

# UNDERSTANDING ADOLESCENT BRAIN DEVELOPMENT

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FOUNDER

PATHWAYS FOUNDATION KOVAI

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@ Masonic Medical Centre for Children , Coimbatore



# WHAT IS ADOLESCENCE?

- ▶ Adolescence, the transition between childhood and adult life, is one of the most dynamic stages of human development.



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- ▶ Adolescence is accompanied by dramatic physical, cognitive, social, and emotional changes that present both opportunities and challenges for adolescents, families, health professionals, educators, and communities.



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- ▶ Adolescence is accompanied by dramatic physical, cognitive, social, and emotional changes that present both opportunities and challenges for adolescents, families, health professionals, educators, and communities.
- ▶ Experiences during the adolescent years contribute significantly to the unique characteristics and maturation of the young adult.



# DURATION OF ADOLESCENCE

- ▶ Starts around puberty



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# DURATION OF ADOLESCENCE

- ▶ Starts around puberty
- ▶ Puberty and adolescence are not one and the same, not always correspond



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# DURATION OF ADOLESCENCE

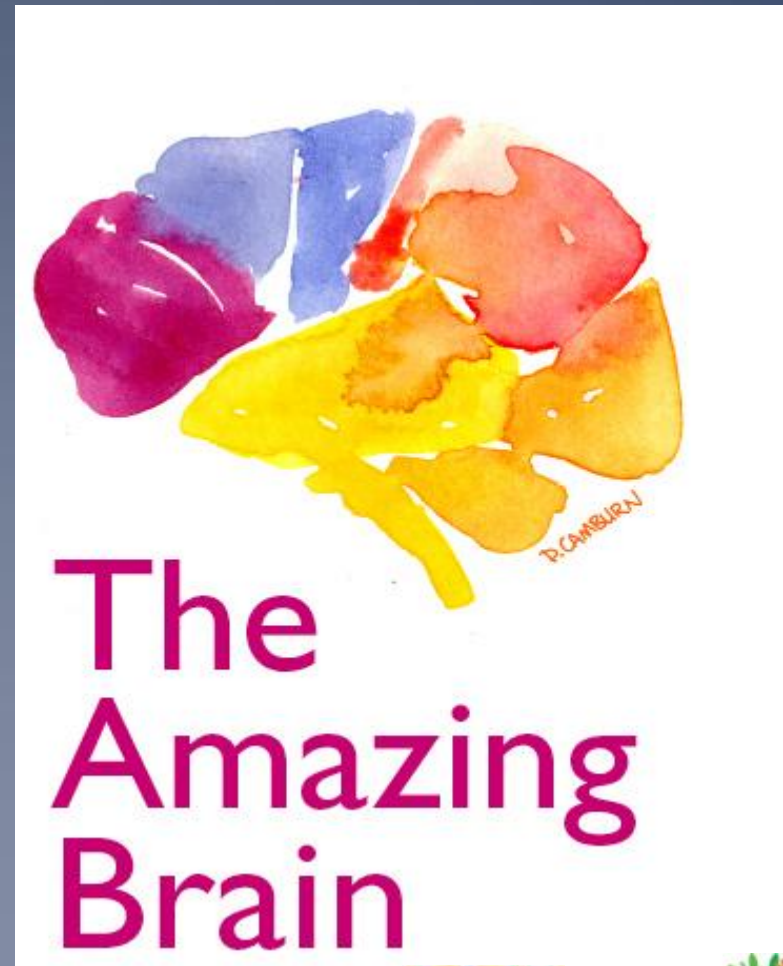
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- ▶ Puberty and adolescence are not one and the same, not always correspond
- ▶ Older times 16 to 18
- ▶ Current 12 to 20 and above





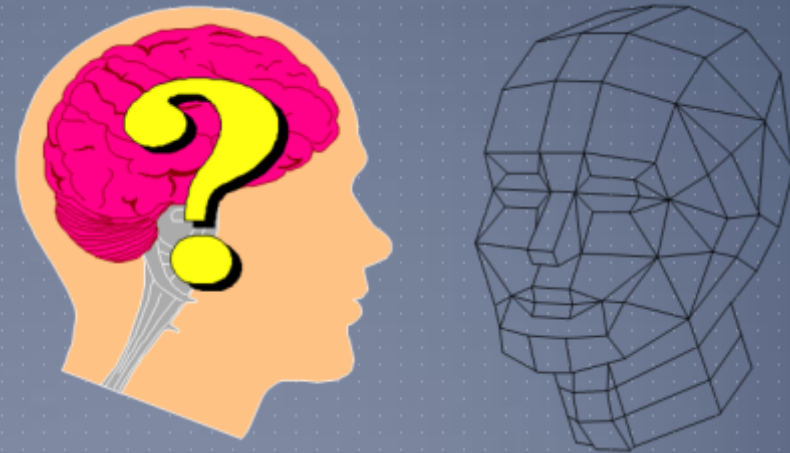
# ADOLESCENT DEVELOPMENT

- ▶ Brain
- ▶ Physical
- ▶ Emotional and social
- ▶ Cognitive
- ▶ Moral



# ADOLESCENT BRAIN = CONSTRUCTION ZONE

- ▶ The adolescent brain is a work in progress that is more similar to the brain of a child in some ways and of an adult in other aspects



# ADOLESCENT BRAIN DEVELOPMENT

- ▶ Bottom up
- ▶ Back to front
- ▶ Inside out



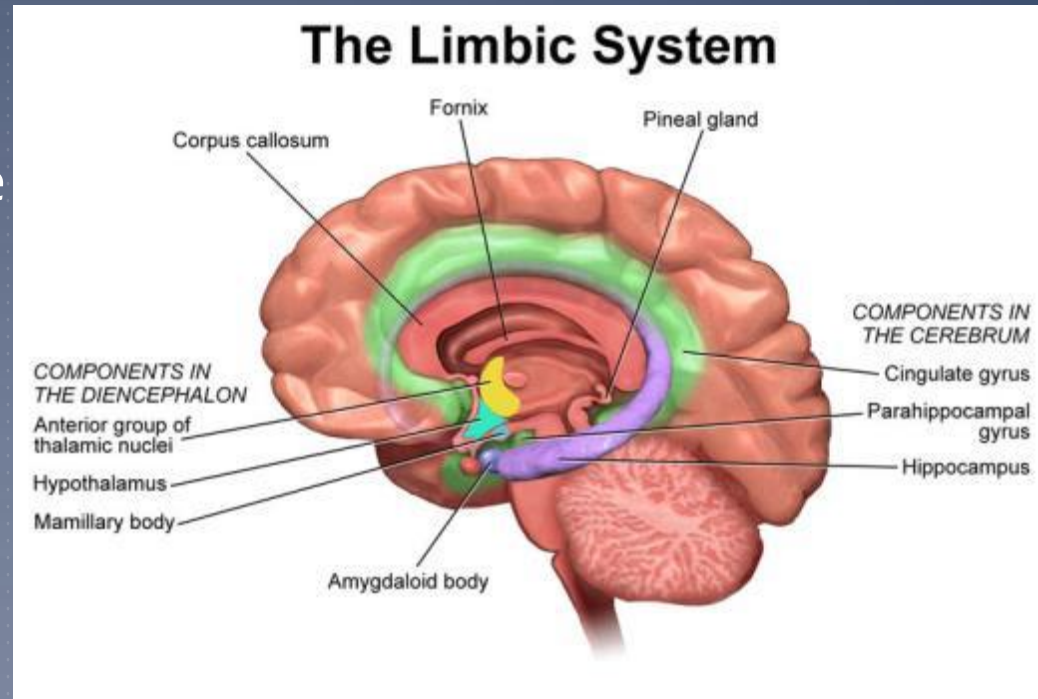
# ADOLESCENT BRAIN DEVELOPMENT

- ▶ Lower building blocks; survival brain
- ▶ Upper building blocks; intellectual brain



# THE LIMBIC SYSTEM

- ▶ Consists of donut shaped structures that wrap around the brain stem in the middle of the brain
- ▶ Brain specialist for emotional matters
- ▶ Reactive brain
- ▶ Fight, Flee, Freeze or Faint



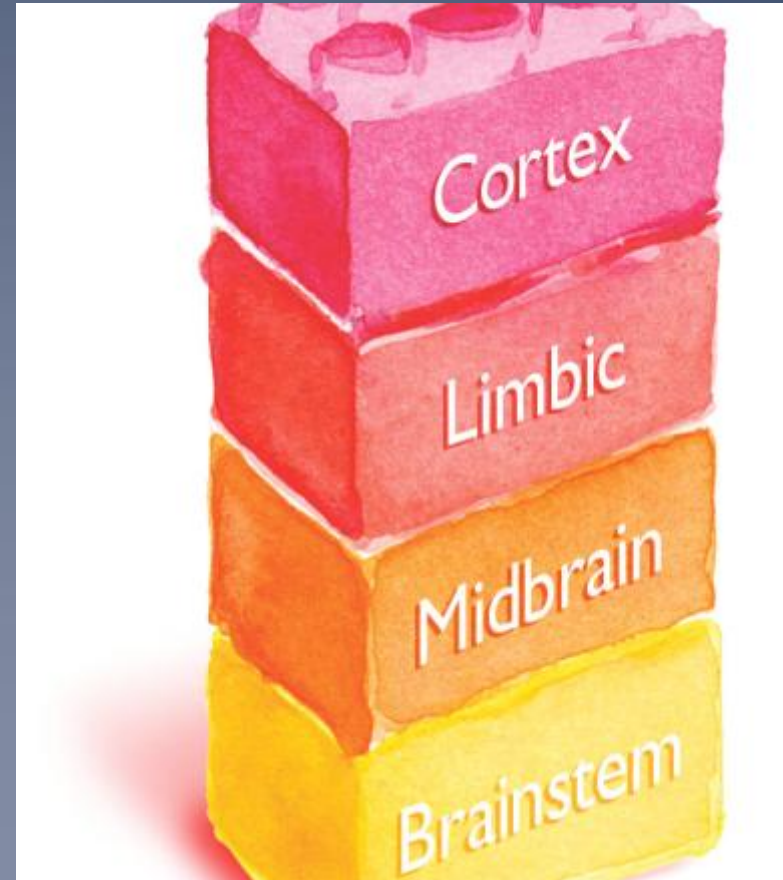
# LIMBIC SYSTEM

- ▶ Emotion and reward processing
- ▶ Kick out of taking risks
- ▶ Hypersensitive to the rewards of risk taking in adolescents compared to adults
- ▶ Prefrontal cortex which stops us from taking risk is still developing.
- ▶ Environment including teaching shape developing adolescent brain



# ADOLESCENT BRAIN DEVELOPMENT

- ▶ Nature saves the best for last
- ▶ Adolescence: cortex goes through major period of growth
- ▶ Prefrontal cortex: CEO of brain; one of the last to develop, until about 24.



# BRAIN REGIONS AND FUNCTIONS

## Executive Function

- reasoning
- problem solving

## The Conductor

- judgement
- impulse control
- emotions

- numbers

- processing sensory input
- language
- analytical abilities

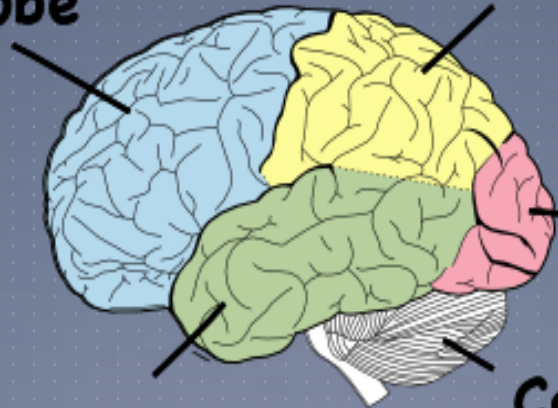
## Frontal Lobe

under development

The last part of the brain  
to mature  
(at about 24 years old)

## Parietal Lobe

under development



## Occipital Lobe

visual processing

## Temporal Lobes

hippocampus - long-term memory  
amygdala - emotional center

## Cerebellum

supports higher learning  
- math, music, advanced social skills  
under major development



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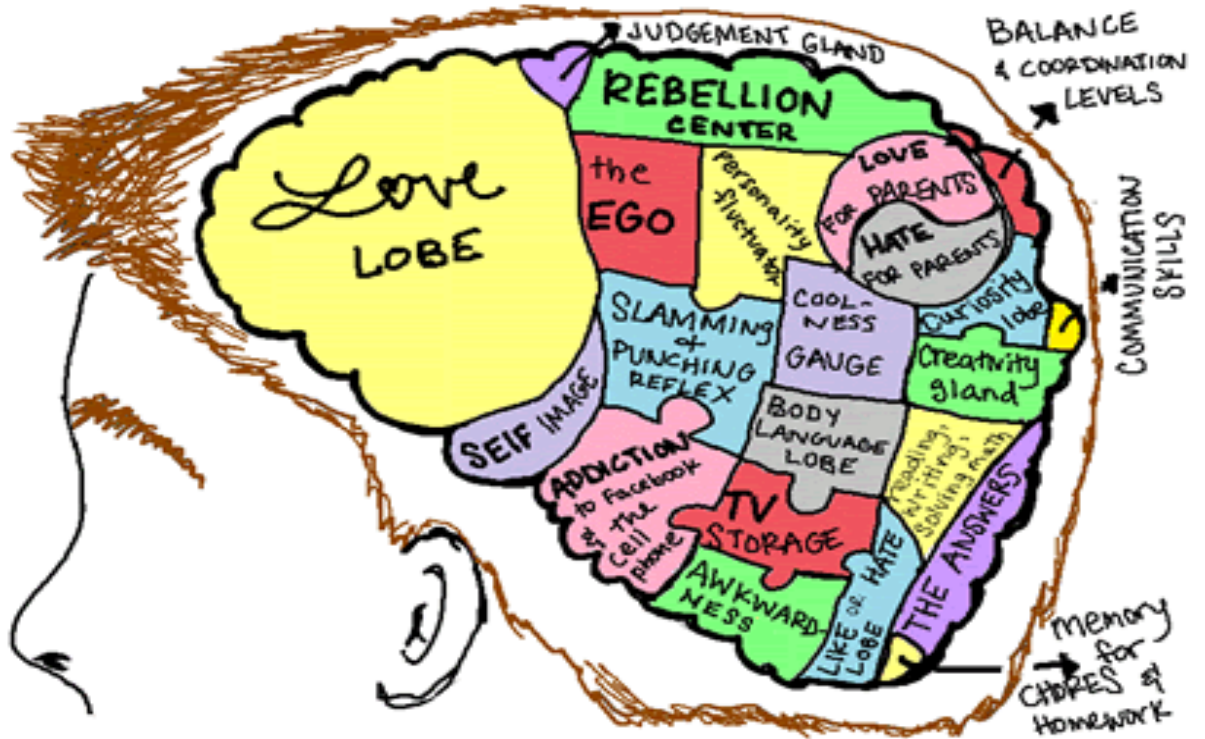


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# THE AVERAGE TEENAGE BRAIN



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# HOW DOES THE BRAIN MATURES?

- ▶ Pruning (15% in adolescence, compared to 1-2% at other times)
- ▶ Fine tunes brain tissue
- ▶ Myelination



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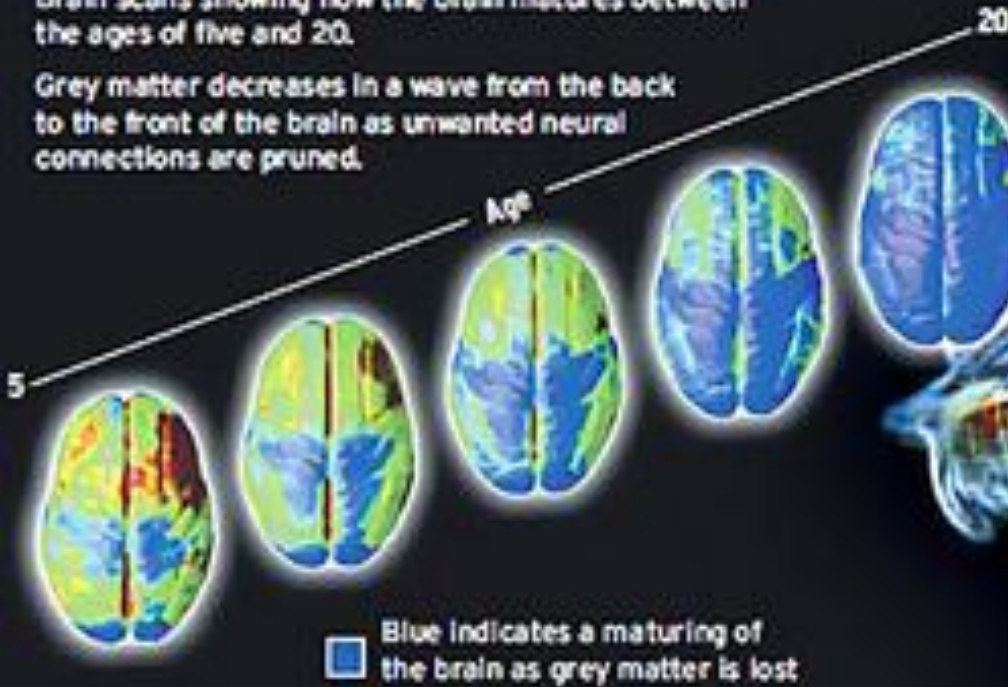
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# FROM HERE TO MATURITY

Brain scans showing how the brain matures between the ages of five and 20.

Grey matter decreases in a wave from the back to the front of the brain as unwanted neural connections are pruned.



## The Adolescent Years

- Greater capacity to learn and create
- Increased risk of damage from drugs and alcohol
- Increased risk of developing addiction
- Increased risk of mental illness
- Increased desire for risk taking
- Parts of brain that control impulses and emotions not yet mature





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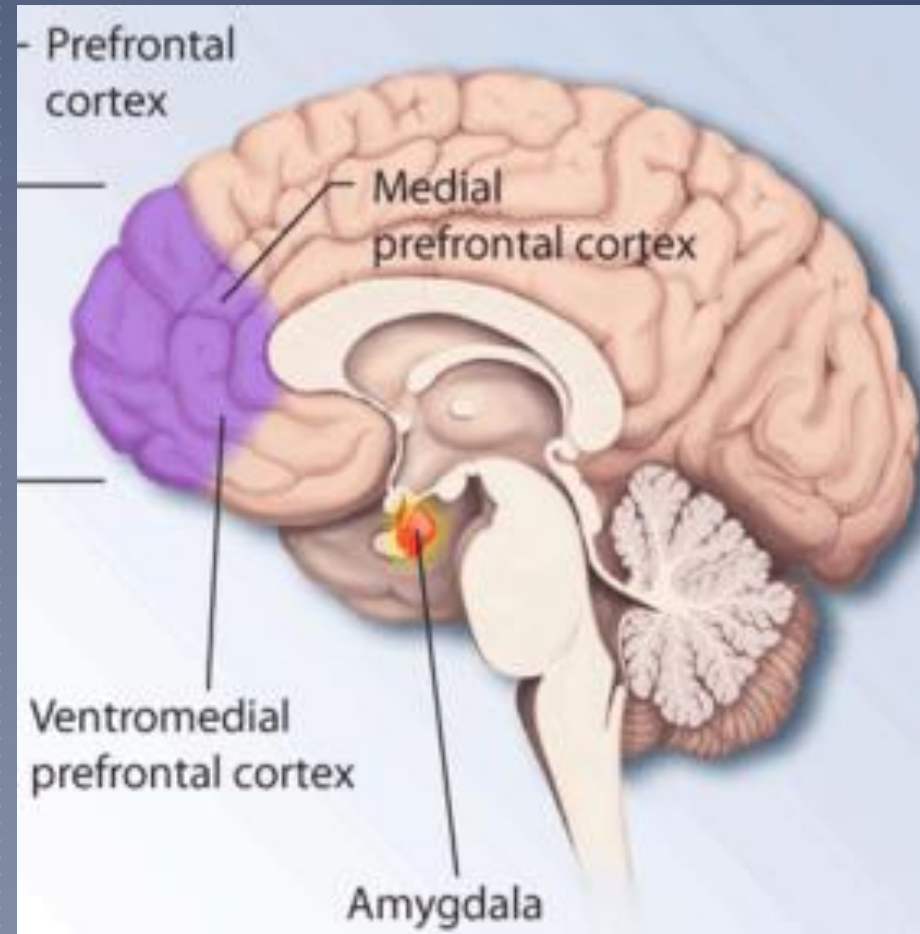


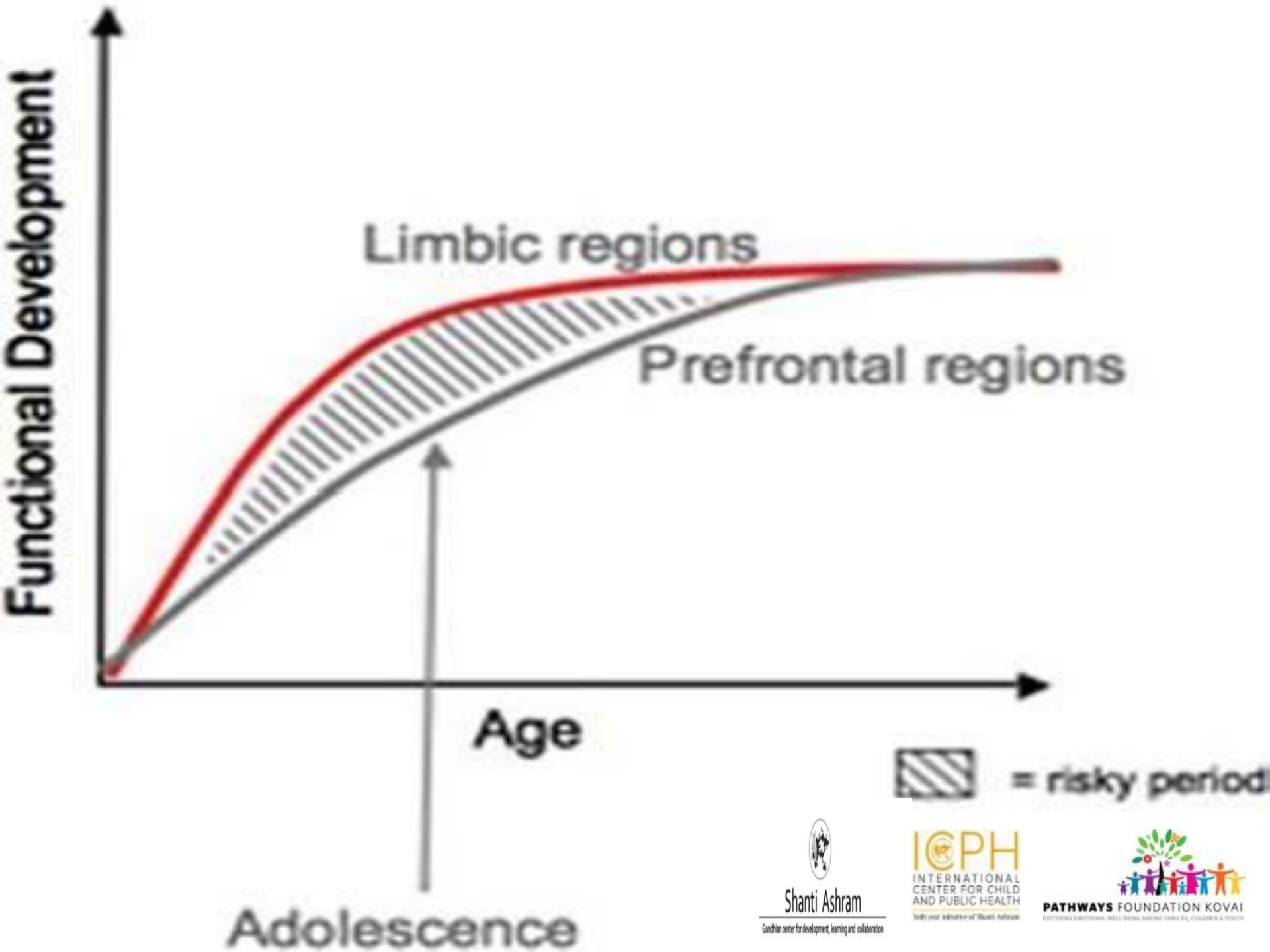
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# SOCIAL BRAIN

- ▶ Soccer game
- ▶ Reading other people's behaviour
- ▶ Medial prefrontal cortex : activity decreases during adolescence
- ▶ Adolescence use different strategies to read social situations
- ▶ Conflict between perspectives
- ▶ Ability to develop capacity to take someone else's perspective to guide behaviour is still developing in mid to late adolescence.





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# CLINICAL RELEVANCE OF BRAIN-IMAGING STUDIES

- ▶ Ventromedial prefrontal cortex associated with ability to estimate risk and potential rewards and to guide decision making, is among the last to fully develop.
  - ▶ Recklessness, impulsivity, shortsightedness and risk-taking behaviour, in part biologically driven
- ▶ Campaigns designed to change adolescent thinking may not be sufficient on their own. They need to be bolstered by external controls, such as parental oversight, supervision at school, legal sanctions regarding selling cigarettes to minors, and strict drinking and driving legislation.
- ▶ Parents, counselors and health care practitioners should view risk-taking behaviours in a developmental context and not attribute to poor character and peer pressure.



- ▶ As in Shakespeare's (1623) *The Winter's Tale*, an older man laments the recklessness of youth: "I would there were no age between sixteen and three-and-twenty, or that youth would sleep out the rest," he grumbles, "for there is nothing in the between but getting wenches with child, wronging the ancients, stealing, fighting . . . ." (Act III, Scene 3).







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# WHAT DOES THIS MEAN FOR TEENS?

- ▶ Teens may actually be able to control how their own brains are wired and sculpted
- ▶ Laying neural foundations
- ▶ Use it or lose it
- ▶ Alcohol use and teen brain: more vulnerable to the effects of alcohol on learning and memory; ongoing use can impair brain functioning
- ▶ Teens and understanding emotions: misread facial expressions (underactive frontal lobes and overactive amygdala)



# WHAT CAN BE DONE WHILE PREFRONTAL CORTEX IS DEVELOPING?

- ▶ Give simple instructions, both verbal and written
- ▶ Avoid multitask and complex instructions
- ▶ Help teens create systems to manage time, organise tasks and identify priorities
- ▶ Teenage brain need lot of stimulation
- ▶ Provide many varied opportunities to get involved in new hobbies and to discover their own interests, passion and talents
- ▶ Use active learning methods such as role plays, values clarifying exercises and forced choice scenarios



# WHAT CAN BE DONE WHILE PREFRONTAL CORTEX IS DEVELOPING?

- ▶ Educate about changes in the brain and help understand and make sense of their shifting emotions and mood swings
- ▶ Provide opportunities to share their feelings, open ended questions
- ▶ Clearly state rules and expectations for behaviour and involve teens
- ▶ Teach healthy ways to deal with stress: physical exercise, journaling, peer support groups, yoga and meditation
- ▶ Female brains matures sooner. Female brains have larger hippocampus, male brains have larger amygdala and hypothalamus



# TEENS NEED MORE SLEEP

- ▶ Changes in melatonin secretion released two hours later at night and stays later into the morning
- ▶ Adequate sleep essential to brain maturation
- ▶ Function best with 9 hours of sleep
- ▶ Avoid stimulating activities closer to bedtime, such as computer games, exercising and drinking caffeinated beverages.



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# RISK TAKING

- ▶ Teens perceive risk differently than adults
- ▶ More enticed by the challenge than by reward or outcome.
- ▶ Levels of serotonin (calming effect) and dopamine (feel good) fluctuate in adolescent brain
- ▶ Taking risk elevates dopamine; risk of drug use
- ▶ Provide opportunities for challenging experiences such as sports, hiking



# DANGER OF ALCOHOL AND DRUGS

- ▶ Alcohol, drugs and tobacco causes damage to adolescent brain
- ▶ Most addictive substances increase the level of dopamine in the reward centers of the brain, causes a sense of well-being
- ▶ Teens more likely to blackout (be conscious but unable to remember)
- ▶ Compared to adults teens less likely to succumb to the sedative effects of alcohol. Impairment of motor coordination is delayed.
- ▶ Hippocampus, which has an important role in forming new memories, is smaller in adolescents who drink heavily. Young drinkers have more learning problems as well as long-term memory impairment compared to teens who don't drink
- ▶ Drugs such as ecstasy can cause imbalance in brain chemicals and can lead to problems with impulse control and depression. Nicotine in tobacco also causes chemical imbalance and problems with connections in the brain.
- ▶ Teens are more prone to addiction



# WHAT CAN BE DONE?

- ▶ Talk with teens about the vulnerability of the developing brain to neurotoxins such as alcohol, tobacco and drugs. Teachers can add this topic to science classes. Healthcare providers can offer anticipatory guidance to teens and parents.
- ▶ Teens who are experiencing trauma, such as living in a violent household are more likely to self-medicate.
- ▶ Doctors should routinely screen for drug and alcohol use.





# HELP ADOLESCENTS DEVELOP HEALTHY RELATIONSHIPS

- ▶ Hormones and changes in the adolescent brain affect teens' sexual development, desires and decisions.
- ▶ Sexual development is a healthy, normal part of adolescence.
- ▶ Implement developmental and age appropriate programs to help teens make healthy decisions. In the west social and emotional learning curricula have been shown to improve students' interpersonal skills, reduce problem behaviours and improve academic performance.
- ▶ Teach teens about birth control before they become sexually active.



# IMPACT OF VIOLENCE IN TEEN'S LIVES

- ▶ Domestic violence and /or victims of abuse in their own home.
- ▶ Bullying, cyber bullying (via cellphones and internet) and aggressive behaviour from peers
- ▶ Exposure to violence on media
- ▶ Portrayal of women by TV and movies. Dating abuse



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# IMPACT OF TRAUMA ON TEEN'S BRAINS

- ▶ Teens need predictable and stable environment at home, school and communities.
- ▶ They need to feel safe and nurtured.
- ▶ Teens growing up in chaos and fear tend to spend more time using their 'survival brain', trying to feel okay rather than developing their prefrontal cortex.
- ▶ They adapt to their environment but at a high cost.
- ▶ Have trouble paying attention, sitting still and controlling emotions.
- ▶ Long term health effects, increased risk of teen pregnancy, risk of depression or suicidal thoughts and risk of alcohol and drugs
- ▶ ACE study



# IMPACT OF TRAUMA ON TEEN'S BRAINS

- ▶ Promote education among teachers, healthcare providers and parents regarding impact of trauma.
- ▶ Promote stronger connections with healthy adults.
- ▶ Teach media literacy in classroom and educate students on how gender stereotyping and violence can influence their beliefs, desensitize them to violence and lead to unrealistic expectations about lifestyles and relationships.
- ▶ Encourage parents to set limits on the time they spend on electronic media. Encourage parents to be closer to their teens by spending more time together.



*emotional and social Development*

# ESSENCE OF ADOLESCENCE



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CREATIVE  
EXPLORATION



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REMEMBER, MOST OF THE TIME

