PHYS20008: COMPLETE COURSE SUMMARY

2022	Semester 1	BCMB20002	Biochemistry and Molecular Biology	1	[redacted]	H1	First Class Honours	12.500
2022	Semester 1	PHYS20008	Human Physiology	3	94	H1	First Class Honours	12.500
2022	Semester 1	PSYC20006	Biological Psychology	2	[redacted]	H1	First Class Honours	12.500
2021	Semester 2	BIOL10010	Introductory Biology: Life's Complexity	1	[redacted]	H1	First Class Honours	12.500
2021	Semester 2	CHEM10003	Chemistry 1	1	[redacted]	H1	First Class Honours	12.500
2021	Semester 2	PSYC10004	Mind, Brain and Behaviour 2	2	[redacted]	H1	First Class Honours	12.500
2021	Semester 2	SCIE10004	Human Sciences: From Cells to Societies	2	[redacted]	H1	First Class Honours	12.500
2021	Semester 1	BIOL10008	Introductory Biology: Life's Machinery	1	[redacted]	H1	First Class Honours	12.500
2021	Semester 1	CHEM10007	Fundamentals of Chemistry	1	[redacted]	H1	First Class Honours	12.500
2021	Semester 1	PHYC10009	Foundations of Physics	1	[redacted]	H1	First Class Honours	12.500

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	Nervous system	Endocrine system
Anatomy	A '**wired**' system, in that neurons are physically connected to one another	A '**wireless**' system, because glands and target cells are not structurally connected
Type of chemical messenger	**Neurotransmitters**, which are released into the **synaptic cleft**	**Hormones**, which are released into the **blood**
Distance over which chemical messenger acts	Very **short distance**: neurotransmitters diffuse over cleft	**Long distance**: hormones are transmitted by blood
Specificity of signal	Signals between neurons are **highly specific**	Hormones are **non-specific**; they act every cell throughout the body that has the appropriate receptor
Speed of response	**Rapid** (milliseconds)	**Slower** on average (seconds to hours)
Duration of action	**Brief** (milliseconds)	**Long** (minutes to days)

Types of Neurotransmitters

Excitatory neurotransmitters: trigger a small **depolarisation** in the target cell, making action potentials **more likely** to occur

> **Example:** glutamate is the **main excitatory neurotransmitter** in the body, and is needed for **synaptogenesis** (the formation of new connections between neurons in the brain)

Inhibitory neurotransmitters: lead to a small **hyperpolarisation** in the target cell, making action potentials **less likely** to occur

> **Example:** GABA is the **main inhibitory neurotransmitter** in the body, slowing down the rate at which neurons in the brain communicate with one another. Drugs that act on GABA receptors include **alcohol** and **benzodiazepines** (Xanax, Valium) which slow down neural activity, making you feel **calm and relaxed**

	Leak channels	Ligand-gated channels	Mechanically-gated channels	Voltage-gated channels
Description	Channels that **continually** open and close	Channels that open with a **chemical** binds to it	Channels that open in response to **mechanical stimulation**,	Channels that open in response to **voltage changes** in the cell
Location in the body	Located in **most cells** throughout the body	Located in **interneurons** and **motor neurons** and some **sensory neurons**	Located in some **sensory neurons**	Located in the axons of **all neurons**

Question: what makes calcium such a good transmitter of electrical signals?

Answer: the high equilibrium potential of calcium means that calcium ions are trying to diffuse into the cell regardless of the membrane potential. Thus, even when the membrane is depolarised during an action potential, calcium ions are still able to transmit signals

Factors Affecting Rate of Diffusion Across the Membrane

1) Lipid solubility

Lipid-soluble substances can diffuse into the cell because the membrane is a **lipid bilayer**. Remember, lipids are **hydrophobic**, so they can easily pass through the hydrophobic interior of the bilayer

2) Molecular size

Smaller molecules face **lower resistance** in diffusing across the membrane, and therefore transverse the membrane more rapidly

3) Cell membrane thickness

The thickness of the cell membrane is the **diffusion distance**, ie how far the substance must travel to enter or exit the cell. Thicker membranes correspond to slower rates of diffusion because more distance must be travelled

4) Membrane surface area

The surface area of the membrane determines the number of **entry and exit points** available for substances to diffuse into and out of the cell. The larger the surface area, the more entry and exit points there are, and the faster the rate of diffusion

5) Composition of lipid layer

The **stiffness / fluidity** of the membrane influences how easy it is for substances to enter into or exit the cell. Saturated fatty acids stiffen the membrane while unsaturated fatty acids make the membrane more fluid. Thus, the composition of the membrane affects the rate of diffusion