

Brain development during early childhood has a significant and long-lasting influence on a person's physical and mental health, as well as their ability to form healthy, satisfying relationships and succeed at school and work. Early childhood educators have an important role in supporting children to develop in ways that ensure good health, wellbeing and success throughout their childhood and into the future.

## Brain architecture

A baby is born with billions of brain cells (called neurons), but with relatively few connections between them (synapses). The first 18-24 months of life see a tremendous growth in the connections between brain cells, allowing for electrical signals to pass from cell to cell. Simple connections are formed first and provide the foundation for more complex pathways to develop, which in turn allows for more advanced brain functions.

It is estimated that 700 to 1,000 new connections are formed across different areas of the brain every second, and by six months old, a child has more synapses than an adult. This period of rapid growth slows as a person becomes older.

The experiences and relationships a child has in early childhood determine which connections or pathways are made, and which ones are used the most. As the brain develops, connections or pathways that are used often are sheathed in a white, fatty substance (known as myelin). This increases the speed with which messages can be transmitted from cell to cell.

On the other hand, the connections or pathways that are rarely used fade away in a process called **synaptic pruning**. This means that only connections needed for the child's particular environment are retained on the principle of 'use it or lose it.'

Synaptic pruning is an ongoing process; a child's brain begins forming connections in the womb, and after birth, forming and pruning connections continues into adulthood. It allows brain circuits to become more efficient. The billions of connections that result from this process make up the **brain's architecture**, which forms the basis for their future health, wellbeing, learning and behaviour.

*Healthy brain development depends on the quality and reliability of a young child's relationships with the important people in his or her life, both within and outside the family.*

Furthermore, the brain is not a stand-alone bodily system, but is closely connected to other major bodily systems, including the immune, endocrinal, cardiovascular and metabolic systems. These systems shape and are shaped by each other. What a child learns from their environment and relationships in the prenatal and first two to three years of life affects not only the neurological system, but also the other bodily systems to which the brain is connected, with potentially profound consequences over the life course.

## Serve and return

The main way brain connections are reinforced is through a baby's interaction with their parents or caregivers through a process of **serve and return**.

Babies or young children communicate with those around them through babbling, gesturing or crying. Parents or caregivers then return this communication through eye contact, words or actions. This interaction is often compared to a tennis match; the child serves the ball and their caregiver hits it back to them.

Through serve and return interactions, the neural pathways responsible for communication and social skills are formed



and reinforced. If a caregiver is consistently warm and responsive to the child, the brain architecture develops in an optimal way. If a caregiver is inconsistent, absent, unreliable or inappropriate in their responses, on a regular or semi-regular basis, this can have a negative impact on the child's brain architecture, affecting future learning and behaviour.

## Epigenetic adaptation

The experiences and relationships a child has in early childhood can also effect the expression of particular genes (known as **epigenetic adaptation**). Positive and negative experiences leave a chemical signature on genes, which influences whether that gene will be 'switched on or off.'

This means that a child may have a combination of genes that predisposes them to a particular condition or behaviour; however they may never develop the condition or behaviour because they weren't exposed to the particular environment needed to trigger it. The gene will remain switched off. On the other hand, a child may be exposed to an environment that can trigger the condition or behaviour, but lack the genes that would predispose them to develop it.

An example of this is if a child has a family history of mental illness. A genetic predisposition does not mean the child will automatically develop a mental illness themselves. It is the experiences and relationships the child has, and the environments in which they develop, that influence whether or not these genes are activated.

## Toxic stress

Stress can have a significant impact on the developing brain. However not all stress is damaging. In fact, experiencing stress is a normal and important part of growing up; it is what helps children become resilient.

### *Building a brain from the bottom up*

The Center on the Developing Child at Harvard University uses the analogy of building a house to explain brain development.

In building a house, there are a series of predictable steps to follow. First the foundations of the house are laid, then the rooms are framed and the electrical system is wired. The roof is put on and the walls plastered. The building process continues, and over time distinctive features are included that bring personality to the home and make it unique.

In constructing a home, each step must be complete before you can move on to the next. For example, the walls can't be built if the foundations haven't yet been laid, and the electricity can't be wired in if there are no stud walls. The quality of the first task also influences the quality of the next. For example, if the foundations are weak and uneven, then the walls will be crooked and unstable.

The brain also develops in a series of predictable steps that begin with simple connections between brain cells (e.g. connections that enable vision, hearing and touch). Once these are in place, more complex neural pathways are created that allow for more advanced skills (e.g. communication, reasoning and decision-making). These connections are made in a particular sequence, and the quality of earlier connections influences the quality of later pathways. In this way, a person's brain architecture is built from the bottom up.

Like a house, the brain depends on strong foundations from which to develop. And the quality of the brain's foundations has far-reaching consequences. Just as a weak foundation in a house compromises its quality and strength, impaired brain architecture can compromise a person's future health, wellbeing and success.



When children are faced with distressing situations that are minor and temporary, such as saying goodbye to their parent at day care or receiving a vaccination, they may have a short period of elevated heart rate, high blood pressure and increased stress hormones such as cortisol. However this **positive stress response** does not last long and is not harmful to the developing brain.

More serious situations, such as a natural disaster or life-threatening injury, may activate a more significant stress response. However if this **tolerable stress response** is temporary and the child is well-supported by an adult in their life, the brain can recover from what might otherwise be a damaging event.

**Toxic stress** occurs when a child experiences strong, frequent and/or prolonged adversity without the support of a caring adult, and is one of the most damaging influences on the developing brain. Toxic stress can arise in situations of chronic violence; physical, emotional or sexual abuse; neglect; mental illness or drug addiction of a parent or caregiver; or the accumulated effects of living in extreme financial hardship.

The experience of toxic stress in early childhood can negatively impact developing brain circuits and hormonal systems in a way that leads to a poorly controlled stress response system: one that is overly reactive or slow to shut down when faced with challenges throughout the lifespan. This influences every aspect of health and wellbeing in childhood and beyond.

Regardless of the type of stress, it is important to remember that if a child has a strong, supportive relationship with at least one adult in their life, the damaging effects of these situations on brain development can be minimised or prevented altogether.

## Neuroplasticity

Although brain development slows as a person ages, it does not stop altogether. The brain can still adapt later in life in response to life experiences (the term for this is **neuroplasticity**). However it requires much more effort to make changes to the brain as a person gets older.

Plasticity is at its greatest in the period from conception to the first two to three years after birth. This means that relationships and environments in early childhood are critical to a child's future health and wellbeing.

This capacity to adapt through plasticity makes humans both versatile and vulnerable. While changes to the structure and function of the brain can be beneficial for the immediate environment, they may also have long-term negative consequences on the health and wellbeing of a child.

For example, if a child is exposed to chronic violence, they will develop more connections in the part of their brain dedicated to fear, anxiety and impulsive actions. This may make them hypervigilant and wary, useful characteristics in their current situation, but characteristics that may lead to anxiety and relationship difficulties as an adult.

## Positive brain development in early childhood settings

There are a number of things early childhood educators can do to positively influence brain development in babies and children. These strategies are particularly important when a child is experiencing difficulties at home and they may not be receiving the support they need from the other adults in their life.



### **C – Creating safe and supportive environments for optimal wellbeing and development**

- Providing a safe and secure environment, where people are treated with care and respect;
- Providing warm and responsive care to the physical and emotional needs of babies and children;
- Building strong, positive relationships by showing an interest in a child's thoughts, feelings and experiences;
- Being inclusive of diverse cultures, personalities and interests.

### **H – Helping children to learn social and emotional skills and manage their own behaviour**

- Providing opportunities for children to learn about their emotions and the emotions of others;
- Helping children to manage their behaviour by being clear of rules or expectations, and guiding them on managing strong emotions like anger or frustration;
- Modelling positive communication skills with the children at the service, as well as with other educators;
- Acknowledging children's strengths and planning activities that cater to their development, interests, culture and preferences.

### **I – Identifying babies, children and families who may be in need of additional support**

- Observing and documenting the development and wellbeing of each child at the service;
- Becoming familiar with the potential signs of mental health difficulties, mental illness (e.g. anxiety or depression) or neurodevelopmental disorders, (e.g. Attention Deficit Hyperactivity Disorder [ADHD]);

- Maintaining close relationships with families at the service so they feel comfortable discussing any concerns they have regarding their child's development or behaviour.

### **L – Linking families with support and information services for mental health and wellbeing**

- Being familiar with local health and education professionals who can support children and families experiencing vulnerabilities;
- Respectfully communicating with parents or caregivers about their child's development;
- Raising issues of concern about children with their parents or caregivers and if appropriate, providing them with information about relevant support networks;
- Recommending reliable and trustworthy resources (such as websites) for families to access more information about their child's health and development.

### **D – Developing broader organisational and community strategies that support wellbeing**

- Engaging in reflective practice about how the service supports children's wellbeing and how this could be improved;
- Undertaking professional development on a range of topics related to children's mental health, wellbeing and development;
- Raising awareness regarding the importance of the early years for positive lifelong outcomes amongst colleagues, families and the community.



## Sources and links

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The Alberta Family Wellness Initiative website: [www.albertafamilywellness.org/what-we-know/the-brain-story](http://www.albertafamilywellness.org/what-we-know/the-brain-story)