A Parents Guide to the Teen Brain

Using **CBT** and neuroscience to understand, **teach**, and **strengthen** the adolescent brain

A presentation for The StudyPro

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Overview

Development: **back to front**, **incomplete** wiring, **neurotransmitters**, hormones and more

Logic & reasoning: **emotions are amplified.** Bigger, more intense, and more reactive emotions. **Pleasure in risk.**

Peers matter: **So much.** Safety, status, risk. Dopamine. **Dopamine.** Dopamine.

Teen brain is both **amazing** and **vulnerable.**

CBT naming **FEELINGS**, education, **emotional regulation**, and coping skills.

E L I S A N E B O L S I N E

Four Tasks of Adolescence

Safety

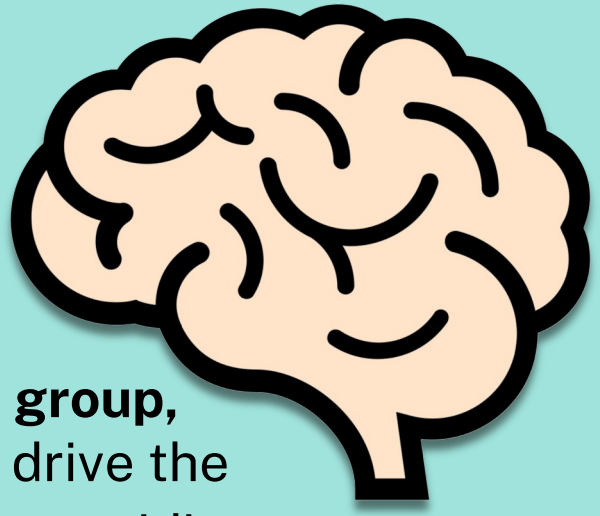
Sexuality

Status

Independence

The Teen Brain is AMAZING

Teens can ↑ their **IQ** during adolescence (they can also lower it)



The teen brain is **built for learning**. More vulnerable but better able to learn and change

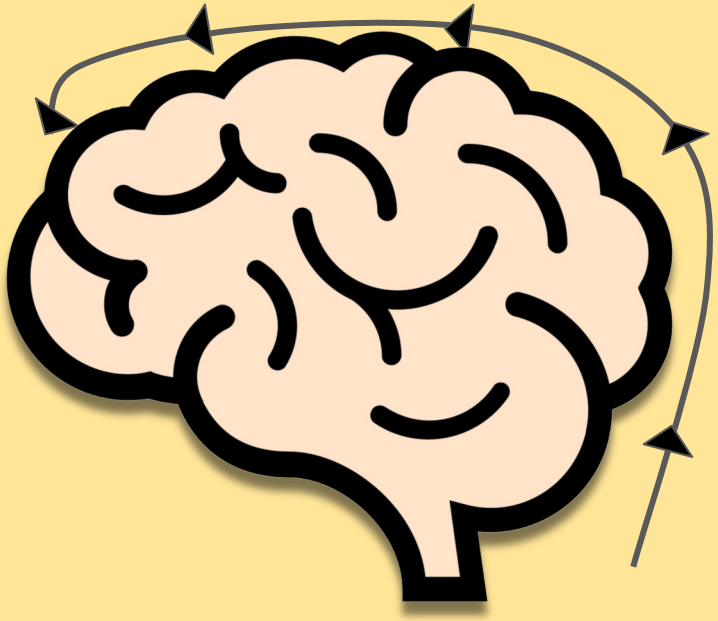
Connection, finding a **group,** and seeking **STATUS** drive the brain with **dopamine** providing the motivation

The teen brain is not a child's brain nor that of an adult. It is **unique** and **distinct** from both.

Teen Brain Development

Back to Front

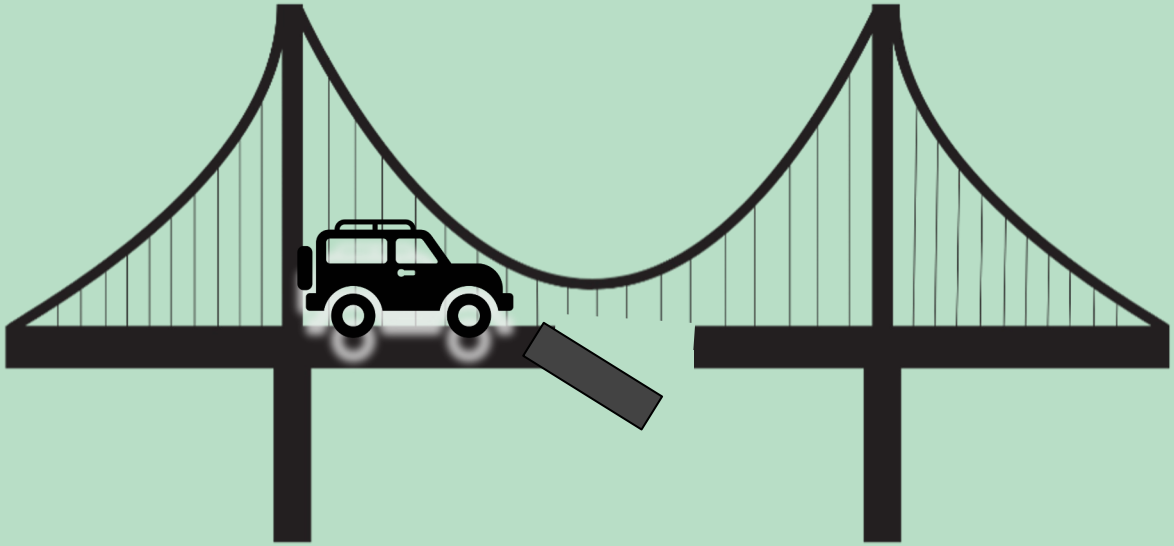
Basic connections and functions develop first and then move from back to front- reaching higher level processes as adolescence progresses

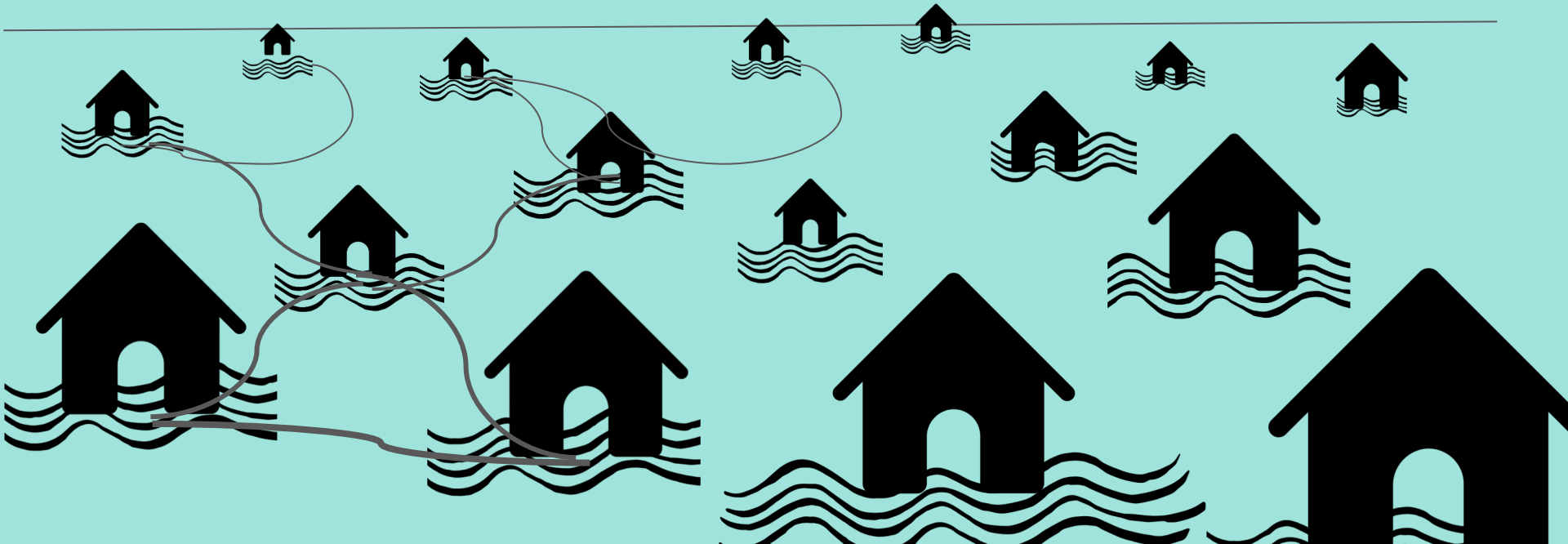


Threat Detection

Amygdala fully formed at 8 months in utero. Despite this, human infants (because of brain size and birth canal size) are most vulnerable infant mammals

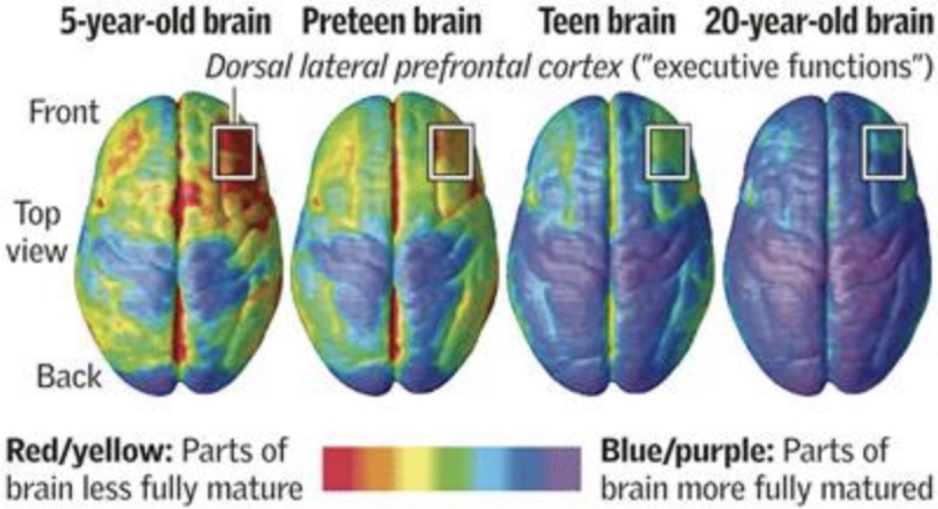
80% Wired
20% Not wired





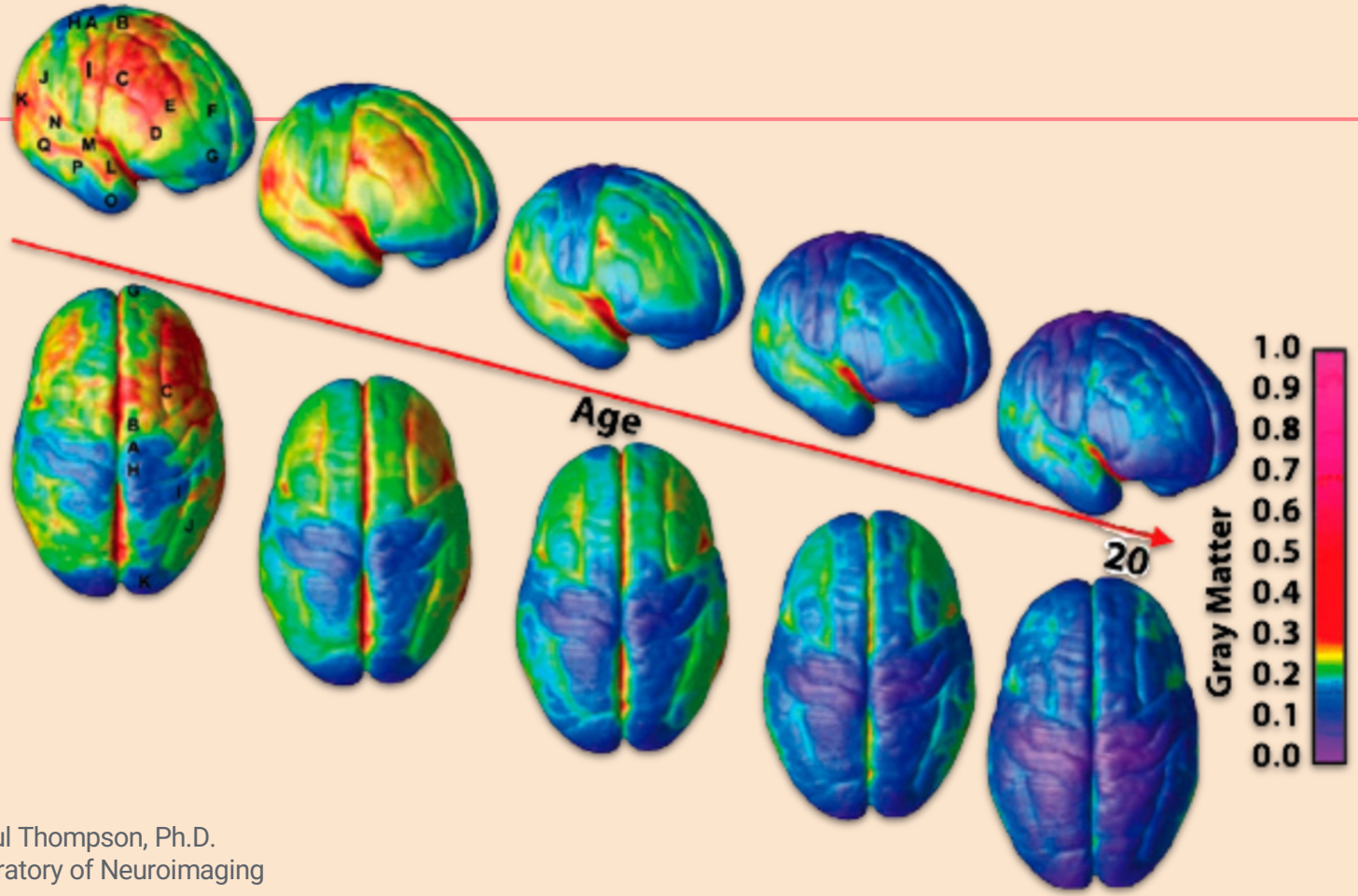
Judgment last to develop

The area of the brain that controls "executive functions" — including weighing long-term consequences and controlling impulses — is among the last to fully mature. Brain development from childhood to adulthood:

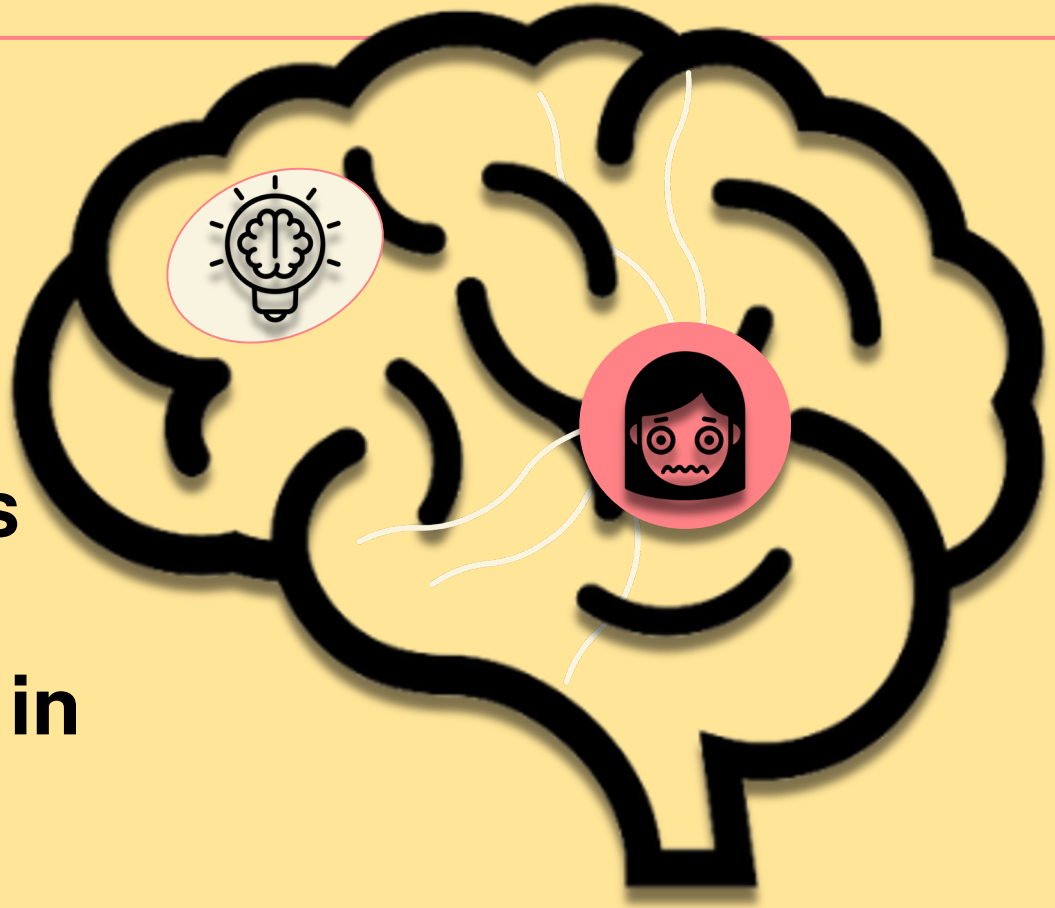


Sources: National Institute of Mental Health; Paul Thompson, Ph.D., UCLA Laboratory of Neuro Imaging

Thomas McKay | The Denver Post



Source: Paul Thompson, Ph.D.
UCLA Laboratory of Neuroimaging



Emotion feels bigger and more intense in adolescence

T E E N B R A I N

↑ Dopamine

At the onset of puberty dopamine is at its highest levels, but by age 17 it slowly starts to decline

Dopamine is your personal cheerleader- it encourages and motivates you to do things

Dopamine rewards you for choices that feel good. This is not always ideal...especially in adolescence

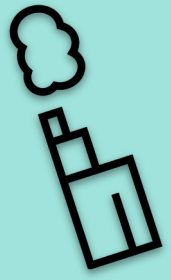
Abundant Dopamine
+ Not-Fully-Connected PFC

Less Cognitive Control

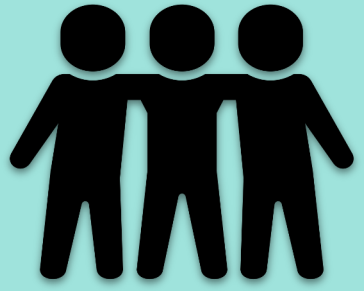
This looks like:

Over-reliance on smartphones (games, social media, communication)

Drugs, drinking, smoking and more. Everything feels intensely pleasurable. Risk is reinforced chemically.



Increased willingness to engage in risky behaviors because of anticipated positive feelings

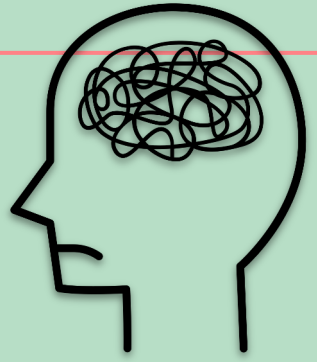


Prioritization on friends and peer group. Fear of missing out on experiences and fear of exclusion

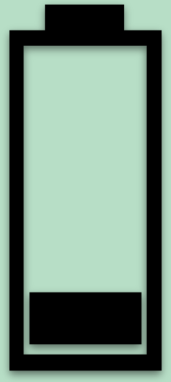
This sounds like:

It seemed like a good idea at the time.
I've done it a million times before.
It's funny.
I think you are over-reacting. It's not that big of a deal.

↓Serotonin



Serotonin levels **decrease** in early puberty and stay at **lowest** levels between 14 & 17



Serotonin is helpful in managing anxiety, stress, and overall mood. Low serotonin makes it **harder to regulate emotion.**

Lower serotonin in adolescence is correlated with **depression, loneliness** and increased feelings of **stress** and **unhappiness.**

This looks like:

Difficulty calming down and self-regulating

Increased aggression, irritability and depression

Heightened feelings of anxiety and stress

This sounds like:

I am never graduating from high school.

I am going to fail this class.

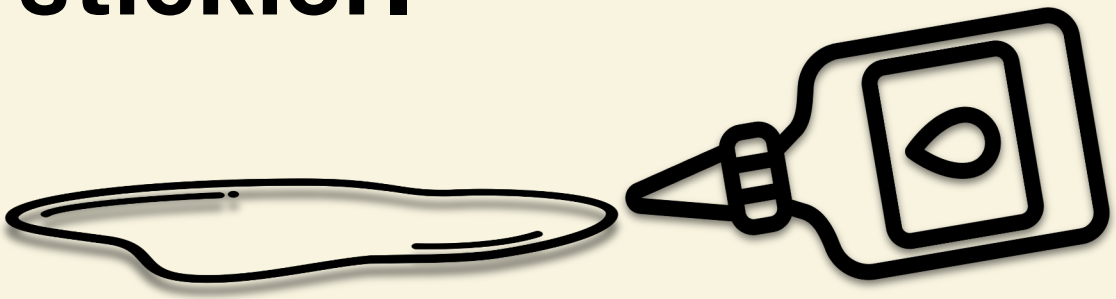
Everyone hates me.

I hate them.

This is so unfair.

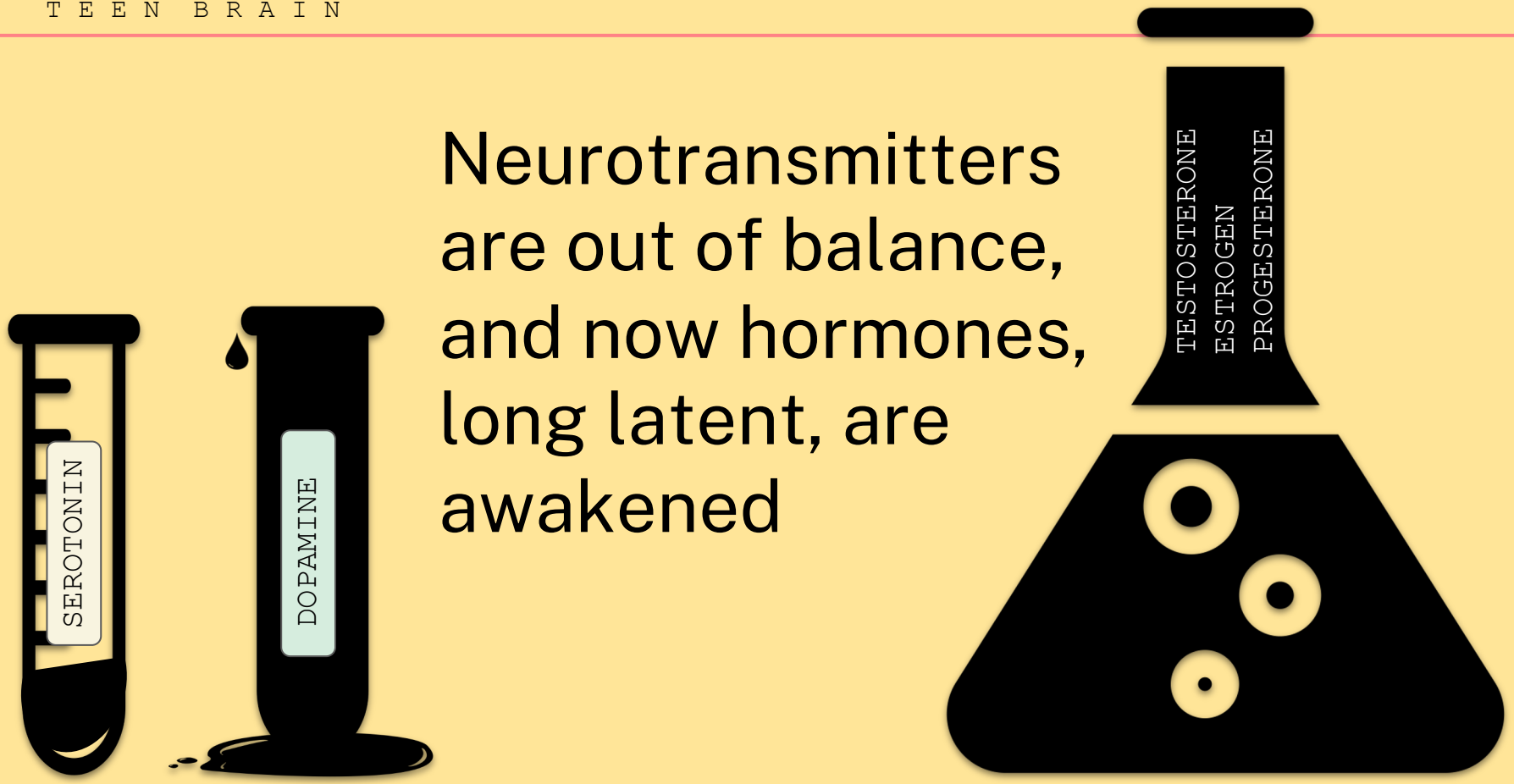
No one listens to me or hears me.

Negative thoughts and amplified feelings are stickier.



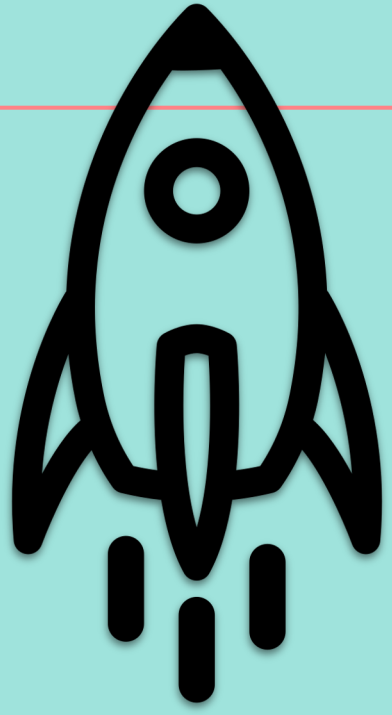
Low serotonin levels, high dopamine, incomplete connectivity all make things feel bigger and worse than they objectively are.

Neurotransmitters are out of balance, and now hormones, long latent, are awakened



Testosterone
Estrogen
\+ Progesterone

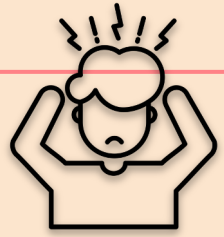
Sex Hormones



Trigger physical & emotional changes of puberty in adolescents

E L I S A N E B O L S I N E

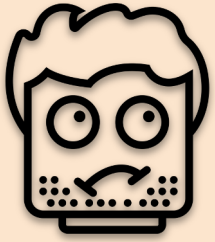
Hormones



The release of sex hormones at puberty triggers the physical changes of adolescence.

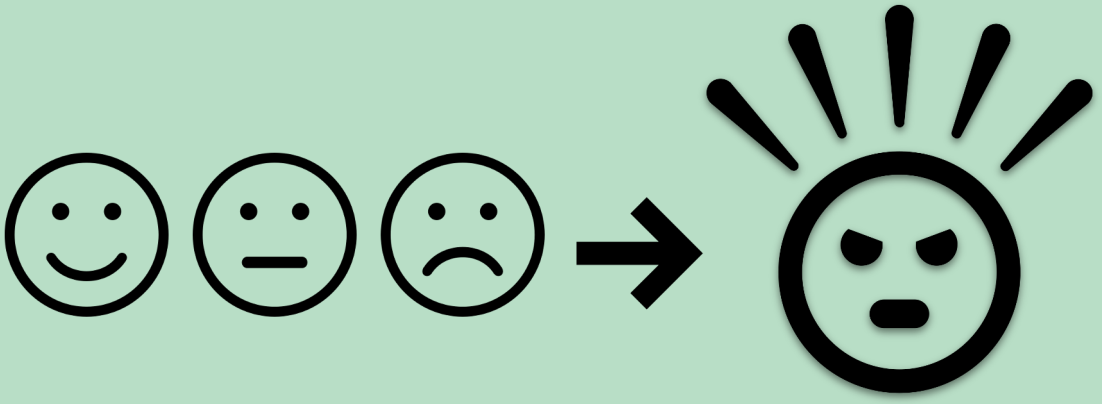
Hormones were always present but not released until puberty. Teen brain is unused to these hormones- has a **low initial tolerance**

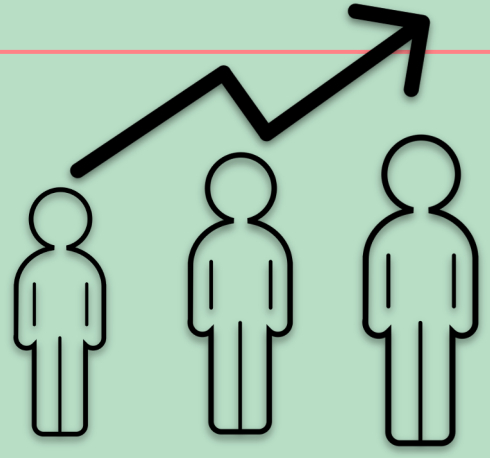
Teens have a **reverse** response to a hormone (THP)- in adults, this hormone helps the brain calm after a stressful event. **Teens stay wired much longer.**



Testosterone

Testosterone and the amygdala are BFFs, with special receptors in the amygdala that welcome testosterone.





Boys have **30 times** more testosterone by end of adolescence

Estrogen + Progesterone

In girls, estrogen and progesterone change with the menstrual cycle.

Estrogen can help produce dopamine and serotonin causing the first two weeks of the cycle to be the easiest (emotionally).

The second through fourth weeks of the cycle (Luteal phase) has more progesterone and less estrogen. This can lead to increased anxiety, sadness and irritability. This is especially true in girls just entering puberty.

Oxytocin

Changes in level of oxytocin during teen years.

Oxytocin itself does not lead to risk, but it does lead to intense feelings of desire to connect and belong

Teens Risk-Taking Occurs in Groups

If a teen's peer group uses **drugs/alcohol**, the teen is significantly more likely to use themselves.

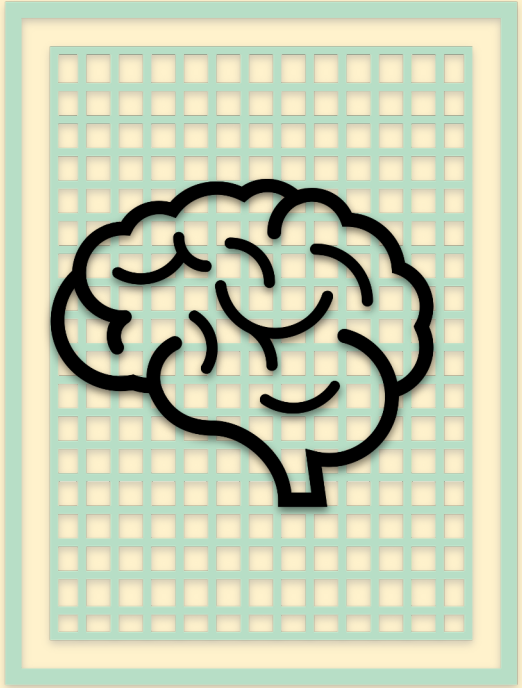
Teens are far more likely to commit **crimes in groups** (as opposed to adults who rarely do)

Having same-age peers in the car with a teen driver dramatically **increases** the likelihood of a serious **accident**

Teens who **believe** their friends are sexually active (regardless of whether or not they actually are) are more likely to **become** sexually-active

Risk, Reward and Logic

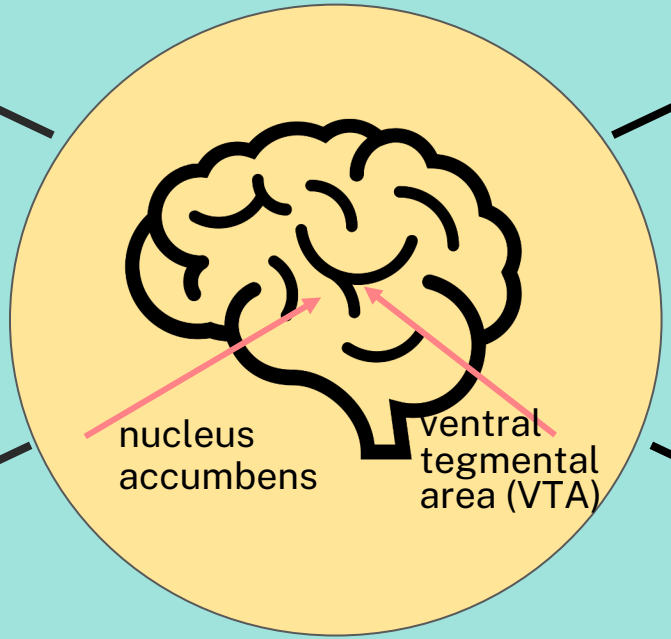
Development matters. When dopamine is high and serotonin low (14-17) teens rate having unprotected sex as worth the risk for the benefit of the experience. (Steinberg, 2007), but as teens age (and their brain's change) they change perspective.



Risk

The reward seeking part of the brain (nucleus accumbens and ventral tegmental area) are in the brain's pleasure area.

The "pleasure area" is big on feeling good. Therefore, dopamine is released when even contemplating a reward.



The teen brain LOVES feeling good and is not great at inhibiting. The connections to frontal lobes make it hard to inhibit.

The nucleus accumbens lights up when pleasure is possible and motivates (through chemicals) teens to experience pleasure.

The chief predictor of adolescent behavior is not the perception of the risk, but the anticipation of the reward *despite* the risk.

-Frances Jensen

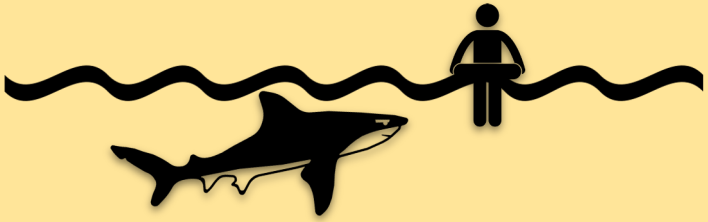
LUNA, B., PADMANABHAN, A., & OHEARN, K., (2010).

Inhibition is Effortful for Teens

U of Pittsburgh study using fMRI: participants had to inhibit eye movements- they had to look away when certain images appeared on a screen.

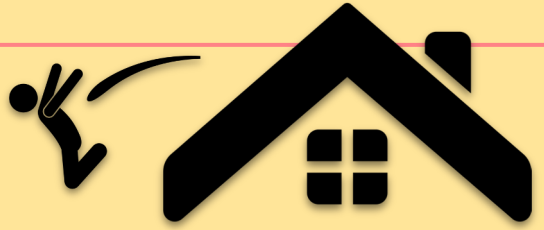
Teens were as capable as adults of doing this (response inhibition) but they had to work harder.

Teen brains had to use several more areas than the adults (whose frontal lobes did all of the work) to inhibit. Inhibition is effortful for teens.



Is it a smart to swim with sharks?

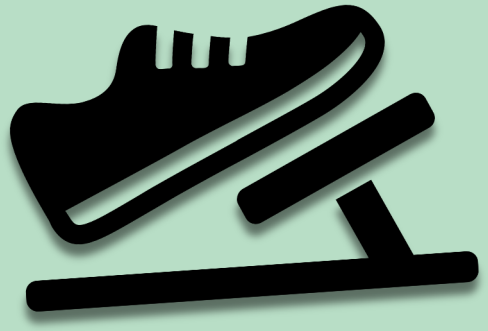
When answering questions like this, a Dartmouth study found that teens use a more limited area of their brain and take more time to answer high risk questions than adults.



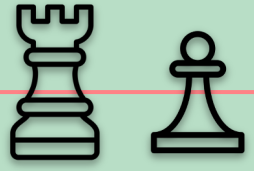
Is jumping off a roof a good idea?

Adults had instinctive responses and mental images appear instinctively. Teens had to "think" it through- not an immediate instinctive response- but a response to a question.

Logic + Risk



Assessing risk and delaying behavior are different. Just because a teen can understand a risk does not mean they have the same inhibitory abilities as an adult. They don't.



Teens are able to be logical. A fifteen year-old is often able to reason as well as an adult in terms of assessing a dangerous situation.

The SAT relies on logic and rational deduction and teens routinely get high scores.

Psychoeducation is integral to CBT

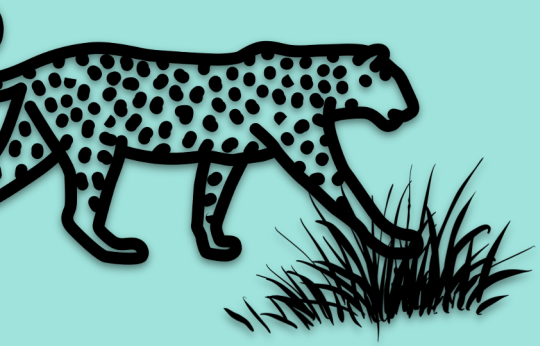
Inhibition. Effort. Logic.

Script:

Your brain is awesome. Seriously. It is ridiculously **busy** and **working very hard** for you right now. At the same time, it's also a little **vulnerable**, and it may be helpful to understand a few key facts about the changes that are happening. My hope is that if you know some of the ways the change impacts you, **you get to make informed choices** about how you want to protect and challenge your brain.

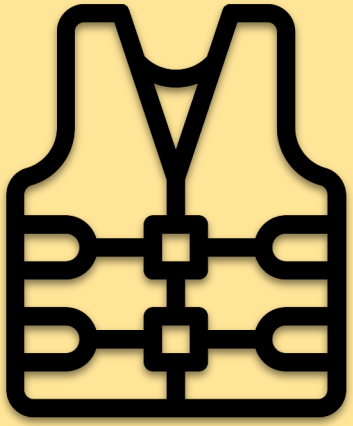
Here's the first thing. **Your brain wants to feel good** more than anything. You make think this is a good thing- and it absolutely can be good- but it also makes you vulnerable. You are much more likely to quickly **react** to the idea of something that feels good. If you **pause** and make a choice to **use reason**, you will be using your full brain rather than letting the dopamine make decisions for you. This will be difficult, but we both know that you can do difficult things.

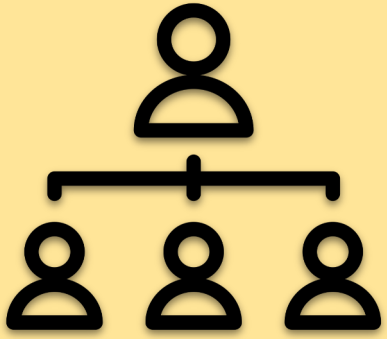
Peers, Survival + Teen Brain



Peers: they matter more

Safety





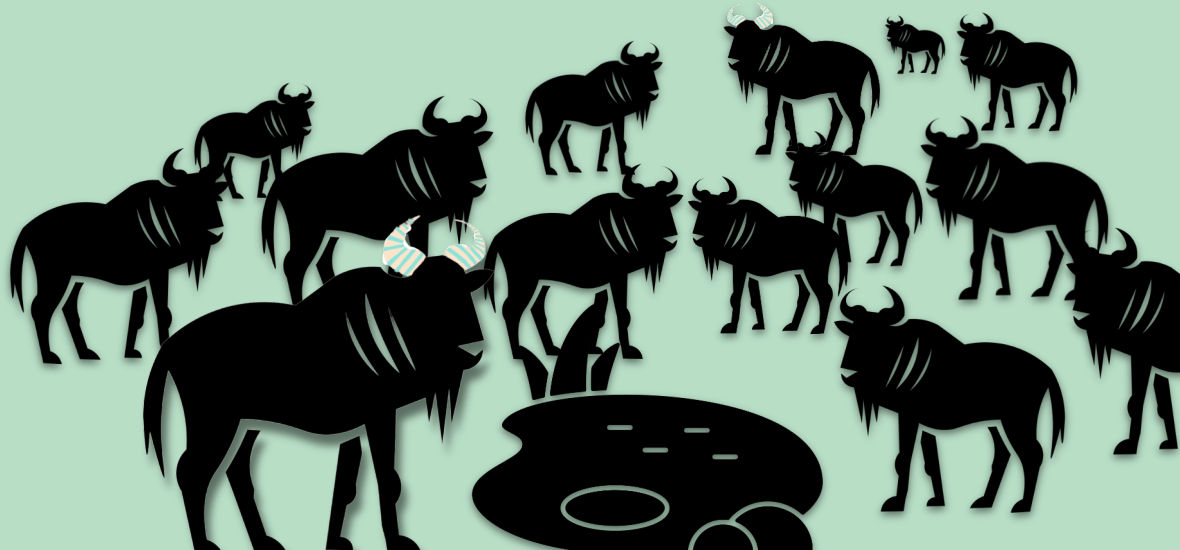
Status

FOMO

Stress +
(loneliness)

WILDHOOD BY K. BOWERS + B. HOROWITZ

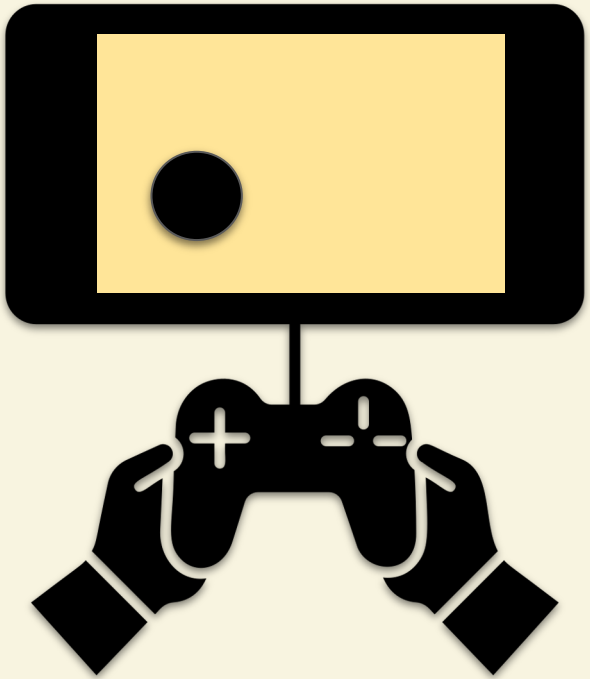
Fitting In: Conformity & Social Risk



M A S T E N, C L, (2 0 0 9)

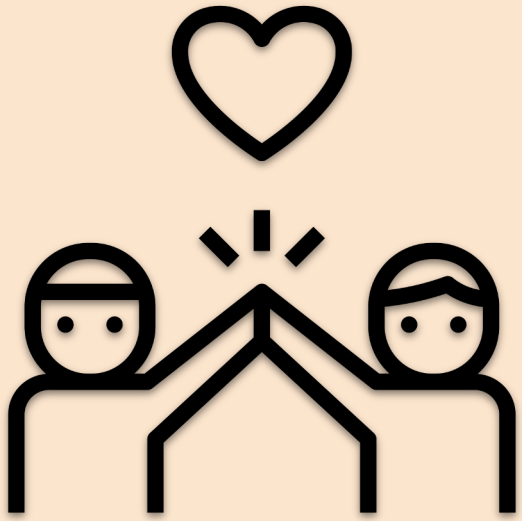
Rejection feels Different

Adolescents feel greater distress from rejection than adults. Rejection causes a higher reported level of pain and distress, and a higher activation in areas of the brain that show emotional pain and dysregulation.



One Close Friend

Significant protective factors in having one close reciprocated friendship in adolescence.



Stress & Teen Brain

Teens have higher levels of cortisol than adults (girls have more than boys)

Cortisol is tied to negative emotions: stress, worry, anxiety and anger

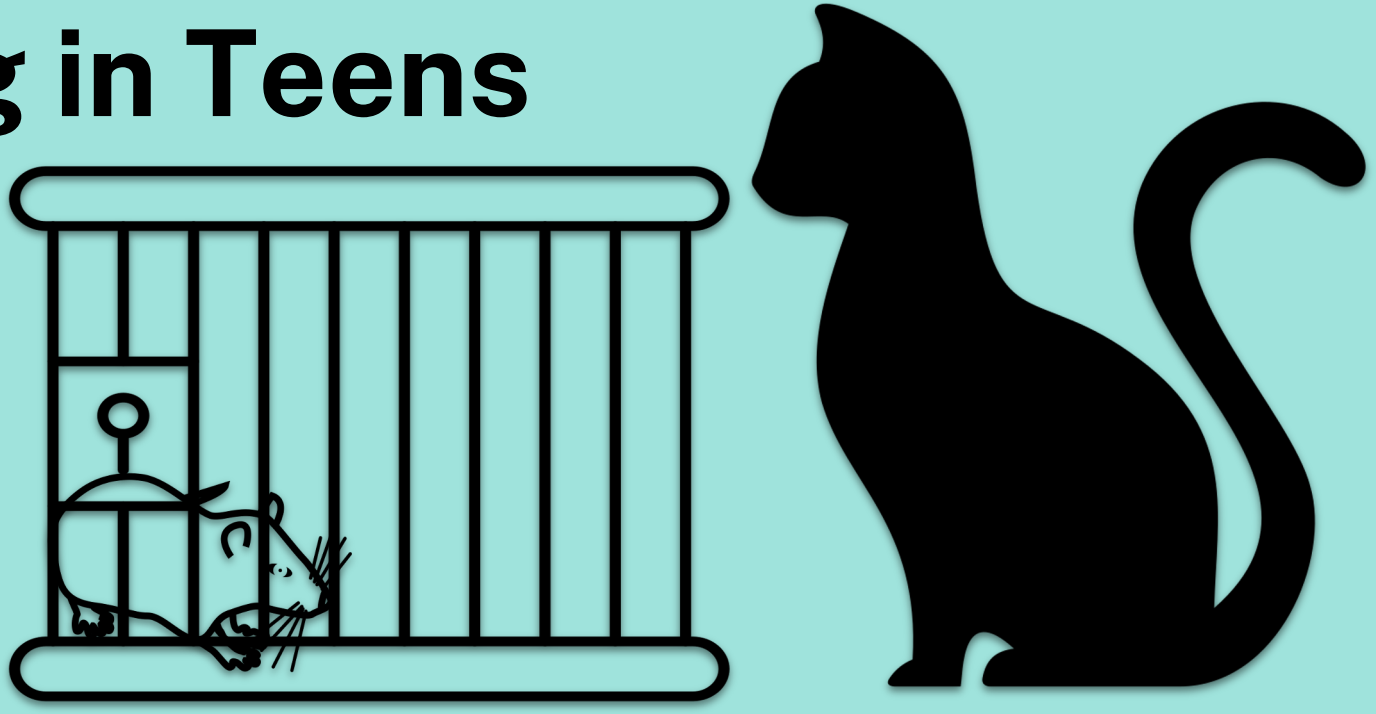
THP, the hormone that helps adults manage stress, actually causes stress and anxiety in teens

Chronic stress in adolescence can cause memory and learning issues

ACES can lead to less gray matter & reduced activity in PFC as teens

Loneliness causes stress in teens. Teens currently reporting high loneliness levels

Significant Stress Impacts Learning in Teens



What if stress can actually be helpful?

If we can change our thoughts, can we change our responses?

Alia Crum's hypothesis:
When 2 outcomes are possible, a person's expectations influence which outcome is more likely.

The effect you expect is often the effect you get

People who believe stress is enhancing report:

- Higher productivity
- More positive mood
- Greater energy
- Greater confidence in their ability to cope with challenges and adversity

People who believe stress is harmful report:

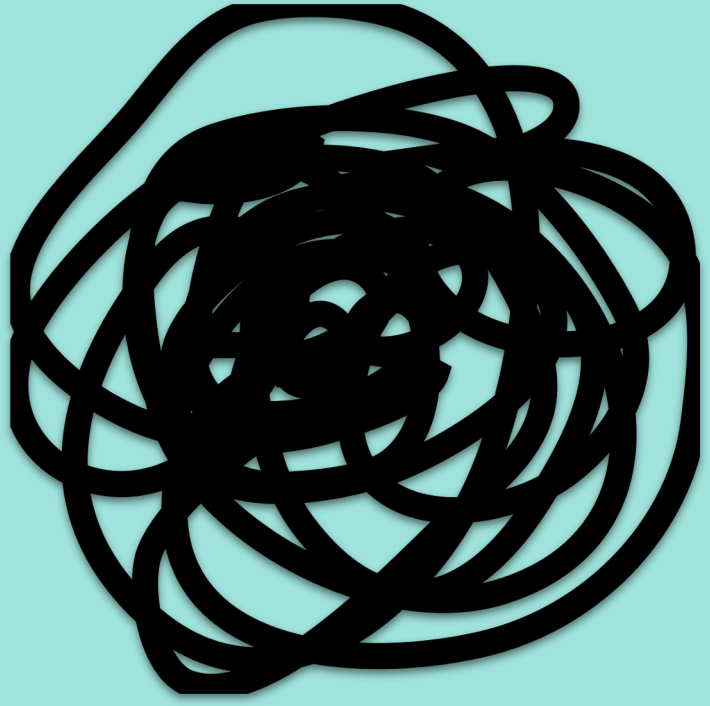
- Use of alcohol, food, and other substances to avoid feeling the stress
- Avoidance of the experience of emotions related to stress
- Increased likelihood of distraction from the cause of stress instead of managing it

Stress Perception has Changed

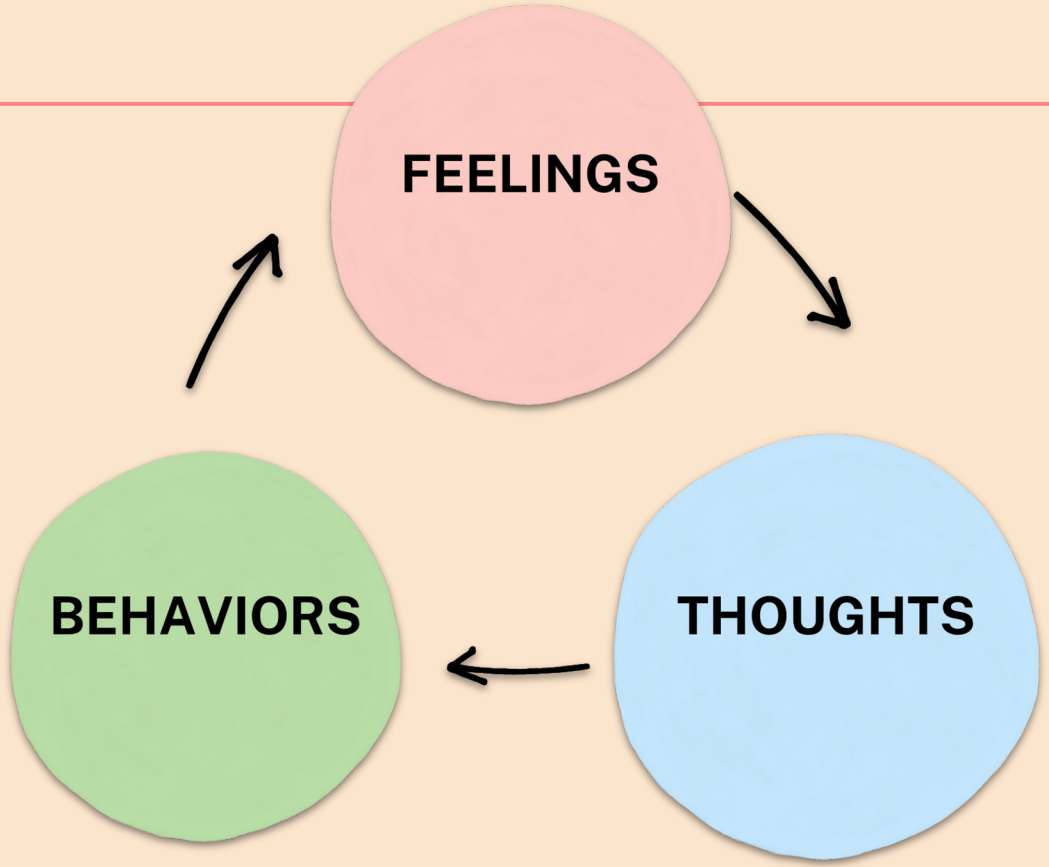
85% of Americans agree that stress has a negative impact on health, family life, and work

Most Americans perceive their stress level as unhealthy- including those who report relatively little stress

In 2007 an APA study found that most people thought a moderate amount of stress was ideal- in 2019 a moderate stress level was rated as unhealthy



Simple CBT Strategies

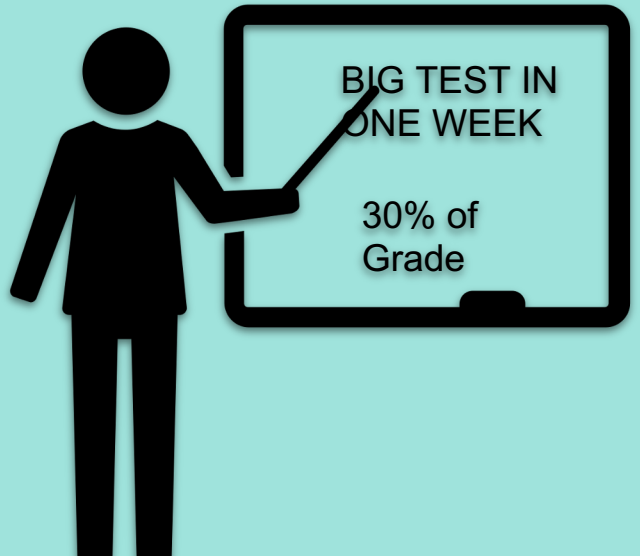


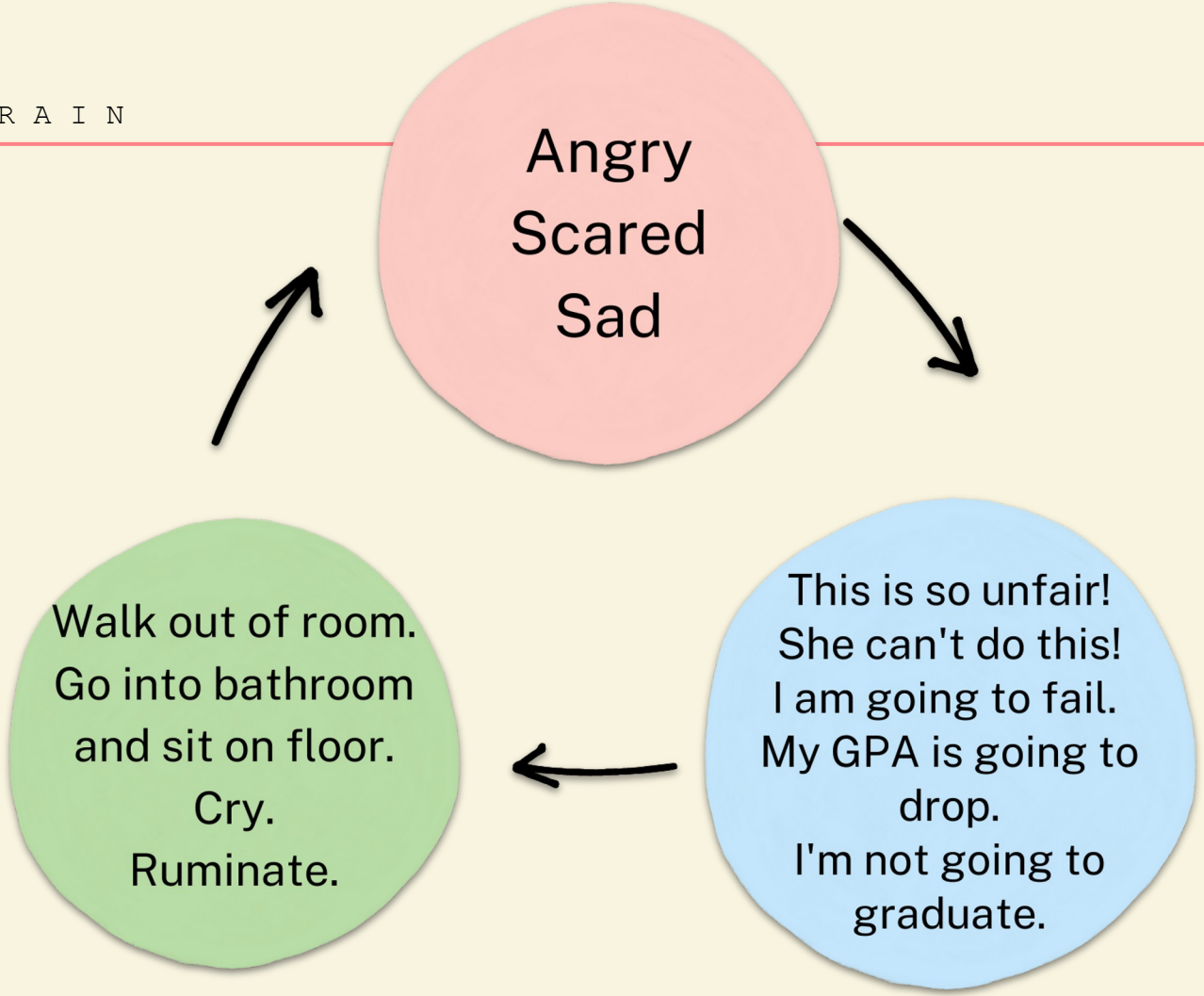
In order **to change feelings**, you need to change either your **thoughts** or your **behaviors**

Emotions are bigger in adolescents. And, if emotions are bigger, **thoughts** and **behaviors** are also **amplified**

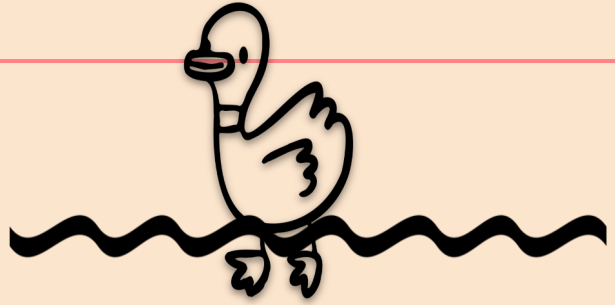
This looks like:

Your teacher announces a test that will count for 30% of the grade. It will cover cumulative material and is scheduled for one week from today.




Angry
Scared
Sad
This is so unfair!
She can't do this!
I am going to fail.
My GPA is going to drop.
I'm not going to graduate.
Walk out of room.
Go into bathroom and sit on floor.
Cry.
Ruminate.

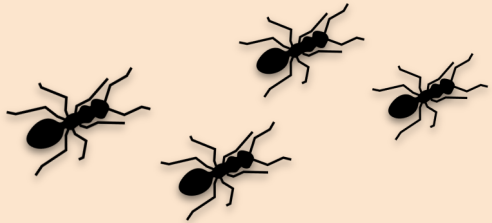
Automatic Thoughts



Often just below the surface of awareness

Are specific to the situation at hand

Pop into a person's mind without warning



Reflect and reinforce the negative beliefs the person has about themselves

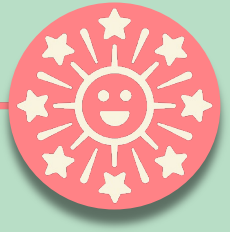
Catching Thoughts

E L I S A N E B O L S I N E

Changing Thoughts

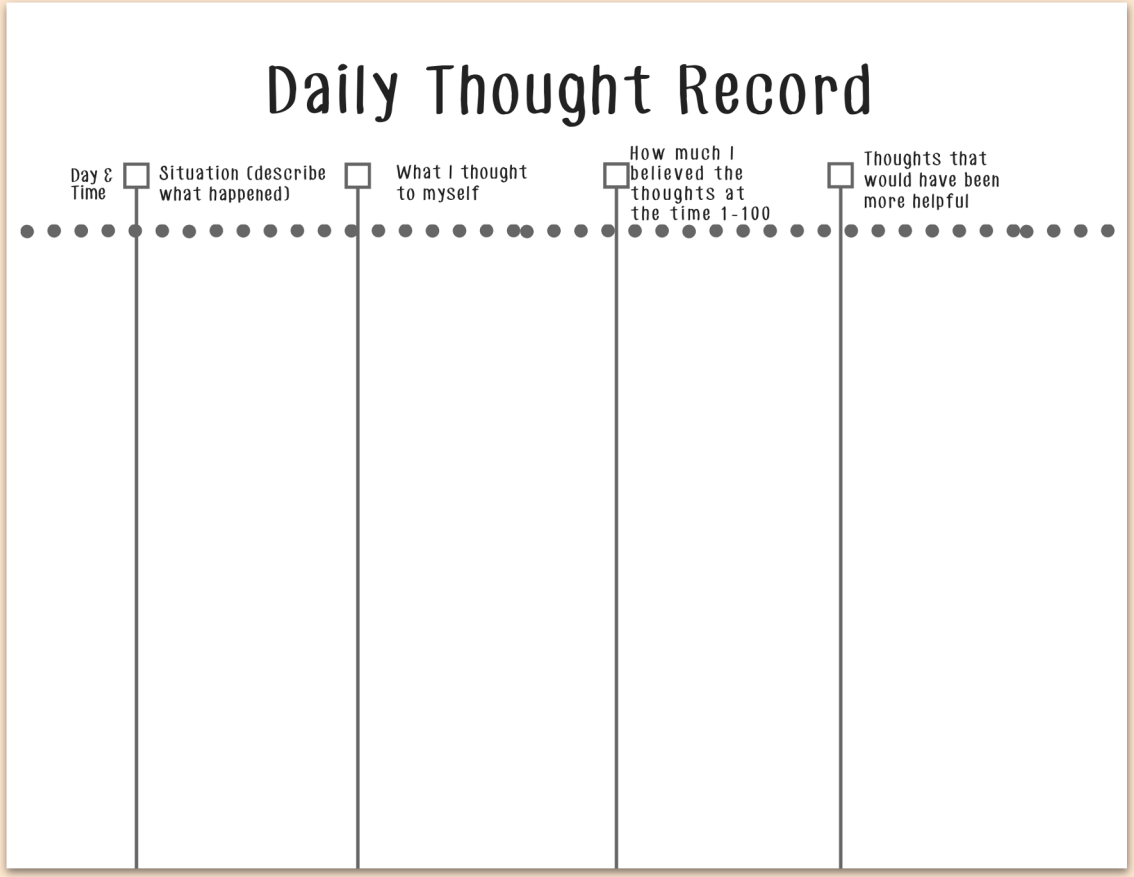
100% terrible

True and helpful



100% Perfect

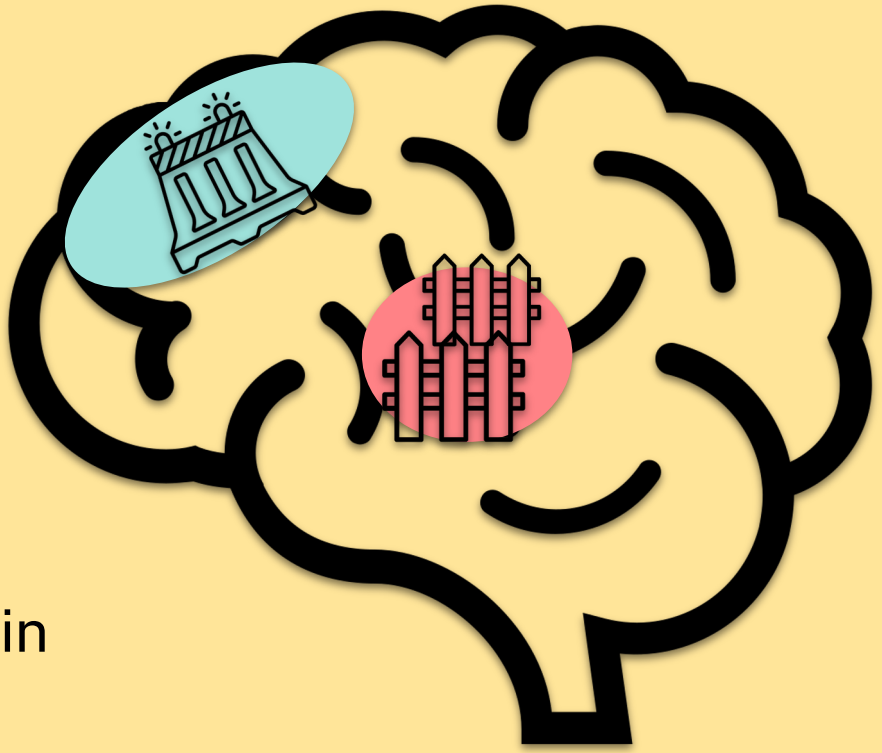
DAILY THOUGHT RECORD (DTR)



Identifying Feelings

When emotion is stuck in the limbic system it grows and becomes less rational and more reactive.

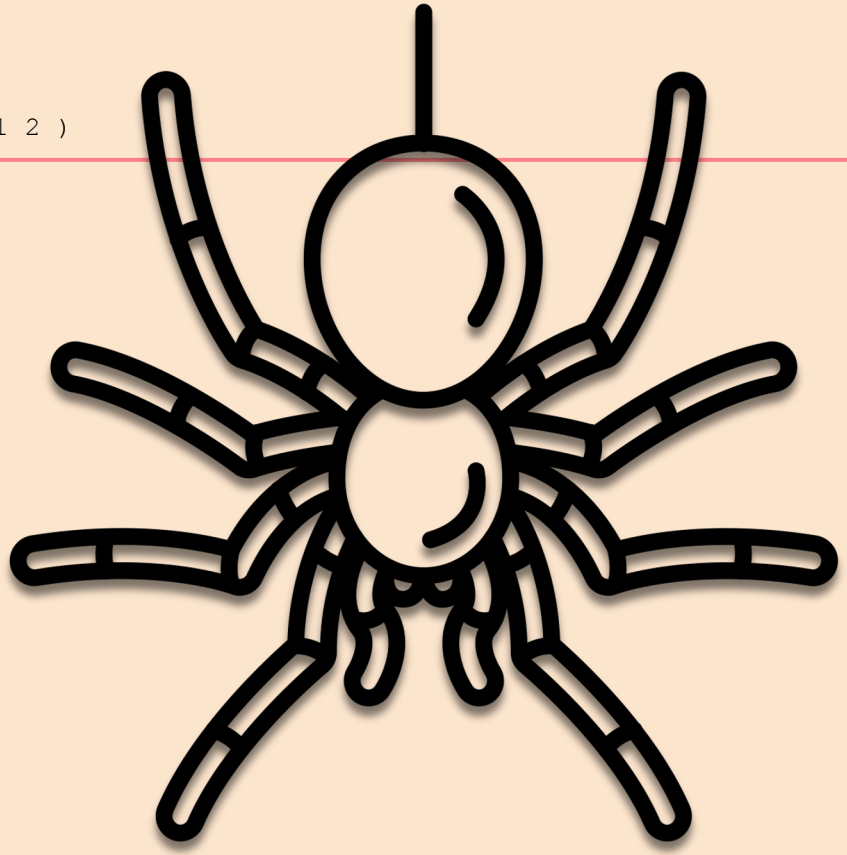
Language moves emotion from limbic system to PFC. Teen brain has limitations in connectivity

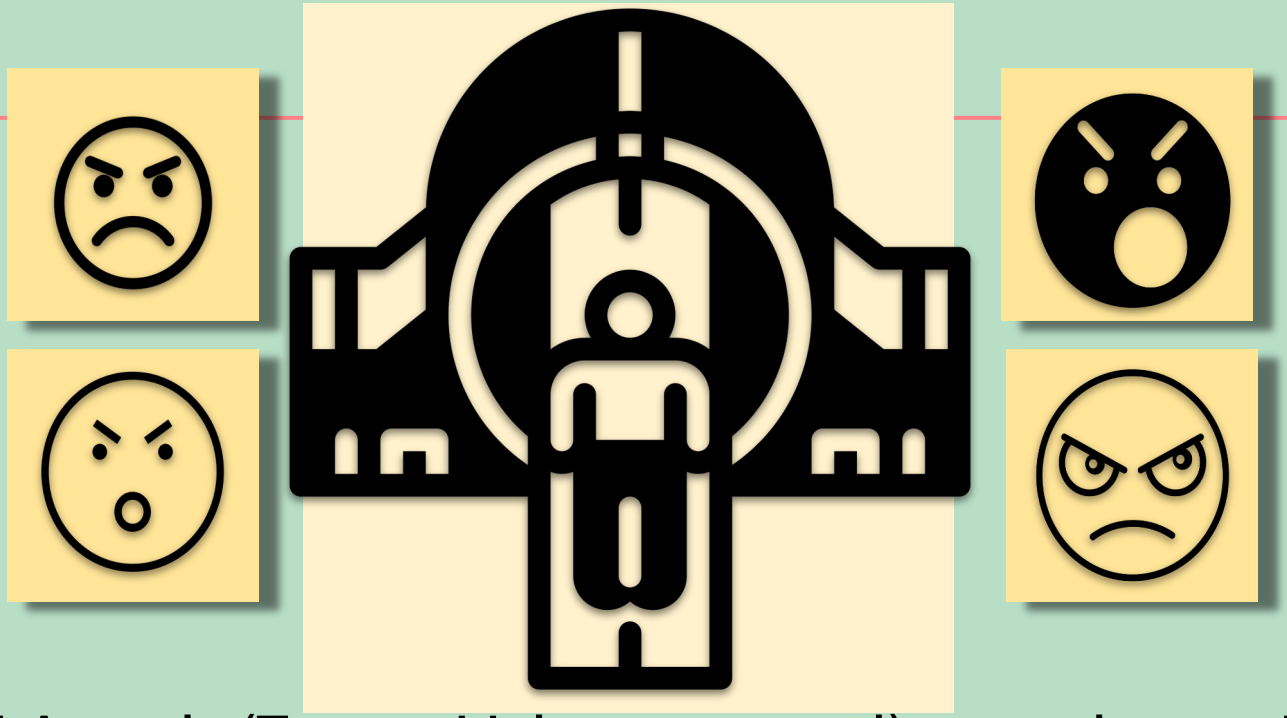


KIRCANSKI, LIEBERMAN, + CRASKE, (2012)

Name to Tame

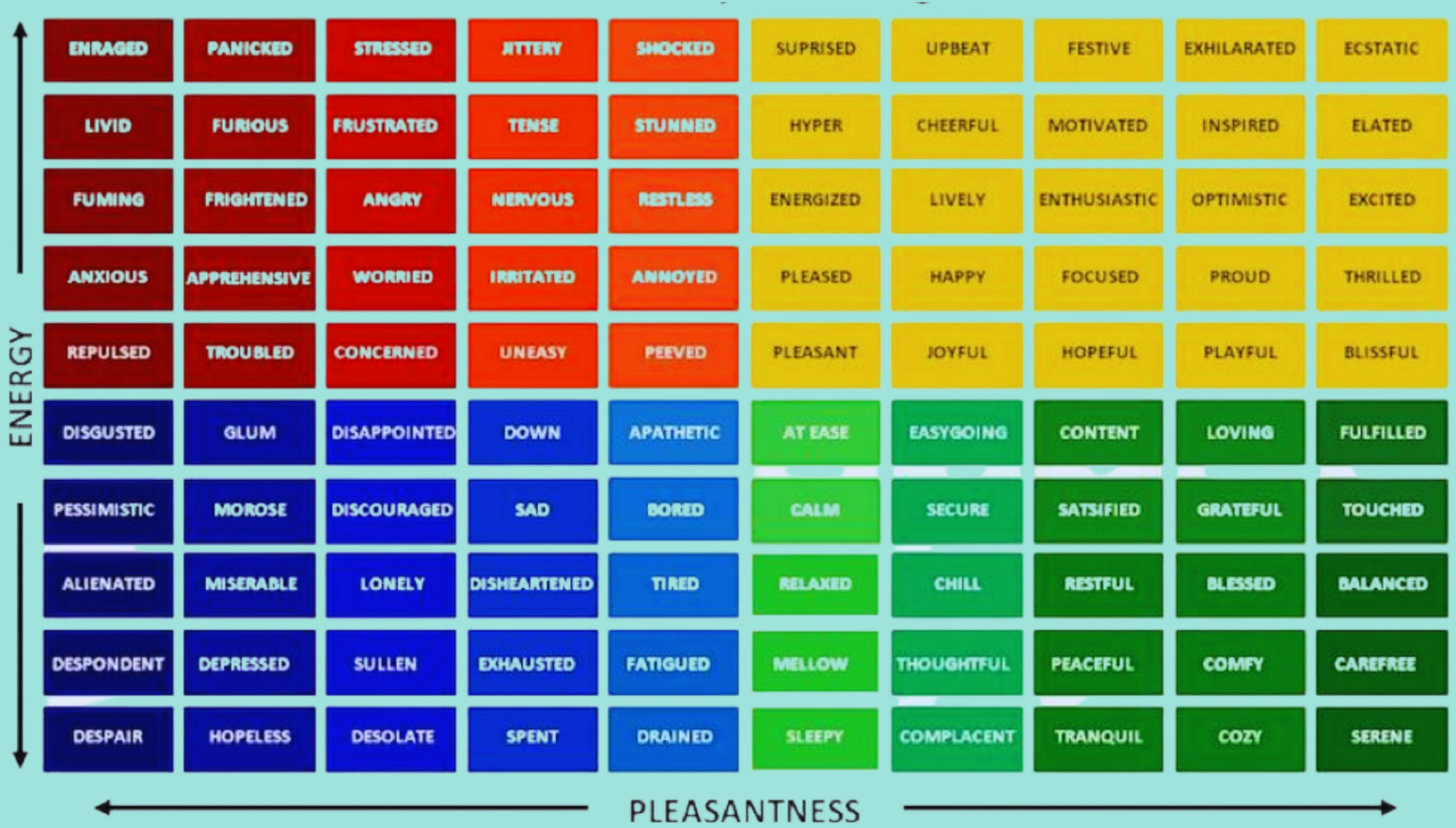
Using language to understand emotion and describe it moves the processing from the limbic system to the PFC.



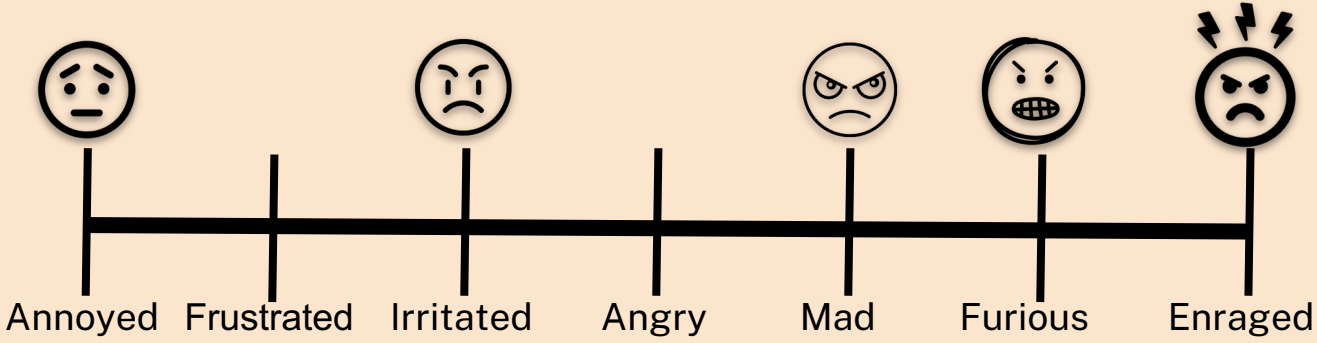


In a UCLA study (Torres, Lieberman, et. al) were shown pictures of angry faces while in an fMRI machine. The participants who named the emotions (“angry”, “mad”, etc.) saw an immediate decrease in activation in their amygdala region.

M O O D M E T E R


ENERGY
ENRAGED
PANICKED
STRESSED
JITTERY
SHOCKED
SUPRISED
UPBEAT
FESTIVE
EXHILARATED
ECSTATIC
LIVID
FURIOUS
FRUSTRATED
TENSE
STUNNED
HYPER
CHEERFUL
MOTIVATED
INSPIRED
ELATED
FUMING
FRIGHTENED
ANGRY
NERVOUS
RESTLESS
ENERGIZED
LIVELY
ENTHUSIASTIC
OPTIMISTIC
EXCITED
ANXIOUS
APPREHENSIVE
WORRIED
IRRITATED
ANNOYED
PLEASED
HAPPY
FOCUSED
PROUD
THRILLED
REPULSED
TROUBLED
CONCERNED
UNEASY
PEEVED
PLEASANT
JOYFUL
HOPEFUL
PLAYFUL
BLISSFUL
DISGUSTED
GLUM
DISAPPOINTED
DOWN
APATHETIC
AT EASE
EASYGOING
CONTENT
LOVING
FULFILLED
PESSIMISTIC
MOROSE
DISCOURAGED
SAD
BORED
CALM
SECURE
SATSIFIED
GRATEFUL
TOUCHED
ALIENATED
MISERABLE
LONELY
DISHEARTENED
TIRED
RELAXED
CHILL
RESTFUL
BLESSED
BALANCED
DESPONDENT
DEPRESSED
SULLEN
EXHAUSTED
FATIGUED
MELLOW
THOUGHTFUL
PEACEFUL
COMFY
CAREFREE
DESPAIR
HOPELESS
DESOLATE
SPENT
DRAINED
SLEEPY
COMPLACENT
TRANQUIL
COZY
SERENE
PLEASANTNESS

Ratings (aka perspective)



E L I S A N E B O L S I N E

We don't always want to lower the volume of our emotions, but we do want to be able to hear (to name and know) our emotions clearly.

Language is legitimately a super power

Our use of language creates our meaning of emotion and experience. It doesn't change what we experienced- it changes how we understand what we experienced.

Toddlers have tantrums when they are overwhelmed with emotion and lack the language needed to express themselves.

Imagine having a high-level brain capable of complex thought and sophisticated use of language and still routinely being completely overwhelmed by your emotions.

JILL BOLTE TAYLOR'S RESEARCH

90 Seconds to Manage Stress

The initial stress response, when your hormones turn on and release into your bloodstream, is automatic and out of your control.

But it is only out of your control for 90 seconds.
90 seconds is how long it takes for the initial burst of chemicals to flush in and out of your bloodstream.

If you do nothing, it continues, if you work to change the thoughts, and control your breathing, you can stop the cycle. You get to try again every 90 seconds.

Jill Bolte Taylor

Notice when you're having a stressful response and rate it on a scale of 1 - 10. Let yourself feel the stress response.

Ask yourself what emotions, other than stress, you are feeling in that moment.

Stress is a neurological response to to your perception of a situation. Ask yourself: "what is this stress telling me?"

Write down the stressors- every single one. Rate each stressor and put a 1 sentence POA next to each

Coping Cards

Just because this feeling *feels* true doesn't mean that it is. Anxiety can make things feel bigger and worse than they really are. What are the facts?

Feelings are temporary. No feeling lasts forever. This feeling will end.

Hang on. Don't give in to the feeling. Feel it, and let it pass through. It's okay to be uncomfortable- you've done it before and you can get through it.

What evidence (what facts) support this feeling?

This feels overwhelming right now. How big of a deal will this seem in 2 hours? In 2 weeks?

Feelings lie. They can make things seem much bigger and worse than they really are.

Feeling is preventive (and necessary)

Stress is necessary (and can be helpful)

Teens are uniquely vulnerable to stress

Language is how we understand emotion

Complex, language-based thoughts originate in the PFC

It is harder for teens to access the PFC

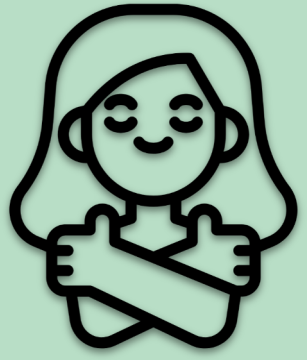
Splashing cold water on your face can lower stress. The cold water lowers your heart rate and give you a chance to regulate your breathing and reset.

Progressive Muscle Relaxation

Loosening and tightening our muscles can trick our brain into thinking the danger is past. Progressive muscle relaxation slowly moves through and calms the threat system.

♡

(or just hug yourself)



Putting it all together

Estrogen + progesterone change dopamine and serotonin levels monthly

Dopamine is high and serotonin is low

Only 80% wired- frontal lobes are missing connections

Inhibiting behavior is not instinctive and is effortful

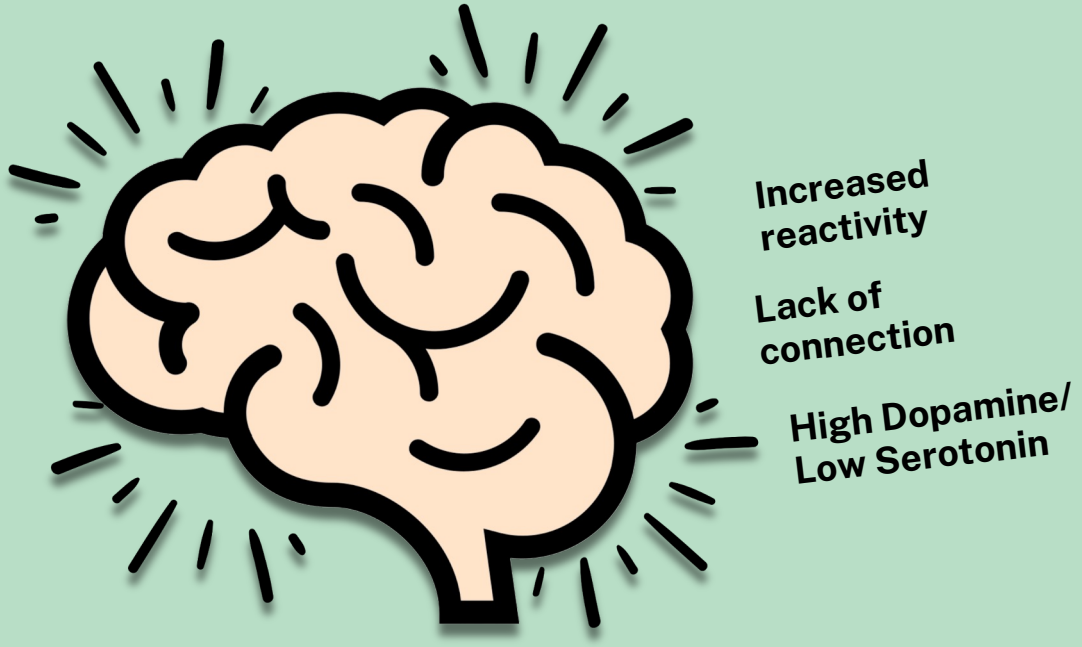
Back to front wiring

Testosterone and the amygdala are BFFs

Risk is reinforced and encouraged

Teens don't learn from their mistakes in the same way adults do.

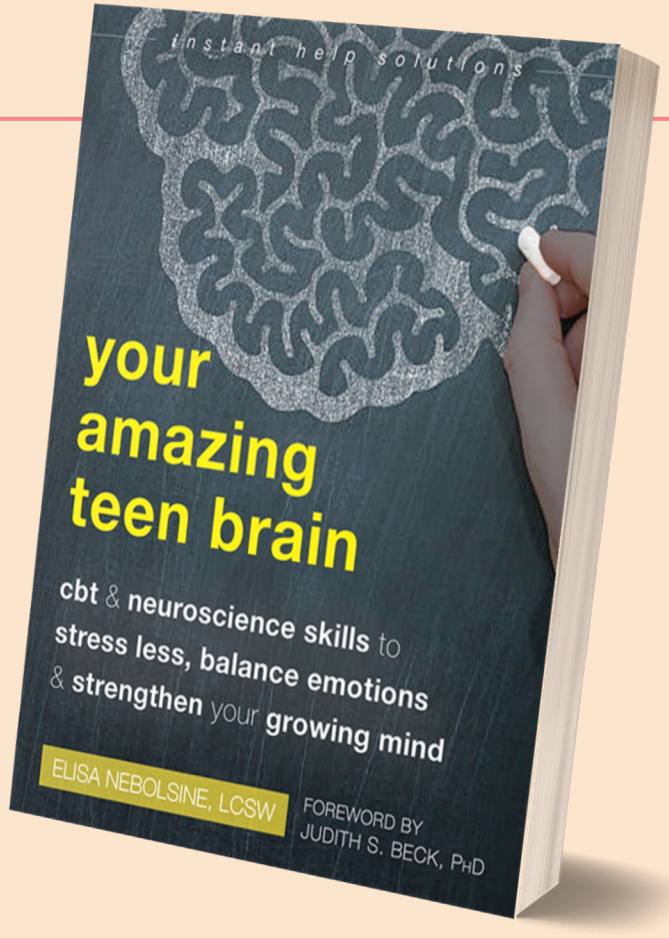
A Changing Brain



An Amazing Brain

E L I S A N E B O L S I N E

Your Amazing Teen Brain is for sale on Amazon, Barnes & Noble, Target and more!



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