Childhood Trauma and the Brain — Deep Dives

Early childhood and the developing brain

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• It is easy to think of the brain as something separate from our social world. But from the earliest years, **relationships** are key to development, including **brain development**.

• All children need care and stimulation from the earliest years: adults who value them and who show them attention and love. These **early relationships** powerfully **shape a child’s brain development**, creating the foundation for later life.

• **The brain is a complex information-processing organ** and is made up of a number of systems that process different kinds of information, including **threats, rewards and autobiographical memories**.

• **These brain systems are shaped by experience**, particularly in the early years. For all children brain systems allow us to learn about the world and respond to the challenges of everyday life.

• **Early experiences also affect a child’s genes**. This happens through gene expression – the process of turning a gene on or off. Epigenetics is the scientific study of how this happens in the body.
We are born helpless and vulnerable and depend on our caregivers for much longer than other animals. Colts can walk from birth, while humans take around one year to learn the same skill.

From the time we are born and throughout our teenage years, we go through many changes in how we think, behave, and manage emotions. Most of us have seen a child learning to walk or speak or have observed an adolescent maturing from a child into a young independent adult. These profound changes happen because of the extraordinary way the brain develops. This development is shaped both by our experience (including our relationships) and by the genes we inherit from our parents.

**How the brain develops**

The brain is made of approximately 100 billion specialised cells called neurons. Each neuron is linked to tens of thousands of other neurons. Together they form a network and communicate with each other through connections called synapses. Synapses help to collect and send information through the brain with electrical signals[1].

These networks of neurons have the capacity to process large amounts of information, allowing the brain to perform many complex tasks. These include the regulation of essential bodily functions, such as breathing and heart-rate; perception, such as seeing and hearing; coordinating movement, such as walking and playing sports; as well as our extraordinary ability to learn, remember, think and feel. These different tasks depend on the co-ordinated activity of different brain areas that develop across childhood[1].
How do experiences shape our brain development?

The basic structure of the human brain is already present at birth. Its development, however, is only just beginning. A child’s experiences and relationships will profoundly shape brain development over time.

Pruning and brain plasticity
The brain’s ability to change in response to experience is called ‘brain plasticity’. This is key to our ability to learn and adapt. In the first two years of life, the brain develops at a rapid rate creating billions of new synapses. An extraordinary number. In fact, a two-year-old child’s brain has approximately 50% more connections than a typical adult’s brain. This is because as the child grows, those connections that are not used are pruned away. Life experiences in childhood and adolescence will determine which connections are used and strengthened, and which are weakened and lost – a process called ‘synaptic pruning’. Pruning can occur at different times. For some brain regions this occurs in early childhood; for other regions pruning continues through adolescence.

Building a specialised brain
During childhood and adolescence, different networks of neurons become dedicated to serving different purposes – we can think of these as different brain systems. Brain systems that regulate body functions (such as heart rate) and process our five senses tend to become established very early in life. Other brain systems involved in more complex thoughts and tasks undergo more gradual transformations. For these, experience plays a central role in their specialisation and development. These include in the brain’s memory systems and systems that help us to process and regulate our social behaviour, as well as our response to threat and reward.

How our experiences impact our genes – Epigenetics
While our focus here is on brain development, it is important to remember the role that genes play. Genes carry the information that we inherit from our parents. Each gene is a single instruction which tells the body how to make a particular protein – these in turn do different jobs, that can influence aspects of our development such as eye colour, height, or temperament. In other words, information in our genes is necessary to build the structure and regulate the function of all cells, tissues and organs, including our brain. Being born with different genes accounts for many of the differences between individuals.

One important consequence of this, is that not all children respond to experience in the same way. Nor do they elicit the same responses from the environment. It is easy to imagine how a baby who is temperamentally irritable may elicit different
Throughout life, experiences continually shape our brains. Thanks to brain plasticity, we continue to learn, acquire new skills and form new memories throughout our lives. That said, infancy in particular, and childhood and adolescence more broadly, are unique periods during which the brain undergoes the most significant changes and is most receptive to experience. These periods of life when our environment is particularly important in shaping brain development are called ‘sensitive periods’.

During these sensitive periods, the development of different brain systems is shaped by experience. Over time, these systems become more finely tuned and it becomes harder for the brain to modify these early calibrations. This is significant because simple structures and functions established early in life impact the development of more complex ones in the future. There can be long-lasting negative consequences, for example, if adequate care and experiences are not provided during childhood. Research with children exposed to extreme forms of institutional neglect in the first six months of life has shown that psychological, social and emotional abilities never reach their full potential, even if high quality care is given later on. The longer a child is exposed to deprivation, the greater the impact on their development. [2]

In summary, a child’s environment during childhood can have long-lasting and profound effects on how their brain develops. Research looking at the impact of institutional settings has helped us understand the impact of severe deprivation. A less severe, but more common, form of early trauma is the experience of abuse and neglect at home. These experiences occur in the context of problematic early relationships.
Relationships: An important key to healthy development

Our genes and our early experiences together shape the structure and functioning of our brain. But which experiences are the most important? There is an almost infinite number of things in our environment that influence us. However, early relationships seem to play a critical role. [4]

We know that caregivers play a central role in how a child’s brain develops. Healthy brain development acts as a foundation as a child develops their identity, abilities, and their feeling of importance in the world. By guiding exploration, providing stimulation and encouraging play, caregivers help the child learn that they can influence their environment. The child realises that they can have an impact on people and objects, that they can perform ever more complex tasks, goal-directed actions, and deal with challenging situations. Early relationships can foster the development of a positive sense of self and encourage children to shape their surroundings through repeated efforts and actions. For example, a child may be supported in finding an activity – a sport or hobby, for example – that they particularly enjoy. Over time, this means that the child’s own preference also plays a role in shaping their social experiences.

We also know that it is essential for caregivers to be attuned to the child’s needs, to be curious about their mind and to be responsive to their behaviours in a reciprocal, consistent and sensitive manner. A caregiver can promote the child’s ability to regulate and understand their own and others’ mental states – such as emotions, desires, beliefs and intentions – laying the foundation for the development of the child’s social skills and adaptive behaviour.
References


