


## The Amazing Adolescent Brain: Opportunities and Vulnerabilities



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Brain-Body Strategies are integrated into this presentation.  
Everything is an invitation.

1


### What We're Talking About

- Adolescence is a critical period of brain development
  - Stress and mental health
- Changes in adolescent brain explain attraction to novel experiences, risk-taking, impulsivity...
- Teen brain uniquely vulnerable to substance use & addiction
- Communicating more effectively with teens

2

## Neuroplasticity= Risk and Resilience

- Brain adapts and changes in response to experience and environment
- Adolescent brains are **fantastically "plastic!"**




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3

## Our Brains

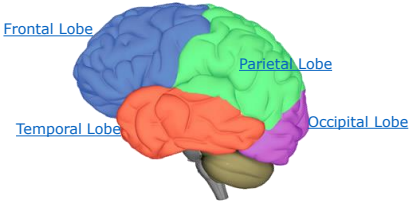
- Weight?
- Size?
- Age it matures?



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## Major Upgrade & Remodel




- Gray matter (=cell bodies) peaks around puberty
- Second surge of synaptogenesis (making new connections) & pruning → efficiency and specialization
- Myelination (white matter=insulation) accelerates → speed & integration

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## THE BRAIN'S CEO



### Prefrontal Cortex

- Impulse control
- Judgment
- Problem solving
- Emotional processing
- Organization & planning
- Motivation
- Goal-setting behaviors

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WHILE PREFRONTAL CORTEX IS STILL MATURING...

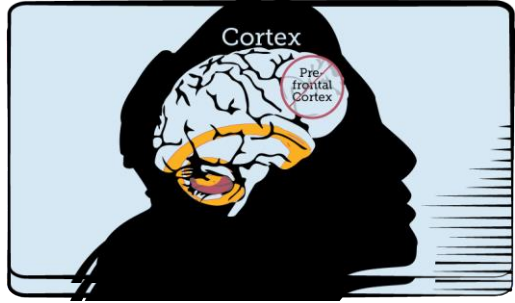
- **More rigid thinking** so harder to see options →
  - **Good decision-making** comes from experience
- **Maturing brain** must work harder to integrate information until it gets all the connections → cross-talk
  - **More vulnerable to stress**

7 out of 10 teens (70%) see anxiety and depression as leading problem among peers

Pew Research Center, 2019

7

## The Brain On Stress

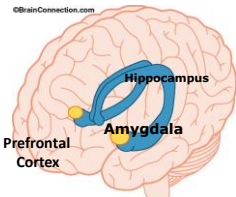


Alaska Native Tribal Health Consortium (ANTHC) Linda Chamberlain PhD, MPH

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### Teen Brain is *Exquisitely Sensitive to Stress*


- Key areas of brain involved in stress response— **hippocampus, amygdala & prefrontal cortex**—undergoing major changes



17.3 percent increase in the use of anxiety medications among adolescents during first two years of the pandemic

©BrainConnection.com

9

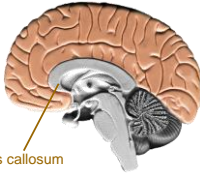



- **Movement, balance, & complex cognitive processes**
- **Greatest changes during adolescence**
- **Physical exercise boosts development**

Corpus Callosum and Cerebellum continue to develop into 20s

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- Communicates information from one side of the brain to the other
- Creativity & higher thinking

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## Brain-Building During Sleep



- Need 9 to 9 ½ hours of sleep
- Brain sleep centers are in transition
- Melatonin secreted up to 2 hours later at night

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## Adolescent Sleep Deprivation

Compromises REM sleep and learning
Mimics symptoms of ADHD
Increases symptoms of depression
Decreases ability to control emotions
Increases aggressive behaviors
Increases risk of obesity

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13



1. Start day with interactive activities and movement
2. More challenging activities later in day
3. **Sleep assessment** if struggling in school, behavioral problems and/or mental health issue

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14

## What Do Teen Brains Need?

1. Hands-on, skill-based learning
2. Novel experiences & leadership opportunities
3. At least 9 hours of sleep for brain-building
4. **Tools** to build brain connectivity & manage stress

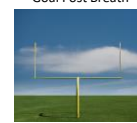
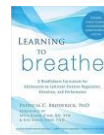


SWING DOGS

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15

### Goal Post Breath



### Steps to evoke Relaxation Response

1. Relax muscles
2. Allow the breath
3. Calm the mind

*People always tell us not to stress out, but nobody tells us how...*

<https://www.health.harvard.edu/blog/using-the-relaxation-response-to-reduce-stress-2010110780>

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16

## Mindfulness Exercise: S.T.I.C.

- S-Stop**
- T-Take a Breath**
- I-Imagine the Future Consequences**
- C-Choose**

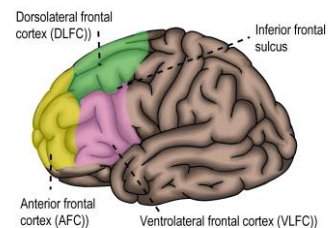
S.T.I.C.- one of six mindful exercises (other included breathing counting, deep breathing and body scans) that tested well with incarcerated youth with trauma who were court-mandated to substance abuse Treatment (Himmelstein et al, 2014)

A 3 Tips for Using Mindfulness in Substance Abuse Treatment at: <https://centerforadolescentstudies.com/>

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17

## Reboot the Brain with 5-Finger Breathing



\*Adolescent marijuana users-hyper-activation in DLFC

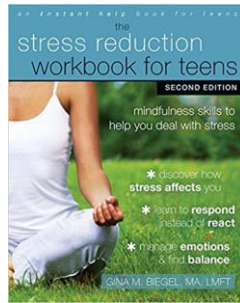
"Breathe" by Dr. Jud- free app

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18

## RESOURCE

- Understanding stress response
- Mind-body connection
- Emotions as sensation
- SEL: working with full range of emotions



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19

## Watching Your Train of Thoughts



Source: *Stress Reduction Workbook for Teens*, 2<sup>nd</sup> Edition, Bina Biegel

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20

## Three Most Consistent Adolescent Behavioral Changes Across Cultures

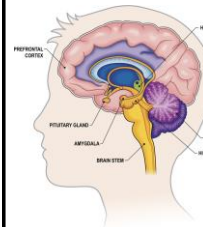
- Novelty seeking
- Focus on peer relationships
- Attraction to risk-taking



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## The Limbic Challenge



- Matures before Prefrontal Cortex
- Influences emotion, reward, novelty-seeking, memory & impulsivity
- *Feel good sensation* with substances use happens here (*and so does addiction*)

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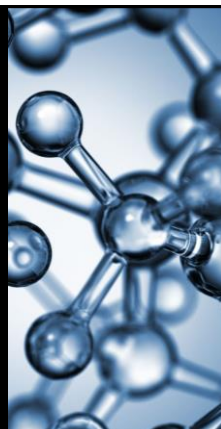
22

## Addiction & the Brain

Dopamine is the *feel good* neurotransmitter → pleasure & making associations between behaviors/environments that make you feel good

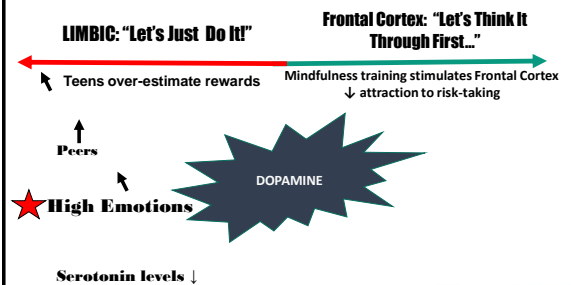
Increase in activity of dopamine system during adolescence makes teens more sensitive to rewards

Reward circuitry of brain still maturing → heightened vulnerability to substance use



23

## Mismatch Model: Neurodevelopmental Tug-of-War



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24

## Limbic surge sends teens into limbic overdrive

- Self-regulation more challenging  
Evidence-based mind-body tools
- **MIND-UP**- mindfulness, SEL & neuroscience
- **Inner Explorer**- *Mindfulness in School*
- **S.M.A.R.T.**- *Sensory Motor Arousal Regulation Treatment*



Adolescence is a window of opportunity for self-regulation interventions  
Office of Research, Evaluation and Planning, OPRE Reports, 2017

25

## Poor Self-Regulation Skills During Adolescents Increases Risk of:

- Substance use
- Sexual risk-taking
- Juvenile delinquency



Self-regulation = skills to manage thoughts & feelings, control impulses & problem solve

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26

## The Adolescent Brain and Substance Use

### THE BIG THREE\*

- Cognitive impairment
- Mental health problems
- Future substance abuse

\*DOSE & AGE MEDIATE IMPACT



27

## True or False

1. At the same blood alcohol levels, adolescents are more likely to show the effects of intoxication on muscle coordination compared to adults.
2. At the same blood alcohol levels, adolescents are more likely to black-out than pass-out compared to adults.
3. The impact of marijuana on the brain suggests that some of the same areas of the brain that affected by alcohol are also affected by marijuana.
4. The earlier a person starts drinking, the more likely they are to become dependent on alcohol.

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28

## Impact of Alcohol on Teen Brain

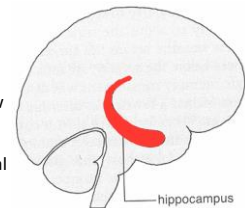
- Smaller prefrontal cortices
- ↓ white matter development, especially Corpus Collosum
- Cognitive impairments
  - Attention
  - Memory



29

## Hippocampus

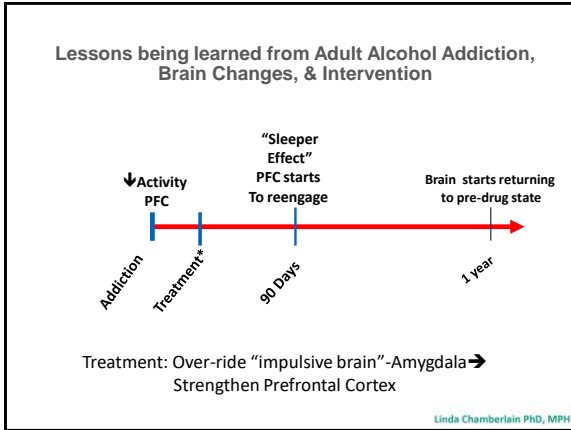
- "Switchboard" between short- and long-term memory = gateway to learning
- Alcohol impairs ability to create new neurons in hippocampus
- Studies show that interruption of binge-drinking patterns led to partial cognitive recovery



ALCOHOL BLOCKS GLUTAMATE RECEPTORS WHICH ARE KEY FOR BUILDING NEW SYNAPSES → MEMORY IMPAIRMENT (Jensen, 2015)

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30



31

## Marijuana

THC concentrates “are as close to the cannabis plant as strawberries are to frosted strawberry pop tarts”

Beatriz Carlini,  
University of Washington  
Addictions, Drug & Alcohol Institute

OILS & WAXES  
~ 90% THC

32

### Marijuana Slows Adolescent Brain Development

- THC disrupts development of neural pathways → greater potential harm for developing teen brain
  - ↓ gray matter
  - ↓ white matter
- Most significant factor between marijuana use and impact on brain is **AGE (before 15 y.o.)**

There is no known safe limit

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### Implications

Higher doses of THC are more likely to produce anxiety, agitation, paranoia & psychosis

Poorer connections between limbic system & Prefrontal cortex

Difficulties with impulse control, attention, memory, learning and problem solving

Increased risk of psychotic symptoms & disorders in young adulthood, especially schizophrenia-hastens onset & amplifies severity

Cannabinoid Hyperemesis Syndrome

34

### How Substances Affect The Adolescent Brain

#### The New Science of Addiction: Genetics and the Brain

Drug addiction is a chronic disease

<http://learn.genetics.utah.edu/content/addiction/>

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### Teens Need to Understand How Their Brains Are Changing and...

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36



### Prevention Paradigm Shift: Youth Message Development (YMD)

Substance abuse prevention curriculum (4 Lessons)

- Strategies used by alcohol, tobacco and drug companies to **attract teens**
- **Media literacy skills via experiential learning** → examine advertising techniques and ads to generate analysis, discussion & peer learning
- Students create **youth-driven anti-substance use messages**


Green & Banerjee & Sloan Kettering, 2017;  
California Evidence-Based Clearinghouse, 2019

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37

### Prevention

- Personality-targeted, school-based curriculum (4 lessons) to prevent alcohol & drug use in high-risk teenagers
- **Media literacy skills via experiential learning** → analyze advertising techniques & peer learning
- Students create **youth-driven anti-substance use messages**



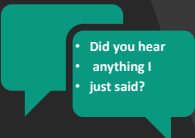
Contact: Dr. Patricia Conrod  
Department of Psychiatry,  
University of Montreal

Green & Banerjee & Sloan Kettering, 2017;  
California Evidence-Based Clearinghouse, 2019

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38

### Communicating More Effectively with Teens



- Did you hear anything I just said?

39

### What emotion do you see?

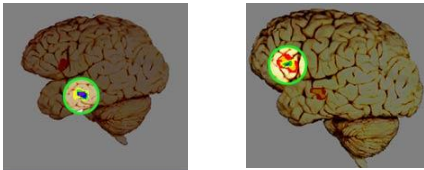


Permission to use photo from Dr. Yurgelun-Todd

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### Teens Use Less of the Prefrontal Region compared to Adults



Adolescent                      Adult

Yurgelun-Todd, D. Frontline Interview; permission to use graphics from Dr. Yurgelun-Todd  
<http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/interviews/todd.html>

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41

### = Communication Gap

**The teen brain:**

- Processes more in amygdala
- Reacts more quickly
- Sees anger when it isn't intended
- Uses less of prefrontal cortex to interpret facial expressions so ↑ likely to misinterpret


Frontline Interview with Dr. Yurgelun-Todd

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42

### IMPLICATIONS

**What were you thinking?!!!!**



- Immature prefrontal cortex goes “limbic”
- Doesn’t focus attention on behavior that needs to change
- Weakens relationship → isolation & less likely to ask for help
- Timing and approach is everything (*think FETI*)

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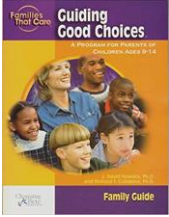
43

### Use “I” Statements

Say how you feel: “I’m ...”

Identify event that makes you feel this way: “I’m feeling \_\_\_ because...”

Explore what the options are to address the problem and make a plan: “What can we do to solve this...?”



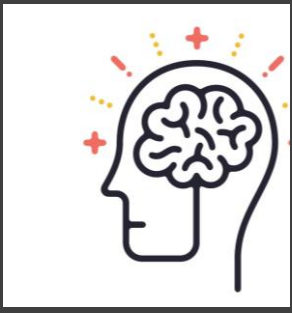
Program and resources for Caregivers & pre-teens

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44

### Considerations for Prevention

- Training for service providers, parents, and caregivers on adolescent brain development & implications for substance abuse
- Education starting in middle school on the amazing teen brain
- More focus & services targeted to pre-teens/early initiation



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**“There are children with problems, but they are not problem children.”**

- Structure
- Consequences
- Parent-child connections
- Lots of relationships
- Powerful identity
- Sense of control
- Sense of belonging, spirituality & life purpose
- Rights & responsibilities
- Safety & support



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46

### Child and Youth Resilience Measure (CYRM-12)


I am able to solve problems without harming myself or others	I know where to go in the community to get help	Getting an education is important to me	I try to finish what I start
I have people to look up to	My parents/caregivers know a lot about me	My family stands by me during difficult times	My friends stand by me during difficult times
I have opportunities to develop skills that will be useful later in life	I am treated fairly in my community	I feel I belong at my school	I enjoy my cultural and family traditions

[www.resilienceresearch.org](http://www.resilienceresearch.org)

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47

### Take Home Messages: Be a Lead Dog for Adolescents



**TUTKA, Lead Dog**

Teen brain has tremendous developmental resilience → how they spent their time matters

Teens need our mature frontal cortexes—more than ever!

Teen brain is more vulnerable to stress and neurotoxins

Skill-based interventions

Teens need to know how their brains are changing

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48





49

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June 2020 Newsletter – New Program to Work with Adult Prison Population

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See research at <https://www.mba-project.org/>

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- MBA Curriculum (usually once weekly for 10-15 weeks) for high-risk and incarcerated populations (focus has been youth with substance abuse issues)
  - Modules include Impulse Regulation, Emotional Awareness, Emotional Intelligence, Cause and Effect and Interpersonal Relationships

50