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Pack Up Your Kitbag

Bob Phillips remarks, 'Teenagers complain there is nothing to do, then stay out all night doing it'. Constant complaints of boredom, reckless behaviour, volatility and moodiness are typical charges that adults make against teenagers. The teenage years are a hectic time for everybody involved.

This chapter helps you pack up your kitbag in preparation for the workouts described in the remaining chapters. It explains some of the reasons why teenagers behave the way they do. When adults and teenagers recognise their behaviour as part of a natural developmental process it reduces conflict and makes life easier for all involved.

This chapter examines:

- Brain restructuring during the teenage years
- The role of dopamine in teenage behaviour
- The importance of social connection in teenage development
- Neuroplasticity and the teenage brain
- How mindfulness supports the development of the teenage brain
- The types of mindfulness exercises in this book

Life on a Teenage Brain

When adults talk to each other about the teenagers in their lives they commiserate about how their once sunny child has morphed into a moody and impulsive teenager, who walks

twenty paces ahead of them and claims that everything is 'boring' with annoying monotony. They exclaim that their teenagers never pay attention and have become forgetful and spacey. They worry that their teenagers won't know their boundaries around drugs and alcohol, and bemoan the fact that their child's life force is being sucked out of them by their compulsion for social media and computer games.

Traditionally, raging hormones have been blamed for these behaviours but the latest neuroscience research shows that the teenage years can be better understood in terms of normal changes related to human brain development (Jensen, 2015). 'What brain?' I hear the adults say. 'My teenager's brain went up in smoke on the day they put on their secondary school uniform!'

In fact, the teenage brain is going through a major restructuring process, and it is this more than raging hormones that is responsible for the characteristic teenage behaviour. At times this process appears to create a kind of craziness, but, in terms of human evolution, there is definite method to the madness. Humans have big brains, much too big to be fully formed at birth. The brain continues to develop and mature until about the age of twenty-five. There are two significant spurts of brain development: the first during infancy, and the second from the onset of puberty up to the age of twenty-five.

The brain changes as it grows, so an infant brain is not the same as a teenage brain, and a teenage brain is not the same as an adult brain. The truth is that when an adult exclaims that a teenager should grow up and act their age, the teenager is acting their age; they are acting exactly as their level of brain development dictates. Expecting a teenager to think like an adult is pointless. They can't. They don't have an adult brain.

The Teenage Brain on Stress

In terms of understanding life on a teenage brain, we will take a simplified view of the current neuroscience research into brain development, concentrating on two structures, the amygdala and the prefrontal cortex, and examining their relationship with the autonomic nervous system. The autonomic nervous system is responsible for regulating all the systems in our bodies, including heart rate, respiration and digestion, and it is made up of two branches, the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS).

The amygdala is a small structure in the brain that acts as a threat detection system. It scans the environment for threats and when it detects a threat it activates an instinctive fight-or-flight or stress response. It works with the SNS to flood the body with adrenaline and cortisol, speed up the heart rate, and tense major muscles in preparation for immediate action. For the sake of evolution, the amygdala is programmed to be very good at detecting threats and it reacts much more quickly to negative information than positive. This stacked the odds in favour of survival in the days when early hominids were prey to large predators. If the amygdala had a motto it would be, 'Act now. Save the questions for later'.

The prefrontal cortex connects to the amygdala. Its job is to provide higher order thinking and executive control. It communicates with the amygdala about how to manage threat. When the threat is not justified, and there is no need for alarm, the prefrontal cortex lets the amygdala know that everything is safe. Then the PNS activates the rest-and-digest or relaxation response, reversing the changes caused by the fight-or-flight response. Digestive enzymes are released into the body, the heart rate drops and muscles relax.

Imagine you were walking through a meadow and suddenly noticed a large rattlesnake in the grass. The amygdala goes on high alert, quickly deciding: rattlesnake = mortal danger

= get out of dodge fast. The sympathetic nervous system activates the fight-or-flight response in readiness for a speedy escape. But then the prefrontal cortex steps in and says: 'Yo, Amygdala, calm down, that is not a snake, it is just a piece of old rope, and anyway St Patrick drove all the snakes out of Ireland yonks ago.' If the amygdala is listening to the prefrontal cortex, it then activates the parasympathetic nervous system to initiate the relaxation response.

Fans of nature shows will recognise both the fight-or-flight and the rest-and-digest response. Imagine a lioness hunting wildebeest on the African plains. When she moves in on her prey, the wildebeest scatter in all directions at great speed, driven by their fight-or-flight response. When the lioness makes her kill and starts to feast, the remaining wildebeest stop running, quickly forget their erstwhile companion, and return to grazing as though nothing happened. The rest-and-digest response lets them know that danger has passed and it is time to chill out and have some well-deserved nosh.

The human brain has the same basic structure as that of the wildebeest, but a larger brain and greater connectivity between the amygdala and the prefrontal cortex mean that humans can make plans. Furthermore, they can process the complex emotional and social information required to engage with other humans to successfully implement those plans.

Back in prehistoric times, when sabre-toothed tigers were snacking on early hominids, this facility for planning, communicating and collaborating saved the day. Hominids joined together in their struggle against large predators. They designed weapons and planned defence strategies and they had the emotional and social intelligence to work together to wage war against the predators. The net result was Hominids: 10; Sabre-toothed Tigers: 0. This is why in today's world our fight-or-fight response is more likely to be triggered by a large, black SUV than a ferocious animal.

One of the most important brain developments during the teenage years is the construction of a complex network of connections between the amygdala and prefrontal cortex. These connections allow the two structures to work together in a cohesive way. While the connections are developing, the teenager's emotional responses to the world are big and intense, and shift dramatically from one stormy emotional state to another. This is in large part due to the amygdala, which runs riot when not under the calming influence of the prefrontal cortex. When the two are fully wired up and working in an integrated fashion, the reasoning processes of the prefrontal cortex calm the overreactions of the amygdala.

The teenage brain is like a home alarm that automatically calls out the emergency services. The amygdala acts as a network of hypersensitive alarm sensors that get activated when toast burns in the toaster, a window rattles in the wind or the family pet jumps against a door. The fire brigade and police arrive with sirens blaring to discover that it was a false alarm. As the neural connectivity of adulthood emerges, the prefrontal cortex acts like the control centre in a monitored alarm. It can check the sensors, evaluate the level of threat and use intelligence to decide what to do.

The Dopamine Effect

Dopamine is a central part of the neural circuitry that creates the drive for reward. That's why it is often referred to as one of the brain's 'happy chemicals'. To help you understand dopamine, think of any activity that you really enjoy, and keep doing, even though it is not very good for you.

Consider my two-year-old daughter. I was a stereotypical health-obsessed mother. I fed her lots of fruit and vegetables, and kept sweets and chocolate out of her diet, working on a hypothesis that she would learn to prefer the natural sweetness of fruit and vegetables to the intense sugar high of

chocolate and sweets. Wrong! The very first time she tasted chocolate she went into a trance and a dazed smile spread across her face. Her brain was flooded with dopamine. Ever since then, like chocolate lovers the world over, a quest for another dopamine spike has caused her to seek out chocolate.

In the teenage brain, baseline levels of dopamine are low. This contributes to teenagers' feelings of boredom and frequent bouts of grumpiness. Rewarding experiences act in the teenage brain like chocolate did in my daughter's toddler brain: even small rewards alleviate the monotony of living with low levels of dopamine.

Studies show that teenagers understand the risks and consequences of their behaviour; however, given the immense and epic feelings caused by the dopamine spike associated with a rewarding activity, the risks simply don't compute. This is why teenagers frequently do things that seem stupid and thoughtless. For example, the social reward of partying with a gang of friends outweighs the downside of getting in trouble when they arrive home late to their distraught and angry parents.

This has implications in terms of the teenager's susceptibility to addictive and compulsive behaviours. Until the connections between the prefrontal cortex and the amygdala come online, the amygdala is in a constant state of alarm, creating feelings of high stress. Stress feels bad, and to escape the stress, the reward system drives the teenager towards any activity that releases dopamine to get rid of the bad feelings. Any behaviour or substance that feels good will do. Teenagers can become dependent on anything that feeds their dopamine-hungry reward system, including alcohol, junk food, exercise and even activities as simple as checking how many likes a social media status racks up.

Social Connection

Peer friendships are vitally important during the teenage years. Teenagers have a very strong drive for social connection. They are programmed to start moving away from the adults in their lives and forming bonds with their peers. Think of it like mammals that live in family groups, such as apes, elephants or lions. As the adolescents mature they are expelled from their original family group. Alone, they risk being picked off by a predator so they seek companionship with other adolescent animals, finding safety in numbers.

Fortunately, human adults don't expel their adolescents, but, nonetheless, similar survival instincts create strong drives for social engagement with peers. There is both an upside and a downside to this. The ability to make strong friendships predicts well-being and resilience throughout adulthood. Security and comfort is to be found in groups, and the companionship of peers is vital as children make the transition through adolescence to adulthood.

On the downside, a lack of peer friendship or exclusion from the pack feels like a life-or-death scenario. When a teenager says dramatically, 'I will just die if I can't go to that party', they are actually expressing a legacy of two hundred million years of evolution. It truly does feel like their survival rests on getting to roam with the other young cubs. As adults, we no longer remember the intensity of those feelings so to us it sounds overblown and dramatic.

Teenage brains are programmed to be highly reactive to pack behaviour. Brain scans show that when teenagers are shown a neutral face in a photograph, the amygdala goes into overdrive and they perceive the face as hostile. When similar photographs are shown to adults the rational prefrontal cortex lights up, and adults identify that the expression on the face is neutral. This explains why teenagers are excruciatingly aware of the reactions of their peers and

highly dependent on positive feedback and acceptance from them.

Their sensitivity to the reactions of others, combined with the need to conform and be accepted by the pack is where peer pressure can become a problem. Teenagers are more likely to take risks when they are in groups. Behaviours that seem stupid in the cold light of day, even to the teenager, such as driving too fast, drinking excessively or jumping off a balcony into a swimming pool, are easy to engage in when the compulsion to belong works in tandem with the drive towards reward.

Plastic Fantastic

Over the last twenty years neuroscientists have discovered that brain architecture is not fixed, as previously believed. The brain is made up of about one thousand and three hundred grams of tofu-like tissue and has approximately one hundred billion neurons signalling to each other across half a quadrillion synapses. Any mental activity fires neurons and synapses, creating neural pathways or connections. The first time an activity is initiated, a new connection is created. It is as though you walked across a meadow and created a path of flattened grass. If the activity occurs regularly the path becomes more defined, and over time it develops into a country lane, a national route, and ultimately a six-lane superhighway.

This capacity of the brain to adapt and change is called neuroplasticity. One of the earliest studies of neuroplasticity examined the brains of London cab drivers (Maguire, 2006). In order to get their licence London cab drivers are required to commit to memory a complete 'A to Z' of London streets, and must pass a sequence of progressively difficult oral tests referred to as 'the knowledge'. On average it takes four years to pass. Functional MRI studies of their brains reveal that

their hippocampus, an area of the brain associated with memory and spatial awareness, is substantially thicker than average.

During the teenage years the brain is particularly malleable. On the plus side, this plasticity means that teenagers can acquire new and complex skills with great ease. They can learn to kitesurf, solve quadratic equations, skateboard, play the ukulele, adapt to new technology and become fluent in Japanese, while their parents struggle to turn on the TV with a new remote control and rely on their phone calculator to divide the dinner bill.

The brain operates on a use-it-or-lose-it basis. This means that consistent practice is required to maintain any network of connections. Teenagers have direct experience of this if they have ever asked a parent for help with calculus or wanted guidance on metaphysical poetry. Most adults forgot about calculus and John Donne's poetry straight after they walked out of their Leaving Cert exams, and since then they have made no attempt to rebuild those connections!

There is one significant downside to neuroplasticity: the brain learns from negative experiences just as easily as it does from positive experiences. On the journey to adulthood the last brain systems to mature are those that regulate emotion and provide insight and judgement, yet those are the very systems required to navigate the complex social interactions and the pressure to perform facing teenagers. If a teenager is feeling excluded socially or consistently feels unable to deal with pressure, the brain can end up building a six-lane superhighway that ends in a spaghetti junction of worry, low mood, compulsive behaviours and dependency on substances. This is why mental health problems that emerge in adolescence can persist into adulthood if they are not addressed early.

Exercising the Brain Through Mindfulness

The main construction job in the teenage brain is connecting up and integrating the frontal cortex with the amygdala. Unfortunately, this job does not progress in a neat, linear fashion. Brain development is like releasing a new computer or phone operating system: in the early versions there are lots of bugs and glitches to be ironed out but with every release exciting new functionality is added, old bugs are fixed and new bugs surface.

One of the main goals during this phase of development is to bring the prefrontal cortex online so that it is available to moderate the alarm system of the amygdala. In the early stages of development it is like streaming movies over the internet. Occasionally the connection drops and all you see is that infuriating circling going around and around in the centre of a frozen image.

The mindfulness exercises in this book support teenage brain development in a number of ways;

- Each exercise starts with a focus on lengthening the exhalation. Exhaling activates the PNS, telling the amygdala that everything is safe. By repeatedly stimulating the PNS the brain develops a six-lane superhighway that leads to a landscape of calm and relaxation instead of a spaghetti junction of worry, low mood, compulsive behaviours and dependency on substances. This inoculates the brain against future mental health issues.
- All the exercises increase activity in the prefrontal cortex while reducing activity in the amygdala. This is accomplished in a number of ways: noticing and labelling thoughts and feelings; answering questions that require self-reflection; writing about negative experiences or distressing feelings; using visualisation.

There are three categories of mindfulness exercise in this book:

CORE EXERCISES

- Equivalent of abdominal exercises in a physical workout
- Build the core strength required for good emotion regulation
- Form part of a daily mindfulness workout
- Can be done anywhere and at anytime
- Do not require a quiet space

REFLECTIVE EXERCISES

- Encourage active self-reflection
- Require a pen and paper
- Require a quiet place free from distraction

TARGETED EXERCISES

- Equivalent of exercises targeting a specific muscle group in a physical workout
- Target specific areas such as social media usage, sleep and exam pressure

To take full advantage of the plasticity of the teenage brain, the exercises must be practised regularly. But they don't need to be practised for long. Choose any exercise and do it for three to five minutes most days. Mindfulness fits perfectly into daily life, but you have to remember to do it. Here are some ways of keeping mindfulness in mind as you go about your day:

- Pause for a moment between transitions in your day. A transition is any time you finish one activity and move to the next. Use the *Mindful STOP* at the start of every class, before you eat a meal, or every time you finish an activity.
- Choose a specific time everyday to do one to two minutes of mindfulness: before getting out of bed, while travelling to school, or before settling down to watch a box set.
- Download a mindfulness app on your phone and use it any time you are hanging around with nothing to do, like sitting on a bus, or waiting to be collected.
- When you are walking spend a minute or two noticing your environment, listening out for sounds, and observing what is happening around you.
- If you work out in a gym, do at least one workout a week mindfully. Arnold Schwarzenegger recommends putting your 'mind in the muscle' and this is one of my favourite ways of incorporating mindfulness into daily activity.

Summary

- The teenage brain is going through a major restructuring process that makes it difficult for teenagers to regulate their emotions.
- The teenage brain has a low baseline level of dopamine, and this leads teenagers to prioritise reward over risk.
- Teenagers have a strong drive for social connection. They are programmed to start moving away from the adults in their lives to form close bonds with their peers.
- Teenagers can take advantage of neuroplasticity to acquire new skills during their teenage years, but the same neuroplasticity makes teenagers vulnerable to mental health problems.
- Mindfulness supports the development of emotion regulation for long-term mental fitness and emotional resilience.