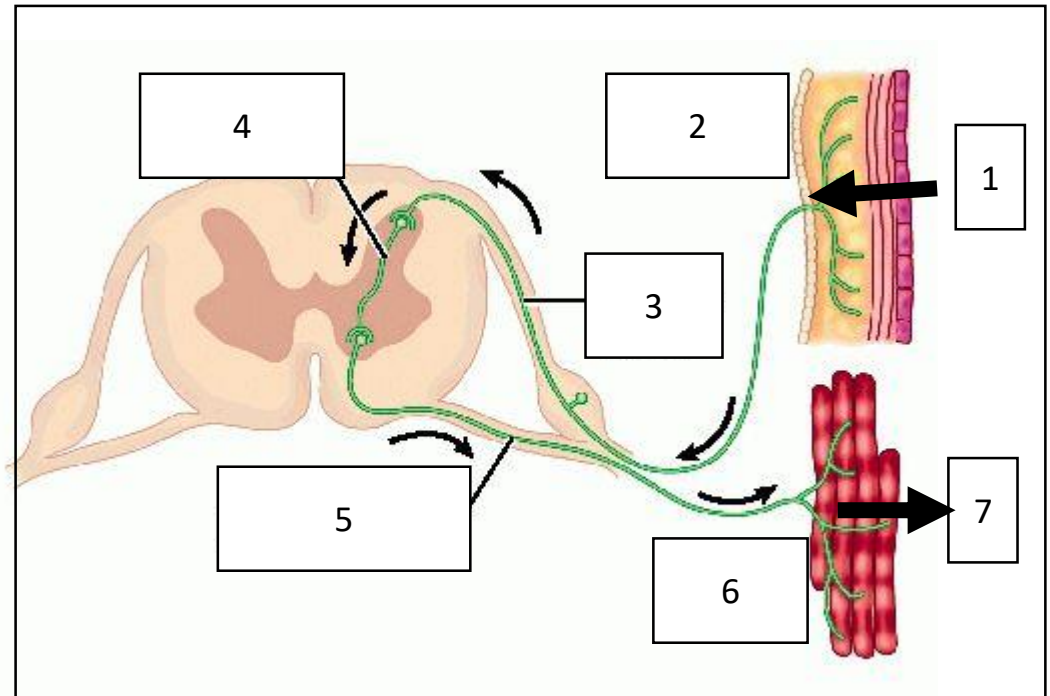


# Biology Topic 5: Homeostasis and response

## 1. Keywords

|                    |   |
|--------------------|---|
| Homeostasis        | The regulation of the internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes. |
| Optimum conditions | The perfect conditions for an organism to survive and grow.<br>E.g. blood glucose level, body temperature and water level.                                |
| Nervous response   | Uses electrical signal in nerves to make fast changes   |
| Chemical response  | Uses hormones in the blood to make changes.   |
| Reflex arc         | A nervous response that is fast and automatic for protection. Does not involve the conscious brain.   |
| CNS                | (Central nervous system)<br>The brain and the spinal chord  |
| Neurone            | Nerve cell. Carries an electrical signal from one end to the other  |

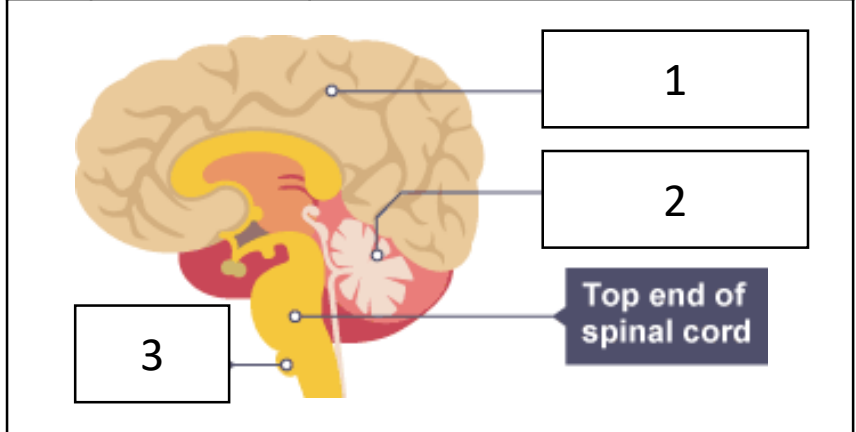


## 2. Nervous system: Reflex arc

| No.        | 1  | 2  | 3   | 4  | 5   | 6   | 7  |
|------------|--|--|---|--|---|---|--|
| Section    | Stimulus   | Receptor                                 | Sensory neurone   | Co-ordinator   | Motor neurone                                 | Effector  | Response   |
| Definition | A change to the environment that triggers a nervous response | A cell which detects a specific stimulus | A neurones which carries electrical signal from receptor to CNS | The area that receives and processes the information | Neurone that connects the CNS to the effector | The organ that creates the correct response form the stimulus | The effect of the stimulus. Often designed to prevent injury |
| Example    | Touching a flame   | Pain receptor in skin                    | Sensory neurone   | Brain Relay neurone                                  | Motor neurone                                 | Muscle gland  | Movement   |

### 3. The brain (TRIPLE ONLY)

| No | Name            | Function  |
|----|-----------------|---|
| 1  | Cerebral cortex | High level functions like language, memory and consciousness                          |
| 2  | Cerebellum      | Balance and coordination of muscles in the body                                       |
| 3  | Medulla         | Controls life supporting functions like breathing and heart rate. Key for homeostasis |

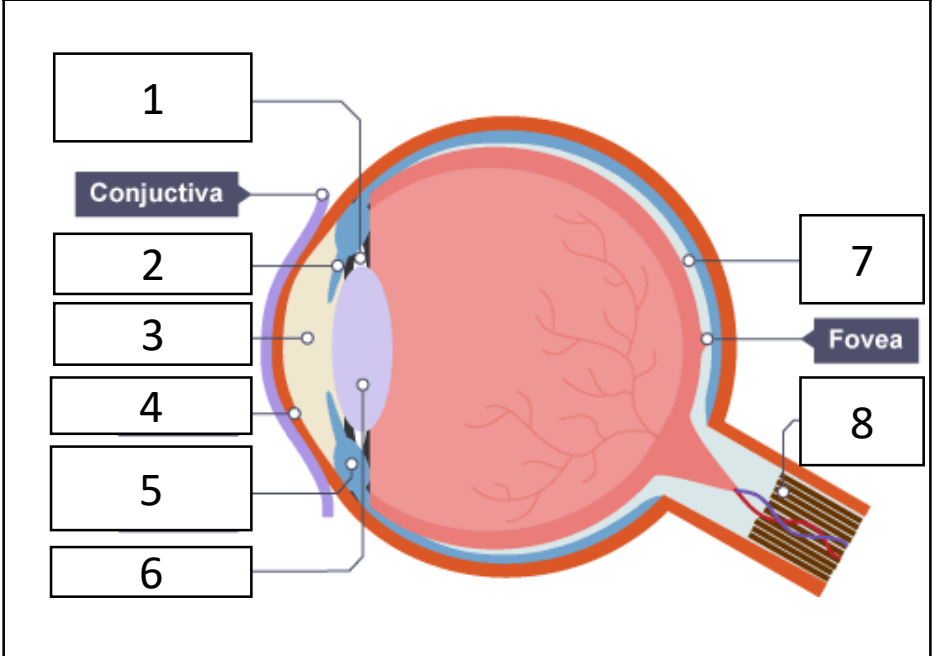


### 5. Adjusting focus (TRIPLE ONLY)

| Object               | Near       | Distant    |
|----------------------|------------|------------|
| Ciliary muscles      | Contract   | Relax      |
| Suspensory ligaments | Loosen     | Tighten    |
| Lens                 | Is thicker | Is thinner |

### 4. The eye (TRIPLE ONLY)

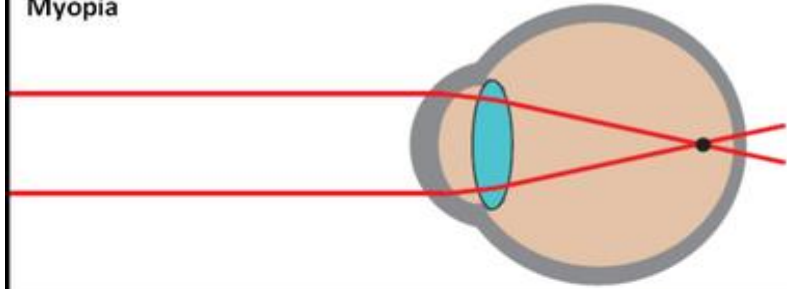
| No | Name                 | Function   |
|----|----------------------|--|
|    | Sclera               | White outer protective layer.  |
| 1  | Suspensory ligaments | Connect ciliary muscles to lens  |
| 2  | Iris                 | Controls the size of the pupil   |
| 3  | Pupil                | Hole in eye that lets light through. Wide in dark conditions small in light conditions |
| 4  | Cornea               | Transparent protective layer   |
| 5  | Ciliary muscles      | Contract to change shape of lens to see near and far objects                           |
| 6  | Lens                 | Refracts light onto retina   |
| 7  | Retina               | Contain light sensitive rod and cone cells   |
| 8  | Optic nerve          | Send signals from retina to brain to make image  |



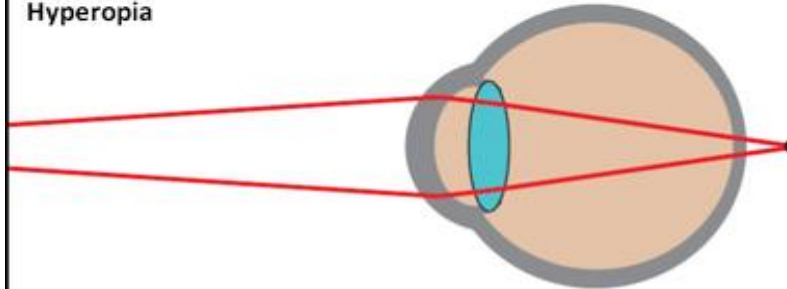
## 6. Vision problems (TRIPLE ONLY)

|              |  |              |
|--------------|--|--------------|
| Name         | Myopia   | Hyperopia    |
| Common name  | Short-sighted  | Long-sighted |
| Corrected by | <ul style="list-style-type: none"> <li>Glasses</li> <li>Contact lenses</li> <li>Laser eye surgery</li> </ul> |              |

### Myopia



### Hyperopia



## 7. Control of body temperature (TRIPLE ONLY)

|                         |   |
|-------------------------|---|
| Thermoregulatory centre | Part of the brain that receives signals about temperature of the blood and skin |
| 37°C                    | Optimum internal body temperature   |
| Vasodilation            | The widening of blood vessels near the surface of the skin                      |
| Vasoconstriction        | The narrowing of blood vessels near the surface of the skin                     |
| Sweat                   | Liquid released from pores on skin to cool the body as it evaporates            |
| Shivering               | Involuntary muscle contractions to generate heat                                |

### How the body responds to changes in temperature

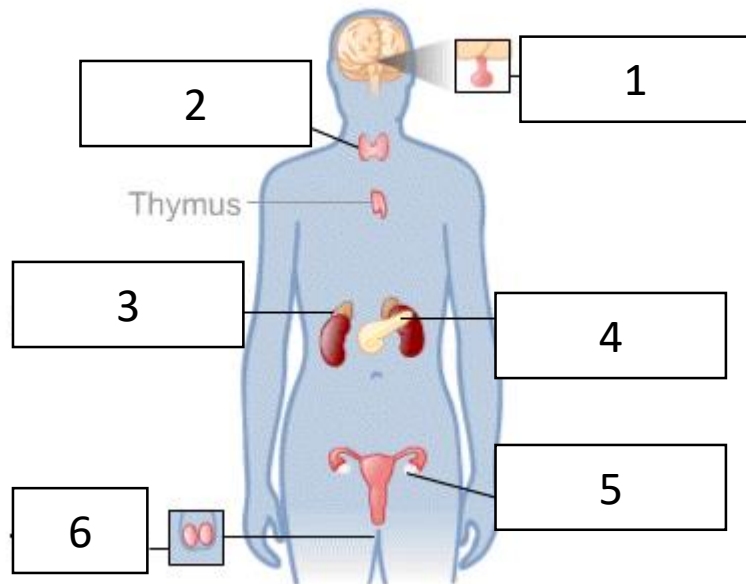
| Too hot  | Too cold  |
|--|---|
| <ol style="list-style-type: none"> <li><b>Vasodilation</b> bring blood near the surface</li> <li><b>Sweating</b> increases</li> <li>Heat is lost through evaporation and radiation</li> <li>Body temp drops</li> </ol> | <ol style="list-style-type: none"> <li><b>Vasoconstriction</b> take blood away from surface</li> <li><b>Sweating</b> stops</li> <li>Muscles contractions (<b>shivering</b>) generate heat</li> <li>Body temp increases</li> </ol> |

## 8. Hormonal control: Endocrine system

|                  |   |
|------------------|---|
| Endocrine system | A chemical response where glands secrete hormones into the blood which make changes around the body |
| Glands           | Special tissues designed to produce specific chemical (hormones)                                    |
| Secrete          | Release   |

## 9. Major glands on the body

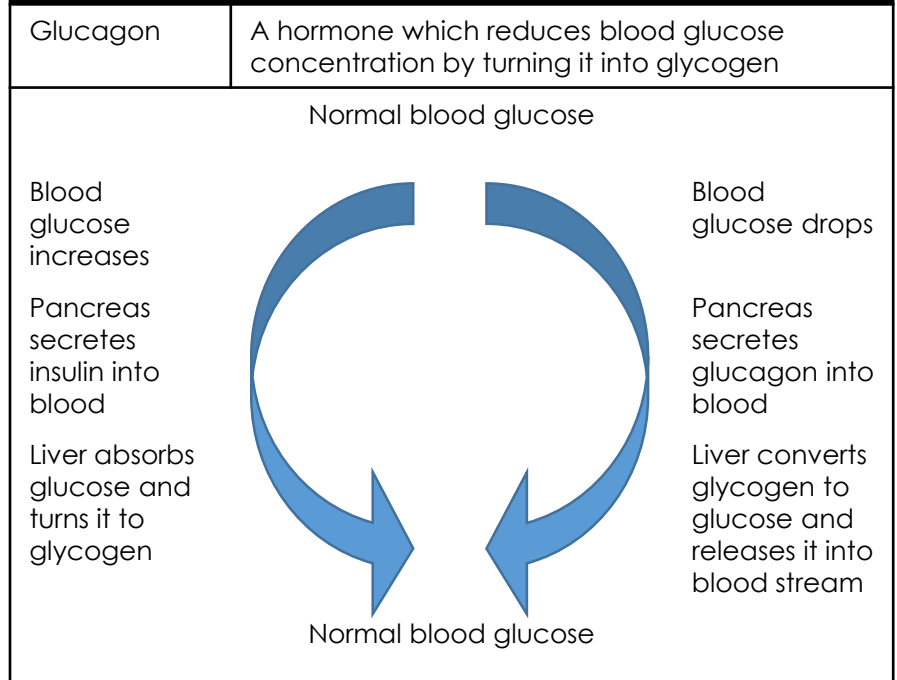
|   |                 |  |
|---|-----------------|--|
| 1 | Pituitary gland | The 'master gland' makes hormones which affect other glands causing them to secrete hormones |
| 2 | Thyroid gland   | Controls metabolism  |
| 3 | Adrenal gland   | Makes adrenalin  |
| 4 | Pancreas        | Controls blood sugar levels  |
| 5 | Ovary           | Produces female sex hormones   |
| 6 | Testes          | Produce male sex hormone   |



## 10. Control of blood glucose levels

|                 |   |
|-----------------|---|
| Type 1 diabetes | When the pancreas is damaged from infection and cannot make insulin. Needs injections to treat                |
| Type 2 diabetes | When poor diet and obesity cause body cells to not respond to insulin anymore. Treated with diet and exercise |
| Insulin         | Hormone made in pancreas that reduces glucose levels in the blood   |
| glycogen        | The long term store of sugar in the body. Made in the liver   |

## 11. Control of blood glucose continued (HT ONLY)



## 12. Controlling water and nitrogen levels (TRIPLE ONLY)

|                        |  |
|------------------------|--|
| Urea                   | The waste product made by the breakdown of amino acids in the liver.   |
| Urine                  | The urea, excess water and ions not needed by the body. Made by the kidneys  |
| Kidneys                | The organ responsible for filtration and selective reabsorption  |
| Selective reabsorption | When the kidneys reabsorb: <ul style="list-style-type: none"> <li>• All of the glucose</li> <li>• Some of the mineral ions</li> <li>• Some of the water</li> </ul> |
| Dialysis               | A way of manually filtering the blood when the kidneys are no longer functioning. Whilst waiting for a transplant  |

## 13. Hormones and the kidneys (TRIPLE HT ONLY)

|                             |  |
|-----------------------------|--|
| ADH (anti-diuretic hormone) | A hormone made in the pituitary gland which increase the reabsorption of water by kidney tubules |
|-----------------------------|--|

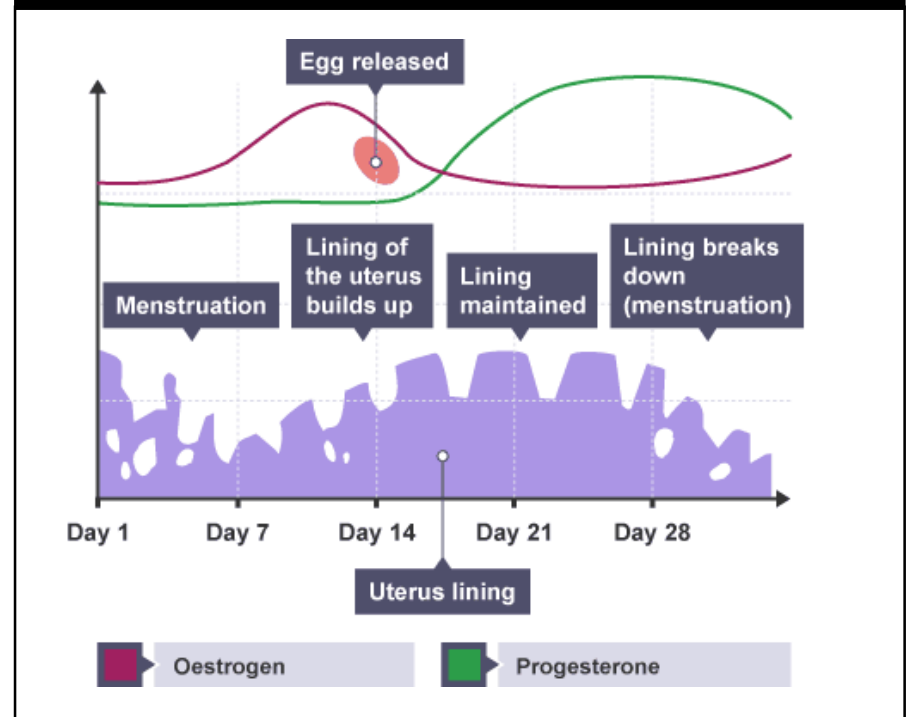
### How ADH works:

1. Blood is too concentrated
2. Pituitary gland releases ADH into blood.
3. ADH increase permeability of kidney tubules
4. More water is reabsorbed
5. Blood dilutes to normal levels. Urine is yellow.

## 14. Reproductive hormones

| Hormone                            | Made in         | Function  |
|------------------------------------|-----------------|---|
| Testosterone                       | Testes          | Creates male sexual changes at puberty including sperm production |
| Oestrogen                          | Ovary           | Creates female sexual changes at puberty including ovulation      |
| Follicle stimulating hormone (FSH) | Pituitary gland | Causes egg to mature in ovary                                     |
| Luteinising hormone (LH)           | Pituitary gland | Causes egg to be released by ovary                                |
| Progesterone                       | Ovary           | Maintains lining of womb  |

## 15. Menstrual cycle (HT ONLY)



## 16. Contraception

| Type                              | How it works   |
|-----------------------------------|--|
| Oral (the pill)                   | Stops FSH so no egg released   |
| Injection/implant                 | Release progesterone which prevents egg maturation for months or years |
| Barrier (condoms)                 | Prevent sperm and egg meeting  |
| Intrauterine (the coil)           | Prevents embryo implanting   |
| Spermicides                       | Kill sperm   |
| Abstinence                        | Not having sex   |
| Surgical (vasectomy/hysterectomy) | Surgically sterilising the adult permanently                           |

## 17. Hormones in fertility (HT ONLY)

|  |  |
|--|--|
| Fertility drugs  | Drugs which stimulate the production and release of eggs. Eg FSH and LH                      |
| IVF (in vitro fertilisation)   | The process of creating an embryo in the lab when couples struggle to conceive a baby        |
| <b>Stages of IVF:</b>  |  |
| <ol style="list-style-type: none"> <li>1. FSH and LH stimulate production of many eggs</li> <li>2. Eggs are harvested and fertilised by fathers sperm in a lab</li> <li>3. Fertilised eggs grow in lab</li> <li>4. A few embryos are implanted into mother womb</li> </ol> |  |
| Possible consequences of IVF   | Physical and emotional fatigue<br>Low success rate<br>Risk of multiple births simultaneously |

## 18. Negative feedback (HT ONLY)

|                   |  |
|-------------------|--|
| Negative feedback | A system where the product reduces the stimulus to return the change to normal levels        |
| Adrenalin         | Fight or flight hormone. Increases heart rate and boosts blood supply of oxygen and glucose  |
| Thyroxine         | Controls metabolic rate and affects growth and development. Controlled by negative feedback. |

## 19. Plant hormones (TRIPLE ONLY)

|                           |   |
|---------------------------|---|
| Phototropism              | The shoot of a plant growing towards light.<br>The root growing away from light   |
| Gravitropism (geotropism) | The shoot of a plant growing up and the roots growing down  |
| Auxin                     | Group of plant hormones which make cells in shoots grow more and cells in roots grow less. Used as rooting powder and weedkiller. |

### How tropisms work

|              |  |
|--------------|--|
| Phototropism | <ol style="list-style-type: none"> <li>1. Shaded side contains more auxin</li> <li>2. So grows faster</li> <li>3. Plant leans towards light</li> </ol> |
| Gravitropism | <ol style="list-style-type: none"> <li>1. Bottom of shoot has more auxin</li> <li>2. So grows slower</li> <li>3. Roots bends downwards</li> </ol>      |

## 20. Other plant hormones (TRIPLE HT ONLY)

|              |   |
|--------------|---|
| Gibberellins | Start seed germination. Used to promote fruit development and flowering |
| Ethene       | Cell division and ripening fruit  |