The iris can dilate the pupil (aperture) to let in more light in dim conditions.

**Sense organ containing receptors sensitive to light intensity and colour**

**Human control systems include**

- **Cells called receptors**
  - Detect stimuli (changes in environment).

- **Coordination centres**
  - e.g. brain, spinal cord and pancreas that receive information from receptors.

- **Effectors**
  - Muscles or glands, which bring about responses to restore optimum levels.

**The Eye (Bio only)**

**The human nervous system**

- **AQA GCSE HOMEOSTASIS AND RESPONSE part 1**

**The brain controls complex behaviour. It is made of billions of interconnected neurones.**

**The CNS is the brain and the spinal cord.**

- Coordinating the response of effectors; muscles contracting or glands secreting hormones.

**The Brain (Bio only)**

- **Cerebral cortex**
  - Largest part of the human brain. Higher thinking skills e.g. speech, decision making.

- **Cerebellum**
  - Balance and voluntary muscle function e.g. walking, lifting.

- **Medulla**
  - Involuntary (automatic) body functions e.g. breathing, heart rate.

- **Synapse (gap where two neurones meet).**

**Typical motor neurone**

**Stimulus**
- Lights switch on

**Receptor**
- Cells in retina

**Coordinator**
- CNS

**Effector**
- Muscles connected to iris

**Response**
- Pupils get smaller

- **Benefit:** thought to alleviate the symptoms of some mental illnesses.
- **Risks:** bleeding in the brain, seizures, loss of brain function.

**Treating brain damage and disease**
- **e.g. Lobotomy – cutting part of the cerebral cortex**

**Reflex arc**
- **Receptor**
  - Detect stimuli.

- **Sensory neurone**
  - Long axon carries impulse from receptor to spinal cord.

- **Synapse**
  - Gap where neurones meet. Chemical message using neurotransmitter.

- **Relay neurone**
  - Allows impulses to travel between sensory and motor neurones in the spinal cord.

- **Motor neurone**
  - Long axon carries impulse from receptor to effector.

- **Effector**
  - Muscle or gland that carries out response.

**Reflex actions are automatic and rapid; they do not involve the conscious part of the brain and can protect humans from harm.**

**Structures of the eye**

<table>
<thead>
<tr>
<th>Structures of the eye</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retina</td>
<td>Light sensitive cell layer.</td>
</tr>
<tr>
<td>Optic nerve</td>
<td>Carries impulse to brain.</td>
</tr>
<tr>
<td>Sclera</td>
<td>Protects the eye.</td>
</tr>
<tr>
<td>Cornea</td>
<td>Transparent layer that covers the pupil and iris.</td>
</tr>
<tr>
<td>Iris</td>
<td>Pigmented layer, controls size of pupil.</td>
</tr>
<tr>
<td>Ciliary muscle</td>
<td>Controls thickness of lens.</td>
</tr>
<tr>
<td>Suspensor ligaments</td>
<td>Connects lens to ciliary muscles.</td>
</tr>
</tbody>
</table>

**Accommodation is the process of changing the shape of the lens to focus**

<table>
<thead>
<tr>
<th>Near object</th>
<th>Far object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciliary muscles contract, suspensor ligaments loosed, lens get thicker, light is more refracted.</td>
<td>Ciliary muscles relax, suspensor ligaments pulled tight, lens pulled thin, light is only slightly refracted.</td>
</tr>
</tbody>
</table>

**Hyperopia (long sightedness)**
- Treated using a convex lens so the light is focused on the retina.

**Myopia (short sightedness)**
- Treated using a concave lens so light is focused on the retina.

**New technologies now include hard/soft contact lens, laser surgery to change the shape of the cornea and a replacement lens in the eye.**

- **T Treating brain damage and disease.**
- **e.g. Lobotomy – cutting part of the cerebral cortex**

- **Better hope – brighter future**
Thermoregulatory receptors are sensitive to temperature changes. Monitoring of glucose levels in the blood is crucial. Skin temperature and vessels constrict or dilate based on temperature. High glucose levels may lead to sweating responses. Skin vessels dilate (vasodilation), sweat produced from sweat glands.

**Thermoregulatory centre (hypothalamus)**

**Too high** Blood vessels dilate (vasodilation), sweat produced from sweat glands.

**Too low** Blood vessels constrict (vasoconstriction), sweating stops, muscles contract (shivering).

**Skin**

**Too high** Thermal energy is lost from blood near the surface of the skin, sweat evaporation transferring thermal energy.

**Too low** Thermal energy loss at the surface of the skin is reduced, respiring muscles cells transfer chemical to thermal energy.

**Human endocrine system**

- **Composed of glands which secrete chemicals called hormones directly into the bloodstream.**
- **'Master gland'; secretes several hormones into the blood**
- **Stimulates other glands to produce hormones to bring about effects.**

**AQA GCSE HOMEOSTASIS AND RESPONSE PART 2**

**Homeostasis**

- **Water and nitrogen balance (Biology only)**
- **Control of body temperature (Biology only)**

**Control of blood glucose concentration**

- **Produced in adrenal glands, increases breathing/heart rate, blood flow to muscles, conversion glycogen to glucose. Prepares body for ‘fight or flight’**
- **Negative feedback (HT only)**
- **Produced in the thyroid gland, stimulates the basal metabolic rate. Important in growth and development**
- **Increasing thyroxine levels prevent the release of thyroid stimulating hormone which stops the release of thyroxine.**

**Blood glucose concentration**

- **Too high** Pancreas produces the hormone insulin, glucose moves from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage.
- **HT only** Pancreas produces the hormone glucagon that causes glycogen to be converted into glucose and released into the blood.

**Diabetes**

- **Type 1** Pancreas fails to produce sufficient insulin leading to uncontrolled blood glucose levels. Normally treated by insulin injection.
- **Type 2** Obesity is a risk factor. Body cells no longer respond to insulin. Common treatments include changing diet and increasing exercise.

**Kidney function**

- **Maintain water balance of the body.**
- **Uncontrolled water/ion urea loss** Water exhaled in lungs, water, ions and urea in sweat.
- **Controlled water/ion/urea loss** Via the kidneys in urine.
- **Kidney failure is treated by organ transplant or dialysis.**

**Kidney transplant**

- **ADH** (HT only) acts on kidney tubules to control water levels.
In Vitro Fertilisation (IVF) treatment.

*Involves giving a mother FSH and LH to stimulate the maturation of several eggs*

The eggs are collected from the mother and fertilised by sperm from the father in a laboratory.

The fertilised eggs develop into embryos.

At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother’s uterus (womb).

Potential disadvantages of IVF

- Emotional and physical stress.
- Success rates are not high.
- Multiple births risk to mother and babies.

Fertility can be controlled by hormonal and non-hormonal methods

- **Oral contraceptives**
  - Contain hormones to inhibit FSH production so that no eggs mature.

- **Injection, implant, skin patch**
  - For slow release of progesterone to inhibit the maturation and release of eggs for months or years.

- **Barrier methods**
  - Condoms or diaphragms which prevent sperm reaching the egg.

- **Intrauterine devices**
  - Prevent implantation of an embryo or release a hormone.

- **Spermicidal agents**
  - Kill or disable sperm.

- **Abstaining**
  - Avoiding intercourse when an egg may be in the oviduct.

- **Surgery**
  - Male or female sterilisation.

The use of hormone to treat infertility (HT only)

(Area) Gibberellins are important in initiating seed germination.

AQA GCSE HOMEOSTASIS AND RESPONSE PART 3

During puberty reproductive hormones cause secondary sexual characteristics to develop

- **Oestrogen (main female reproductive hormone)**
  - Produced in the ovaries. At puberty eggs being to mature releasing one every 28 days – ovulation.

- **Testosterone (main male reproductive hormone)**
  - Produced in the testes stimulation sperm production.

(HHT only) a graph of hormone levels over time

<table>
<thead>
<tr>
<th>Menstrual cycle</th>
<th>Follicle stimulating hormone (FSH)</th>
<th>Causes maturation of an egg in the ovary.</th>
<th>(HT) FSH stimulates ovaries to produce oestrogen.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Luteinising hormone (LH)</td>
<td>Stimulates release of an egg.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oestrogen and progesterone</td>
<td>Maintain uterus lining.</td>
<td></td>
</tr>
</tbody>
</table>

**Light (phototropism)**

Light breaks down auxins and they become unequally distributed in the shoot. The side with the highest concentration of auxins has the highest growth rate and the shoot grows toward the light.

**Gravity (geotropism or gravitropism)**

Gravity causes an unequal distribution of auxins. In roots the side with the lowest concentration has the highest growth rate and the root grows in the direction of gravity.

In new shoots from a seedling the unequal distribution of auxins causes the shoot to grow away from gravity.

**Auxins**

Weed killers, rooting powders, promoting growth in tissue culture.

**Ethene**

Control ripening of fruit during storage and transport.

**Gibberellins**

End seed dormancy, promote flowering, increase fruit size.

**Hormones in human reproduction**

*Oestrogen (main female reproductive hormone)*

*Testosterone (main male reproductive hormone)*

*FSH and LH are used as ‘fertility drugs’ to help someone become pregnant in the normal way*.