# The adolescent brain

## Introduction

15 years ago scientists thought that most brain development was in the first few years of life. Use of MRI has allowed us to develop a picture of how the human brain develops.

We know that there are significant changes and differences in the adolescent brain that may help to account for why adolescents are like they are.

## The main areas of the adolescent brain that are significant:

## Prefrontal cortex:

This is located at the very front of the brain, just behind the forehead.

This is the last section of the brain to mature and MRI has shown us that it is only finally finished by the age of 25 so it's very much still in development during adolescence.

The pre frontal cortex is responsible for

- Decision making
- Planning
- Inhibiting inappropriate behaviour (stopping yourself being really rude, doing something stupid), i.e. regulating behaviour including mediating conflicting thoughts
- Making choices between right and wrong
- Supressing sexual and emotional urges
- Social interaction
- Understanding other people and social awareness.

## The limbic system

This consists of a set of structures on both sides of the thalamus and immediately beneath the cerebrum. It includes the amygdala, the hypothalamus, the thalamus and the hippocampus.

The limbic system is involved in emotion processing and reward processing. It gives you the reward or the kick when taking risks.

MRI and research have shown us that, when compared with the adult brain, the limbic system, is hyper-sensitive to the rewarding feeling of risk taking in adolescents compared with adults.

In essence you have the limbic system that is hypersensitive together with the pre frontal cortex, that stops us taking risks, being very much in development in adolescence.

## Grey matter

Just before puberty (11 for girls and 12 for boys), we see an increase of grey matter in the pre-frontal cortex, the part of the brain that has the most to do with thinking, reasoning, logic and decision making.

However during adolescence there is significant decline in grey matter in the prefrontal cortex.

This is a very important developmental process as grey matter contains synapses (the communication devices). This decline is called synaptic pruning. Synapses which are being used are strengthened and synapses not being used are pruned away. This will eventually allow the remaining, important synapses to grow stronger (this is called myelination) a sort of fine tuning of brain function.

It's as though the cells the brain doesn't need just fall away. By 16/17 you have the adult level synapses. During normal adolescence you lose about 15% of grey matter from your cortex. Adolescence is a period of huge and surprising physical change in the brain. It's as though many different parts are being remodelled to work in the more complex ways necessary in adult life. During

this upheaval and change maybe the pathways for sensible behaviour and just not working that well.

## How this affects our teenage years/what behaviours do we see as a result of our teenage brains?

Typical adolescence behaviours are

- Risk taking
- Self-consciousness
- Being self-absorbed
- Being moody

Teens take more risks that children or adults and particularly when they are with their friends. The development of the brain is the reason why otherwise intelligent and sensible teens engage in high risk or excessive behaviours even though they understand the potential danger. There's a drive to become independent from your parents and to impress your peers. The ability to take into account someone else's perspective in order to guide behaviour is still developing in mid-late adolescence. So if you think the teen you know has problems talking others people perspectives they do.

**Exercise:**

*P 31 of the Nicola Morgan book as referenced.

Look at the picture.

What emotion is the person feeling?

In an experiment, all adults got it right and all teens got it wrong.

This is because the adults used the prefrontal cortex when they looked at the picture. The adolescents used their amygdala (tiny part of the limbic system linked to gut reaction/raw emotion which works through instinct and not logic).

So… teens have difficulty in reading the faces of adults around them. Boys are slightly worse than girls as they use their amygdala more strongly.

## Prevalence of mental health problems in adolescence

Adolescence is a time of increasing incidence of several classes of psychiatric illness including:

- Anxiety
- Mood disorders
- Psychosis
- Eating disorders
- Personality disorders
- Substance misuse

This can be due to the maturational changes in the adolescent brain acting alongside psychosocial factors such as school and relationships and/or biological environmental factors such as puberty, hormonal changes, and substance misuse.

15-20% of teenagers will have depression (similar % as adults). It affects twice as many girls and women as boys and men.

**Suicide**

Teen rate of suicide in teenagers is higher than in adults (second most common cause of death in 15-24 year olds after accidents) so maybe this extreme bad decision making does have something to do with the pre-frontal cortex. Suicide in a teenager is the ultimate bad decision – to end your life because at that moment life so doesn't seem to be worth living. Males are statistically less likely to get treatment for depression, but more likely to commit suicide successfully.

## Effects of culture

Is life more stressful for teens right now? There may be more decisions to be made, more room for arguments, more expected of you. The adults in your life are more stressed and so less containing. This increased stress can lead to depression and addiction.

## References:

Nicola Morgan *Blame My Brain – The Amazing Teenage Brain Revealed* 2013

TED talk: *The mysterious working of the teenage brain* Sarah-Jayne Blakemore cognitive neuroscientist Sept 2012

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