

THE Chrysalis YEARS

Navigating the teenage years can feel akin to walking through a minefield on occasion, but it is also a time of profound transformation and development



WORDS EMMA GREEN

Adolescence is often portrayed as a tumultuous period, filled with acne, angst and awkwardness. The teenager, not quite a child but not yet an adult either, faces a new onslaught of challenges to deal with from increasing academic pressure and negotiating the social politics of school, to riding the rollercoaster of emotions they now encounter on a near-daily basis. It can be a confusing and frustrating time, both for those experiencing it and for those trying to support them.

Fortunately, thanks to advances in neuroscience, there is a far greater understanding of the biological, psychological, cognitive and social factors that shape the inner workings of the teenage mind. Until recently, research in developmental psychology had primarily focused on early childhood, but with the help of magnetic resonance imaging (MRIs), neuroscientists have now been able to discover the powerful influence that puberty and adolescence have on the brain's anatomy.

Far from being a half-baked version of an adult's brain, science is now beginning to appreciate the adolescent mind as a dynamic and evolving entity, built to operate differently from that of a child's or an adult's.

What is adolescence?

Adolescence is the developmental

“IT'S A CONFUSING TIME, FOR THOSE EXPERIENCING IT AND FOR THOSE SUPPORTING THEM”

stage that marks the transition from childhood to adulthood, typically spanning from the ages of 10 to 19. The concept of adolescence, though, is not always synonymous with the teen years. The onset of puberty, which marks the biological underpinnings of adolescence, tends to start well before the teenage years – for girls, as early as eight years old, and for some boys, at nine years old. Most researchers also consider the cessation of adolescence to be around the age of 25 when our brains have fully developed.

Adolescence is typically split into three stages, spanning the significant and drastic changes that occur from being a pre-teen to eventually becoming a young adult. Pre-teens (aged 10 to 13) are classed as being in early adolescence, teenagers (aged 14 to 17) are labelled as being in middle adolescence, and young adults (aged 18+) are deemed to be in late adolescence.

How does the brain change during adolescence?

Although the brain reaches 90-95% of its adult size by the time a child is six years old, adolescence sparks an extensive

remodelling of the brain structure, with notable changes in both the prefrontal cortex and the limbic system. Brain maturation occurs not by the brain getting larger, but through an anatomical reorganisation, starting at the back of the brain where the oldest and most primitive parts reside, and then moving gradually towards the newer, more advanced components at the front.

The limbic system, otherwise known as the emotional centre of the brain, is responsible for processing emotions and rewards, and is the first section to complete the remodelling phase, usually during early adolescence. The prefrontal cortex, on the other hand, which is known as the reasoning centre and responsible for executive functions such as planning and impulse control, continues to mature well into early adulthood. Adolescence marks a period of imbalance where the more advanced and highly aroused limbic system has the upper hand over the under-developed control system. This delayed maturation of the reasoning centre might explain why teenagers tend to face challenges with emotion regulation, risk assessment and future-orientated thinking.

A process that contributes to the eventual development of the prefrontal cortex is the increase in myelination during adolescence. A fatty substance called myelin forms a sheath around the axons of neurons, and acts as an insulating layer. This significantly increases the speed and efficiency of electrical signal transmissions along the nerve cells, which then leads to faster communication and coordination between different areas of the brain, resulting in more complex cognitive processes.

Simultaneously, another process called synaptic pruning also occurs in the prefrontal cortex at the same time. This is where weaker synaptic connections formed during early childhood are removed to improve brain efficiency by focusing energy and resources instead on more frequently used connections. Although pruning and myelination occur throughout the entirety of the brain's lifespan, in adolescence, it primarily focuses on elimination, with more than 40% of synapses being removed during this time. »

TALKING TO YOUR TEENAGER

Creating a safe space for adolescents to express their thoughts and feelings without fear of judgement is paramount. At this age, it's more vital than ever to keep the lines of communication open and to check in with them frequently, even when they don't feel like talking. Keeping conversations positive, and engaging in active listening, can help to build trust and more willingness on their part to discuss heavier topics, such as safe sex, consent and drugs. “We tend to get very laser-focused as parents on correcting all of the things that they're doing wrong, and that sends a message to them that they can do nothing right,” says Dr Caswell. “And that's not a good feeling. When we start focusing on what they do well, we start seeing more of it and the entire dynamic changes completely.”

Cognitive development

With all these anatomical alterations occurring in the teenage brain, it is no surprise that cognitive processes also undergo significant changes. The strengthening of neurocircuitry and the ongoing development of executive functions allows teenagers to have more enhanced abilities to multitask, problem-solve and retain and process complex information.

Jean Piaget, a Swiss psychologist, developed a theory of cognitive development that suggested that children undergo four different stages of intellectual growth. According to Piaget, at around the age of 11 or 12, children enter the fourth and final stage, known as the formal operation stage. This is characterised as a shift from concrete to abstract thinking because, unlike younger children, adolescents are no longer bound to concrete examples of what already exists; they can envision multiple possibilities and prospects for the future.

Teenagers begin to think more critically and logically and are capable of looking at hypothetical situations. This cognitive advancement allows them to engage in metacognition – or thinking about their thinking. They start to reflect on their thoughts, beliefs and values, and may

become sceptical of those handed down to them by social norms or their caregivers.

Another important cognitive process that adolescent brains go through during this time is specialisation, largely thanks to synaptic pruning. As the brain focuses on eliminating unused neural connections and strengthening those that are utilised, it can be an opportune time for teenagers to develop skills, talents and interests that will serve them well into the future. Optimising their brains through productive activities such as reading, playing sports, or learning a new instrument or language can hardwire the relevant synapses and reinforce positive habits into adulthood. This can also work both ways – for example, if a teenager spends most of their time procrastinating or spends too much time on screens, then these will be the behavioural patterns that will be reinforced instead.

It is crucial, though, that as adults we are patient with teenagers while they are trying to develop new skills. “We have to give them the opportunities to learn and make mistakes,” says Dr Cameron Caswell, an adolescent psychologist and parent coach. “Learning is like starting on a dirt road. Things that we think should be easy for teens aren’t because they’re still creating those neural pathways and they are very rocky. But the more they travel down them and reinforce those paths, the smoother they will get as that behaviour becomes more automated.”

Hormones and neurotransmitters

Many of the structural changes that we see in the brain during adolescence are due to the surge in hormones that are triggered by the onset of puberty. Puberty begins when the hypothalamus, found in the limbic system, starts to release gonadotropin-releasing hormone, which then stimulates the pituitary gland to produce and release luteinizing hormone (LH) and follicle-stimulating hormone (FSH) into the bloodstream. These chemical messengers then travel to the gonads (the ovaries in females and the testes in males), which triggers the production of sex hormones, primarily oestrogen in girls and testosterone in boys.

Although they are present before birth, this sudden flood of sex hormones alongside growth and adrenal hormones advances the development of both the prefrontal cortex and the limbic centre, as well as influencing synaptic plasticity. This spike in hormones can also contribute to the unpredictability of teenagers’ moods and behaviour. Oestrogen, for example, can affect levels of serotonin, a neurotransmitter known as the ‘happy chemical’, which is linked to feelings of

wellbeing. When oestrogen levels drop, as they do during a woman’s menstrual cycle, serotonin does as well, leading to a dip in mood. Additionally, high oestrogen levels can also cause mood swings and feelings of irritability. Fluctuations in testosterone can also affect boys’ moods – high levels can lead to aggressive and reckless behaviour, while low levels can cause depressive-like symptoms such as lethargy.

These hormonal changes can also heighten reactivity towards stress and perceived slights or rejections. Dr Caswell likens the experience to them being on their period 24/7. “Hormones are feeding into these big emotions,” she says, “and teenagers don’t yet have the capacity to control them. It’s very hard to manage.”

Changes in other chemical messengers during adolescence can also have a further impact on mood. The boost in dopamine, which is responsible for motivation and the pursuit of pleasurable experiences, makes teenagers more susceptible to rewards, both positive and negative. Adolescents become highly sensitised to novel experiences and social rewards, making them more impressionable towards risk-taking and hedonistic behaviour, such as unprotected sex, under-age drinking or reckless driving. As their control panel, the prefrontal cortex, has yet to fully develop compared to the limbic centre which houses the reward system, teenagers are less likely to be influenced by the threat of any negative consequences their behaviour might cause.

Melatonin, which helps to regulate circadian rhythms and the sleep-wake cycle, is another neurotransmitter that undergoes modifications in production. During adolescence, the timing of melatonin secretion shifts to later in the evening. This delay causes adolescents to feel sleepier later at night and want to wake up later in the morning. Unfortunately, this doesn’t bode well for the majority of teenagers who have to get up early for school or other commitments. A lack of sleep can contribute to poor concentration levels and even less ability to control impulses and mood. There has been much discussion about whether, as a society, we should introduce later school times for adolescents that align better with their natural sleep patterns, rather than trying to force them to adapt to the typical 9-to-5 work culture of adults.

Emotional development

Hormonal-fuelled mood swings aren’t the only emotional challenges that teenagers must face – during this delicate time in their lives, self-concept and self-esteem are also in flux. Teenagers are highly sensitive to how they are perceived by others, and



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self-worth is often tied to peer validation and acceptance. This heightened self-consciousness can lead to feelings of insecurity and inadequacy. 'It's like they are putting on a new pair of glasses and all of a sudden, they see the world a lot more clearly than they did as a little kid,' says Dr Caswell. 'They become far more self-aware and not only do they feel that the entire world is watching them, but they feel they are being judged, too. They are looking to how others respond to them to define whether they are okay or acceptable, and they usually find a lot of reasons as to why they are not. That's why self-esteem issues tend to appear around this age.'

This increased introspection is a necessity, though, if teenagers are to achieve one of adolescence's most important tasks: identity formation. Erik Erikson, an ego psychologist, proposed a theory of psychosocial development that chronicled eight different stages of personality formation over an individual's lifespan. According to Erikson, five of these stages occur during childhood, with the fifth stage happening between the ages of 12 to 18. He refers to this as the struggle between identity and role confusion. The quest for a coherent sense of self means that teenagers need to be able to explore different roles, beliefs and ideas, distinct from those of their parents and caregivers, to forge their own unique identities. This may explain why teenagers seem to flit between liking something one minute and then hating it the next. Erikson's theory suggests that if adolescents are given the freedom to experiment with different identities, they will emerge from this stage with a robust and stable sense of self, along with clear values and goals for the future.

He also believed that the successful completion of each stage resulted in the attainment of a positive virtue or character strength - in this case, fidelity, which is the ability to commit to an identity. However, if for whatever reason teenagers are not allowed to experiment with different identities, they will experience role confusion. Not only will they struggle to find a sense of purpose,



but they will fail to advance to the next stages of Erikson's development model until this issue has been resolved.

As experimentation is essential during this period of personal development, it is no surprise that risk-taking and impulsive behaviours become amplified as well. Increased levels of testosterone in both boys and girls embolden them to take more risks and indulge in sensation-seeking

behaviour. There are also the social benefits such as status and respect that come from participating in risky situations - studies have shown that adolescents make far more precarious choices when they're in a group compared to when they're alone. Teenagers are still able to assess risk just as well as adults do - the difference is that teenagers place far more value on the benefits of risky behaviour over any possible negative »

ADDRESSING MENTAL HEALTH NEEDS

It can be hard to know where to turn to for help when dealing with mental health problems, especially in an adolescent. If you are worried about your child's wellbeing, the first port of call should be speaking to their doctor, a medical professional or someone you trust at their school, such as a teacher or school nurse. They can advise you on what children and young people's mental health services are available. Although the type of help offered will depend on local availability and the nature of your child's mental health condition, the most common types of therapy for teenagers include cognitive behavioural therapy (CBT), dialectal behavioural therapy (DBT), acceptance and commitment therapy (ACT), and interpersonal therapy (IPT). Sometimes, family therapy or group therapy might be recommended. Fortunately, most mental health conditions can be treated or managed if appropriate treatment is accessed early on.

outcomes. Just at the age though where teenagers develop a propensity towards reckless behaviour, is when their brains are at their most vulnerable to developing harmful habits. Studies have shown that teenagers are far more likely to get addicted to substances like alcohol and drugs compared to adults, due to the highly aroused reward centres in their brains.

There are positive aspects to this new-found thrill-seeking though. From an evolutionary standpoint, taking risks enabled offspring to break away from their caregivers to find a mate and discover new methods of doing things. Taking risks helps teenagers to develop their confidence in being able to handle difficult situations, and doesn't always have to be associated with negative behaviour either - it could manifest in plucking up the courage to talk to a crush or standing up for something they believe in. Taking risks also allows them to discover their likes and dislikes in their bid to cement their individuality. Making questionable and impulsive choices, such as dying their hair green, should be seen by parents as less an

act of defiance and more as a means of expressing their current affiliation with a chosen identity, however temporary.

Social development

Another change that we see in children as they become teenagers is in their interpersonal relationships. The attainment of independence and control over their lives is another main task of adolescence. Teenagers will begin to assert their autonomy, often opposing parental

authority and pushing boundaries, resulting in more arguments, slamming of doors, and long periods spent hiding in their rooms.

A teenager's relationship with their family will also begin to take less priority over spending time with friends and chasing romantic interests. This search for independence, again, has a biological underpinning behind it. It is believed that separation from the primary family in our adolescent ancestors not only encouraged the exploration of new environments, but

RAISING HAPPY AND HEALTHY TEENAGERS

ENCOURAGE HEALTHY LIFESTYLE CHOICES

Adopting the fundamentals of a healthy lifestyle (a balanced diet, regular exercise, and eight to ten hours of sleep per night) into your teenager's routine can help mitigate the effects of stress and hormone fluctuations. The best way to encourage this is to model these in your own lifestyle too.

FOSTER SUPPORTIVE SOCIAL NETWORKS

Having positive relationships with peers and other supportive adults, such as family friends, teachers and counsellors, can create a robust support system for your teenager. This is especially important when they are feeling disconnected from us and need someone to vent to.

NURTURE A POSITIVE ENVIRONMENT

"I have talked to hundreds of teens who want a better relationship with their family and that means spending time with them," says Dr Caswell. "That is not in the form of lectures, discussions or serious conversations. It is through playing games and talking about the stuff they love." Make sure you regularly schedule time together and focus on your teenager without distractions.

PROMOTE WHOLESOME RISK-TAKING

Encourage your teenager to participate in constructive pursuits that push them outside of their comfort zone, such as competing in a sport or performing. These types of activities can help to develop their confidence and satisfy their innate desire for thrill-seeking.

SET LIMITS AND BOUNDARIES

Although they will instinctively want to rail against it, teenagers thrive where there is structure and rules. They need a consistent and stable environment to create a sense of safety so they don't become completely overwhelmed by all the change that is going on around them.



“POSITIVE AND SUPPORTIVE FAMILY RELATIONSHIPS REMAIN CRUCIAL DURING THIS TIME”

diminished the chances of inbreeding, hence leading to a healthier population.

Some parents, though, may find this change in family dynamics difficult to come to terms with. “They take it personally and start to withdraw from their kids because they think their kids are withdrawing from them,” says Dr Caswell. “But teenagers still want a connection with us. In fact, they crave it.” It is important to remember that positive and supportive family relationships remain crucial during this time, as they provide the stability, guidance and emotional comfort that teenagers need. In later adolescence, once independence from the family unit has been established, older teenagers tend to seek a more ‘adult’ relationship with their parents, one that is grounded in mutual respect and on a more equal footing.

Another major development that we see in adolescence is the push towards relationships with their fellow peers. Friends become the central figures in their lives, often surpassing family in terms of influence. In early childhood, children usually form close friendships with peers of the same sex, but during adolescence these peer groups expand to include members of both sexes. Being part of a peer group can provide a much-needed sense of belonging, but it can also promote problematic behaviours as a result of peer pressure or needing to conform to group norms.

Romantic relationships also start to blossom around this time, and with the flood of sex hormones coursing through their body, a new preoccupation with dating and sex will begin to emerge. Entering adolescence can spark curiosity in teenagers to explore both their changing bodies and their sexual identity, which may manifest in fantasising over a crush, watching porn or trying masturbation.

An additional challenge that this generation of teenagers must navigate is the role that technology plays in their socialisation. While the internet can help to facilitate connections with others, it can also expose teenagers to harmful practices such as cyberbullying, as well as unrealistic standards from curated content, all of which can negatively impact mental health. “The teenage brain has been the same for centuries, but technology is changing at such an incredible rate now that their brains can’t keep up,” says Dr

Caswell. She warns against trying to shield them from using devices, though. “There’s so much fear from adults about the impact that phones are having on kids, and that fear is very reasonable, but technology is so central to their social world and that’s how everyone connects. What we need to focus on is teaching them how to have a healthy relationship with technology.”

Mental health vulnerabilities

Something that caregivers should be aware of is that adolescence can be the catalyst for the emergence of mental illness. This is due to a combination of several different factors affecting teenagers, including hormonal imbalances, an increase in stress hormones, pressure from external stressors, and as a result of the extensive remodelling of their brains. According to the World Health Organization (WHO), one in seven young people aged between 10 and 19 years old experience a mental health disorder, although some studies suggest that as many as one in four teenagers have a diagnosable condition, most of which remain unrecognised and untreated.

Certain demographics are more prone to developing mental health problems during adolescence than others, including those from an ethnic minority background, LGBTQ+ teens, pregnant girls, and those on the autism spectrum or with other neurological conditions. Other risk factors are exposure to adversity, violence and poverty, harsh parenting, and an unstable home life.

Some of the most common mental health conditions that we tend to see emerge at this age are emotional disorders (depression and anxiety), behavioural disorders (ADHD and oppositional defiant disorder), and eating disorders (anorexia and bulimia). Other disorders that can arise during adolescence are psychosis, substance abuse, self-harm and suicidal ideation. One study found that 50% of all mental illnesses surface by the age of 14, which then increases to 75% by the age of 24, just around the time the brain has finished developing.

Although most teenagers will go through phases of low mood, being able to identify and address a potential mental health problem promptly can reduce its severity and duration. “I think it’s very important to go with your gut,” says Dr Caswell.



“Parents know their kids and know what is familiar. If there is a drastic change and they are disengaging from everyone, they may need professional help.” While each disorder will have its own unique set of symptoms, here are some classic signs to look out for if you suspect that your child may be suffering and they have been present for two weeks or more:

- Increased isolation from friends and peers
- Neglecting their hygiene and appearance
- Changes in eating and sleeping patterns
- Withdrawal from social activities and hobbies
- Suddenly doing poorly academically or wanting to avoid school
- Being unusually tearful or emotional
- Expressing thoughts of suicide or hopelessness
- Displaying secretive behaviour

Recognising early signs of mental health conditions, along with providing adolescents with a loving, supportive environment and access to mental health services can help to address issues before they escalate further.

Embracing challenges

All in all, adolescence is a pivotal period in a human’s lifespan marked by profound changes across multiple dimensions – biological, cognitive, psychological and social. While this can be a tricky time for all involved, it also holds immense potential for growth and opportunity, not only in the type of person that your child will become, but also in your relationship with them. By understanding and supporting teenagers’ needs during this time, we can help them to emerge from their cocoons and flourish as well-rounded, resilient adults. ■