

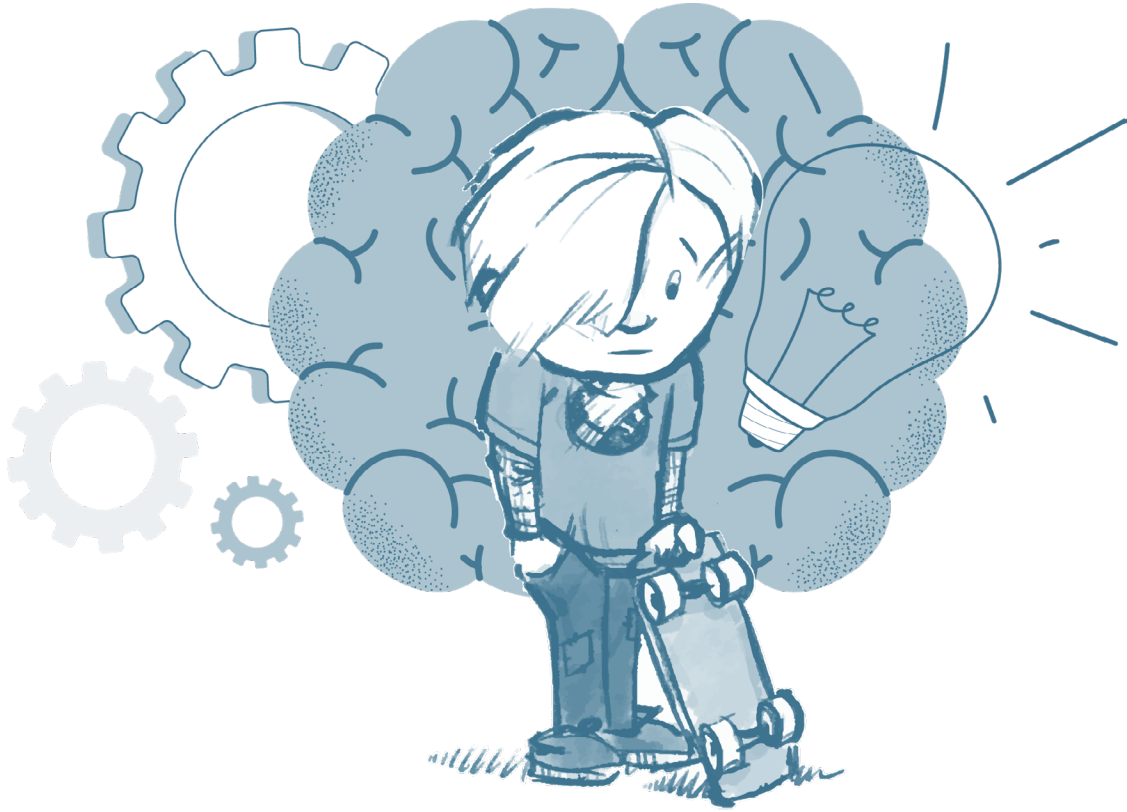
Module 3:

Mental Health and the Brain

- The brain changes over time
- Our thoughts, feelings, behaviours and reactions to the environment are linked with the brain
- The brain and the body are connected
- Mental health is a component of health



Mental Health and the Brain



Mental health is brain health. It is important to understand the brain's structure and functions as we explore topics like mental health and mental disorders. Everything that we do, feel, think or experience involves our brain and the functions it performs. The brain is a remarkable organ that controls the complex activities which help define our humanity. It is never fully developed because it is constantly evolving and reshaping as a result of our experiences.

The brain is made up mostly of water and fat, which are the building blocks of cells called neurons; glial cells which support neurons and perform various brain functions and other components as well. Neurons send and receive information through chemicals (called neurotransmitters) and electrical signals. Neurons are connected in complex networks called circuits. These circuits control specific brain functions and are connected directly or indirectly to most other circuits within the brain and the central nervous system. The early years are the most active period for

establishing neural connections, however new connections can form throughout life and unused connections continue to be pruned, allowing brain circuits to become more efficient. Our experiences interacting with the environment leads to continual reorganising and changing of connections in our brains at any age so that new connections are made (e.g. learning and remembering new concepts in the classroom), existing connections are strengthened (e.g. mastering a previously learned skill), or existing connections are weakened (e.g. forgetting information no longer perceived as important).

Although genes provide the blueprint for the formation of brain circuits and turn on and off in response to their own internal clocks, we now also know that our environments play a role in how these genes work. This is called 'epigenetics'.

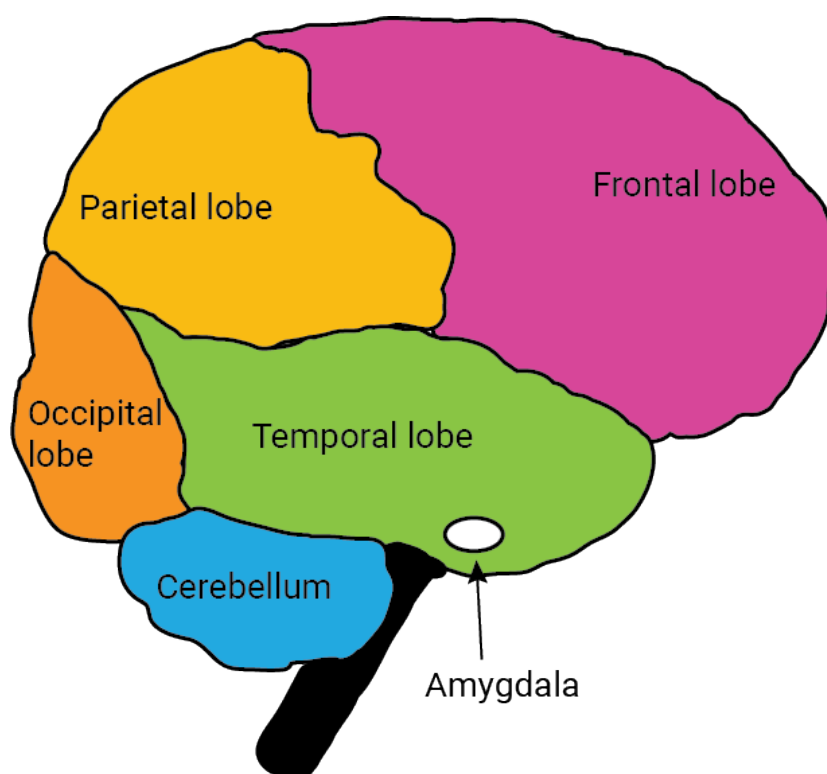
Epigenetic processes alter the activity of genes without changing a gene's DNA sequence, or 'instruction manual' that tells a gene what to do in the body. Essentially, our experiences and circumstances in life can either 'turn on' or 'turn off' combinations of genes that can lead to illness, whether it be mental or physical. The human genome can be described as the 'cookbook of life'. Our genome is the cellular recipe for each person to look, act, and exist as human beings. Similarly, we can think of epigenetics as a cook; different cooks will prepare the recipe of life differently. The study of epigenetics can help to explain why some people are more susceptible to mental disorders, while others are more resilient even in harsher environments – it is always a combination of nature and nurture factors, with many more insights left to be discovered.

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The cerebral cortex is the wrinkly outer layer of the brain that is responsible for higher cognitions and processing sensory information. The wrinkles maximise the surface area of the brain, allowing for more neurons and increased connections between them.

The cortex is divided into four areas called 'lobes' that carry out different functions. The frontal lobe is primarily responsible for processing cognitive tasks such as planning, reasoning, speech, movement and problem solving. The parietal lobe processes sensory information such as smell, touch, pressure, temperature, pain and certain motor information.



The temporal lobe is important for memory, learning, hearing, and language. The occipital lobe is the visual processing centre of the brain. These areas are all responsible for conducting certain brain functions. However, most brain functions actually involve many different areas that work together.

We can break down the main functions of the brain into six separate but integrated components. These include: 1) thinking or cognition, 2) perception or sensing, 3) emotion or feeling, 4) signalling, 5) physical or somatic and 6) behaviour.

1. Thinking / Cognition

Thinking or cognition includes all of our internal mental processes and functions. As the 'primary control centre', the brain is constantly working by receiving and sending signals to put together the different pieces of our world. This includes:

- Planning
- Reasoning
- Calculating
- Decoding symbols
- Self-awareness
- Focusing
- Sequencing
- Paying attention
- Making judgments
- Memory storage
- Comprehension
- Contemplation
- Social understanding
- Social decision-making

2. Perceptions / Senses

Perceptions and senses are complementary processes that determine how we experience our world. Sensation is when our senses gather information from our environment through sight, sound, smell, taste, and touch and send that information to the brain via the peripheral nervous system. Perception is the way our brain interprets these sensations to make sense of what is around us. Our individual experiences shape how we perceive external stimuli, which makes our own sense of perception somewhat unique from others. It is important to understand that the brain creates the perception that we experience. We do not see with our eyes, we see with our brains. We do not touch with our fingers, we touch with our brains.



3. Emotions / Feelings

Our brain is responsible for our ability to experience, label, describe and express feelings and emotions. It also helps us perceive how others may be feeling. While our emotions are personal and subjective, the human brain processes our experiences into feelings we all experience, for example:

- Joy
- Shame
- Anger
- Loneliness
- Sadness
- Guilt
- Consternation
- Resentment
- Demoralisation
- Serenity
- Happiness
- Annoyance

We have developed a rich lexicon to categorise and describe nuances in our emotional states. For example, disgruntled and disappointed are somewhat similar yet very different emotional states. Increasing our emotional literacy helps us name and manage our emotions better. Helping children expand their vocabulary of feeling words helps them to regulate their emotional responses more effectively.



4. The Signalling / Alarm System

Signalling / alarm system is our hard-wired response mechanism to external stimuli. Our brains are constantly experiencing and responding to inputs from the environment. One of the most important jobs our brain performs is to create appropriate responses. We then learn which responses worked well and which did not, for future reference. This is called 'adaptation'.

Our signalling / alarm mechanism is what allows us to employ our 'fight-or-flight' mechanisms and our 'excite and delight' mechanisms. It is the signal that our brain uses to tell us adaptation is needed for either a challenge or an opportunity.

Our signalling / alarm system is directly related to stress and anxiety disorders. Experiencing usual daily stressors is necessary for growth and development. The 'stress response' is actually our friend, not our enemy. It drives us to adapt and learn – to become resilient. However, a dysfunction in one or more of the neural circuits of the signalling mechanism may lead to an Anxiety Disorder.

5. Physical control of the body

All of our physical functions are under the control of our brain. This includes the respiratory, circulatory, genitourinary, digestive, musculoskeletal, endocrine and immune systems. Examples include:

- Regulation of our breathing (respiratory system)
- Regulation of heart rate and blood pressure (circulatory system)
- Sensory information from our bladder (genitourinary system)
- Drinking and eating behaviours, and conscious control of our muscles for eating and elimination (digestive system)
- Sensory receptors in our body that send signals between the brain and muscles to keep our body balanced and moving

6. Behaviour

Behaviour is the way we act; it is our ability to interact with others and our environment through 'doing'. Our behaviour includes our actions in response to internal or external stimuli. Every behaviour is the result of a complex interplay between all of the other brain functions. Our brain integrates all of these functions to enable us to do tasks every second of every day. Such behaviours might include:

- Social interactions
- Acts of kindness
- Acts of aggression
- Goal-directed activities
- Relaxation activities

All these functions indicate that the brain and body are connected. Our thoughts, feelings / emotions, behaviours and physical sensations are all controlled by the brain. For example the cortical limbic system (made up of smaller structures in the brain such as the Amygdala, the Hippocampus, the Corpus Callosum and the Thalamus) activates the fight, flight or freeze response during a stressful event, which leads to a series of physical reactions such as: dizziness, difficulties focusing, tunnel vision, blushing, dry mouth, difficulties swallowing, breathing problems, chest tightness, heart pounding, muscle tension, trembling, sweating, butterflies in the stomach, and nausea.

Imagine that you are hiking and you come across a bear. Your **senses** see and hear it, your **thoughts** recognize the bear as a dangerous threat, you start to **feel** scared, your fight-or-flight reaction is triggered, your body sends **signals** to increase your breathing rate and heart rate and your **behavioural** response is to run away.

Sources:

- Mental Health & High School Curriculum Guide:
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- Dana Organization | Brain Awareness Week:
<http://brainawareness.org/handouts-resources/>
- SickKids | Mind-Body Connection:
<http://aboutkidshealth.ca/article?contentid=3667>

