

# Brain and Behaviour

## Summary

# Topic 2 - How nerves work

- **GABA** is an inhibitory molecule → releases  $\text{Cl}^-$  to the post synaptic cell.
- Since it's a negative charge, it lowers the chance of an action potential happening (making it harder to reach the threshold of  $-70 \text{ mV}$ ).
- **EPSP (excitatory post synaptic potential)** → a temporary depolarisation of postsynaptic membrane potential caused by a flow of positive charge ions into the postsynaptic cell as a result of opening of ligand gated ion channels.
- **IPSP (inhibitory post synaptic potential)** → makes the postsynaptic neurone less likely to generate an action potential.
- **Spacial summation** → the sum of a bunch of neurons, whether excitatory or inhibitory, that acts on the postsynaptic cell.
- **Temporal summation** → when a single neuron rapidly fires, having the same effect as multiple cells.

# Topic 3 - Structure of CNS & PNS

- **CNS** (central nervous system)
- **PNS** (peripheral nervous system)
  - **Somatic** (SNS)
  - **Autonomic** (ANS)
    - **Sympathetic** (fight or flight) — releases NAd (noradrenaline)
    - **Parasympathetic** (rest and digest) — releases ACh (acetylcholine)
- **Efferent axons** —> from CNS to PNS
- **Afferent axons** —> from PNS to CNS
- **Ganglion** —> nerve cell cluster
  - nerve before the ganglion —> **pre ganglionic fibre**
  - nerve after the ganglion —> **post ganglionic fibre**
- Sensory neurons (has a ganglion) come out of the spinal cord from the front (**dorsal**)
- Motor neurons come out of the spinal cord from the back (**ventral**)

## Hindbrain

- Includes: **pons** and **cerebellum**.
- The sensory information comes from the body —> **thalamus** —> either **cortex** or **basal nuclei**
- All the automatic functions the body deals with is regulated by the **medulla oblongata**

## Midbrain

- **Reticular activating system** —> deals with arousal
- **Superior & inferior colliculi** —> receives and does reflex movements for vision and auditory information
- **Substantia nigra** —> inhibits (controls) motor movements

## Forebrain

- Many different regions, e.g. **basal nuclei** and **thalamus**

- The **hypothalamus** is a structure 'below' the thalamus
- It's function is changes in the body via hormones
  - **Thermoregulation** —> dealing with body temperature
  - **Preoptic area** —> very front of the hypothalamus, detecting changes by monitoring blood temperature
    - The changes detected are sent to the vasomotor centre of the medulla oblongata
- **Fluid balance**: thirst centre —> measures the amount of dissolved things in the blood
- **Nutrient balance**: ventromedial hypothalamus —> initiates hunger
- **Blood pressure**: baroreceptors —> information goes to medulla oblongata which alters the heart rate based on the needs, via altering the pace maker
- **Hemispheric specialisation** —> where one hemisphere of the brain does something better than the other side.
- **Motor cortex** (front) —> control voluntary motor movements via pyramidal cells
- **Somatosensory** cortex (behind) —> linked to consciousness and awareness
- **Visual cortex** —> located in occipital lobe, processes visual information
- **Association areas** —> remaining areas of the brain

# Topic 4 - Neurotransmitters & Drugs

- Control in various ways:
  - **Synthesis** → prevents the neurotransmitter from being made in the presynaptic cell
  - **Release** → alters the rate at which it's released into the synapse
  - **Deactivation** → prevents removal of neurotransmitter from synapse
  - **Binding** → prevents neurotransmitter from binding to the postsynaptic cell
- Drugs can either be **agonist** (work in favour of the neurotransmitter) or **antagonist** (working against the neurotransmitter)
- **Cholinergic synapse** → a synapse that repeat releases **ACh**
- **Toxins** usually affect the activity of ACh
- **Nicotine** → binds to receptors called **nicotinic**, and can block ACh from normally binding → paralysis of muscle
  - The nicotinic will 'act' like it wants nicotine, instead of food and water
- **Monoamines** → are molecules which contain 1 amine group (NH<sub>2</sub>)
  - When bound to receptors they trigger the synthesis of **secondary messengers** in the postsynaptic cell
    - e.g. **cAMP** (cyclic adenosine monophosphate)
- **Metabotropic effect** → when a secondary messenger is activated
- **Catecholamine** → includes a catecho group and an amine group
  - excess catecholamine is broken by **monoamine oxidase**
- **Noradrenaline (NAd)** is an excitatory neurotransmitter
- **Dopamine (DA)** is a catecholamine (has an amine and a catecho group), and has 3 pathways:
  - **hypothalamus** → **pituitary** (hormonal function)
  - **substantia nigra** → **basal nuclei** (motor function [parkinson's])
  - **midbrain** → **frontal cortex** [mesofrontal] or limbic system [mesolimbic] (emotion)
- **Serotonin** → is a monoamine, and is a type of **indoleamines**