

The Teenage Brain

The teenage years can be a challenging emotional rollercoaster for young people as well as the adults in their lives. Risk taking behaviours, pushing boundaries and lack of impulse control are things most families experience.

For millennia these have been considered simply as teenagers' bad behaviours or rebellion, but nowadays we know they are a consequence of a normal and essential part of development.

So what's going on?

Scientists used to think our brains stopped developing in childhood, but we now know they keep changing until we're about 25. They also believed the behavioural changes of the teenage years were due to hormones and widening social lives at secondary school.

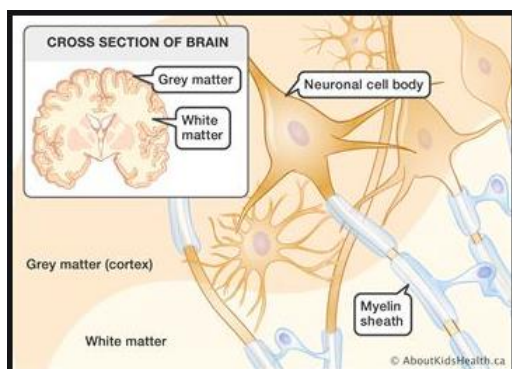
However, technological advances in the last 10-15 years have enabled scientists, psychiatrists and psychologists to do more detailed studies of the brain. They've shown that from puberty until the late teen years, young people's brains undergo significant structural and functional changes that neuropsychiatrist and author Professor Dan Siegel calls "remodelling." Clinical Psychologist and author Professor Sarah-Jane Blakemore is another leading expert in this field. She explains: "The adolescent brain isn't a dysfunctional or defective adult brain; it is the result of a formative and essential period of development to reach adulthood."

It is these physiological and functional changes that lead to the sometimes dramatic changes in behaviour we see in our young people.

Understanding the changes

Brain remodelling: upgrading to adult version 1.0

The brain comprises billions of specialised nerve cells called neurons that connect with each other to form neural pathways via junctions called synapses. The outer part of the brain is called our grey matter, the inner layers are our white matter.



During adolescence, there's an increase in white matter caused by increased insulation of the nerve fibres via a process called myelination, which enables faster and more efficient processing (3000 times!) to prepare us for the greater complexities of the adult world.

In addition, up to 17% of the neurons and their connections in our grey matter in the outside cortex or 'higher brain' area is lost. This process of 'pruning' means less well used connections are lost, while frequently used pathways are strengthened.

The logical, higher thinking pre-frontal cortex (the area behind our forehead) is responsible for our cognitive functions, such as decision making, planning, self- and impulse control, social interaction and self-awareness. This matures later than the parts of the brain responsible for emotions.

So when our teenagers frustrate us with unclear thinking, poor judgement and lack of organisational abilities, we need to cut them some slack: their brains are undergoing enormous structural changes and the adult circuitry and associated abilities and skills simply aren't developed yet. This explains why a teenager could win an Oscar for their emotional drama, but probably couldn't organise themselves to get to the ceremony on time to receive it!

Despite these down sides, this re-structuring is also a period of great opportunity as the adolescent brain is primed for change, with experiments showing it is particularly sensitive to experience and learning in certain areas, such as mathematical ability and performance.

[Teen Brain upgrade video](#)

Sleep

Re-modelling takes a lot of energy, so it's no surprise that teenagers suddenly need more sleep. Unfortunately this tends to be in the mornings, which again has a biological basis.

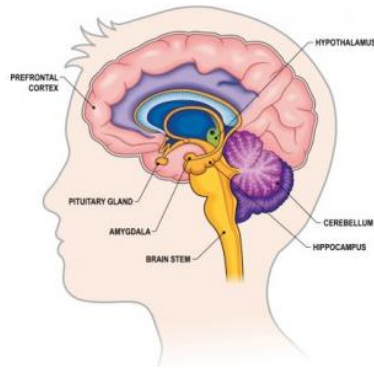
During adolescence, the body's circadian rhythm (the internal biological clock) is reset, telling a teen to fall asleep later at night and wake up later in the morning. This change is because the brain hormone melatonin is produced later at night in teens than in younger children and adults. So, teenagers can have a [hard time falling asleep](#).

In fact, many teenagers are not getting the minimum nine hours sleep a night that they need. Sleep deprivation, however, has a detrimental effect on learning because while we sleep our brains consolidate learning from the previous day. Lack of sleep also lowers mood. Exposure to daylight is an important factor in supporting our bodies' natural circadian rhythm as it regulates production of the sleep hormone melatonin in the pineal gland overnight. So ensuring young adults spend time outside in daylight each day is important.

Emotional rollercoaster

During adolescence the older and more primitive [limbic](#) or emotional part of the brain develops faster than the logical, higher thinking pre-frontal cortex, which is responsible for our cognitive functions.

A key part of the limbic system is the amygdala, which controls our fight or flight survival response. This is automated, meaning we have little control over how it responds unless we specifically train our brains to [better regulate its reactions through practices such as mindfulness](#).



Our amygdala also can't distinguish between real and perceived threats, or between physical and psychological dangers.

So if a teenager feels psychologically threatened, intimidated or unsafe (for example, if they feel criticised, judged or like they have no control in a situation), their amygdala will fire up and create emotional responses and outbursts to this perceived threat. This fear will be seen in a variety of emotions and behaviours such as anger, aggression,

frustration and so on.

Until the higher brain (the pre-frontal cortex) is more developed, it's not possible for young adults to overlay these responses with any perspective or logic. So when our teenagers fly off the handle, say things they don't really mean or go from calm to angry in seconds, it's their amygdala that's talking and acting out.

Our job as adults is to help them learn how to manage and respond to these intense feelings – by being calm and rational, speaking respectfully, not shouting and so on. By role modelling higher brain responses, we can teach them about appropriate behaviours. And the opposite is also true – if we allow our amygdala to control *our* emotions, then we are behaving in the ways we find so frustrating and disrespectful in our teenagers.

The practice of mindfulness has been shown to be highly effective at helping people to regulate their emotional responses and in particular, in [supporting parenting of teenagers](#). It teaches us to observe our emotions rather than 'become the emotion', so we are better able to remain calm in the face of challenging behaviours. It also teaches us the art of acceptance and letting go – so being able to witness chat back for example, accepting it's part of our teenager's brain development and also accepting that underneath the behaviour is an emotion our teenager is learning how to cope with, which enables us to let go of the emotional response we'll have (eg anger or frustration), so we can respond with greater understanding and compassion to what they're going through.

Impulsive behaviour, risk taking and decision making

The developmental mismatch between the early developing limbic area and the later developing thinking brain also accounts for why many teenagers are more pre-disposed to impulsive and pleasure seeking behaviours than adults. It's also why they will also respond more positively to immediate rewards rather than punishments (perhaps useful when considering parenting approaches!).

This means young adult behaviour is biased towards choices that might result in high rewards even if the behaviours have negative consequences. That said, it's worth pointing out that these tendencies to seek pleasure and reward don't always lead to poor consequences.

Teenagers' abilities to use information to make risk-based decisions is particularly under-developed in social contexts. So teenagers are more likely to try activities with perceived immediate rewards, such as drinking, when with others than when by themselves.

This development mismatch also means that a young adult is likely to find it hard to concentrate on a task in the presence of emotionally distracting stimuli. So, for example, being able to concentrate sufficiently while driving with a friend sitting in the passenger seat.

The good news is that impulse control does increase as they move into early adulthood as their pre-frontal cortex catches up, so this stage doesn't last forever. It's also important to remember that risk taking and experimenting are an important part and way of learning, providing of course that the person comes to no serious short or long term harm as a result of their actions.

Why others' views and opinions are SO important

Experiments have shown that adolescents become increasingly aware of and concerned about the opinions of others and are more sensitive to and place more importance on the views and judgements of others. They may often over-estimate the extent to which others' evaluate them, which helps us to better understand the importance they place on social media likes, for example, as well as their sensitivity to negative comments. Of course the importance they place on others' views can have negative influences, resulting in feelings of inadequacy, for example, on [social media](#).

Studies have also shown that friendships and fitting in and being accepted by their peer group matter more to young people than to children or adults. And this is more important to them than the opinions of their parents or family. So hard as it is, we need to try not to feel upset or frustrated when our teenagers just don't want to listen to us any more!

Peer influence also affects decision making and risk taking behaviours. This is in addition to the development mismatch between the limbic and thinking parts of the brain that already make it harder for young people to make rational decisions.

The importance of peer influence means young people's decisions are driven by their need for peer acceptance and the desire to avoid social exclusion rather than by logic, so as we saw in the section on risk taking and decision making, it means they are more likely to take risks when with others that they wouldn't take when on their own.

For example, trying smoking, drinking or driving fast when they are with friends even though they know the dangers – because it's more important to them to look cool or maintain face with their peers than to put their safety or needs first. In other words, social exclusion is considered more risky in the brains of teenagers than activities considered risky by adult brains, such as taking drugs.

Studies show that young people are hyper sensitive to social exclusion, resulting in increased anxiety and low moods. It can also affect their feelings of social and personal worth, with peer rejection leading to feelings of unworthiness as individuals. In fact, in experiments with

adolescent rats, researchers found long term behavioural, hormone and brain changes in rats separated from their peers.

Developing a sense of self

Our experiences during adolescence shape our emerging sense of self and we start constructing who we are and how we're seen by others in the world as well as how we fit into the world and our place in it.

While younger children soak up facts and thoughts in concrete ways, teens and young adults are able to see things in more abstract ways. They are also able to be more creative with their problem solving and think critically about themselves and others. This means young people may be idealistic and opinionated and may challenge 'old ways' of doing things. This is fine and normal, and in fact is important as they develop their sense of self.

Clothes, music, fashion, posters, partners, films, books, moral and political beliefs and allegiance with particular social groups all start to emerge during this time. As adults it's important we're able to support our young people to express their emerging preferences during adolescence (assuming they are making healthy choices of course, and however much we may dislike their music or their taste in clothes!), so they are able to develop this clear sense of identity and who they are.

Risk factors

Environmental factors have been shown to influence brain development in adolescents.

Cannabis increases the risk of schizophrenia and decreases cognitive ability, such as memory, processing, reasoning and verbal comprehension. It's worth noting though that not all teenagers who smoke cannabis are negatively affected by it. This is an area of ongoing research into why cognitive functions in some teenagers are more affected than others.

Research has shown that alcohol use during adolescent years may have a higher potential for harming the brain than during adulthood as young people who drink a lot (more than 4 or 5 units in one go) show a different pattern of brain structure and function compared to those who don't. However, it's unclear currently whether the different brain structures observed in adolescent drinkers and non-drinkers cause them to engage in more risky behaviours such as drinking, or whether the drinking itself cause changes in brain structure. What is clear, however, is that drinking has a direct association with rates of risky behaviours, including those that result in accidents and injuries.

With regards to screen time, studies suggest that moderate amounts of screen time are not detrimental to mental wellbeing. However, the cause and effect are unknown – so it is possible that low wellbeing causes young people to spend very little or a lot of time on screens rather than the other way around. A 2016 study found that eating healthily and getting regular sleep are more important factors for wellbeing, with a stronger association between these and wellbeing than screen time. That said, spending hours on a screen can [affect physical, mental and emotional wellbeing in other ways](#), such as reducing academic performance and spending less time being active or outside. Screen time can also lead to [gaming and social media addiction](#).

Coping with the teenage years

Teens and young adults can often feel overwhelmed by these dramatic brain changes when everything about who they are seems to change. While the rush of new experiences can be exhilarating, changes in relationships, managing social situations and feeling torn between pulling away from parents and wanting to stay 'little' forever can feel really challenging.

It's also normal for parents to feel threatened, concerned and confused when faced with the emotional rollercoaster of the teenage years.

As parents and teens learn to navigate this re-modelling stage, helpful comments are interpreted as criticism, suggestions turn into lengthy lectures, and differences of opinions quickly become power struggles.

By understanding the changes that are taking place, we can start to view the teenage years through a different lens – one where we can try and be more understanding, kinder and compassionate to challenging behaviours. So rather than seeing our young adults as disrespectful and rebellious, trying instead to appreciate that the behaviours are due to normal and necessary changes in brain structure and function.

Embracing the changes

While it may be easy to mock and lament teenagers for their behaviour, adolescence is also a time of heightened creativity and novel thinking, energy and passion. We just need to support them to channel these in constructive ways. Adolescent brains are also plastic and malleable and they are quick learners, so we need to keep finding ways to challenge and engage them in new ideas and activities, remembering that we'll motivate and interest them more with plenty of (managed) risk and (appropriate) immediate rewards!

1. *Take time to understand how and why the structure and function of the teenage brain changes so you can try and reframe the behavioural challenges as opportunities to support and teach your teen* to work with and get the most from their developing adult brain. Hopefully this will also help you to reframe any exasperation and frustration as chances to observe, nurture and celebrate the passionate and creative individual that is emerging
2. *Help your teenager to understand and reframe the changes too* – so they don't feel there's anything 'wrong' with them. So they know that flying off the handle and saying hurtful things sometimes is just their amygdala firing up and taking over because their pre-frontal cortex is still developing. And when they sleep in, they're not being lazy, and when they struggle to organise themselves, they're not useless. You'll do wonders for their self esteem and feelings of worth.
3. *Try to see or hear the emotions and feelings underneath the behaviours and acting out.* Emotional outbursts/behaviours will be linked to a feeling or emotion that they may not be able to identify, but which has 'become them' in how they're behaving. For example, feeling threatened by something you say or the tone in which it's said (eg "You need to get up earlier"), will trigger the automatic 'fight or flight' response, and will be seen as a defensive or aggressive 'fight' behaviour such as shouting back, or a flight behaviour, such as storming off. Try and teach them to see they are not their

behaviour; help them to name the emotions they're feeling (eg anger, frustration, resentment); and help and teach them different and more acceptable ways of dealing with and feeling those emotions. Note: this is likely to involve some work on yourself too! Start to notice your behaviours, eg when you may shout, and try and identify the feeling or emotion behind that behaviour. In this way we can role model the behaviours we need to teach our young people. Using a [Feeling Wheel or App](#) can help you and them to better tune in to emotions and feelings.

4. *Become curious.* Are they shouting out of frustration? Try acknowledging this and see what happens. You can simply say: 'You seem frustrated'. Or maybe you think it's anger behind the behaviour, so again, become curious and focus on trying to understand their anger rather than telling them off for shouting. In this way your teenager will feel listened to, understood and supported in their moment of angst, which will help reduce their stress response and calm them down.
5. Linked to becoming curious, *learn to listen to them.* Really listen. So listening rather than talking, hearing rather than 'lecturing' or trying to provide solutions. As adults we know how infuriating it can be when we just want to sound off and be heard when something's upset us or made us angry. So again, seeing beyond the behaviour to what's really going on and the emotions and feelings they're going through. Try repeating or paraphrasing what they're saying ('It sounds like you've had a tough day', 'I can see that's upsetting', 'You seem down'), or ask questions to check understanding of what they're saying ('That sounds really frustrating. What happened?', 'I think you're feeling the criticism was unfair?'). You will gain a greater understanding of why they're behaving how they are, and your teen will feel heard and understood. Sometimes they may not understand or know what's wrong. That's ok, just be there for them and let them know you're happy to listen whenever they want to talk.
6. *Become a witness to what's happening rather than reacting to it.* This can be challenging in the heat of the moment, but remember, their behaviour is simply an expression of a feeling or emotion that they haven't yet learned how to handle (because their pre-frontal cortex isn't yet fully developed and/or because they need more help from you to role model and show them how to deal with the emotion). Try not to 'join' them in also becoming the emotion you're feeling, but stand back and observe with detached curiosity. Ask yourself, what's going on here? Observe, listen and resist getting sucked in. Sometimes simply acknowledging their feeling (eg 'You seem upset') is all you need to say or do.
7. Standing back will help you to *see them as an individual*, as you would with adult friends. This can help to reduce the judgements you may feel and help you to accept them more for who they are. Most of us wouldn't dream of talking to our adult equals like we sometimes speak to our young adults, and we wouldn't dream of trying to make our adult friends and colleagues more like us; we accept them as they are, warts and all. Let's try and do the same with our own young adults.
8. *Be prepared to be vulnerable yourself, and also to acknowledge if you get something wrong.* Sharing our own emotions and how we feel helps us to feel less frustrated, angry, upset or resentful because we're being heard and understood, and it also helps to teach our teens about identifying and handling emotions in constructive and acceptable ways. And an apology goes a long way. So if you feel upset about how you handled a situation or upset with how they've spoken to you, express this. For example: 'I'm sorry I lost my temper; I felt frustrated with the situation' or 'I need you

to know that I'm feeling upset by our argument / by how you spoke to me. I hear what you're saying and I understand how you're feeling but it's important to learn how to express what you're feeling in kinder/other ways. So maybe next time, help me to better understand where you're coming from by xxxxxx [show them how they could have handled the situation differently or expressed their emotions differently]'. In this way you're trying to role model how they need to learn to behave. If we can't show them without shouting ourselves, how are they going to learn anything different?

9. *Pick your battles.* Maintaining the relationship is everything. Try doing 1-8 and it will help.
10. *Be kind and compassionate to yourself too.* The teenage years aren't easy and none of us gets it right all of the time, and sometimes not even most of the time. All we can do is be open to learning alongside them and to do our best. [Mindfulness practice](#) by parents has been shown to support both parents and their young adults through developing skills such as listening, curiosity, observing/standing back, being compassionate, acceptance and being non-judgemental (remember, being judgemental and critical induces the automatic fight or flight response in the amygdala, which results in behaviours such as defensiveness, aggression and anger).

Try and enjoy these turbulent, crazy years, they are precious. Your teen is on the cusp of their adult lives; it's an exciting if sometimes scary and frustrating whirlwind for everyone. As they stand on the edge of the nest, they need to know you're still there for them when they need you. But they also need to be allowed to test their wings, makes mistakes, learn and eventually fly the nest and live as individuals and adults in their own right.

Further resources

- Professor Dan Siegel on supporting teenagers with, and helping them to develop, empathy and compassion: <https://www.youtube.com/watch?v=TLULtUPyhog>
- Read his book: Professor Dan Siegel book, *Brainstorm: The Power and Purpose of the Teenage Brain*: adolescence is not a problem to be tackled but an opportunity to be realised
- Professor Dan Siegel does a positive take on the adolescent brain: <https://www.youtube.com/watch?v=0O1u5OE5eY>
- Professor Dan Siegel explains the limbic area of the brain and how changes in the teenage brain affect behaviour <https://www.youtube.com/watch?v=gw9GrgNcYcg>
- Professor Dan Siegel on the 4 key changes of adolescence and how they prepare teenage brains for adulthood: <https://www.youtube.com/watch?v=GGZD8xxbzmU>
- Professor Sarah-Jane Blakemore on the mysterious workings of the adolescent brain: <https://www.youtube.com/watch?v=6oKsikHolIM>
- Read her book: *Inventing Ourselves – The Secret Life of the Teenage Brain*
- In the *Neuroanatomical Transformation of the Teenage Brain*, Neuroanatomist Dr Jill Bolte Taylor asks: 'What are you doing with your power?': https://www.youtube.com/watch?v=PzT_SBI31-s
- *The Teenage Brain Explained* – a whistle stop tour of the teenage brain <https://www.youtube.com/watch?v=hiduiTq1ei8>
- Dr Dickon Bevington, Child and Adolescent Psychiatrist and Medical Director at the Anna Freud National Centre for Children and Young People on understanding adolescent brains and behaviour: <https://www.youtube.com/watch?v=C3l1xVzESqc>
- <https://www.headspace.com/mindfulness/mindful-parenting>