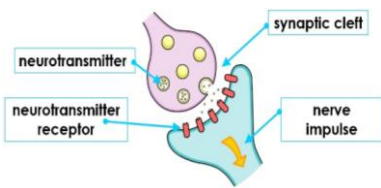


Reflexes - Prevent harm, avoid conscious parts of the brain (faster)

1. Stimulus e.g. stand on nail
2. Receptor pain
3. Sensory neurone electrical impulse
4. Relay neurone (CNS) CNS
5. Motor neurone electrical impulse
6. Effector muscles

Synapse - Gap between two neurones

1. Electrical impulse arrives at synapse
2. Neurotransmitter diffuses across synapse
3. Bind to receptors on 2nd neurone
4. Electrical impulse passed on



REQUIRED PRACTICAL

Independent Variable:

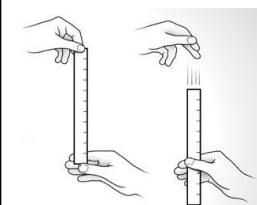
- Number of practices

Dependent Variable:

- Reaction time (distance where ruler is caught converted into a time)

Control Variables:

- Ruler dropped from same height
- Use weaker hand each time
- Same mass of ruler
- Same thickness of ruler

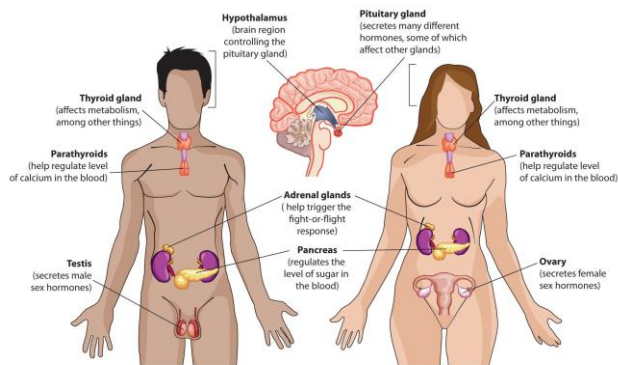


Homeostasis - the maintenance of a constant internal environment.

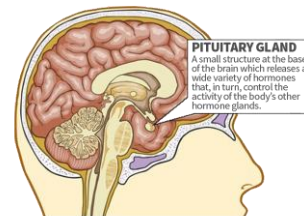
The main things we need to control in the body are:

- Temperature (thermoregulatory centre in the brain)
- Blood glucose (pancreas)
- Water (kidneys)
- Mineral ions/salts (kidneys)
- Urea (waste) (liver and kidneys)

Endocrine System - the glands of the body - secrete hormones



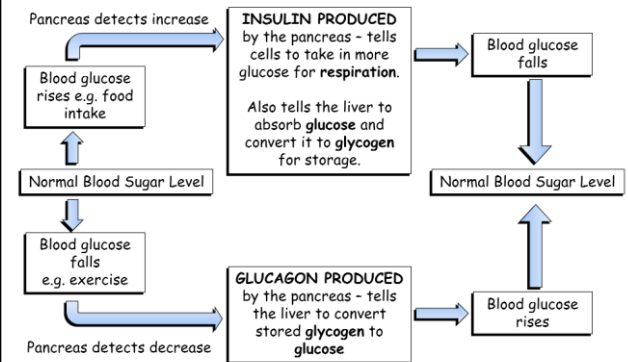
The **pituitary gland** is often referred to as the **master gland** because it stimulates other glands in the body e.g. TSH stimulates the thyroid, FSH and LH stimulate the ovaries.



PITUITARY GLAND
A small structure at the base of the brain which releases a wide variety of hormones that, in turn, control the activity of the body's other hormone glands.

NERVOUS SYSTEM	ENDOCRINE SYSTEM
What type of message? Electrical impulse	Chemical hormone
What do they travel through? Along neurones	In the blood
Speed? Faster	Slower
Local or general response? Local i.e. affects one particular part of the body	General i.e. can affect several organs in the body
How long does the effect last? Short lasting	Long lasting

Glucose Regulation - Prevent nerve and brain damage



Problem	Hormone	Effect
Too much glucose	insulin	Stores glucose as glycogen and tells cells to increase respiration
Too little glucose	glucagon	Converts glycogen to glucose

Type 1 Diabetes

- Born with it
- Don't make insulin

Treatment

- Insulin injected daily
- Pancreas transplant

Type 2 Diabetes

- Brought on by bad diet/obesity
- Body desensitized to insulin

Treatment

- Careful diet
- Exercise

Menstrual Cycle - 28 days (ovulation day 14)

FSH	<ul style="list-style-type: none"> • From pituitary gland • Egg matures in ovary
Oestrogen	<ul style="list-style-type: none"> • From ovaries • Stops FSH • Thickens uterus lining • Stimulates LH
LH	<ul style="list-style-type: none"> • From pituitary gland • Egg released (ovulation day 14)
Progesterone	<ul style="list-style-type: none"> • Maintains thick uterus lining

Contraception

- Hormonal methods (pill, patch, implant, injection) contain oestrogen and/or progesterone to prevent FSH release so no egg matures.
- Barrier methods (condoms, diaphragm, cap) can also help prevent spread of STDs.
- Intrauterine devices (coils) prevent implantation of embryo.

IVF (HT ONLY)

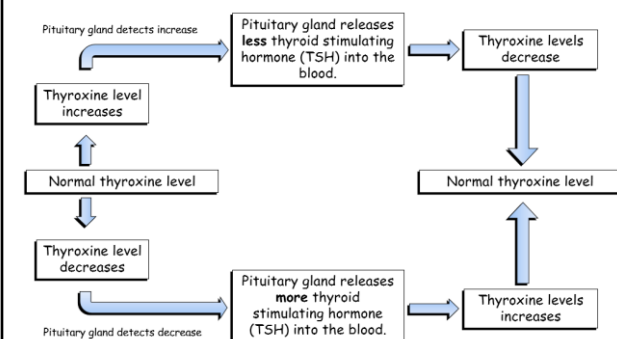
1. Give fertility drugs (FSH and LH)
2. Remove mature eggs from ovaries
3. Mix with sperm in petri dish
4. Incubate until it is an embryo
5. Insert into woman's uterus

IVF Downsides

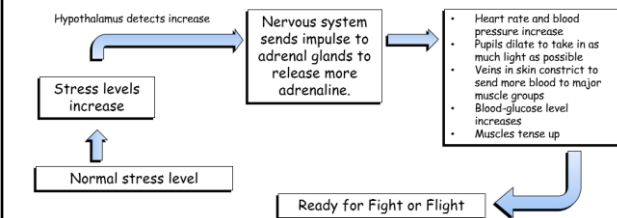
Expensive, poor success rate, multiple pregnancies (low birth-weight babies)

Negative Feedback (HT) - Prevent nerve and brain damage

Thyroxine - Metabolism, growth, brain development in children



Adrenaline - This is positive feedback.



Brain

Cerebral Cortex
Consciousness, intelligence, memory and language.

Hypothalamus
Controls temperature and water balance.

Medulla
Controls breathing, heart rate, digestion.

Pituitary Gland
Master gland, controls menstrual cycle, thyroid.

Cerebellum
Coordinates muscles and balance.

How can we find out how the brain works?

- Study people with brain damage
- Electrically stimulate different parts of the brain
- MRI scans
- Problems with the brain

Eyes

Ciliary Muscle

Iris

Pupil

Cornea

Lens

Suspensory Ligament

Sclera

Retina

Blind Spot

Optic Nerve

Kidneys

Glucose, mineral ions, urea and water move out of the blood along a concentration gradient. The larger cells and proteins are too big to fit through the cell membranes. All the glucose is reabsorbed but mineral ions and water are **selectively reabsorbed** depending on the needs of the body.

renal artery

renal vein

renal pelvis

ureter

medulla

cortex

Water balance is controlled by a negative feedback system monitored closely by the **pituitary gland** in the brain

```

    graph TD
        A[Normal water level] --> B[Solute concentration decreases / water level increases]
        B --> C[Pituitary gland detects change]
        C --> D[Less ADH released - this prevents the kidneys from reabsorbing water]
        D --> E[Urine is more dilute]
        E --> F[Normal water level]
        F --> G[Solute concentration increases / water level decreases]
        G --> H[Pituitary gland detects change]
        H --> I[More ADH released - this makes the kidneys reabsorb more water and put it back into the blood]
        I --> J[Urine is more concentrated]
        J --> F
    
```

The cornea refracts the light but it is the lens that must change shape in order to see the image in focus. The changing of the lens is called **accommodation**.

Distant:

- Ciliary muscles relax
- Suspensory ligaments are pulled tight
- Lens pulled thin
- Less refraction

Close up:

- Ciliary muscles contract
- Suspensory ligaments loosen
- Lens gets short and fat
- More refraction

Myopia - you can see close objects clearly but distant objects look blurred.

- short-sighted.
- The light is focussed in front of the retina - lens is too curved or the eyeball is too long.
- Treatment - concave lens in front of the eye to diverge the light rays before they hit the cornea.

Hyperopia - people can see distant objects but close up objects appear blurry.

- Long sighted.
- The lens is too flat and thin or because the eyeball is too short - light rays are not refracted enough so they focus beyond the retina.
- Treatment - convex lens is used to diverge the light rays before they hit the cornea.

Kidney Failure

Infections, accidents or inheritance can lead to kidney failure. Toxins would build up, pH levels would change, cells would be damaged, enzymes would denature.

Treatment:

- Transplant - Tissue match to ensure antigens are similar
 - Immunosuppressant drugs are given for the rest of your life to decrease the activity of the immune system.
 - Transplanted organs need replacing on average every 9 years.
- Dialysis

1. Arterial blood from the patient enters the dialyzer.

2. The dialyzer removes waste products from blood by filtration.

3. Purified blood is returned to a vein in the patient.

The fluid in the dialysis machine on the other side of the partially permeable membrane has **no urea**, a **normal glucose** concentration and a **normal ion** concentration.

Downsides: 8hrs a few times per week, controlled diet, tired, unwell, expensive, can cause fistulas.

Thermoregulation

receptors in thermoregulatory centre in the hypothalamus along with temperature receptors in the skin detect small changes in body temperature.

```

    graph TD
        A[Normal Body Temperature] --> B[Body temperature increases]
        B --> C[Thermoregulatory centre detects increase]
        C --> D[Sweating - water evaporates from skin using heat energy. Vasodilation - blood vessels dilate to allow more blood flow at the surface of the skin. Hairs lay flat to prevent insulation.]
        D --> E[Body temperature decreases]
        E --> A
        A --> F[Body temperature decreases]
        F --> G[Thermoregulatory centre detects decrease]
        G --> H[Shivering - Rapid muscle contraction requires energy from respiration which releases heat energy. Vasoconstriction - blood vessels narrow to allow less blood flow at the surface of the skin. Hairs stand erect to trap a layer of air insulation.]
        H --> I[Body temperature increases]
        I --> A
    
```

Waste Products

- Carbon Dioxide - produced during respiration, removed along concentration gradient by lungs (causes uncontrollable release of water when we breathe out)
- Urea - deamination in liver

```

    graph LR
        A[Excess Amino Acids] --> B[Ammonia]
        B --> C[Urea]
    
```

Plant Hormones

Auxin - builds up to cause growth in shoots (opposite effect in roots)

Phototropism - growth to light (shoots)

Geotropism / Geotropism - growth to gravity (roots)

Auxin released on dark side of shoot

Area of cell elongation

Shoot grows towards sunlight

Plant Shoot

Normal size cells

Why do plant shoots grow towards the Sun?

1. Auxin builds up on shaded side.
2. Shaded side grows faster
3. Plant grows in direction of sunlight

Auxin is used as a rooting powder when taking **cuttings** of plants. Also given to **weeds** to disrupt their growth.

Other plant hormones include:

Gibberellins

- Brewing industry to speed up seed germination
- Promote all year round flowering
- Increase fruit size

Ethene

Control fruit ripening for easier transport and longer lasting fruit.