-Exam topics-

The basic structure of DNA (e.g., what is a nucleotide? A codon?)

- **Deoxyribonucleic acids (DNA)** are twisted strands of nucleotides bonded together.
- A Nucleotide is a special molecule consisting of **sugar**, a **phosphate group(s)** and a single or double **carbon** ring with **nitrogen** in it.

The basic structure of proteins

- Proteins are large molecules built up from many smaller molecules called amino acids**.**
- A **peptide** is a small protein**, Amino acids** are small molecules.
- There are **20** different varieties that are the building blocks of proteins in the human body.
- Proteins can **coil** – the **amino acids** in proteins can make **hydrogen bonds** with each other.

The role of ions in cell depolarisation, and what they are called

- Ions help maintain the positiveness and negative charges of a cell to generate an action potential.
- (Inside a cell) is more negative as it contains **proteins (-ve)** and a little **potassium (k+)**.
- (Outside a cell) is more positive as it contains **sodium ions (Na+)** and a little **chloride ions (Ci).**

The 'numbers' associated with depolarisation (Hint: expressed as millivolts)

- **-70mV:** inside a full negative cell before depolarisation (resting membrane potential).
- **-55mV:** The threshold of a cell (zero).
- **-30mV:** more positive charge inside a cell before voltage-sensitive cells open.

When threshold is reached, alternative voltage-sensitive cells open, positive charge enters cell.

Factors that influence action potential conduction velocity

Neurotransmitters can **excitatory** and **inhibitory** e.g. GABA. This neurotransmitter causes an influx of Cl- into the post-synaptic cell which makes it *less likely* for an action potential to be generated in that cell because the inside is now more negative than normal – it is **inhibited.** Often **many** cells must synapse on **one cell** to cause that cell to fire, this is termed **spatial summation.** There may also be a cumulative effect on the postsynaptic cell of many rapidly successive excitatory postsynaptic potentials (**EPSPs)** or inhibitory postsynaptic potentials **(IPSPs)** from a single presynaptic neuron, this is called **temporal summation.**

- **Myelin:** the fatty substance surrounding the axon which "speeds up" the action potential. **Length of axon** the faster is conducts, **temperature –** decreased temperature slows down conduction velocity.

The names of the various important neurotransmitters studied in the unit

- Acetylcholine **(ACh)**,
- Gamma-amino butyric acid **(GABA)**,
- Noradrenaline **(NAd)**,
- cyclic adenosine monophosphate **(cAMP),**
- Dopamine **(DA)**,
- Serotonin

Which neurotransmitter systems use second messenger systems

- Monoamines. Rather than directly open channels on the surface of the post-synaptic cell, the binding of a monoamine neurotransmitter to a receptor causes the synthesis of a chemical inside the cell (the second messenger), which performs its action inside the cell. E.g. cyclic adenosine monophosphate (cAMP).

Which neurotransmitters are excitatory, and which are inhibitory. How to they work? (e.g., ACh, GABA)

Excitatory

- They generate action potentials in other neurons to fire
- E.g. ACh- propagate a signal across a range of cells
- **ACh** – synapses that release Ach are termed **cholinergic synapses**. It is found at *skeletal neuromuscular junctions, CNS synapses, neuron/neuron PNS synapses.* **ACh** crosses the synapse and binds to receptors on the post-synaptic cell and this immediately opens channels, known as the **ionotropic effect.**
- **NAd** – an example of a catecholamine. Common in the CNS and PNS and most **sympathetic ganglionic neurons** release NAd. In the **sympathetic** nervous system, NAd acts as a **stimulant.**

Inhibitory

- They can prevent propagation of a signal
- E.g. Gamma-Amino butyric acid (GABA)
- This cause an influx of Cl^- (chloride) into the postsynaptic cell
- Action potential won't generate to more negativeness than normal

The different conduction velocities of the different types of fibres studied in the unit

- The name given to the wires that leave nerve cells and travel around the body.
- Different types of fibres carry *depolarisation* messages from the different tactile and pain receptors, there are 3 types of *myelinated* axons that carry signals at speeds between 15 and 120 metres per second, and relay **touch** and **pressure** information.
- **A-fibres:** A-alpha, A-beta, A-delta (fastest to slowest) carry signal at the speed between 15 to 12 m/s and relay touch and pressure information.
- **C-fibre:** Carry most signals from free nerve endings. Slow compared to A-touch fibres.

The process of synaptic communication – how does it occur?

- **Synapse** = The gap between a neuron and another neuron, muscle or gland.
- It releases neurotransmitters such as Ach to the **post-synaptic cell.**
- Once the action potential is released into the axon terminal, voltage sensitive calcium gates open allowing calcium to enter. Which encourage neurotransmitter to be released and the postsynaptic cell changes its activity (e.g. muscle contraction).
- The neurotransmitters are then destroyed by specific enzymes (e.g. acelytolineesterase) in the synaptic gap.
- Postsynaptic cell goes back to its normal resting state waiting for the next action potential, to be released.

Drug concepts – the definition of agonists and antagonists

- **Agonists** mimic (or "copies") the normal effect of a neurotransmitter.
- **Antagonist** if it impedes ("prevents") the normal effect of a neurotransmitter.