SAP - Welcome Video

- Access tutorials and lectures through **weekly checklists**
- Online learning: Lt, Virtual rooms
1. Lectures, Tutorials, Virtual rooms

Anatomy and Physiology Basics

Week 1

*Homeostasis*

- Maintain internal environment
  o Stimulus > receptor > Control centre > Effector> response
  o Negative: response is opposite to the stimulus
    ▪ < Blood Glucose Level > Chemoreceptors > Pancreas – Insulin released
      • 1. Uptake
      • Glycogen > BGL <
  o Positive: stimulus and response go same way
    ▪ Baby pushes against cervix > Stretch receptors > 'Brain" > Posterior pituitary gland – Oxytocin (uptake in uterine contraction)
  o Negative feedback is much more common than positive feedback
- Dynamic equilibrium
- Nervous and endocrine system

*Endocrine System*

A

- Exocrine: secrete hormonal substances directly through sweat, urine, etc
- Endocrine: secrete hormonal substances directly to blood stream or lymph
- Target cells are tissues with receptors for that specific hormone. Depends on:
1. Blood levels of hormone
2. Number of receptors
3. Strength of bond between hormone and receptors
- Functions: growth and maintenance

B

| Class of Hormone | Examples | Solubility | Location of Receptor | Principle mechanism of action |
|---|---|---|---|---|
| Steroid based (and Thyroid) | - Testosterone<br>- Estrogen<br><br>- Aldosterone<br>- Cortisol | Lipid soluble (must be bound for travel in the blood) | Intracellular receptors (cytoplasm and/or nucleus) | Alter transcriptional activity of responsive genes |
| Amino Acid based (Protein or peptide). Note: | - Insulin<br>- Oxytocin<br>- ADH | Water soluble (is free to travel in the blood) | Cell surface receptors | Generation of second messengers |

| | | | | |
|---|---|---|---|---|
| while thyroid is amino acid it acts like a steroid | | | (plasma membrane) | which alter the activity of other molecules, usually enzymes within a cell |

C

Diabetes Insipidus – too little ADH

- ADH deficiency due to hypothalamus or posterior pituitary damage
- Without enough ADH:
  - o Water is lost from the body in urine
- Without treatment, diabetes insipidus can cause dehydration
  - o Significant issues with concentration of sodium in the blood
- Alcohol inhibits ADH
- Homeostatic Imbalance:

| Type 1 diabetes | Type 2 diabetes |
|---|---|
| - Body produces either no or too little insulin<br>- Insufficient glucose can enter the tissue effectively > blood glucose concentration levels remain high | - Body does not make enough insulin or does not use insulin efficiently<br>- Mostly due to individuals being overweight |

### *Cells*

Cytoskeleton – determines shape

- **Microfilaments** are protein strands that form a network on the cytoplasmic side of the plasma membrane.
- **Intermediate filaments** resist stresses placed on a cell and participate in junctions that attach some cells to their neighbours.
- **Microtubules** are hollow, they hold organelles in place, form bundles that maintain cell shape and rigidity, and act somewhat like railroad tracks to guide organelles and molecules to specific destinations in a cell.

Cellular Organelles

| Organelle | Role |
|---|---|
| Endoplasmic Reticulum<br>- Smooth | **Smooth:** does not contain ribosomes and therefore cannot synthesize proteins. Instead it synthesizes fatty acids and steroids, such as oestrogen and testosterone; inactivates or detoxifies drugs and other potentially harmful substances. |
| - Rough | **Rough:** has ribosomes on the surface. The primary role of rough ER is to serve as a transportation network and participate in |

| | |
|---|---|
| | membrane synthesis. The attached ribosomes manufacture all of the proteins that are secreted from the cell. |
| Ribosomes | Site of protein synthesis.<br>1. Free ribosomes which float freely in the cytoplasm and make proteins for use in the cytosol<br>2. Ribosomes associated with the endoplasmic reticulum which synthesis proteins destined for intersection into the plasma membrane or secretion from the cell |
| Mitochondria | Generates most ATP through aerobic cellular respiration. Active cells that use ATP at a high rate such as muscle cells, have a large number of mitochondria. ATP is produced in the cristae. |
| Golgi Apparatus | First step of protein transportation<br>- Modifies, sorts, packages, and transports proteins received from the rough ER<br>- Forms secretory vesicles that discharge processed proteins via exocytosis into extracellular fluid; forms membrane vesicles that carry molecules to other organelles, such as lysosomes. |
| Lysosomes | Membrane enclosed vesicles that form from the golgi apparatus.<br>- Digest substances that enter a cell via endocytosis and transport final products of digestion into cytosol.<br>- Carry out autophagy, the digestion of worn-out organelles.<br>- Implement autolysis, the digestion of an entire cell.<br>- Accomplish extracellular digestion. |
| Peroxisomes | Smaller versions of lysosomes. They contain several oxidases, enzymes that can oxidise (remove hydrogen atoms from) various organic substances. For instance, amino acids and fatty acids are oxidised in peroxisomes as part of normal metabolism. |

**Transcription** (copying the DNA sequence to make an RNA molecule) **and Translation** (decoding the RNA (mRNA to build a protein that contains a specific series of amino acids)

1. Interphase is a state of high metabolic activity in which the cell does most of its growing.
2. Prophase
3. Metaphase
4. Anaphase

5. Telophase/cytokinesis