

4.5 Homeostasis Knowledge Organiser

Homeostasis is the regulation of the internal conditions in a cell or organism. It is very important to maintain the optimum conditions for enzyme action and all cell functions, when the internal or external environment is changing.

In humans we control three key things:-

- Body Temperature
- Blood Glucose Levels
- Water Levels

All control systems include...

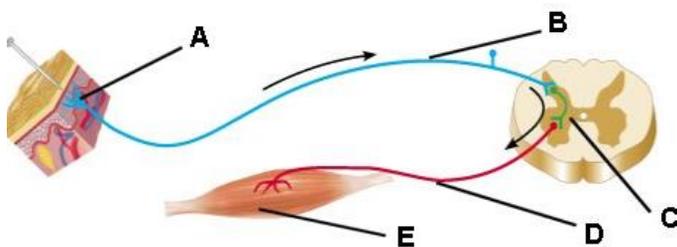
- 1. Receptors** - to detect stimuli (environmental changes)
- 2. Coordination Centres** – organs that receive and process info.
- 3. Effectors** – Muscles or Glands which bring about responses to restore optimum conditions.

The nervous system uses **electrical impulses** to send messages along **neurons**. These are very **fast** and allow us to react quickly to changes in the environment.

Examples of a stimulus: Loud noise, Fire, Sharp objects
Examples of receptor organs: Ears, Eyes, Skin, Nose, Tongue

Gaps between neurons are called **SYNAPSES**, here the electrical impulse is converted into a chemical messenger that diffuses across to the next neurone

The Reflex Arc – an automatic, rapid response that doesn't involve the conscious parts of the brain



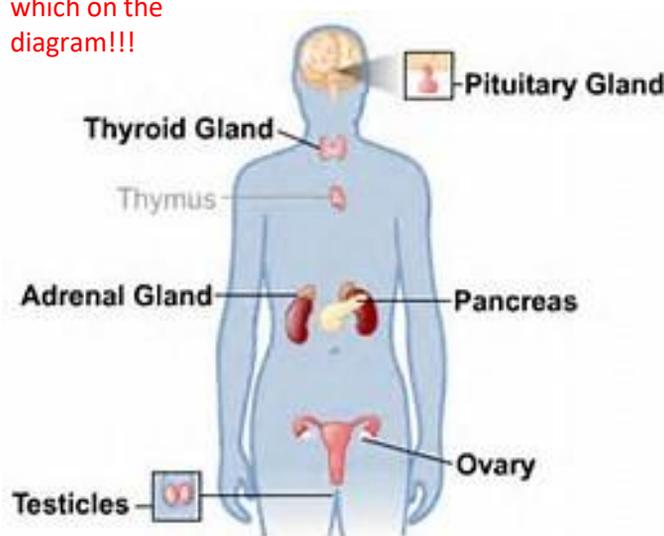
- A – Receptor (reacts to a stimulus)
- B – Sensory Neuron (carries message to the co-ordinator/CNS)
- C – Relay Neuron
- D – Motor Neuron (carries message away from co-ordinator/CNS)
- E – Effector (a muscle contracts or a gland secretes a hormone)

The Central Nervous System (CNS) includes the brain and spinal cord. This is the coordination centre in a nervous response.

The Endocrine System – composed of glands which secrete hormones (Chemical messengers) into the blood.

You need to know which gland is which on the diagram!!!

Hormones travel in the **blood**, for this reason their effects are slower but longer lasting than those of the nervous system.



The pituitary gland in the brain is very important in the endocrine system. It secretes several different hormones into the blood in response to changes in body conditions. These hormones then cause more glands to release hormones that bring about a range of effects. SO THE PITUITARY GLAND IS SEEN AS A 'MASTER GLAND'.

Thyroxine is produced by the Thyroid gland to stimulate your base metabolism, it is important for **HT** human growth and development.

Adrenaline is produced by the Adrenal gland when we are stressed or scared. It increases heart rate to deliver oxygen and glucose to the brain and muscles faster... **FIGHT OR FLIGHT!**

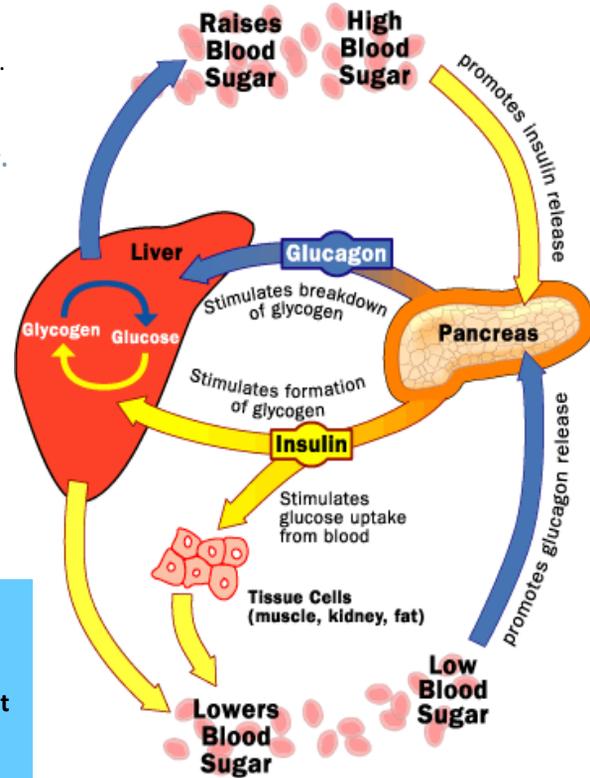
Blood Glucose Regulation

The **pancreas** monitors the amount of glucose in your blood. It coordinates a response to changes by producing one of two hormones... **INSULIN** or **GLUCAGON**.

Insulin lowers blood sugar so is released when glucose levels are high.
Glucagon raises blood sugar so is released when it glucose levels are low.

The **liver** is the main effector in this mechanism.

It stores glucose as insoluble glycogen when insulin has been released.
It converts glycogen back into glucose when glucagon has been released.



Type 1 Diabetes

Blood glucose can get fatally high as not enough **insulin is released by the pancreas**.

To treat this a person can **inject insulin before their meals** so that excess glucose can be converted to glycogen and stored.

There is no cure.

Type 2 Diabetes

Body cells **stop responding to insulin** even when the pancreas is making lots of it.

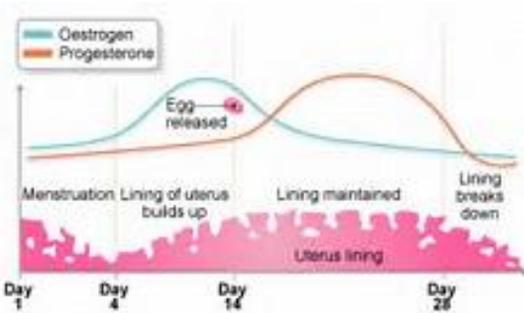
Eating a healthy diet low in carbohydrates, losing weight and exercise can help control this type of Diabetes.

Obesity is a risk factor for Type 2 Diabetes.

Hormones of Human Reproduction

During puberty reproductive hormones cause secondary sex characteristics to develop... this includes menstruation.

The Menstrual Cycle



Oestrogen is the main female hormone **produced in the Ovary**.
During puberty a females eggs begin to mature and one is released every 28 days (approx.)

Testosterone is the main male reproductive hormone **produced by the testes** to stimulate sperm production.

The release of egg from the ovary is called **ovulation**, this happens half way through the menstrual cycle (approx. day 14).

Hormone	Produced in...	Causes...
Follicle Stimulating Hormone (FSH)	Pituitary Gland	Egg to mature and Oestrogen to be released
Oestrogen	Ovaries	Lining of the uterus to develop and LH to be released. FSH production to stop.
Luteinising Hormone (LH)	Pituitary Gland	Egg to be released (Ovulation at Day 14)
Progesterone	Ovaries	Maintenance of uterus lining and inhibits the production of FSH and LH.

Contraception

Fertility can be controlled in a variety of ways.

Hormonal Methods include...

Oral Contraceptives – pills that contain oestrogen... to inhibit FSH production, so no eggs mature.

Injections, Implants and Skin Patches – slowly release progesterone to inhibit FSH and egg maturation for an extended period of time.

Intrauterine Devices (IUD) – some of these devices, plastic ones, release progesterone to pause the cycle.



Non - Hormonal Methods include...

Barrier Methods (e.g. condoms/diaphragms) – prevent sperm reaching an egg (stop fertilisation from happening).

Spermicidal agents (e.g. creams) – which kill or disable sperm to stop them from reaching the egg.

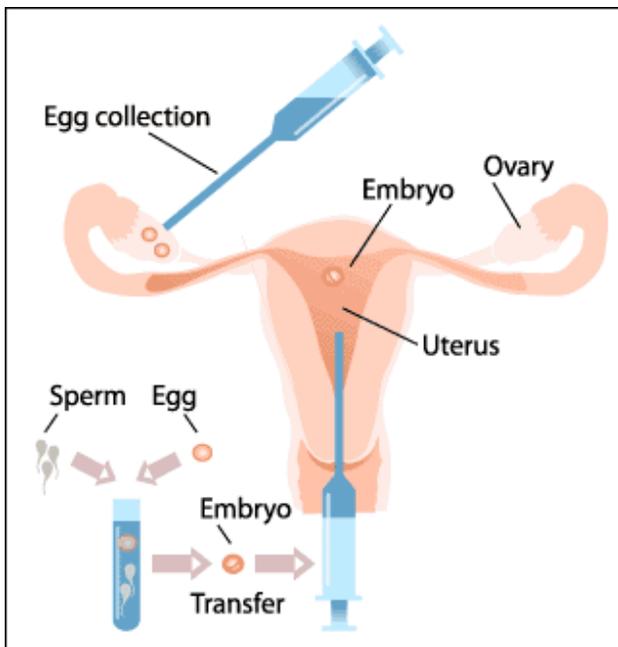
Natural Methods – Abstaining from sexual intercourse during the parts of the cycle when the woman is most fertile.

Surgical methods of sterilisation – this is possible for both males and females where the reproductive passages are cut or blocked... this is a permanent procedure.

Hormones used to treat Infertility HT

Hormones can be used to increase a woman's chance of having a baby naturally. For example, if her FSH and/or LH levels are low she could be given a fertility drug (containing these hormones) to stimulate ovulation.

IVF – fertilising the egg with sperm in a lab



1. FSH and LH are given to a woman to cause eggs to mature.
 2. These eggs are then removed, mixed with the sperm of the father in the laboratory and allowed to develop into embryos.
 3. One or two of these embryos will then be placed back into the uterus of the mother to develop naturally.
- + **Great if you cant get pregnant naturally as it allows you to have a baby.**
 - **Can be expensive and doesn't always work (LOW SUCCESS RATES).**
 - **Can cause multiple births (too many babies!!) this can be risky for both mother and babies.**

ETHICAL ISSUES!

This often has left over embryos that will eventually be destroyed, each embryo could grow into a human life.

Some couples may opt for their embryos to be tested for genetic disorders before implantation, could this lead to selection of certain 'beneficial or preferred characteristics'...

The Designer Baby Debate.