PRESENTATION USAGE

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Understanding the Adolescent Brain

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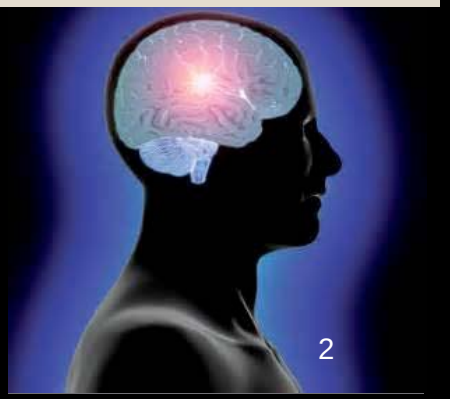
BOSTON COLLEGE SCHOOL OF SOCIAL WORK

BOSTON COLLEGE
WORLDWIDE WEBINARS
May 22, 2019



WEBINAR OUTLINE

PART I: Framing Adolescence

PART II: The Adolescent Brain Needs…

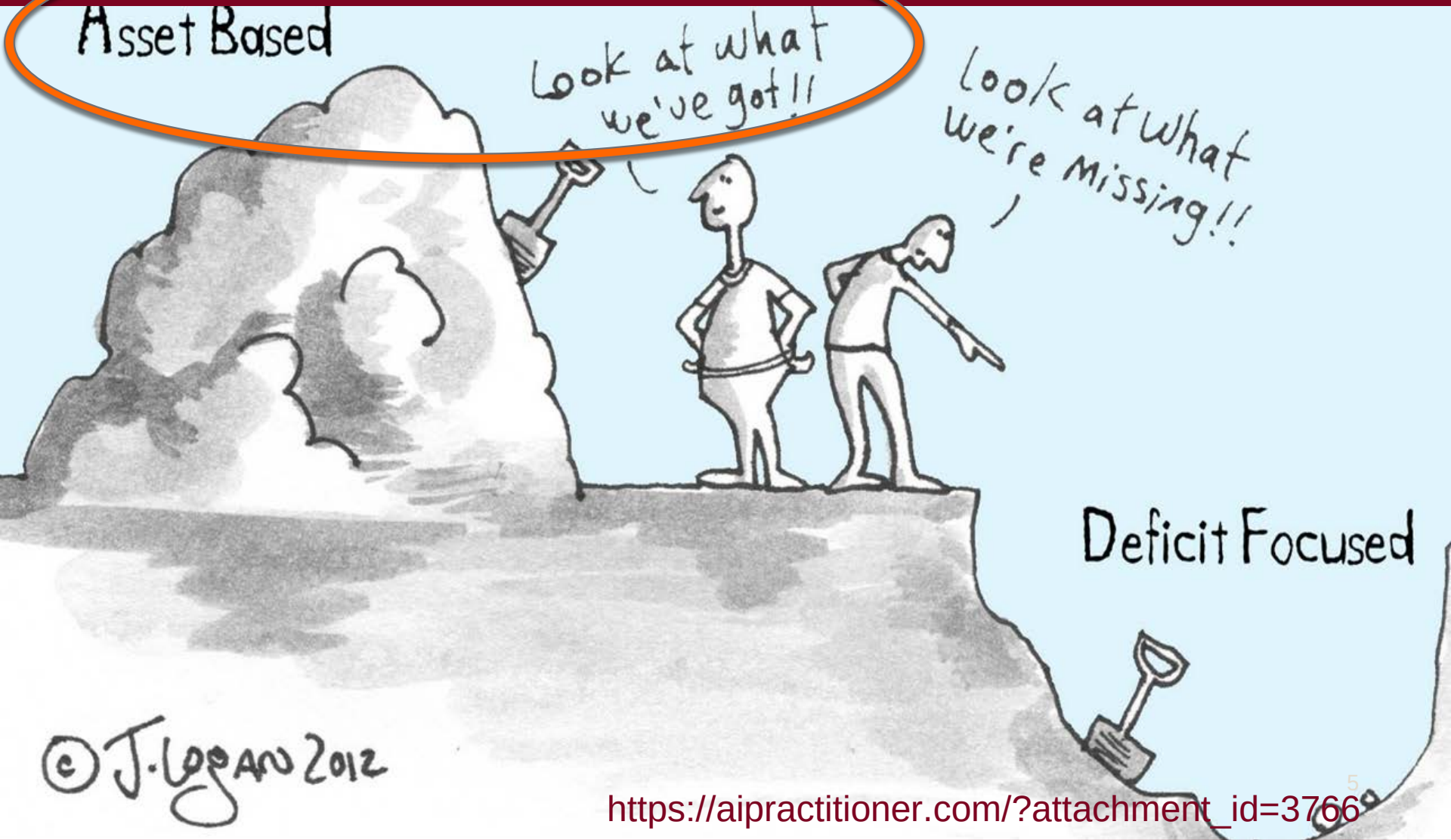
a. Building
b. Connecting
c. Laughing
d. Sleeping

PART III: Resources

What is the first word that comes to mind when I say….

Teenager

STRENGTHS PERSPECTIVE



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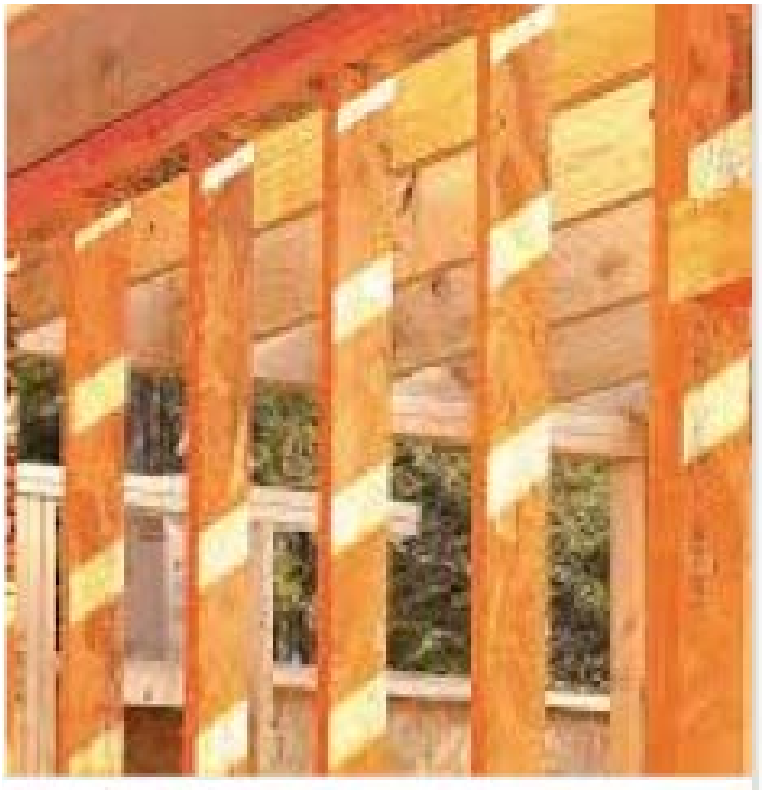
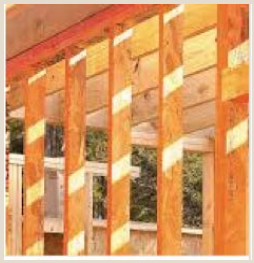
Framing Adolescence



Brains are Built

Opportunity

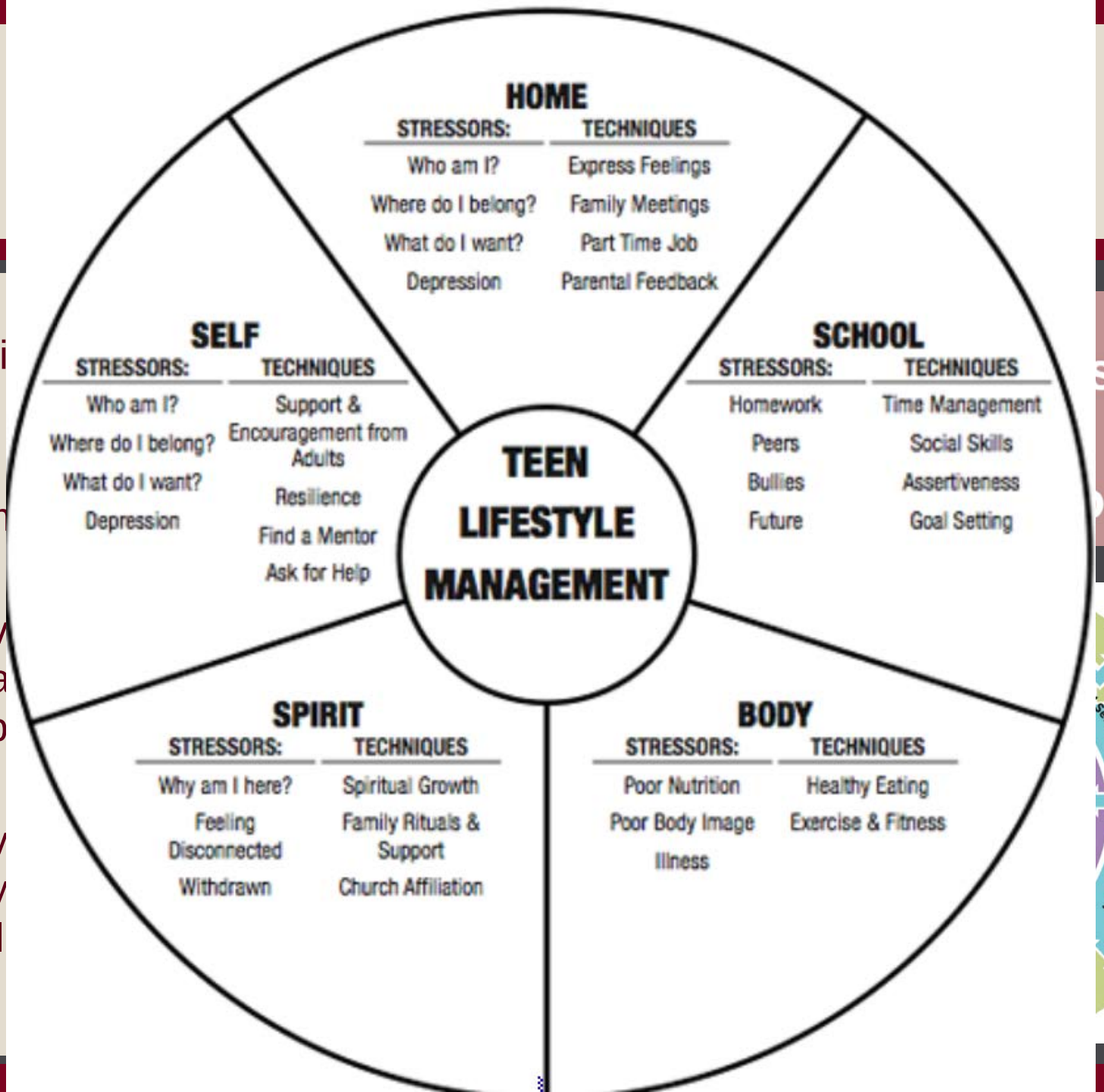


THREE MAIN CONCEPTS
The Adolescent Brain ...

1. IS UNDER CONSTRUCTION
   - Maturity: Adult Brain > Adolescent Brain
   - Balance: Childhood Brain > Adolescent Brain

2. NEEDS MODELS
   - Plasticity: Adolescent Brain > Adult Brain
   - This is not a time to back off
   - Opportunities for trial and error are important
   - The adult brain is on loan to the adolescent brain

3. CRAVES REWARD, PURPOSE AND BELONGING
   - Highly responsive to reward
   - Signifies an incredible time of opportunity

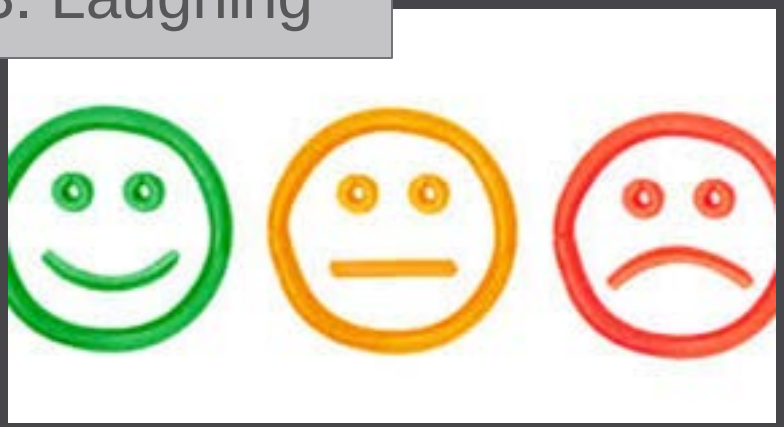

HOME
STRESSORS:
Who am I?
Where do I belong?
What do I want?
Depression
TECHNIQUES
Express Feelings
Family Meetings
Part Time Job
Parental Feedback
SELF
STRESSORS:
Who am I?
Where do I belong?
What do I want?
Depression
TECHNIQUES
Support & Encouragement from Adults
Resilience
Find a Mentor
Ask for Help
SCHOOL
STRESSORS:
Homework
Peers
Bullies
Future
TECHNIQUES
Time Management
Social Skills
Assertiveness
Goal Setting
TEEN LIFESTYLE MANAGEMENT
SPIRIT
STRESSORS:
Why am I here?
Feeling Disconnected
Withdrawn
TECHNIQUES
Spiritual Growth
Family Rituals & Support
Church Affiliation
BODY
STRESSORS:
Poor Nutrition
Poor Body Image
Illness
TECHNIQUES
Healthy Eating
Exercise & Fitness

The Adolescent Brain Needs

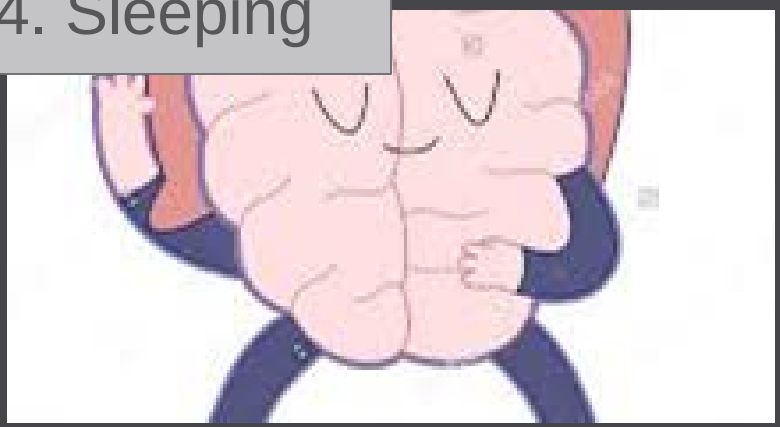
1. Building

2. Connecting

3. Laughing



4. Sleeping



THE BRAIN

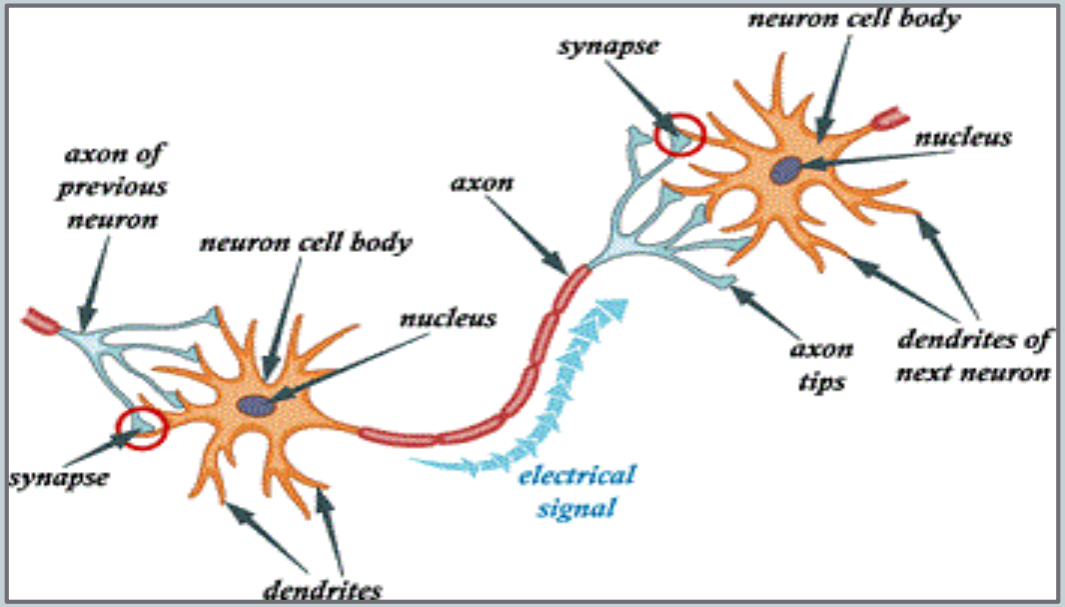
1. **Our brain's job is that of a learning machine.**
   - The brain adapts
   - The brain is structured and restructured by interactions with our environments
2. **The "use it or lose it" principle applies to brain development.**
   - Neural connections that remain are the ones used
   - Sensitive Periods – experiences have greater impact
3. **The sensitivity of the brain to respond to experience is referred to as neuroplasticity.**
   - Education seeking positive/sustained behavioral changes relies on neuroplasticity.
   - Change is possible at the neurobiological level - any behavioral change is in fact a brain-based one

LEARNING

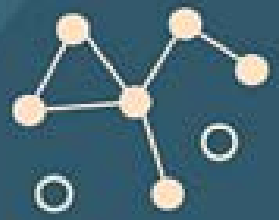
1. **LEARNING: modification of neural networks**

2. **NEUROPLASTICITY: capacity to grow new neurons and form new neuronal connections throughout life**

NEURAL SYSTEMS

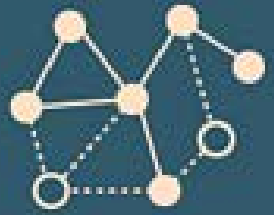


HOW THE BRAIN CHANGES



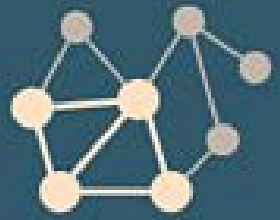
NEUROGENESIS

Continuous generation of new neurons in certain brain regions



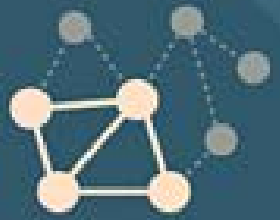
NEW SYNAPSES

New skills and experiences create new neural connections



STRENGTHENED SYNAPSES

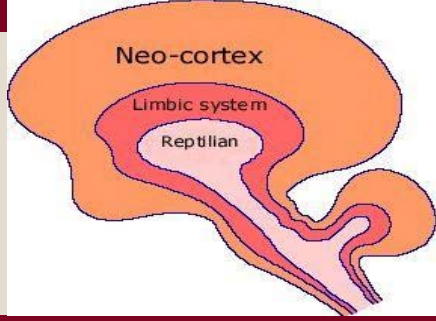
Repetition and practice strengthens neural connections



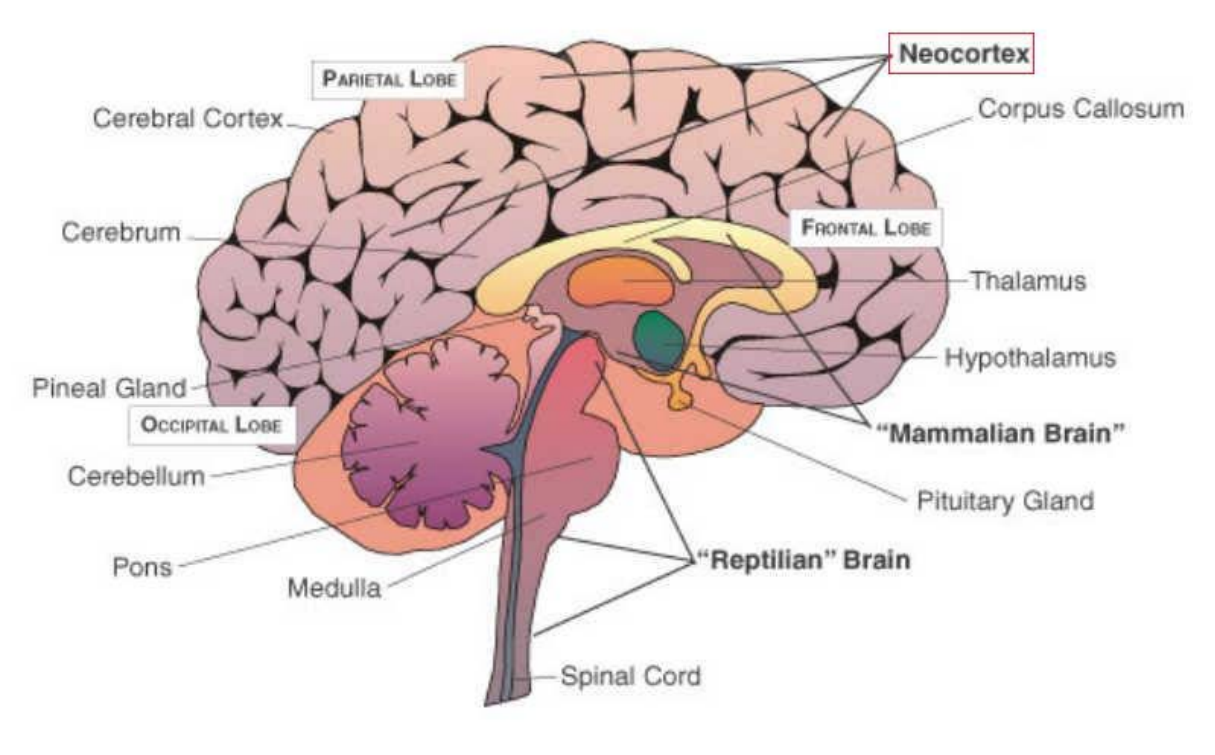
WEAKENED SYNAPSES

Connections in the brain that aren't used become weak

TRIUNE BRAIN



In adolescence key structural and functional changes take place in the limbic system and the neocortex, such as the frontal lobe (prefrontal cortex).

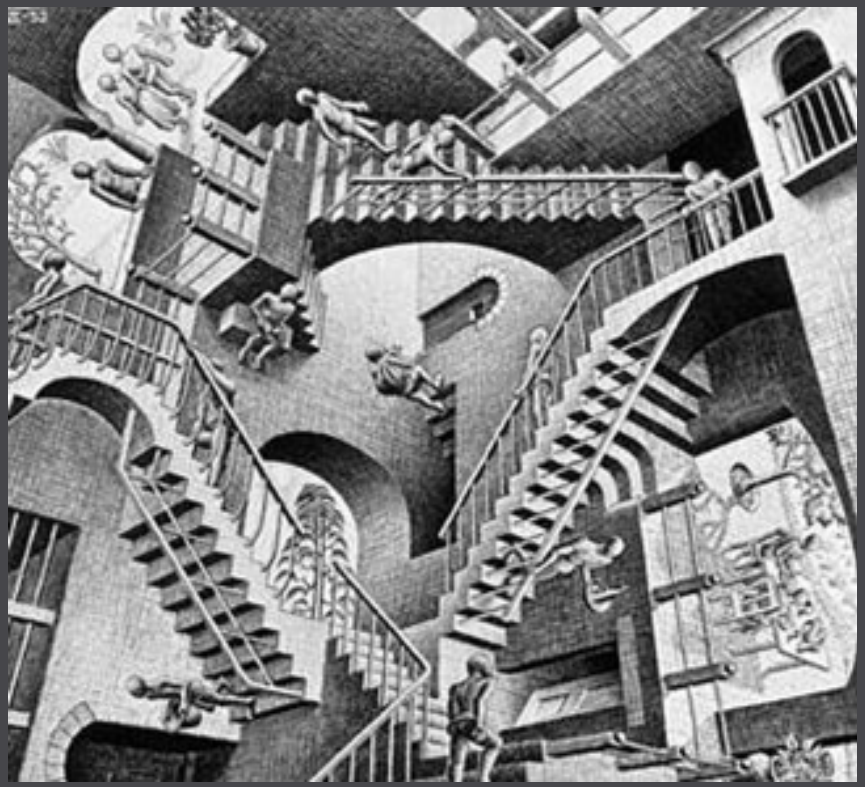


The brain of a six-year-old child is already 90-95% the size of an adult brain.

GROWTH ON PLATFORM 9 ¾

EXPECTATIONS

EXPERIENCE



Changes in the Adolescent Brain

1. Parts of the brain that control planning, decision making, impulse control, language, memory and reasoning have developed prior to puberty

2. Adolescent brain undergoes another period of overproduction of gray matter just prior to puberty and then a second version of pruning

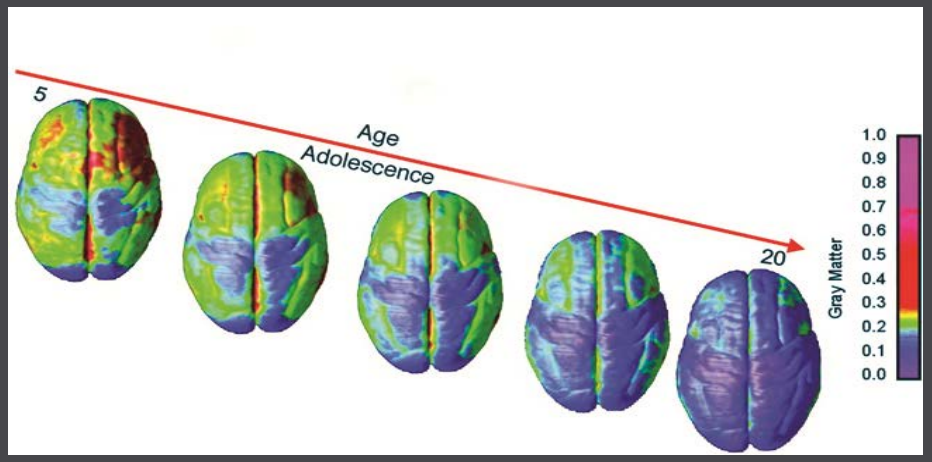
3. “Higher order” brain centers, like the prefrontal cortex, that inhibit risky behavior do not fully develop until young adulthood

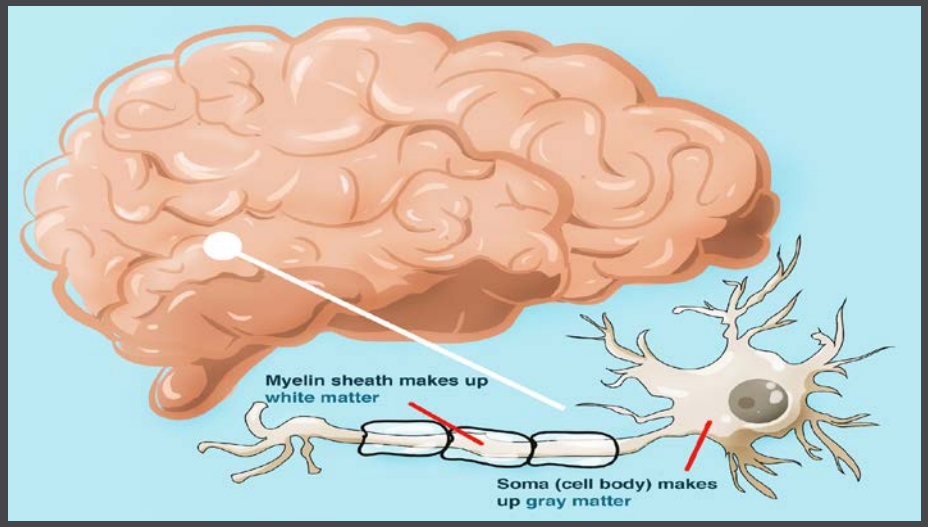
ADOLESCENT BRAIN SHOWS DECONSTRUCTION & RECONSTRUCTION

1. Pruning **gray matter volume is decreasing** and weak synaptic connections are being eliminated (especially frontal lobe 15% pruned) (Giedd 2004, Lebel et al. 2012).

1. **White matter fiber tracts continue to develop** and myelination allows for more efficient/timely communication between brain regions (Giedd 2004, Lebel et al. 2012).

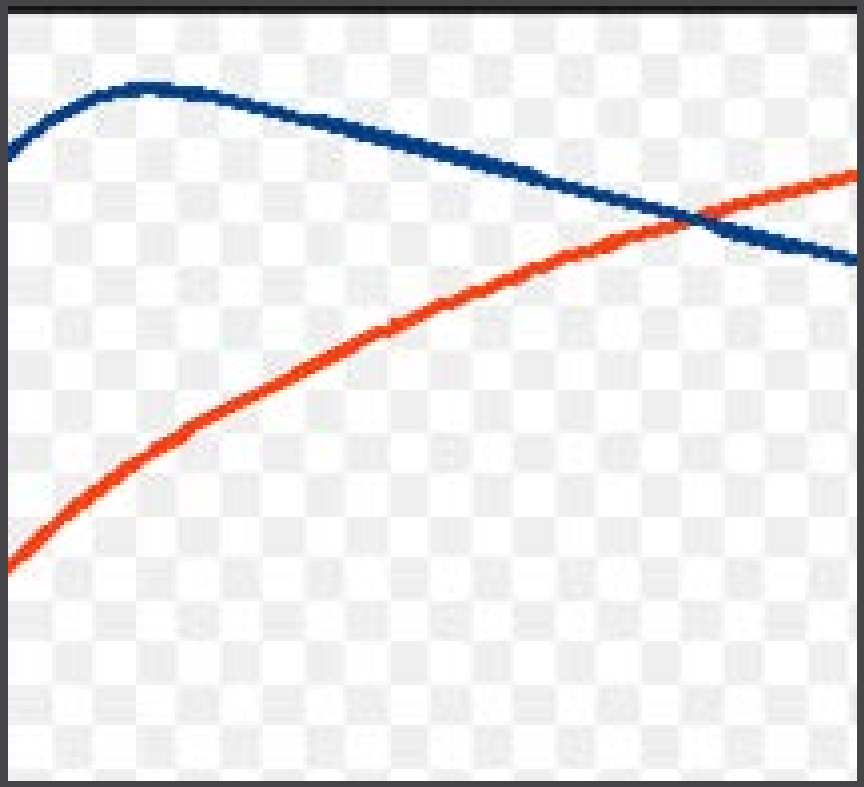
1. **Temporal specificity pattern** and brain regions important for higher-order cognitive functioning (e.g., frontal-subcortical brain regions) reach peak maturity last compared to lower-order sensorimotor regions (Stiles & Jernigan 2010).





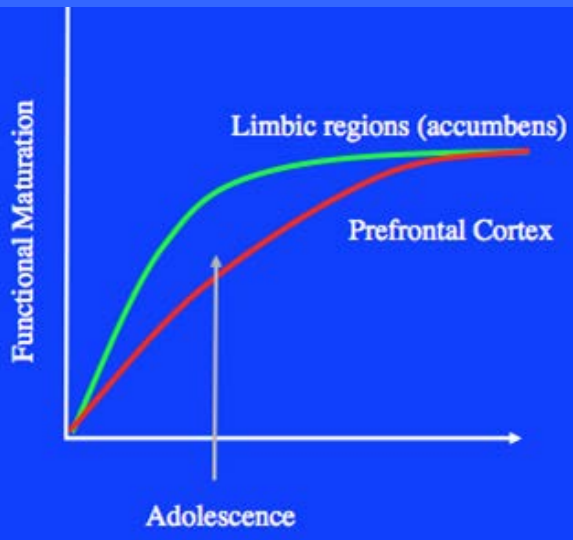
BRAIN DEVELOPMENT IS NONLINEAR

Brain Regions and Behavior



Feeling vs. Thinking

Development of Earlier Subcortical Limbic Regions versus Protracted Prefrontal Control Regions



Casey, B. J. (2007). Insights into the Adolescent Brain from Functional Neuroimaging Studies
http://archives.drugabuse.gov/meetings/translatinginsights/adolescent_brain.html

WOULD YOU…

BITE ON A LIGHTBULB?

SIGNIFICANCE OF NONLINEAR DEVELOPMENT

1. There is differential development of bottom-up limbic systems, implicated in incentive and emotional processing, to top-down control systems (compared to childhood and adulthood).

1. Decision-making relies on limbic regions more so than frontal executive regions.

2. During adolescence there is a heightened responsiveness to incentives and socio-emotional contexts during this time, when impulse control is still relatively immature.

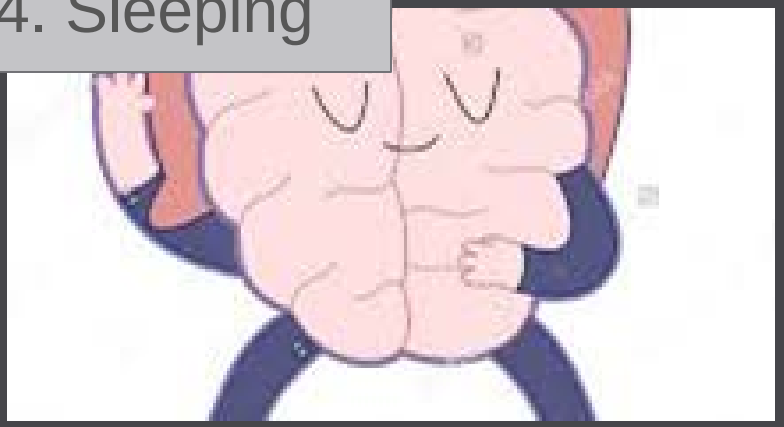
FUELING RESILIENCE IN ADOLESCENCE

1. Building

2. Connecting

3. Laughing

4. Sleeping



ADULT AND ADOLESCENT BRAIN

DRS. ADRIANA GALVAN AND ABIGAIL BARD

ADULT BRAIN	ADOLESCENT BRAIN
1. Reward center – the nucleus accumbens active (dopamine – exciting/pleasurable)	1. Do not get pleasure out of things they find mildly/moderately rewarding
1. Brain scans revealed quick visualization of scenarios, distress and aversion (automatic)	1. Did not have different responses but response took longer (they were thinking about it, not feeling it)
1. Less influenced by the group when making decisions	1. Are afraid of the possibility of having their preferences displayed – enough that the brain is signaling distress and danger
1. Amygdala registers facial expressions + frontal lobe finds the meaning	1. Amygdala registers facial expressions but frontal lobe cannot accurately identify them

SERVE AND RETURN RELATIONSHIPS

SECURE AND INSECURE ATTACHMENT

- **How do secure attachments seem to build the brain?** (Cozolino, 2014)
  - ✓Optimize network integration, autonomic arousal and positive coping strategies – regulation of the systems early in life becomes established
  - ✓Organizes patterns of arousal, stress reactivity, and interpersonal behavior

- **How do insecure attachments build the brain?** (Cozolino, 2014)
  - The role of the physiological stress reaction – insecurely attached individuals more a measure of arousal than a form of coping

ADOLESCENT BRAIN AND RELATIONSHIPS

(CASEY ET AL., 2008)

1. Need adults to help model/regulate emotions (not parents just backing off)
2. Remember then that the immature (adolescent brain) uses the mature (adult) brain for mood regulation, impulse control, judgment, and moral reasoning.

LONELINESS AND THE NEED FOR HUMAN CONNECTION
(CACIOPPO & PATRICK, 2008)

1. People who lack social support are more prone to a variety of ailments.
   - An analysis of 148 of these studies suggests that social isolation increases the risk of death about as much as smoking cigarettes and more than either physical inactivity or obesity (Miler, 2011).
2. Lonely people also have elevated molecular markers of stress.
   - Cortisol and epinephrine are elevated in saliva and urine, respectively, lonely people report feeling more stressed in situations most people experience as only moderately stressful.
     - Boosts the body's fight-or-flight responses.
     - Prepares the body for some looming threat. Quality of sleep is also not as good.
3. In the fMRI study those who reported loneliness exhibited less activation in the ventral striatum, a component of the brain's reward circuitry, when they viewed pictures of smiling faces.

THE HEART-BRAIN CONNECTION: THE NEUROSCIENCE OF SOCIAL, EMOTIONAL, AND ACADEMIC LEARNING

DR. RICHARD DAVIDSON

Summary and conclusions

- The brain is plastic, built to change in response to experience
- The prefrontal cortex is key and is a convergence zone for affect and cognition; negative emotion will interfere with cognitive prefrontal function
- Social-emotional learning is an empirically verified strategy to improve skills of emotion regulation and social adaptation
- As such, social-emotional learning likely produces beneficial brain changes
- Education literally shapes the child's brain and likely produces alterations that lay the foundation for all future learning, emotion regulation and social functioning

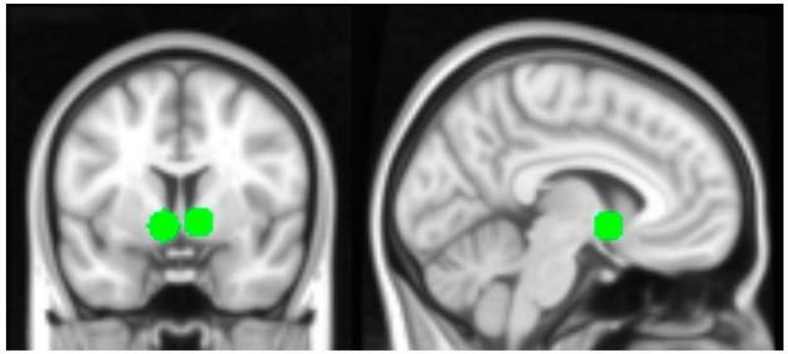
Emotional Attunement & Learning

1. Mirror neuron systems (so far discovered in frontal and parietal lobes) – social and skill-based behaviors to be automatically transferred from one animal to another across the social synapse
   - The brain automatically connects these behaviors with a goal, motivate and reinforce the behavioral sequence leading to it
   - Mirror neurons are important in the establishment of language (to grasp = to understand)
2. Being connected to others is good, but also lets us become "infected" by others' feelings – adult phobias and facial expressions, teachers' fatigue or stress
3. Teacher expectations can greatly influence student achievement (Pygmalion in the Classroom) and academic self-concept
   - "Students will not remember what you said, but they will remember how you made them feel" (Cozolino, 2013, p.154)
   - Why? Prefrontal cortex: pairs positive social experiences with feeling good/optimism (and reward circuitry).

THE BRAIN & SOCIAL MEDIA/TECHNOLOGY

- UCLA study (2016)
  - More “likes” = heighted reward responses
  - “Likes” of risky behaviors/images = less executive function involvement (e.g., the brakes)
- More texting = less time to process faces and practice regulatory mechanisms (e.g., serve and return, conversation, balance of limbic and frontal activity)

1. TV no longer at pace of life
2. Learning Works for Kids online games by skill area



Lauren Sherman/UCLA

Two views of the brain with the nucleus accumbens, a hub of the brain’s reward circuitry, highlighted in green. This region was more active when teenagers saw that their own photographs, and those of others, had been “liked” by more peers. Past research suggests that this region is particularly sensitive in adolescence.

UCLA Children’s Digital Media Center

HIGH SCHOOL RECESS

MHS UNPLUGGED & EDUCATION RESOURCES AT EDUTOPIA

MHS Unplugged is a 15-minute recess period every day for all Montpelier High School students. Recess includes activities that are student- or teacher-led, like yoga, meditation, Frisbee, basketball, jam band, and art projects. Students unplug from the curriculum, from stress, and from electronics during these 15 minutes. The short break provides them an opportunity to connect with one another and teachers in a new way, and as a result, students feel more productive and more connected to the school community.

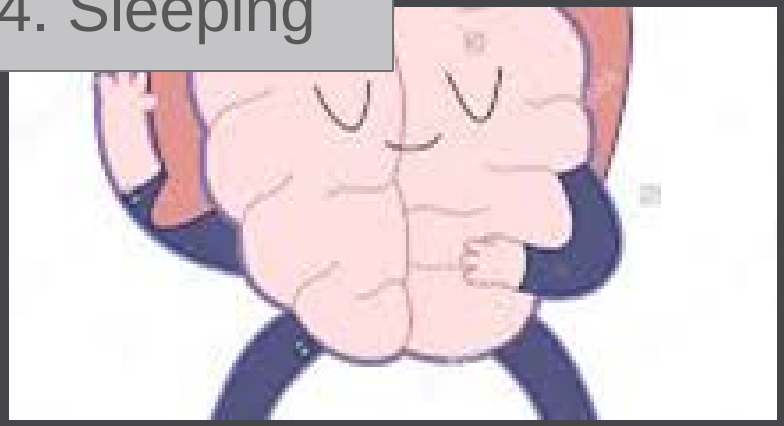
FUELING RESILIENCE IN ADOLESCENCE

1. Building

2. Connecting

3. Laughing

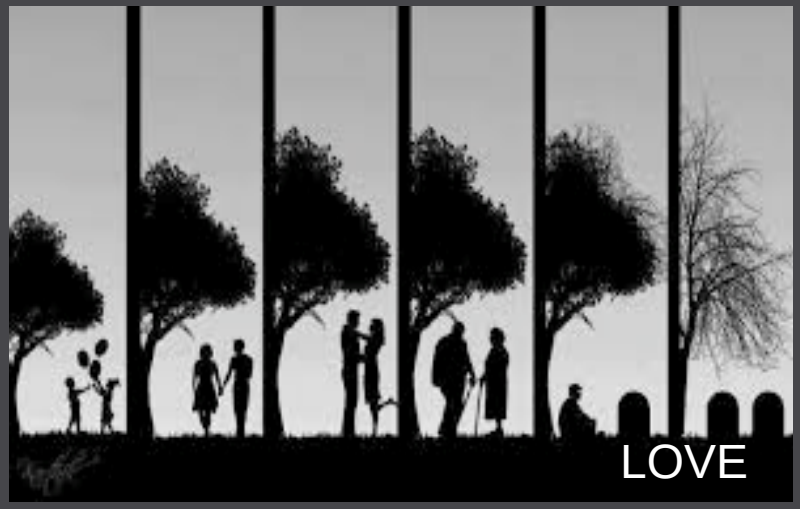
4. Sleeping



POSITIVE EMOTION

SELECTED BECAUSE MAXIMALLY DISTINCT & CROSS-CULTURAL

(Fredrickson, 1998)



BROADEN-AND-BUILD THEORY OF POSITIVE EMOTIONS

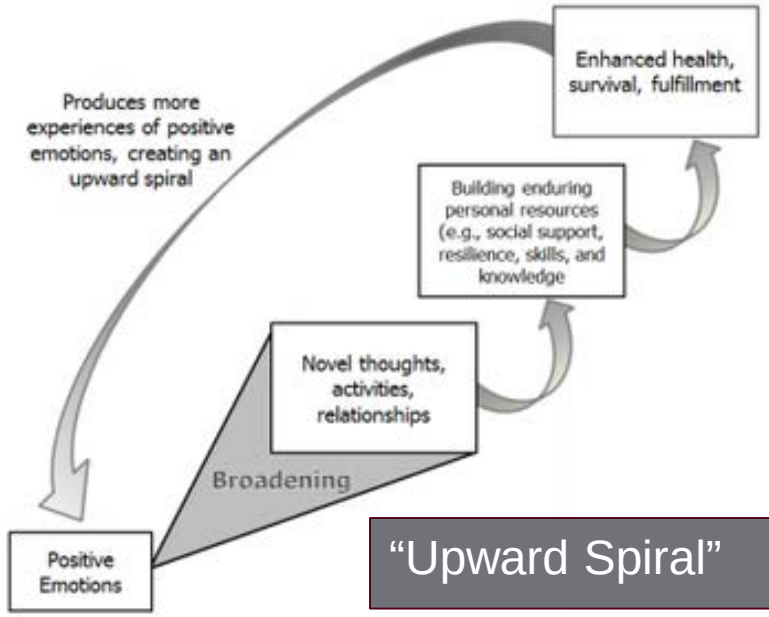
Barbara L. Fredrickson: "As a product of recurrent play, **joy** can have the incidental effect of building on individual's physical, intellectual, and social skills. Importantly, these new resources are durable and can be drawn on later, long after the instigating experience of joy has subsided."

(Fredrickson, 1998, 2004; Garland & Fredrickson, 2010)

Broadens our Scope of…

1. Attention
2. Cognition
3. Action

Fredrickson & Cohn, 2008, Figure 48.1).



"Upward Spiral"

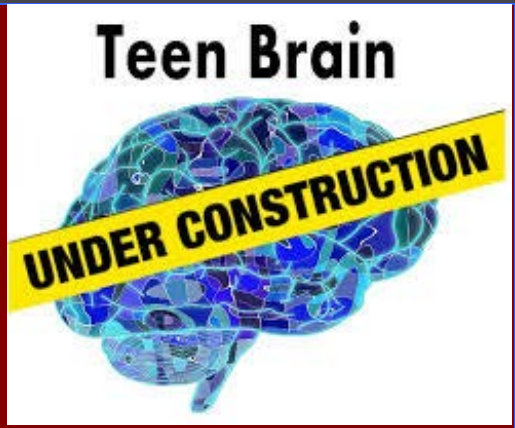
Resource Building…

1. Physical
2. Intellectual
3. Social

Theory points to positive emotions perhaps protecting health and effects of negative emotions.

REWARD AND THE TEEN BRAIN

- Adolescence is a time of increased dopamine release
- Dopamine is involved in all behaviors and substances that are addictive
- The teen years are a time of susceptibility to addiction



- Teens are more likely to experiment with new experiences and more likely to respond with a very strong dopamine release can become part of an addictive cycle
- If alcohol wears off then dopamine plummets (need more of it for the same response in the future)
- Foods with a high glycemic index (processed foods, bread) lead to a rapid rise in blood sugar, rise in dopamine levels, activation of reward circuitry

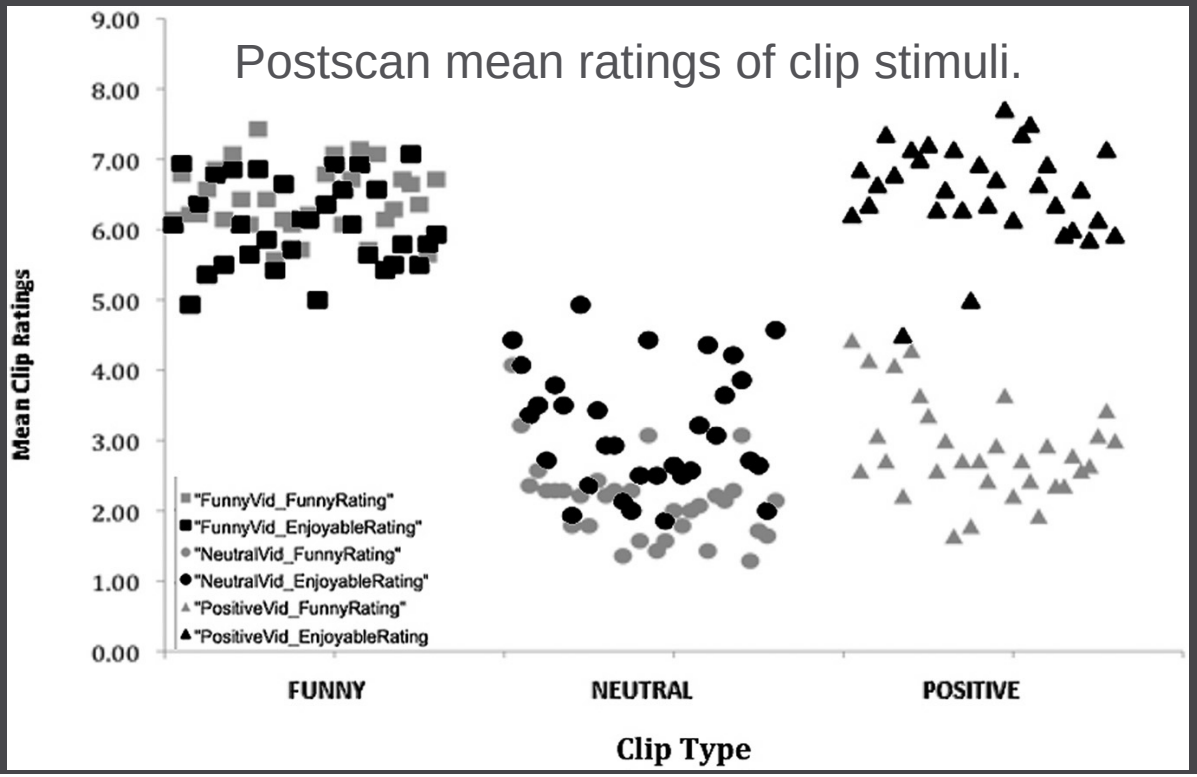
HUMOR RESEARCH

- Less (neuroscience) research attention is paid to elucidating the development and function of positive affective states such as humor relative to work examining negative affective states like fear and sadness.

- The paucity of attention paid to positive emotion and humor in neuroscience is surprising given findings from other fields suggesting that, for example, humor
  - is critical to adaptive social functioning
  - plays an essential role in positive mental health
  - aids in coping, acts as a natural stress antagonist,
  - and enhances adaptive cardiovascular, immune, and endocrine responses.

(For review see Vritcka, Black, & Reiss, 2013)

HUMOR CONDITION
TWO CONTROL CONDITIONS (NEUTRAL AND POSITIVE)

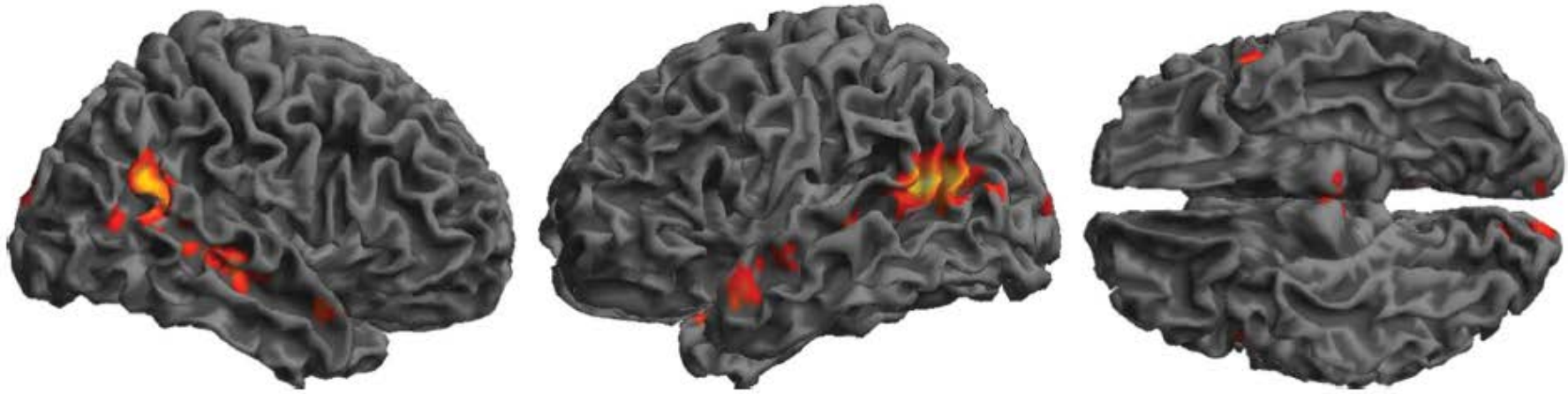


The results of aggregated postscan ratings demonstrate that with few exceptions, clips were assessed in general agreement with the Pilot 1 and Pilot 2 participants' evaluations. Gray symbols represent funny ratings; black symbols resent enjoyable ratings. Funny, Neutral, and Positive clips are represented by squares, circles, and triangles, respectively.

(Neely et al. J Neuro, 2012)

HUMOR PROCESSING: TWO STAGES

In this image we see the functional (activation) data (funny > positive) from our child group sample (N=22) overlaid on a single-subject anatomical brain template.



The **first stage** (cognitive humor component) involves the detection and resolution of incongruity, and is associated with activity in temporo-occipito-parietal brain areas (TOPA).

The **second stage** (emotional humor component) includes the positive feelings related to mirth/reward. This is linked with reward-related activity in mesocorticolimbic dopamingeric circuits.

RESILIENCE

EMOTIONAL AND COGNITIVE CONSIDERATIONS

Those who are resilient tend to be flexible

1. **These individuals do not rely on just one pattern of coping (*cross-training*)**

1. **They use cognitive reappraisal – positive reappraisal (find meaning), gratitude, humor**

   - fMRI: reappraisal of negative situations relies on PFC (cognitive control) and reduced amygdala activation

   - fMRI: humor shows nucleus accumbens, amygdala and ventromedial PFC (cognitive appraisal, reward, motivation)

Southwick & Charney, 2018

FUELING RESILIENCE IN ADOLESCENCE

1. Building

2. Connecting

3. Laughing

4. Sleeping

SLEEP STUDIES SNAPSHOT

1. Sleep is **required for healthy and adaptive neurobehavioral and psychosocial functioning** throughout the life course.

1. Sleep is **restorative**, facilitates **memory** consolidation, improves **immune function**, and **regulates emotional responses**.

1. **Sleep deprivation**, whether due to sleep disorders or other life conditions and transitions, **is a significant risk factor** for negative developmental outcomes at all stages in the life course.

(for review see Black, ESW, 2016)

SLEEP
SAPOLSKY (2004)

1. Brain is 3% of body weight and needs 25% of the energy

2. The brain does not seem to conserve energy well and slow wave sleep is needed to “restock” the depleted energy reserve that you experience through the day.

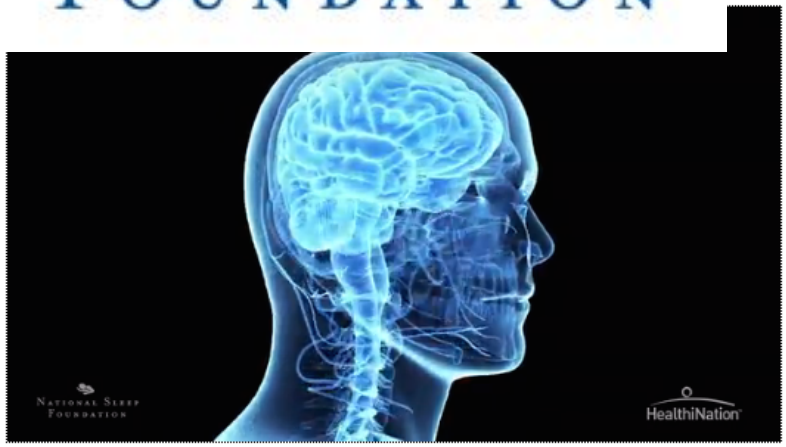
SLEEP STATISTICS ON ADOLESCENCE

(BRONSON AND MERRYMAN, 2009)

- The majority of US parents (90%) think that their child is getting enough sleep (National Sleep Foundation).
- The majority of US high school students (60%) report daytime sleepiness.
- Somewhere between 20-33% of US high school students report falling asleep in class at least once a week.
- One study suggests half of US high schoolers are getting about 6.5 hours per night and only 5% are getting the recommended 8 hours.
- One study found 94% of high schoolers set their own bedtimes.

SLEEP DISORDERS AND STATISTICS

NATIONAL SLEEP FOUNDATION



~1/2 of teenagers fall asleep in class at least once a week

THE BRAIN, BODY AND SLEEP

1. Neurons lose their plasticity without enough sleep, and the brain can forget what it just learned

1. Young people may be inattentive because the sleep loss negatively impacts the body's ability to extract glucose from the bloodstream – this basic energy is needed for the prefrontal cortex (impulse control, executive function, abstract reasoning, difficulty coming up with new solutions)

1. Sleep deprivation affects the hippocampus (positive emotions, memories) more than the amygdala (negative emotions, memories).

2. Sleep loss increases gherlin (appetite up) and decreases leptin (suppressed appetite). It increases cortisol (lipogenic increases fat).

1. Human growth hormone is affected, and HGH breaks down fat.


Distractibility
Poor attention span
Poor organizational skills
Poor motivation
Irritable
Easily frustrated
Depression
Anxiety
Defiance
Insufficient sleep

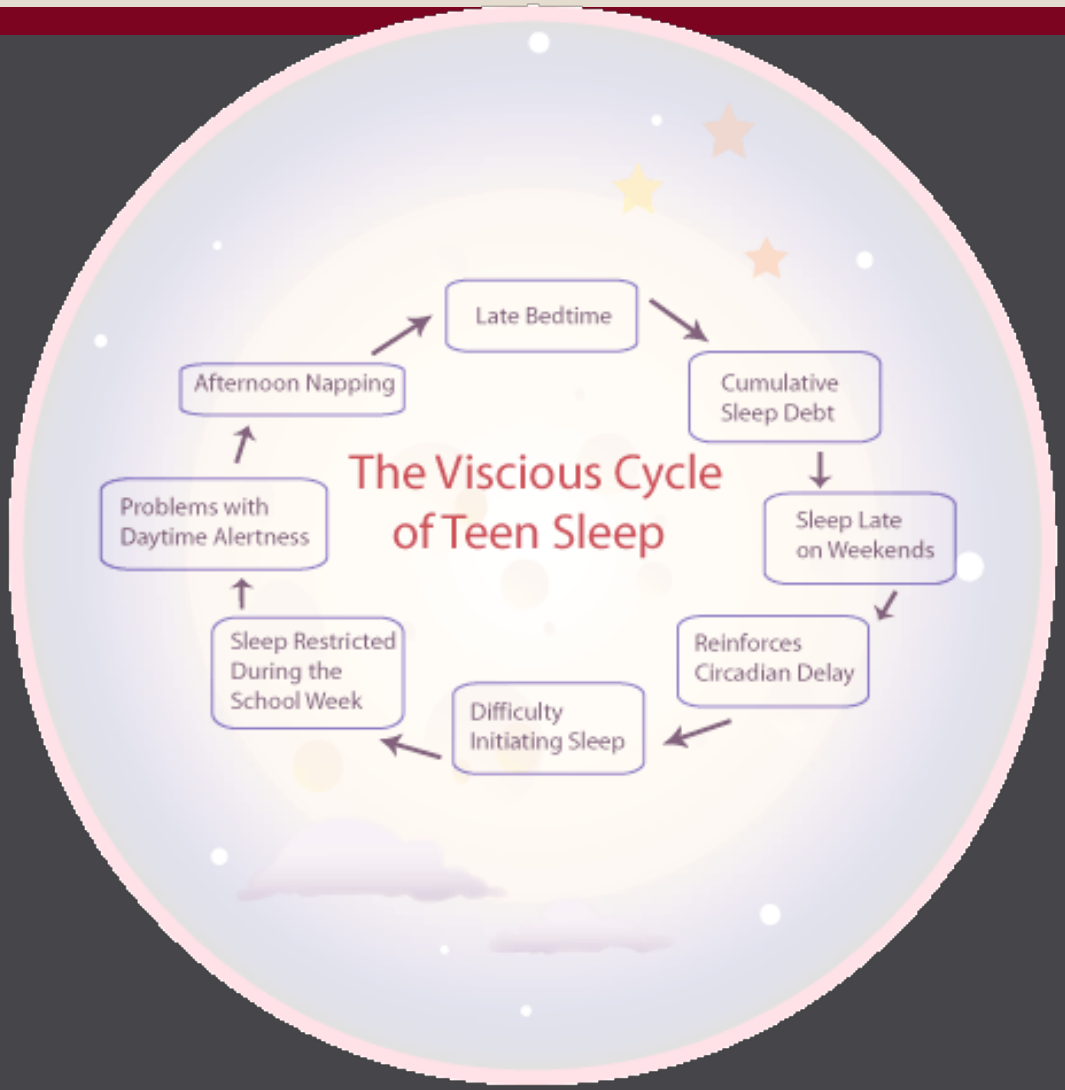
THE ROLE OF SLEEP IN EARLY ADOLESCENCE

(SOFFER-DUDEK ET AL., 2011)

- Emotion processing is a key aspect of social competence
- Sleep and facial information processing was assessed among 94 healthy children (age 10 at Time 1)
- Facial information was processed under neutral (gender) and emotional (expression) conditions.

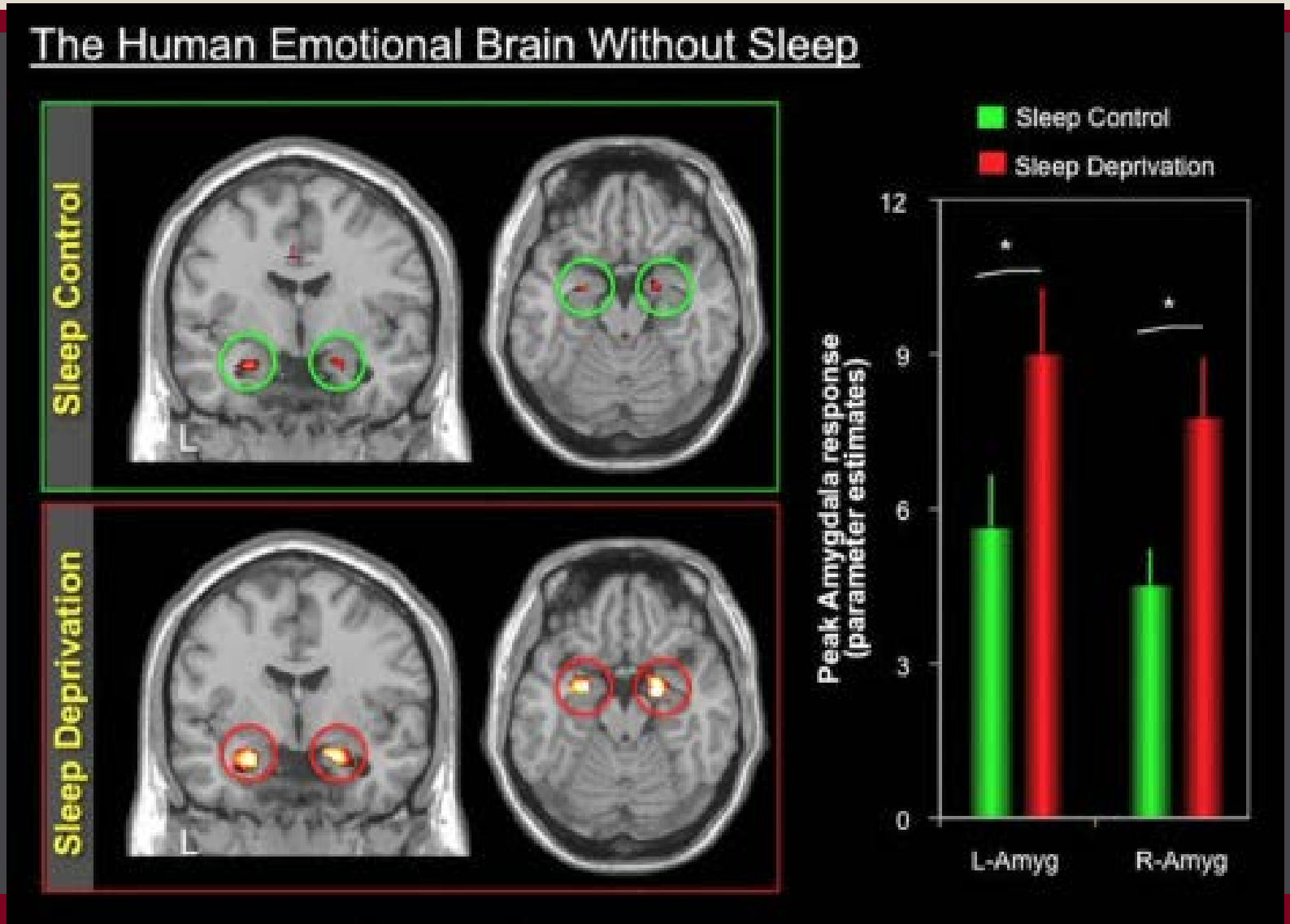
1. Findings suggest that elevated night wakening and decreased sleep efficiency significantly predicted poor performance on the emotional processing task but not the neutral task.
2. Poor sleep is associated with compromised emotional information processing during adolescence.
3. Adolescence is a sensitive period for socio-emotional development.

ADOLESCENT SLEEP



- Shifts in circadian rhythms cause teens to be more alert late at night and to wake later in the morning.
- Risks of sleep deprivation include:
  - Police-reported traffic collisions
  - Substance use, including caffeine, nicotine, and alcohol
  - Misdiagnosis for ADHD

SLEEP DEPRIVATION IS STRESSFUL



SLEEP HYGIENE

- SCHEDULE: Keep a consistent sleep schedule. (Get up at the same time every day, even on weekends or during vacations.)
- BEDTIME: Set a bedtime that is early enough for you to get the minimum amount of sleep recommended for your age group.
- TIMING: Don’t go to bed unless you are sleepy.
- LIMIT: If you don’t fall asleep after 20 minutes, get out of bed.
- ROUTINE: Establish a relaxing bedtime routine.
- HABITS: Bed is for sleep.

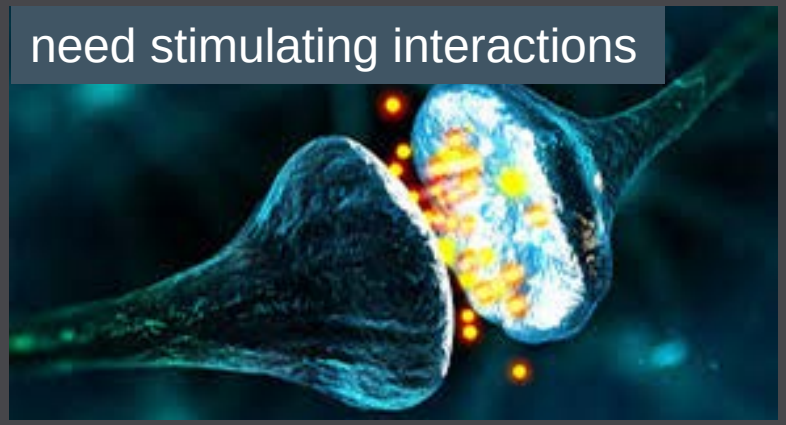
http://sleepeducation.org/essentials-in-sleep/healthy-sleep-habits

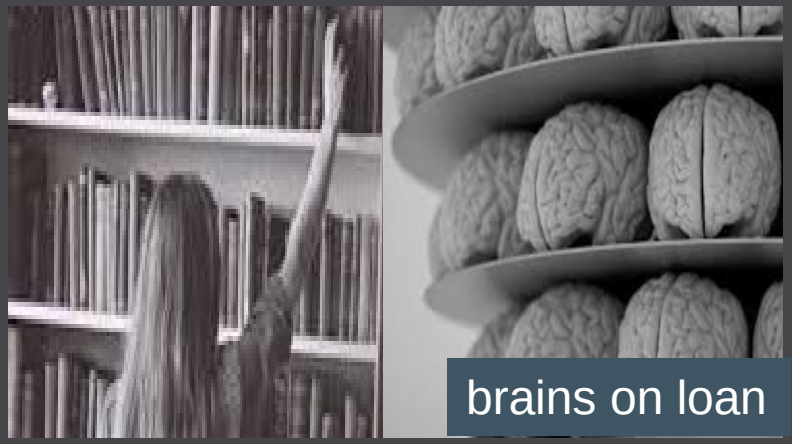
SLEEP HYGIENE

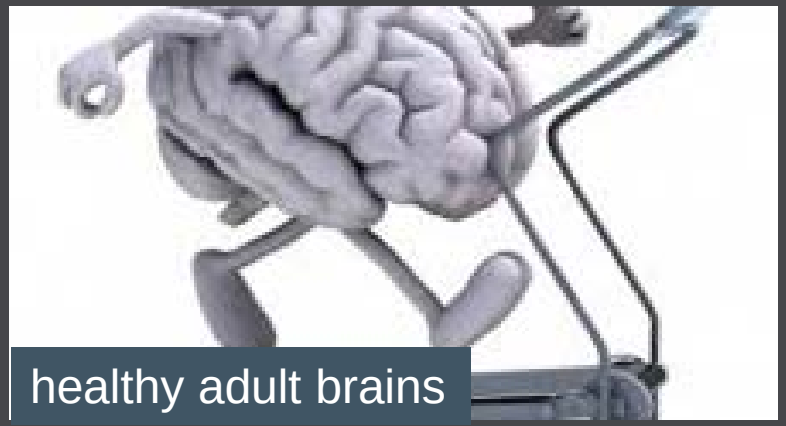
- CLIMATE: Make your bedroom quiet and relaxing. Keep the room at a comfortable, cool temperature.
- LIGHT: Limit exposure to bright light in the evenings
- ELECTRONICS: Turn off electronic devices at least 30 minutes before bedtime.
- EXERCISE: Exercise regularly and maintain a healthy diet.
- CAFFEINE: Avoid consuming caffeine in the late afternoon or evening.
- FLUID: Reduce your fluid intake before bedtime.
- FOOD: Don’t eat a large meal before bedtime. If you are hungry at night, eat a light, healthful snack.

http://sleepeducation.org/essentials-in-sleep/healthy-sleep-habits

SUMMARY
OUR SOCIAL BRAINS ARE BUILT, NOT BORN







IMPORTANCE OF BALANCE FOR BRAIN DEVELOPMENT

BOUNDARIES, LIMITS AND CONSEQUENCES

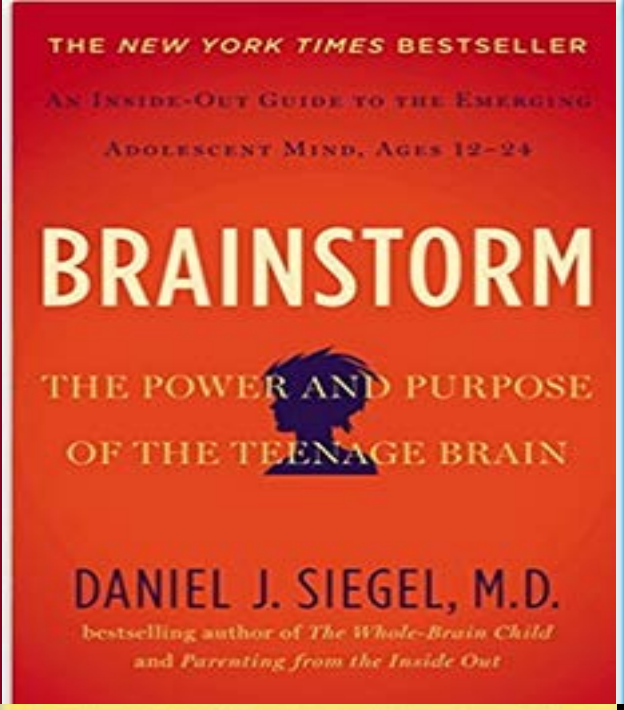
POSITIVE ACTIVITIES AND SOCIAL INFLUENCES

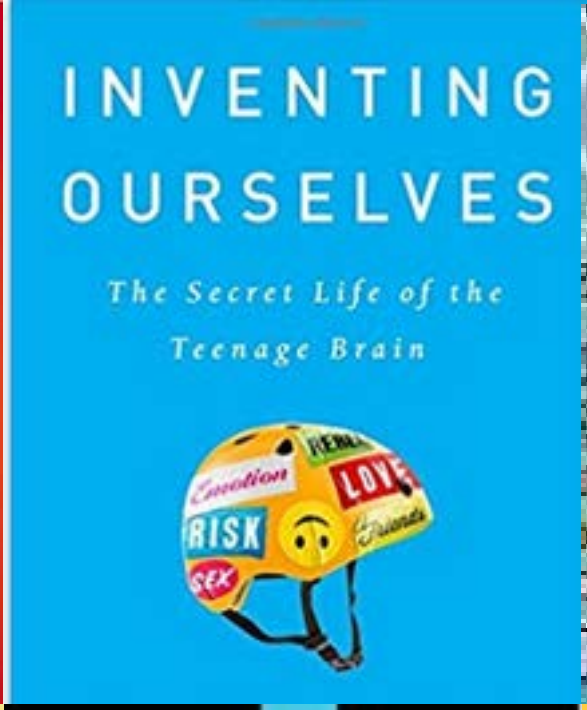
HEALTHY RISK-TAKING AND CREATIVITY

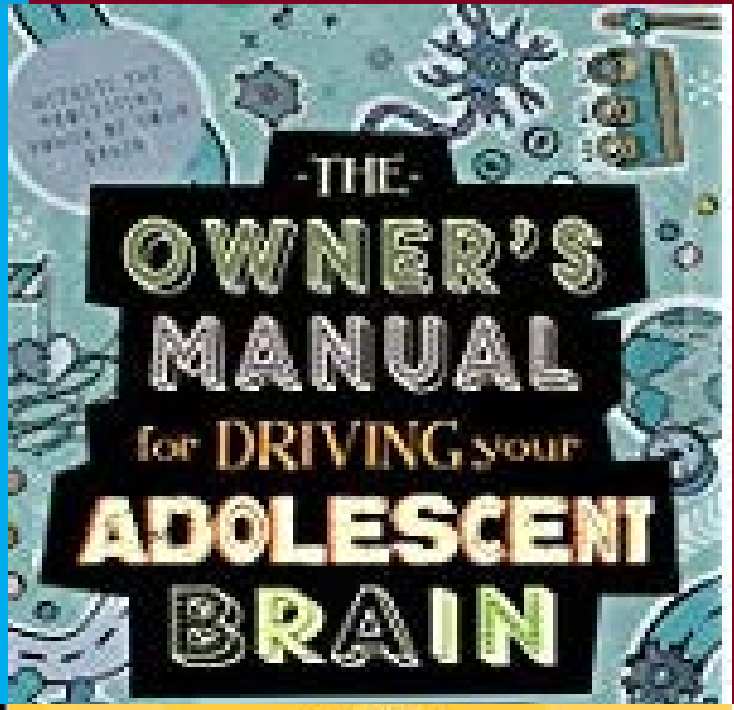
LEARN AND PRACTICE REAL-LIFE SKILLS

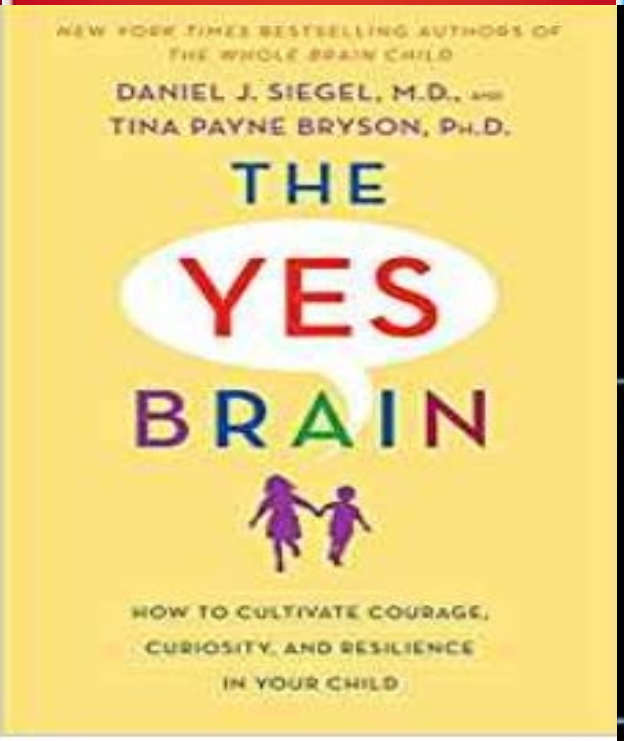
EDUCATIONAL NEUROSCIENCE RESOURCES

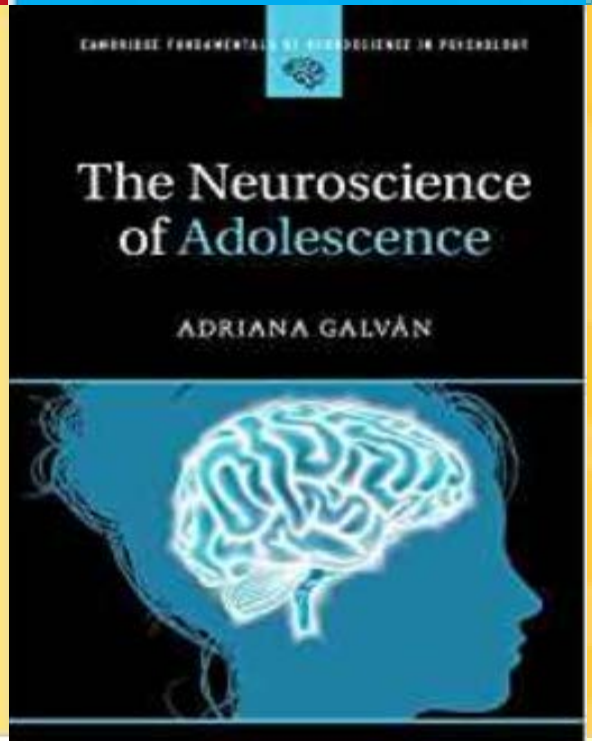
1. Brain Facts
2. Neuroscience for Kids
3. Edutopia: Learning and the Brain
4. Learning and the Brain Conference
5. Mind, Brain and Education (Journal)
6. Trends in Neuroscience and Education (Journal)

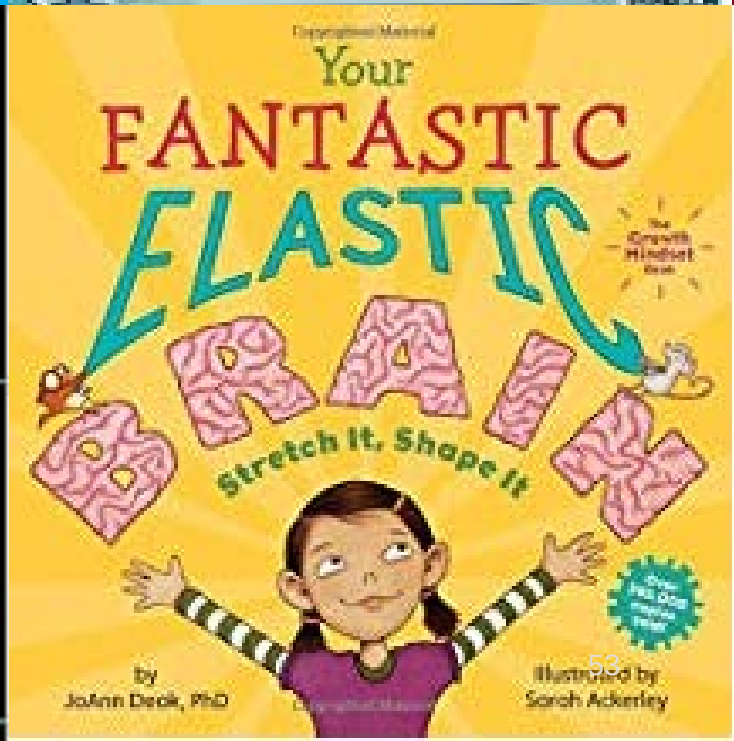

THE NEW YORK TIMES BESTSELLER
AN INSIDE-OUT GUIDE TO THE EMERGING ADOLESCENT MIND, AGES 12–24
BRAINSTORM
THE POWER AND PURPOSE OF THE TEENAGE BRAIN
DANIEL J. SIEGEL, M.D.
bestselling author of The Whole-Brain Child and Parenting from the Inside Out


INVENTING OURSELVES
The Secret Life of the Teenage Brain
Emotion
LOVE
RISK
SEX


-THE-
OWNER'S MANUAL
for DRIVING your
ADOLESCENT BRAIN


NEW YORK TIMES BESTSELLING AUTHORS OF THE WHOLE BRAIN CHILD
DANIEL J. SIEGEL, M.D., AND TINA PAYNE BRYSON, PH.D.
THE YES BRAIN
HOW TO CULTIVATE COURAGE, CURIOSITY, AND RESILIENCE IN YOUR CHILD


The Neuroscience of Adolescence
ADRIANA GALVÁN


Your FANTASTIC ELASTIC BRAIN
Stretch It, Shape It
by JoAnn Deak, PhD
Illustrated by Sarah Ackerley

TALKS ON RESEARCH ON THE ADOLESCENT BRAIN

- Dr. Adriana Galvan (10 min)
- Dr. Sarah-Jayne Blakemore (15 min)
- Dr. Dan Siegel (1 hr. 30 min)
- Dr. Richard Davidson (30 min)
- Dr. Jill Bolte (15 min)
- Dr. Abigail Baird (1 hr.)
- Dr. B.J. Casey (30 min)
- PBS Inside the Teenage Brain (1 hr.)
- NPR: The Teen Brain: It's Just Not Grown Up Yet (5 min)

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THANK YOU!

Question & Answer

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