CHAPTER 7

The neurobiology of child mental disorders and stress

We know that the lack of a warm, positive relationship with their primary caregiver and insecure attachment are strongly linked with subsequent behavioural and emotional problems in the child.

It may be helpful to understand the physiological processes that can explain why a child expresses the effects of abusive or traumatic experiences through mental health or behavioural disorders.

Neurobiologists have been researching what might be happening in a child's brain to drive these behaviours, with a particular emphasis on the physiological effects of stress. This research is still in its infancy and much is conjecture, for obvious reasons – it is impossible to know for certain what is happening inside a living child's brain. Much of the current theory is built on experimentation with animals. [3]

[3] This chapter draws on Glaser D (2000) 'Child abuse and neglect and the brain: a review', *Journal of Child Psychology & Psychiatry*, 41:1, pp 97–116.

The child's brain

A child's brain is very sensitive and very plastic (malleable), particularly in the first two years of life, when it undergoes a massive amount of development in a very short period of time. In normal, healthy child-rearing, the parents/caregiver will have a huge amount of interaction with the child. This interaction, often called "serve and return", stimulates the brain to form the synaptic connections in the frontal lobe that become the framework for the child's lifelong cognitive capacity and behaviour. The child does something, and the parent responds, and vice versa, as in a tennis game. These interactions should be sensitive, nurturing and predictable; the child should be protected from fear and stress, and from too much sensory input, and gently encouraged and supported to explore new things. If the child is secure in the knowledge that their parent is there to provide comfort, safety and reassurance, then the child will be securely attached.

Neglected and abused children do not have these kinds of interactions with their parent. Nor do they have the security of a safe base from which to explore the world and new experiences. This means the synaptic connections in their brain are not stimulated, which means the cognitive framework is not built. Parts of the brain may even die off, leaving (famously in the case of abandoned children found in Romania's orphanages after the fall of Ceausescu in 1989) a "black hole" in the frontal lobe – the part of the brain concerned with emotions, behaviour and cognition.

The frontal lobe is more highly developed in humans than in other mammals. This is the part of the brain that gives us the capacity to think ahead, to be aware of consequences of our actions, to build relationships with other people and to feel kindness, empathy and concern. It enables us to be self-aware, to solve problems, to be creative and to use our imagination. It also helps us to regulate

our own emotions so that we can calm ourselves when we feel stressed.

These functions don't develop until the end of the first year of a child's life. A child who does not have a nurturing relationship with their parent does not learn how to express their emotions or how to regulate their stress levels by themselves.

When the role of this part of the brain and its importance in early childhood development are understood, it is easier to see why some adopted children from abusive families or families with a history of mental disorder or substance misuse behave as they do, and can struggle throughout life, despite a subsequent nurturing upbringing.

The brain of a child who is neglected, abused and/or under-stimulated in these early years will remain under-developed, leaving the child less able to learn and less likely to achieve their full potential and develop good social skills. It can also mean they behave in unusual and often anti-social ways, because those parts of their brain that govern social behaviours and emotions are under-developed, or simply not there.

Neurobiologists theorise that an abused, mistreated child will not be able to regulate their emotional responses to stressful situations. Their brain will not have the capacity to do so, resulting in inappropriate and difficult behaviours and, ultimately, mental disorders. The longer the child is exposed to abusive or neglectful parenting, the more difficult it will be to recover the lost connections in their brain. The child may be taught in later life, using cognitive behavioural techniques, how to behave and respond in certain situations, but they will lack the seemingly automatic and instinctive response of the child brought up in a safe and nurturing environment.

Stress

Neurobiologists are also making important discoveries about the physiological mechanisms of the human stress response system.

A small amount of stress is a good thing: it is a normal human response to the new, the unfamiliar and the unexpected. It heightens our senses. At its most basic, it enables us to "fight or flee" threat or danger. But when the stress is repeated, persistent and long term, without relief, it becomes literally toxic, and can lead to damage to parts of the brain, as well as major physical and mental health problems (including high risk of coronary heart disease and mental ill health such as depression) in adult life.

The stress response is the body's way of coping with frightening, unexpected and abusive situations. It is highly complex. Put very simply, it involves the hypothalamic-pituitary-adrenal (HPA) axis – the pathway connecting the brain to the adrenal cortex, which secretes the stress hormone cortisol into the blood stream. When cortisol is produced in response to exposure to stressful or frightening situations, it suppresses the body's immune response, increases the levels of glucose in the blood stream and dampens the fear response. These all improve the body's ability to deal with the threat.

This system is self-regulating, in that when certain parts of the brain register that the amount of cortisol in the blood stream has risen, they send a message via the HPA axis to the adrenal cortex to reduce the levels, so the body is not flooded with damaging amounts of cortisol and can return to homeostasis (this would be like taking the foot off the accelerator in a stationary car, so the engine returns to normal, idling state). If increased levels of cortisol are still needed (for example, in situations of extreme danger, requiring extra energy and strength), this too can be communicated via the HPA axis. Cortisol levels normally fluctuate

over the course of the day – they are higher in the morning and reduce in the afternoon.

Another response to stress is certain kinds of behaviour. Interestingly, cortisol levels and these behaviours do not necessarily coincide. At age two to six months a child's raised cortisol levels and crying in response to fear or pain will be about equal. But in a healthy child at 15 months, crying will exceed the levels of cortisol. Studies have also found that giving a child a dummy will stop the crying behaviour, but the levels of cortisol will remain unaffected – the equivalent to the body's engine continuing to accelerate hard, even though the car is not moving.

Raised cortisol levels can be harmful to brain development. In particular, they affect the hippocampus. This is the part of the brain concerned with verbal and visual memory. High exposure to cortisol leads to hippocampal cell death.

Studies both of humans and animals show that reassuring, nurturing contact with the mother restores levels of cortisol to normal levels. Specifically, studies show that insecurely attached children are much more likely than securely attached children to have high levels of cortisol in their system when exposed to frightening situations. Children with a disorganised/disoriented attachment style are particularly vulnerable to raised cortisol levels when exposed to situations that securely attached children find only slightly scary.

Long-term exposure to stress has been found to lead to passive and withdrawn behaviour ("learned hopelessness"), which neurobiologists explain as the body's attempt to control the flood of cortisol within normal, manageable limits.

Another important part of the body's stress response system is the adrenal gland. This secretes adrenaline and noradrenaline,

which increase the heart rate and blood pressure, cause sweating, and activate the body's "fight or flight" response to stress. Persistent and repeated raised levels of these hormones may be linked to the impulsive behaviour and short attention span associated with ADHD.

The difficult behaviours of abused children can thus be described in terms of the body's physiological responses to extended and repeated stress, and the excess release of adrenaline and cortisol.

Research suggests that exposure to adverse environments and abuse has a greater effect than genetic vulnerability or resilience.

The good news is that early intervention to remove the child from the source of stress and provide safety and reassurance can prevent long-term damage to his or her mental health and wellbeing. In studies of rats, the hippocampal cell death caused in the brains of young rats by the stress of being removed for a prolonged period from their mother is reversed by her vigorous licking when they are returned to her. This mirrors the effects of the focused, highly nurturing care described in the previous chapter on attachment theory, which has been shown to restore a child's ability to develop secure attachment patterns and trusting relationships (Dozier *et al*, 2009).