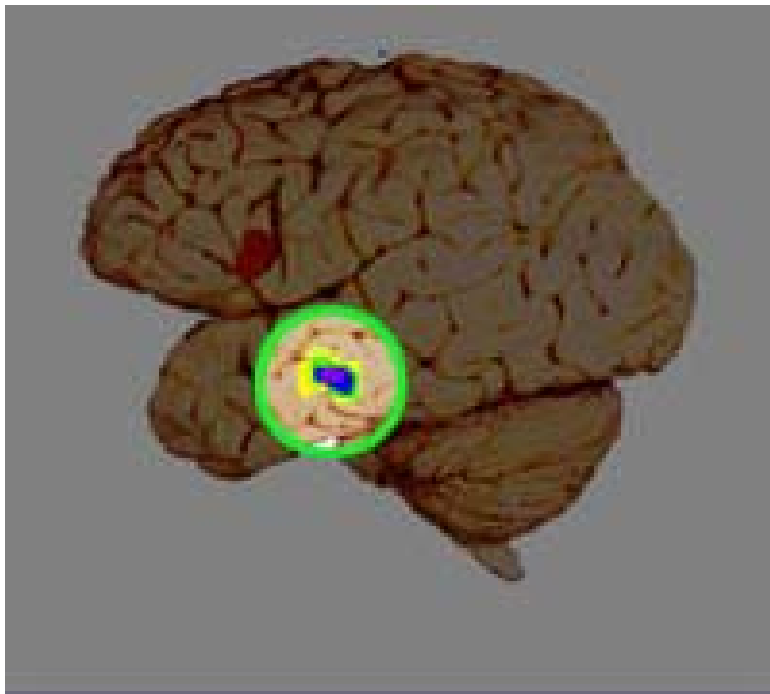
Adolescent Brain Development (cont.)

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- To appreciate consequences of risky behavior, one has to have the ability to think through potential outcomes and understand the permanence of consequences. Because of an immature prefrontal cortex, teens are not skilled at doing this.
- Teens do not take information, organize it and understand it in the same way that adults do—they have to learn how to do this.

Adolescent Brain Development (cont.)

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Brain Facts

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- The brain has approximately 100 billion neurons and one trillion supporting cells.
- The brain weighs approximately three pounds.
- Neurons grow and organize themselves into efficient systems that operate a lifetime.
- The brain controls ALL activities.
- Emotion and cognition are intertwined.
- Neurons can re-route circuits.
- The brain and environment are involved in a delicate duet.
- The brain never stops adapting and changing.

Structures

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- All behavior is a manifestation of the brain at work.
- Our thoughts, behaviors and emotions are the result of how the different parts of the brain work together to process information and memories.

Frontal Lobe

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- CEO functioning
 - Provides for logic and understanding of consequences
 - Governs impulsivity, aggression, ability to organize thoughts and plan for the future
 - Controls capacity for judgment, reasoning, problem solving and rational decision-making

Practice & Experience

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- Experience and practice helps prefrontal cortex to mature.
- Prefrontal cortex is one of last areas of brain to fully develop
- Increased need for structure, mentoring, guidance

Temporal Lobe

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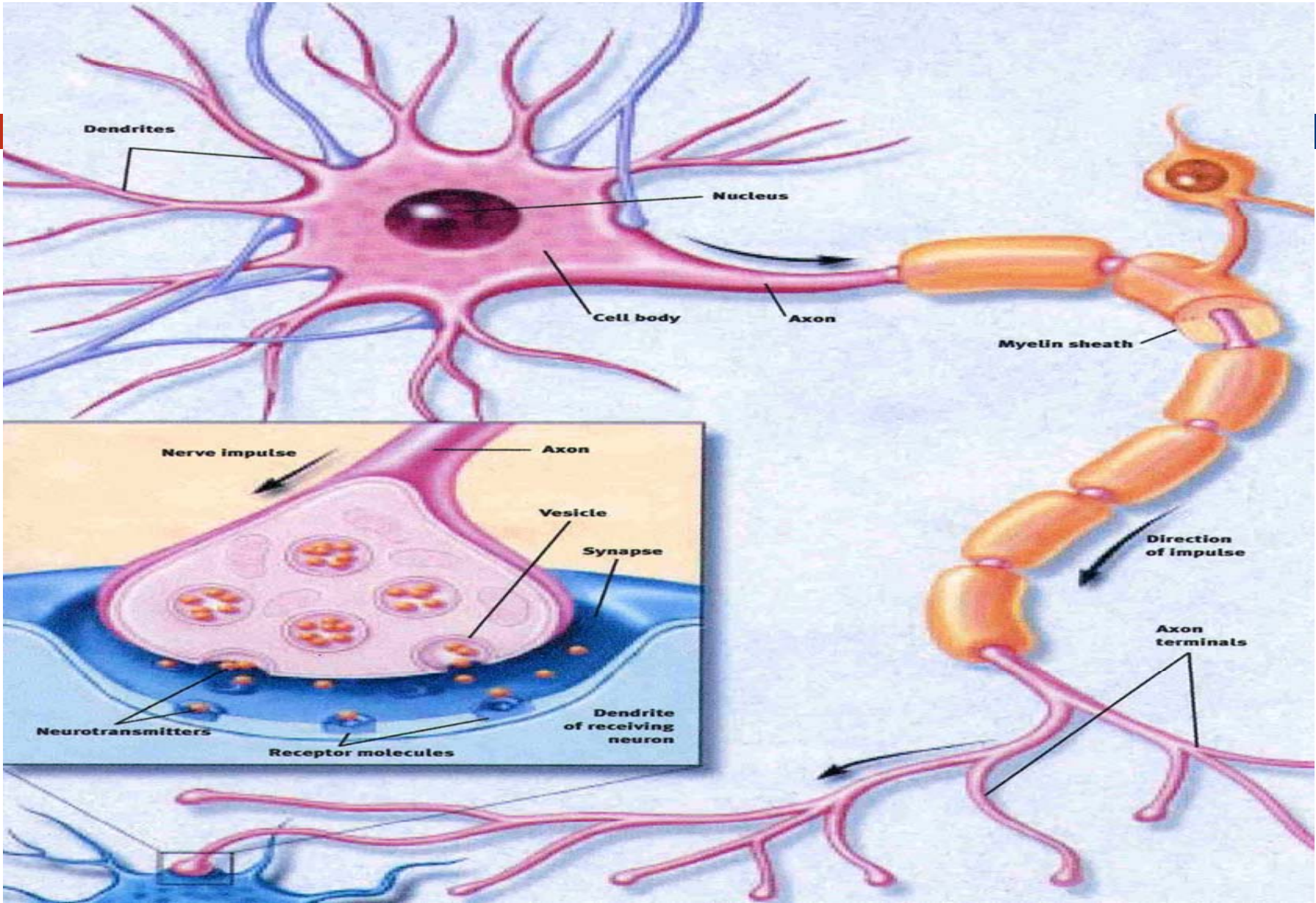
- Contains the limbic-reward system (amygdala, hippocampus, nucleus accumbens and vta)
- Responsible for hearing, understanding speech and forming an integrated sense of self
- Responsible for sorting new information and for short-term memory
- Matures around ages 18-19

(Marvin Zuckerman, psychologist from University of Delaware)

Temporal Lobe/Limbic System

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- The limbic system regulates emotions and motivations—especially those related to survival. (food, flight, fight, fluids and propagation of the species)
- Pleasurable behaviors activate the limbic area. This system produces and regulates pleasurable activities and produces feelings that are very rewarding and self-sustaining.



Brain Circuitry

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The brain is made up of:

- Gray matter responsible for “thinking”
- White matter containing supportive cells

The role of myelin:

- Myelin is a layer of insulation that coats the cells in the white matter. This enables the brain to work more efficiently.

Impact of Nicotine on Myelin

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University of Pittsburgh Medical Center Study

- Nicotine breaks down nerve cell membranes in the brains of young people.
- Younger subjects experienced brain changes that could make addiction more likely in adulthood.
- Male test subjects appeared particularly likely to have their brain cells altered by nicotine exposure.

Nicotine & Addiction

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- Even just a few puffs from a cigarette can activate a significant number of nicotine receptors in the brain, fostering the urge to continue smoking.
- For kids already addicted to other substances, the act of cigarette smoking serves as a cue for drug and alcohol craving, and nicotine serves as a primer for this craving. (NIDA)

Overproduction & Pruning

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- Critical stages of brain development occur in two basic stages—growth spurts/overproduction of neurons and pruning.
- Overproduction results in a significant increase in the number of neurons and synapses.

Pruning

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- These critical phases are quickly followed by a process in which the brain *prunes and organizes* its neural pathways.
- The brain keeps only the most efficient and “strong” synapses.
- Children/teens need to understand that they decide which synapses flourish and which are pruned away.

Pruning (cont.)

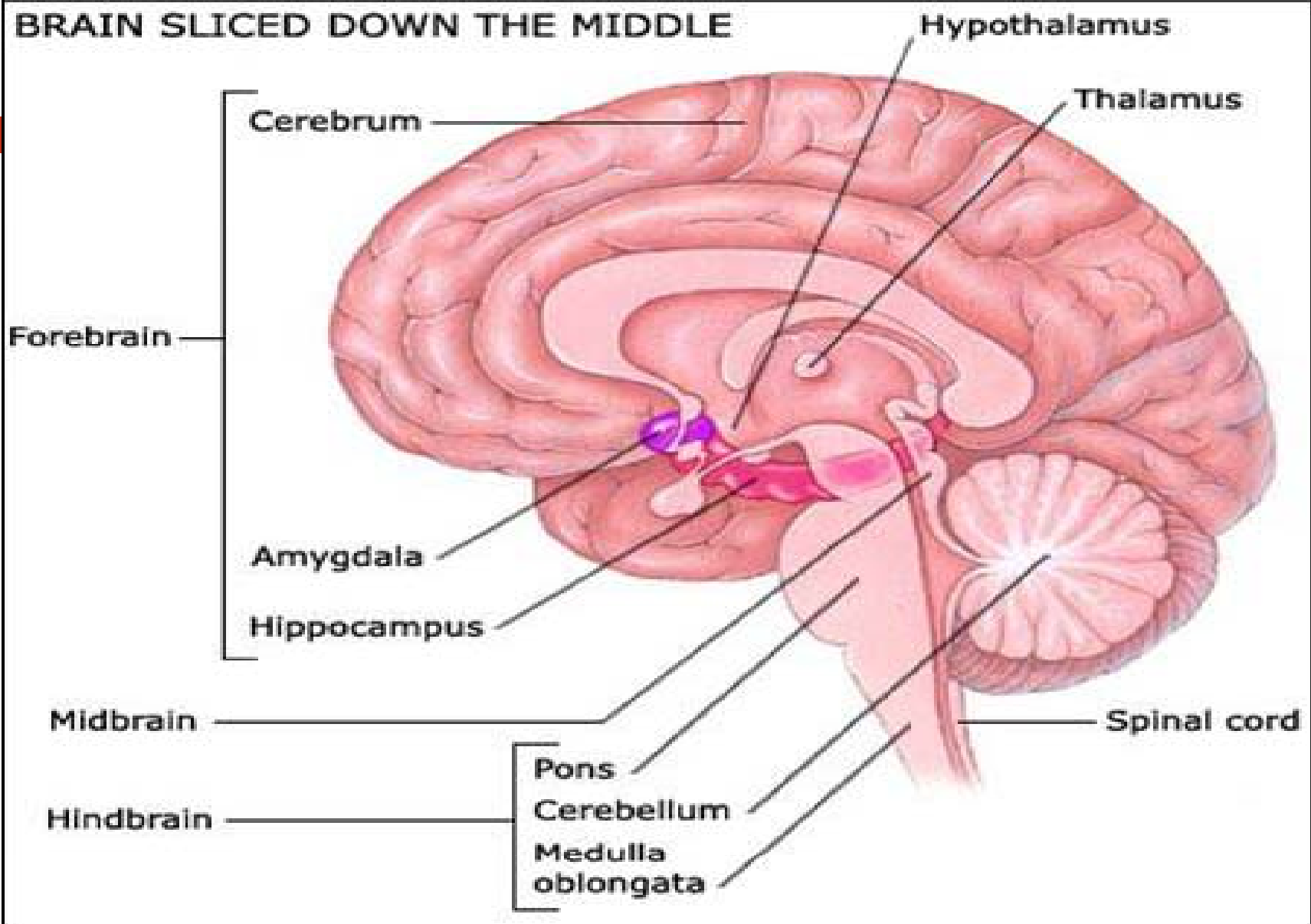
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“USE IT OR LOSE IT”

What will your child be good at in the future?

- Your child is deciding which neural synapses will be retained.
- Their activities guide the structure of the brain.

BRAIN SLICED DOWN THE MIDDLE



Hot and Cold Cognition

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- Teens lack balance between cognitive (pre-frontal cortex) and affective (limbic) systems of the brain
- “COLD” cognition—thinking under conditions of low emotions and/or arousal—pre-frontal cortex driven
- “HOT” cognition—thinking under conditions of strong feelings or arousal—limbic system driven
- Decisions made while feeling strong emotions difficult to influence by cool rational thought alone

Hot & Cold Cognition (cont.)

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- Adults must consider the interaction of thinking and feeling in adolescent decision-making.
- Adolescents aren't sitting there and making a list about pros and cons, especially when operating under hot cognition.

Link Between Nicotine & Alcohol

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“Do smokers appear to be more sensitive to the effects of alcohol?”

- Adolescent smokers are at a 50% greater risk of developing an alcohol use disorder.
- Once the “central reward system” is exposed to one drug, the brain may become more sensitive to the effects of other drugs.

Genetic History

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- Two genetically distinct rats
 - P—Innately bred for heavy drinking
 - NP—Bred not to prefer alcohol
 - Neither ever exposed to alcohol
- Lever dispensing nicotine
 - P rats pressed lever twice as much to get nicotine as NP rats.
- Affinity for nicotine suggests that genetics make the P rats more vulnerable.



(Drs. Funk and Shram for NIH)

Gateways

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“Cigarettes and alcohol are also known to be ‘gateway’ drugs, that is, the overwhelming majority of illegal drug users begin their use with one or both of these drugs.”

Kids at Risk for Alcohol Use Disorder

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- Nicotine appears to directly impact vulnerability for addictions development.
- This is a strong message to add to health education programs.

Insula

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- Smokers with a damaged insula quit smoking easily and immediately. (brain lesions)
- This raises the possibility that other addictions have an equally strong hold on the neural circuits for pleasure.
- Could disruption of the insula be the Achilles' heel of all addictions? (Nicotine Addiction Depends on a Healthy Insula, published Jan. 29, 2007, by authors of study, Antoine Bechara and Hanna Damasio)

Scars That Won't Heal

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- There is growing evidence of changes in brain development and functioning as the result of abuse and neglect.
- Our brains will develop in response to a positive or a negative environment.

(Shore, 1997)

The Effects of Abuse & Neglect

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- Diminished growth in the left hemisphere—may increase risk for depression
- Irritability in the limbic system can set the stage for the emergence of panic disorder and PTSD.
- Smaller growth in the hippocampus can increase the risk for dissociative disorders and memory impairment.
(Teicher, 2000)

Programming & Policy Issues

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- Teens are not adults.
- Teens are operating from the emotional/impulsive/reward-oriented part of the brain.
- Communication is a complicated process.
- Technology is transforming the world.
- Disparities between knowing/feeling and understanding/behaving exist.

Neuroscience of Skill Building

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- Skill building is a means of developing neural network integration and coordination among various neural networks. (Cozolino, 2002)
- In order to heal a “damaged” or altered brain, interventions must activate those portions of the brain that have been altered. (Perry, 2000)


Cortical Integration

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- Strengthens the frontal cortex—judgment, reasoning, rational decision-making, problem solving, etc.
- Increases the ability of the cortex to process, inhibit and organize reflexes, impulses, information and emotions
- Increases ability to engage thought with affect, words with emotion, and reason with unconscious behavior (Seigal, 1999)

Limbic Regulation

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- The limbic system plays a critical role in the regulation of emotion and memory.
- Teens need to re-wire their brains by learning new skills/options.
- Teens need to be in a state of “attentive calm” to learn new cognitive or behavioral skills/options.
- Emotions/impulses  Logic/reason

Elements of Effective Prevention Interactions

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- **Safety**—provides understanding of persistent fear and hyper-vigilance and helps teens develop a state of “attentive calm”
- **Role-playing, music, immediate rewards, and role models**—provides corrective experiences, activates pre-frontal cortex to form new pathways and creates new memories/options

Elements of Effective Prevention Interactions (cont.)

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- **Corrective thinking**—corrects false assumptions and reframes thinking
- **Structure**—provides a safe, predictable, consistent environment that helps to reduce anxiety
- **Discernment**—provides experiences in which young people practice “reading” facial expressions and “social” situations

Elements of Effective Prevention Interactions (cont.)

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- **Information**—helps teens understand how their brains develop; how brain function impacts behavior; and process for re-wiring the brain
- **Hot/cold/cognition**—“Problem solving” information in the cortex is not easily accessed when teens operate under hot cognition; teens need practice and concrete ways to access information and skills.

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This presentation was prepared by the staff at Addiction Medicine Services.