



## MODULE ONE:

# THE AMAZING TEENAGE BRAIN

### Brain Science

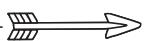
Teenage behaviour can be hard to understand. For years, neuroscientists (and parents) have struggled to figure out why teens exhibit inconsistent and sometimes challenging behaviours. Extensive MRI studies are now revealing important insights into why teen brains are 'different'. Medical experts can now help to explain why these years are often characterised by amazing triumphs and sometimes scary pitfalls. This new knowledge may help young people to maximise the opportunities the teen years bring while minimising some of the risks and challenges they face.

#### The Science in Brief:

**MRI studies** show that "the teenage brain is not an old-child brain or a half-baked adult brain; it is a unique entity characterised by changeability and an increase in networking among brain regions". **The limbic system** – which drives emotions – intensifies at puberty, but the **prefrontal cortex** – which controls impulses – does not mature until the 20s. There are pros and cons to this mismatch – while it can make teens prone to risk taking, it also allows them to adapt readily to their environment. This stage of development is now more prolonged due to the **earlier onset of puberty** in children worldwide.

**Greater understanding** of the teen brain should help parents and society better distinguish typical behaviour from potential mental illness, and enable them to navigate this tricky time more effectively. If they can 'pick their battles' and, try not to 'sweat the small stuff' they will be able to help their teens focus on becoming the people they want to be while navigating their way through this tumultuous time of their lives.

*Dr J. N. Giedd, Scientific American, June 2015*



## Key Facts:

### FACT ONE:

**Teenage brains have amazing plasticity (ability to change and adapt). Extensive changes take place in the brain during the course of adolescence.**

#### Pros:

This amazing plasticity allows teenagers to make enormous strides in thinking and socialisation.

#### Cons:

This plasticity also makes teenagers vulnerable to dangerous behaviours and mental disorders.

## Mental Health

Adolescence is the peak time for several types of mental illnesses to emerge including; anxiety disorders, bipolar disorder, depression, eating disorders, psychosis and substance abuse. Understanding that the adolescent brain is unique and rapidly changing can help parents, society and teens themselves to better manage the risks and grasp the exciting opportunities of the teenage years. Knowing that the prefrontal executive functions are still under construction may help parents avoid overreacting to their teen's questionable decisions and give them hope for better judgment in the future.

### FACT TWO:

**The two major areas of the teenage brain are out of balance for an increasingly significant period of time.**

Development of the limbic system, which drives emotions, intensifies as puberty begins (typically between the ages 10 and 12), and the system matures over the next several years. But the prefrontal cortex, which keeps a lid on impulsive actions, does not approach full development until a decade later, leaving an imbalance throughout the interim years. With the earlier onset of puberty, hormones are being boosted when the prefrontal cortex is even less mature.

## The Limbic System

The limbic system regulates emotion and feelings of reward. It also interacts with the prefrontal cortex during adolescence to promote novelty seeking, risk taking and a shift toward interacting with peers. These behaviours, deeply rooted in biology and found in all social mammals, encourage young teens to separate from the comfort and safety of their families to explore new environments and seek outside relationships. While these impulses diminish the likelihood of inbreeding, creating a healthier genetic population, they can also pose substantial dangers, especially when mixed with modern temptations such as easy access to drugs, firearms and high-speed motor vehicles. When sound judgement isn't at play, the consequences from risky actions can sometimes be devastating.



## The Prefrontal Cortex

The prefrontal cortex plays a very important role in an individual's judgement and control.

### Specific functions include:

- Organization
- Decision making
- Planning
- Regulation of emotion
- Consideration of hypothetical 'what if's' to weigh likely outcomes of actions
- Evaluating short term versus long term rewards

The prefrontal cortex functions are not absent in teenagers; they are just not as good as they are going to get. Because the functions don't fully mature until their 20s, teens may have trouble controlling impulses or judging risks and rewards.

What most determines teen behavior, then, is not so much the late development of executive functioning or the early onset of emotional behavior but a mismatch in the timing of the two. If young teens are emotionally propelled by the limbic system, yet prefrontal control is not as good as it is going to get until, say, age 25, that leaves a whole decade when teens are vulnerable to the imbalances between emotional and contemplative thinking.

## Implications for Educators and Career Development

Adolescents' inherent capacity to adapt raises questions about the impact of one of the biggest environmental changes in history: the digital revolution. Computers, video games, cell phones and apps have, in the past 20 years, profoundly affected the way teens learn, play and interact. With the sheer volume of information available, the skills of the future won't be focused on remembering facts, but to critically evaluate a vast expanse of data, and apply learnings to real-world problem solving.

Harnessing the passion, creativity and skills of the unique adolescent development period can also benefit greater society as well.

For teens themselves, the new insights of adolescent neuroscience should encourage them to challenge their brain with the kinds of skills that they want to excel at for the rest of their lives. They have an opportunity to craft their own identity and to optimise their brain's capacity by making the most of the exciting data-rich future that will be dramatically different from the present lives of their parents.

### Themes:

- Capitalize on the brain plasticity of teenagers to train their brains for the demands of the digital age and career paths that may not yet even exist.
- Creativity, innovation, critical evaluation, ability to synthesize multiple sources of complex information and problem solving will be key skills required in the future. Teenage brains are designed for these functions.
- While developments in the teenage brain present amazing opportunities for rapid learning and skill development, they also present vulnerabilities. Teenagers are very open to external influences (both positive and negative).
- There is a world of possibilities available to teenagers and the research on brain development indicates that there are still significant opportunities to train the brain in a range of directions. While clear personality traits and natural skill sets may be evident, opportunities to excel and pursue a multitude of career paths remain very open.



# AN EXERCISE IN LATERAL THINKING FOR THE AMAZING TEENAGE BRAIN!

The following questions will test your ability to think laterally. If you get more than 50% of these right you're certainly strong on your lateral thinking skills.

## Question One

What can you put in a wooden box that would make it lighter? The more of them you put in the lighter it becomes, yet the box stays empty.

## Question Two

A woman lives on the tenth floor of a block of flats. Every morning she takes the lift down to the ground floor and goes to work. In the evening, she gets into the lift, and, if there is someone else in the lift she goes back to her floor directly. Otherwise, she goes to the eighth floor and walks up two flights of stairs to her flat. How do you explain this?

## Question Three

A window cleaner is cleaning the windows on the 25th floor of a skyscraper, when he slips and falls. He is not wearing a safety harness and nothing slows his fall, yet he suffered no injuries. Explain.

## Question Four

John's mother has 3 children, one is named April, one is named May. What is the third one named?

## Question Five

You are running in a race. You overtake the second person. What position are you in?

## Question Six

Name three consecutive days in English without using the words Tuesday, Thursday, or Saturday

## Question Seven

Name an ancient invention still in use in most parts of the world today that allows people to see through walls.

## Question Eight

A five letter word becomes shorter when you add two letters to it. What is the word?

## Question Nine

If a red house is made of red bricks, and a blue house is made of blue bricks, what is a greenhouse made of?

## Question Ten

When asked how old she was, Beth replied "In two years I will be twice as old as I was five years ago". How old is she?

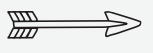
## Question Eleven

A farmer has 15 cows, all but 8 die. How many does he have left?

## Question Twelve

The amount of water flowing into a tank doubles every minute. The tank is full in an hour. When is the tank half full?

[Sourced from the University of Kent, United Kingdom 2/10/2015]



## ANSWERS:

- |  |                               |                |
|--|-------------------------------|----------------|
| 1. Holes   | 4. John                       | 9. Glass       |
| 2. She is too short to reach the upper level buttons | 5. Second                     | 10. 12         |
| 3. He was cleaning the inside of the windows         | 6. Yesterday, today, tomorrow | 11. 8          |
|  | 7. The window                 | 12. 59 minutes |
|  | 8. Short                      |                |

## Source Material:

This document relied heavily on material sourced from Dr Jay N. Giedd's June 2015 article in Scientific American, The Amazing Teen Brain: Rapidly changing wiring leads to mental agility – and risky behaviour.

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### VIDEO:

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