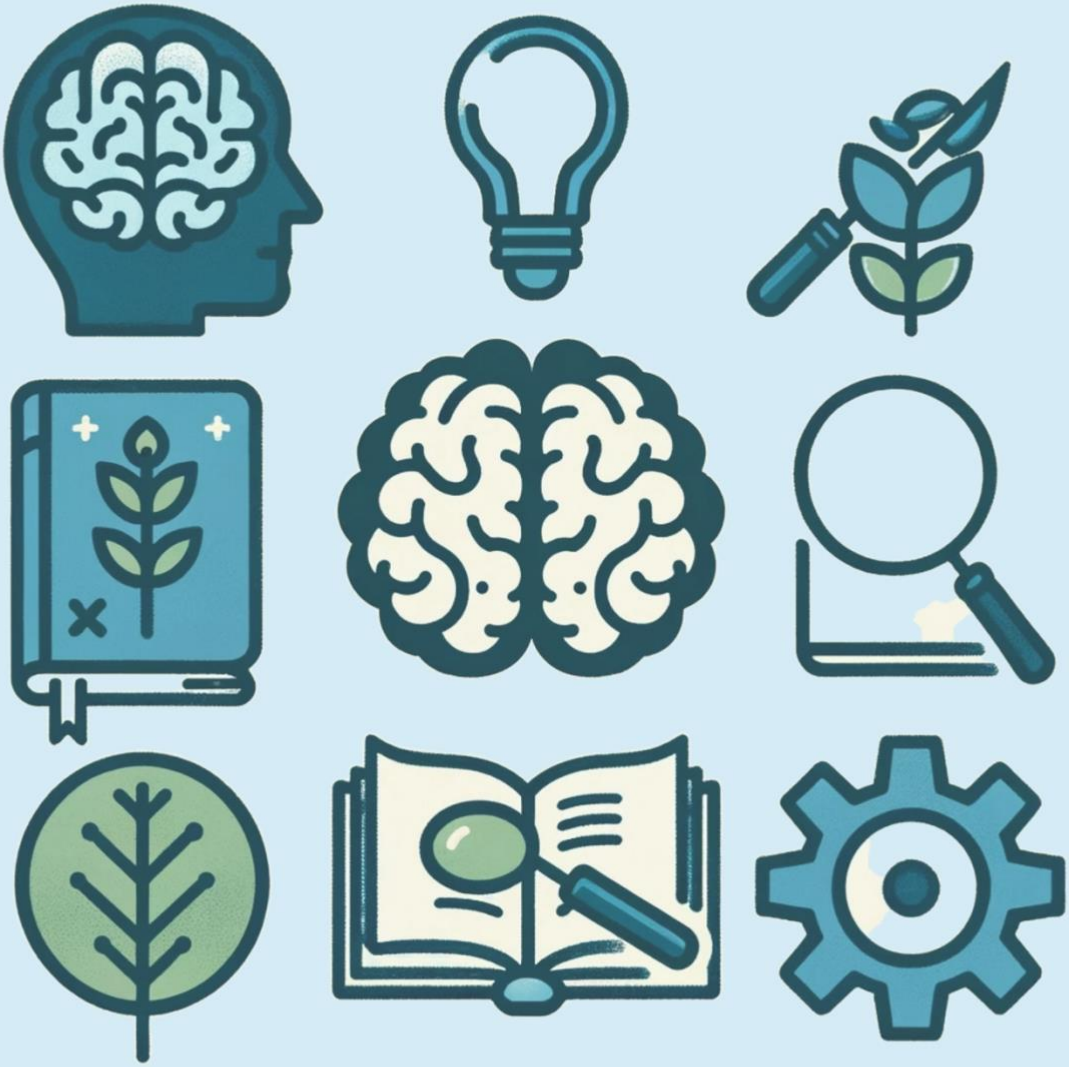
Mind, Brain & Behaviour 1

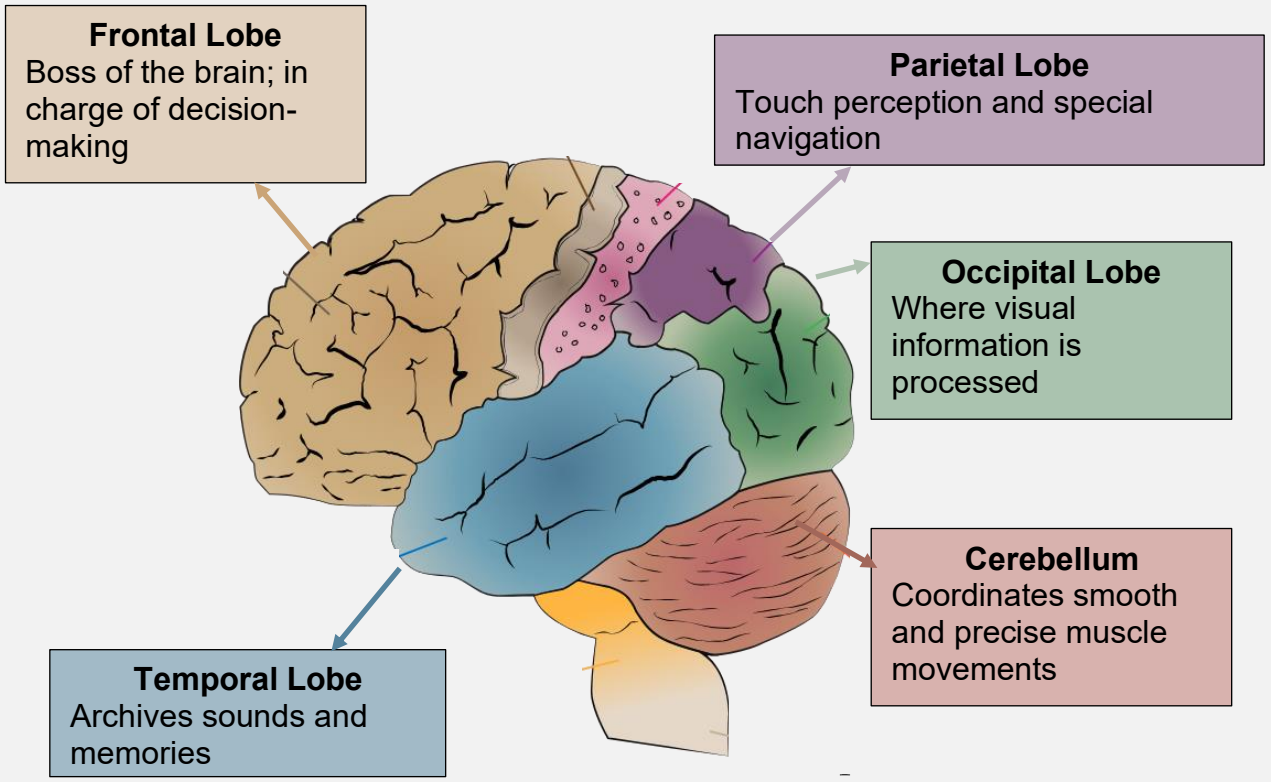


YOUR ULTIMATE STUDY GUIDE

Behavioural Neuroscience

Brain Modularity

- **Brain Modularity Theory** - This theory says that the brain has **specialised modules** for different cognitive functions
- **Neural Efficiency** - Modularity allows the brain to process complex information **efficiently**, with each **module** performing its function without overwhelming the entire system
- **Development Specialisation** – As we age, our brain's modules become **more distinct** and **specialised**, which is essential for the development of complex cognitive abilities



The Modular Brain and Its Functions

The Modular Brain

- **Gall's proposal** (1758) - suggested the brain has distinct ‘organs of thought’
- **Influence** - was influenced by **physiognomy**, relating **facial features** to personality **traits**
- **Phrenology** - Gall's flawed method to determine **psychological attributes** by feeling the **skull**
- **Cortical localisation** - introduced the idea that different **brain areas** have specific **functions**
- **Broca's aphasia evidence** - damaged left frontal lobe caused speech loss, supported brain specialisation
- **Wernicke's aphasia evidence** - damaged brain area causes language comprehension issues, supporting modularity

---

Challenges in Neuropsychology

Clinical Neuropsychology Limits

- **Clinical Neuropsychology** = using **real-world patients** to infer relationships between brain regions and psychological processes
- **Testing difficulties** - intensive testing of patients is challenging
- **Replicability issues** - single cases lack replication
- **Assumption** - presupposes local lesions cause local effects
- **Uncontrolled variables** - no control over lesion size or location

---

Neuroimaging

Recording Brain Activity

- **EEG use** - measures **brain activity**, albeit indirectly, by recording scalp activity
- **First human EEG** - conducted by Hans Berger in 1924
- **Epileptic spikes** - first noted in EEGs by Fisher & Lowenback in 1934
- **Robot control** - EEG utilised for robot operation in 1988
- **Main uses** - now a primary test for **epilepsy** & **sleep disorders**

Brain Imaging Techniques

Technique	Function	How It Works	Connection to Behaviour
MRI (Magnetic Resonance Imaging)	Shows brain **structure**	Uses **magnetic fields** and **radio waves** to create detailed images of the brain	Can correlate certain brain **structures** with types of **behaviour**
fMRI (Functional MRI)	Shows brain **function**	Detects **changes** in **blood oxygen** levels to show which areas are active	Links **brain activity** to **specific functions** or behaviours
PET (Positron Emission Tomography)	Measures brain **activity** processes	Uses **radioactive tracers** to detect changes in brain chemistry	Can show how different **areas** of the brain work during various **activities**

Neural Communication Mechanics

Action Potentials

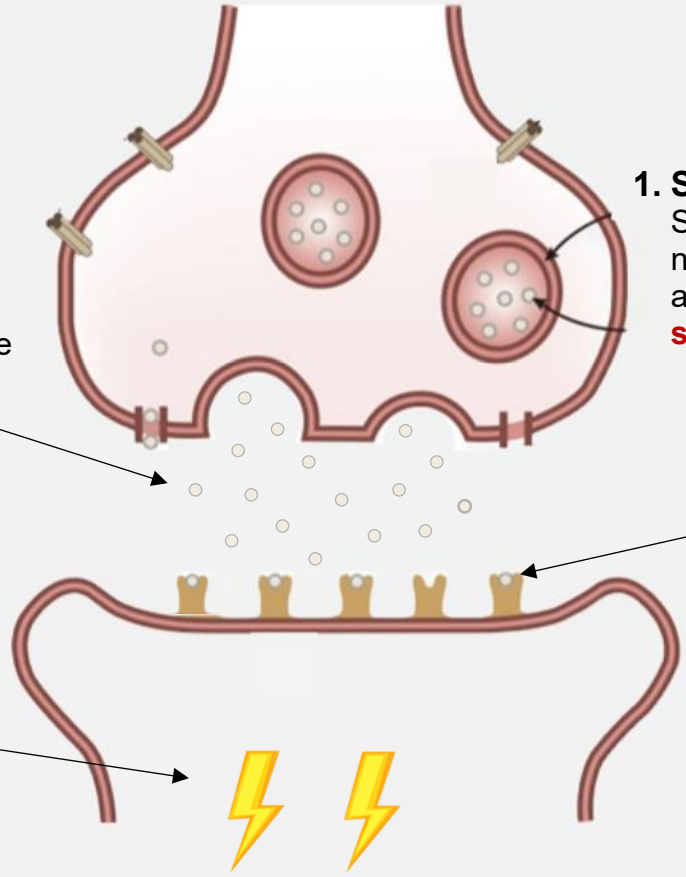
- **Action potential** - neuron firing caused by ion flow changes across the membrane, causing **neurotransmitter release** into the **synaptic cleft**
- **Rate law** - the action potential's 'all or none' property with **signal strength** dictated by **firing frequency**

Neurotransmitters and Neuromodulators

- **Neurotransmitters** - act like quick text messages between neurons throughout your body, triggering rapid responses such as muscle contractions or mood shifts
- **Neuromodulators** - influence mood, attention, and motivation over longer periods but adjusting the volume of neural signals

	Neurotransmitters	Neuromodulators
Function	**Directly transmit** signals across the synapse	**Indirectly influence** neuronal signalling
Examples	**Glutamate** (excitatory), **GABA** (inhibitory)	**Dopamine** and **serotonin**
Duration of Effect	**Short-lived**	**Longer lasting**; modulate overall neuronal activity

Neurotransmitter Storage, Binding and Effect



1. Synthesis
Synthesised neurotransmitters are stored in **synaptic vesicles**

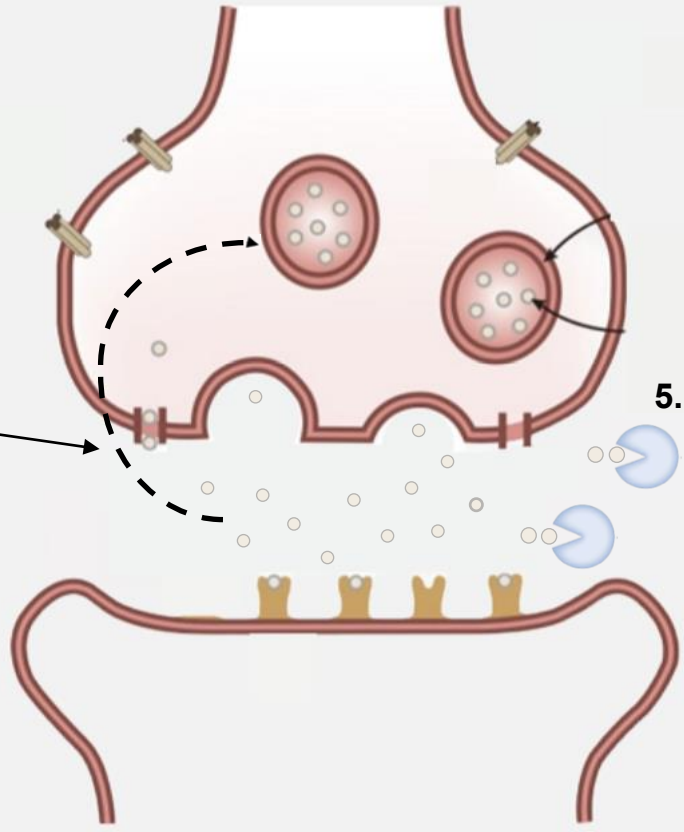
2. Binding
Neurotransmitters **bind** to receptors on **adjacent neuron**

3. Release
Neurotransmitters are released into the **synaptic cleft**, the space between neurons

4. Effect
The binding of neurotransmitter **changes** the **electrical activity** of the post-synaptic cell

---

Neurotransmitter Clean-up



5. Breakdown
Some of the neurotransmitter is **degraded** by **enzymes**

6. Reuptake
Some of the neurotransmitter is **transported** back into the **vesicle** for re-use ☺