

# Brain Development Basics

The early years of a child's life are important for later health and development. This is particularly true for brain development. Although the brain continues developing and changing into adulthood, the first eight years build a foundation for future learning, health, and success.<sup>1</sup>

## Stages of Brain Development

Different structures of the brain develop at different rates and times.<sup>2</sup> Brain development can be disrupted by chronic exposure to stress hormones (e.g., cortisol, adrenaline, etc.). Significant adversity in childhood can lead to a vicious cycle of stress that is toxic to important brain structures.<sup>3</sup> [See our Child Maltreatment: Effects on the Brain factsheet for more.](#)



### Early Child Brain Development<sup>4</sup>

- Neurons are created and form connections both before and after birth.
- Brainstem and midbrain fully develop first, governing functions necessary for life like heart rate, breathing, eating, and sleeping.



### Young Child Brain Development<sup>5</sup>

- Formation of synapses occur at a high rate.
- Higher function brain regions (governing emotion, language, and abstract thought) grow rapidly in the first three years.
- By age two, a child has formed 100 trillion synapses.
- Synapses are eliminated as experiences deem them unnecessary. This is known as pruning.
- By age three, a child's brain is nearly 90% of its adult size.



### Adolescent Brain Development<sup>6</sup>

- Prior to puberty, there is a growth spurt in the areas of the brain governing planning, impulse control, and reasoning.
- While these areas develop, teenagers can act impulsively, make poor decisions, and take increased risks (all normal behaviors for this stage).
- More pruning occurs in the teenage years.
- Limbic system grows and transforms.

## Terms to Know

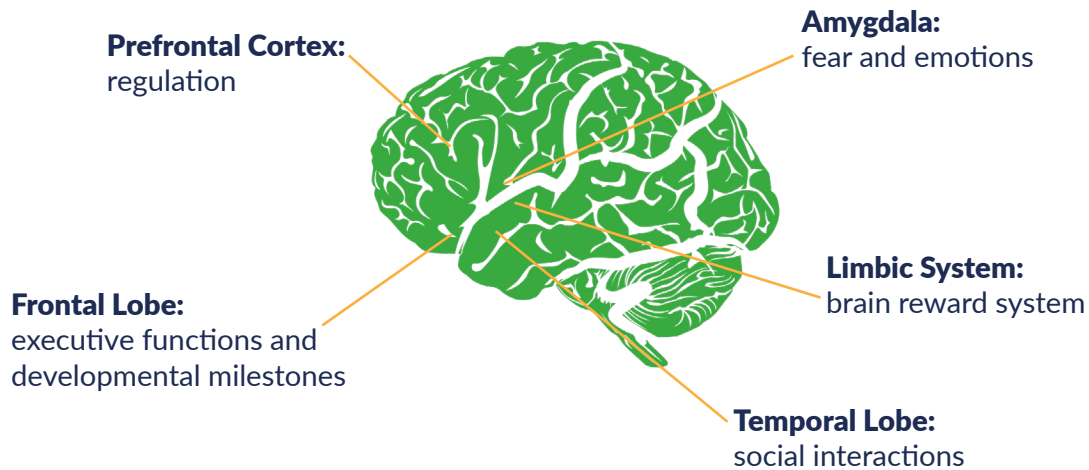
**Neuron:** nerve cells that send messages across the body to allow you to do everything from breathing to talking, eating, walking and thinking<sup>7</sup>

**Synapse:** the place where neurons connect and communicate with each other<sup>8</sup>

**Pruning:** the selective elimination (or “weeding out”) of non-essential synapses based on a child's specific experiences<sup>2</sup>



# Parts of the Brain and Their Functions



**Amygdala:** the processing center for emotions; associated with survival instincts (e.g., fight or flight); also plays a role in aggression, learning through rewards and punishment, handling unconscious memory (e.g., tying a shoe or riding a bike), learned behaviors related to addiction, and ties emotions we connect to memories<sup>10</sup>

**Brainstem:** responsible for many of the vital functions in life, such as breathing, consciousness, blood pressure, heart rate and sleep<sup>11</sup>

**Frontal lobe:** one of the five lobes of the brain; handles reasoning, social understanding, executive functions, voluntary muscle movements, and learning and recalling information<sup>12</sup>

**Limbic system:** assists in various processes relating to cognition, including spatial memory, learning, motivation, emotional processing and social processing<sup>13</sup>

**Midbrain:** the highest part of the brainstem which is responsible for certain reflexes, helps with visual and auditory process, contributes to the control of eye movement, regulating auditory and visual processing, motor control, arousal, and alertness<sup>14</sup>

**Prefrontal cortex:** one of the last places in the brain to mature; the prefrontal cortex manages insight, foresight, and planning capabilities<sup>15</sup>

**Temporal lobe:** a pair of areas on the brain's left and right sides, which play a role in managing emotions, processing information from senses, storing and retrieving memories, and understanding language<sup>16</sup>



# References for Brain Development Basics

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