

## Understanding the relationship between brain development and offending behaviour

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The brain is the most complex organ in the human body and is responsible for controlling all of the body's functions. The brain consists of nerve cells, which interact with the rest of the body through the spinal cord and nervous system. In the early years of life more than [1 million new neural connections form every second](#) (Harvard, 2009). This overabundance of neural connections are repeatedly pruned and refined, creating space for developing new pathways and strengthening the ones that are used (use it or lose it). Brain development begins before birth and continues into adulthood and the interactions between genes and experiences are what shape the developing brain. However, it is the initial building blocks within the brain that provide the foundations for future learning, thinking and reasoning, social and emotional behaviour and health.

Adolescence is now recognised as a critical period in brain development and an opportunity for new learning. Subsequently, research evidences that the [brain is not fully mature](#) until mid-20s and that psychosocial and cognitive development continues up to age 25 and possibly even beyond. For this reason, [child and youth justice rationale](#) and functions should extend to the young adult age group because of their psychosocial immaturity.

Developmental changes in the brain occur sequentially and progressively from the back of the brain (cerebellum), with the frontal lobe (particularly frontal cortex) being the last to develop. The frontal lobe is where the [executive functioning](#) (working memory, cognitive flexibility and inhibitory control) takes place, hence why those executive functions are slowest to fully mature. This is central to understanding the time it takes for children and young people to shift more consistently away from those emotive-driven responses to more rational and considered judgements, which are the mark of adult thinking.

### What can affect brain development?

A number of factors can influence the brain's development and physical structure from its initial development and throughout the life course. For example: a mother's diet; substance or alcohol misuse during pregnancy; disabilities; exposure to stress either pre or post birth; abuse; and substance or process addiction [especially technology addictions during adolescence](#).

[Traumatic brain injuries](#) (TBI), which are the leading form of acquired brain injury (ABI), affect about 8.5% of the population. [Adolescents and young adults](#) are the most at risk group, with males at far greater risk than females. Evidence shows TBIs can be a significant contributing factor in later offending behaviour, violent offending, greater risk of substance misuse and mental health problems and increased risk of offending in women, with up to [70% of children in prison](#) having a brain injury that has affected neurodevelopment. A wider understanding and actively considering whether a child has experienced a TBI and how this has affected them is crucial. Systematically [screening](#) for TBI in health assessments and within the Justice system would inform sentencing and appropriate supports and interventions.

The type of care provided in childhood influences the development of the neural pathways from which new connections in later life form. These influences can have a lifelong impact as highlighted through the [adverse childhood experiences study \(ACEs\)](#); experiences of trauma without care,

nurture and protection can result not just in psychological, cognitive and emotional difficulties but affecting one's physical health too. The National Scientific Council on the Developing Child (2014) outlines [three classifications of stress](#) as positive, tolerable and toxic.

Within the bounds of caring and supportive relationships, exposure to stress teaches children to manage situations, develop positive problem solving and coping strategies. It becomes **toxic** when a child experiences prolonged, frequent or chronic exposure to situations where they feel inherently unsafe and unprotected. Studies indicate that toxic stress can have an adverse impact on [brain architecture](#). In the most extreme scenarios, such as in cases of severe, chronic abuse and especially that which occurs during early, sensitive periods of brain development, the regions of the brain involved in fear, anxiety, and impulsive responses may overproduce neural connections while those regions dedicated to reasoning, planning, and behavioural control may produce fewer neural connections.

Despite the crucial period for brain development occurring in infancy, the brain has the ability to adapt and learn through experience, in a process known as '[brain plasticity](#)'. By understanding, what experiences negatively affect brain development these can be re-dressed by creating opportunities for positive experiences. Children and young people can learn from these to create the building blocks (neural pathways) that adapt their understanding and behaviour. Whilst it is not possible to eradicate old pathways completely, the strengthening of new ones with positive behaviours can improve outcomes overall and thereby reduce the risk of offending. A key strategy with adolescents involved in offending behaviour should include learning about the basic functioning of the adolescent brain, especially the concept of neuroplasticity and the adolescent brain's vulnerability to overstimulation and addiction.

## Adolescence

Adolescence is a key period for all children and young people and research shows us that this is a critical period for children and young people with most of them being involved in some level of offending behaviour ([McAra & McVie, 2010](#)).

Adolescence is a time of significant physiological, emotional and cognitive change when the changes we see outwardly are a reflection of the myriad of complex processes going on within the brain. During adolescence, there is generally an increase in excitement-seeking/risk taking behaviour. Suggestions as to why this occurs are that there is an increased need for sensory input and a higher arousal to stimuli that influence the [reward system](#) within the brain. That the adolescent brain is particularly [susceptible to the increased impact](#) of stimulation of the reward centre in relation to addictive behaviours such as alcohol, substance misuse and, increasingly, the use of internet pornography. Chronic overstimulation because of internet technology can lead to a dysregulated stress system and a state of hyper arousal leading to brain changes that may contribute to offending behaviour. Moreover, chronic exposure to highly arousing and violent sexual material in mainstream pornography and many gaming sites that are inappropriate for the child's stage of social and sexual development are further examples of toxic stress. A contrasting position suggests adolescents are not lacking in control due to the brain's lack of connectedness and development but that they are merely [curious and exploring](#) situations to build their experience in order to be better equipped to make those risky and difficult decisions later in life.

Irrespective of these varying positions, given this crucial period of brain development, there may be significant consequences in both the short and longer term. Young people can benefit significantly from support during these challenging years to manage their behaviour and physiological responses.

By understanding how negative and positive experiences affect brain structure and development and that the brain is adaptive to such influences, we can use interventions to create positive experiences to teach children and young people the skills they need to move away from offending behaviour. For some this may mean going back to those initial building blocks that they missed, developing experiences such as feeling safe, positive relationships, trust, [serve and return](#), learning that the world is not always hostile and managing stress. Learning about the brain's reward system, its vulnerability to overstimulation along with the hope that lies in neuroplasticity to unlearn negative habits and replace with positive ones is also important to empower children to understand they can change behaviours. Developing healthy relationships with people in real life, spending time in nature, doing physical exercise, and taking up hobbies that provide emotional expression are all examples of beneficial ways of helping young people develop well-rounded personalities and pro-social behaviours.

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