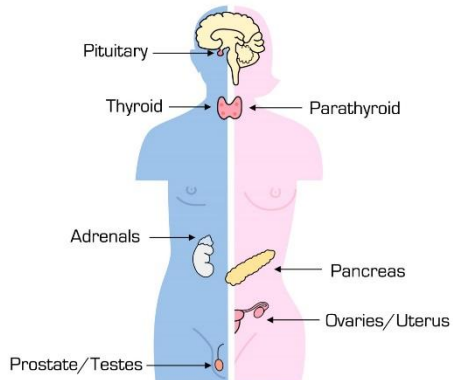


### B7: Animal Coordination, Control and Homeostasis

#### Lesson sequence

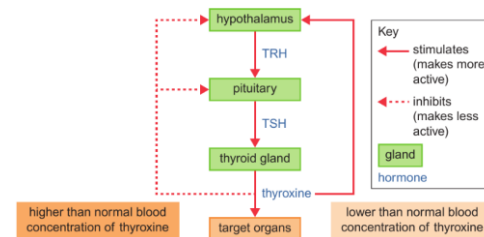
1. Hormones
2. Hormonal control of metabolic rate (thyroxine and adrenalin)
3. The menstrual cycle
4. Hormones and the menstrual cycle  
Contraception and fertility treatment
5. Controlling blood glucose
6. Diabetes
7. Thermoregulation
8. Osmoregulation
9. The kidneys



#### 1. Hormones

<b>Hormone</b>	A chemical messenger that changes the way a part of the body works.
<b>Important hormones</b>	Insulin, glucagon, adrenalin, oestrogen, progesterone, testosterone, thyroxine, LH, FSH, ACTH, growth hormone.
<b>Endocrine gland</b>	Parts of the body that produce hormones.

<b>Important endocrine glands</b>	Pituitary gland, thyroid gland, pancreas, adrenal glands, ovaries and testes.
<b>Target organ</b>	The part of the body affected by a hormone.
<b>Important hormones</b>	Insulin, glucagon, adrenalin, oestrogen, progesterone, testosterone, thyroxine, LH, FSH, ACTH, growth hormone.
<b>Sex hormones</b>	<b>Women:</b> oestrogen and progesterone. <b>Men:</b> testosterone.



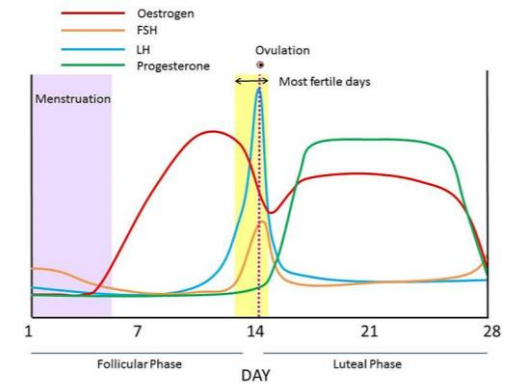
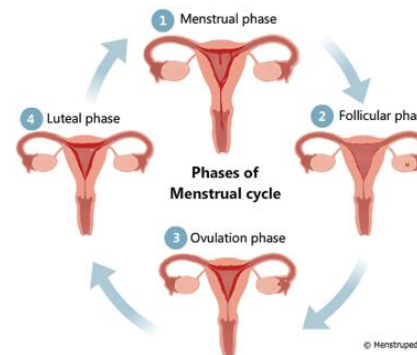
#### 2. Hormonal control of metabolic rate: thyroxine and adrenalin (HT)

<b>Metabolic rate</b>	The rate at which the body uses the energy stored in food.
<b>Thyroxine</b>	<b>Role:</b> To control your metabolic rate. <b>Endocrine gland:</b> Thyroid gland <b>Target organ:</b> Most of the body
<b>Negative feedback</b>	The way the body responds to high levels of something by bringing them down, and low levels by bringing them up.
<b>Negative feedback and the metabolic rate</b>	<ol style="list-style-type: none"> <li>1) Low levels of thyroxine stimulate production of TRH in hypothalamus</li> <li>2) This causes the release of TSH from the pituitary gland</li> <li>3) TSH causes the thyroid to produce thyroxine</li> <li>4) Normal levels of thyroxine inhibit the release of TRH and the production of TSH.</li> </ol>

<b>Adrenaline</b>	<b>Role:</b> To prepare the body for fight or flight. <b>Endocrine gland:</b> Adrenal glands <b>Target organ:</b> Heart (beats faster and stronger), blood vessels going to muscles (get wider), blood vessels going to organs (get narrower), liver (releases glucose).
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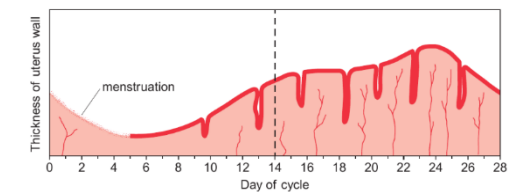
#### 3. The menstrual cycle

<b>Menstrual cycle</b>	A (roughly) 28-day cycle that prepares a woman's body for pregnancy.
<b>Ovulation</b>	The release of an egg cell by an ovary.
<b>Fertilisation</b>	When a sperm cell fuses with an egg cell to form a zygote.
<b>Days 1-5</b>	Menstruation (a period): the lining of the uterus breaks down and leaves the body through the vagina.
<b>Days 6-12</b>	The uterus lining begins to thicken again.
<b>Days 13-15</b>	Ovulation happens.
<b>Days 16-28</b>	The uterus lining continues to thicken and would be able to accept an embryo if fertilisation happens.
<b>Control of the cycle</b>	The menstrual cycle is controlled by the sex hormones: oestrogen and progesterone.



#### 4. Hormones and the menstrual cycle (HT)

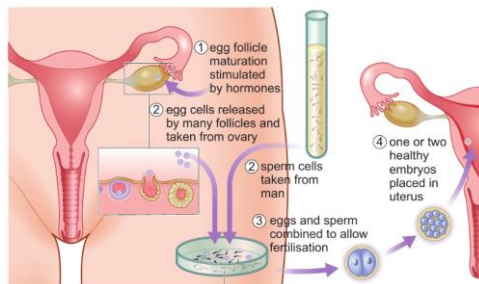
<b>Egg follicle</b>	A layer of tissue surrounding each of the immature eggs in the ovaries.
<b>Oestrogen</b>	Causes the release of FSH and the thickening of the uterus lining. High oestrogen levels cause LH release.
<b>FSH</b>	Causes one follicle to develop and mature the egg cell within it.
<b>LH</b>	Causes ovulation when the egg is released from the follicle.
<b>Corpus luteum</b>	The follicle becomes a corpus luteum after ovulation, and releases progesterone. It breaks down over two weeks.
<b>Progesterone</b>	Maintains the thickness of the uterus lining, inhibits FSH release. Falling progesterone levels trigger ovulation.



Method and success rate (% of pregnancies prevented)	How it prevents fertilisation
male condom (98% success rate)	placed over erect penis, prevents sperm entering the vagina
diaphragm or cap (92-96% success rate)	placed over the cervix (entrance to the uterus), prevents sperm in the vagina entering the uterus
hormone pill or implant placed under the skin (>99% success rate)	release hormones to prevent ovulation and thickens mucus at the cervix, making it difficult for sperm cells to pass through

### Contraception and fertility treatment

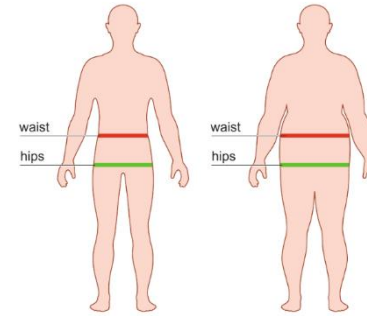
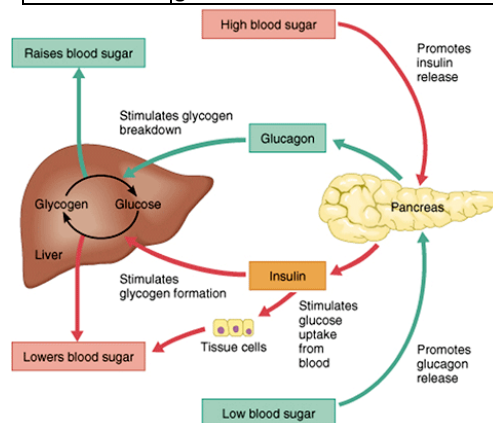
Contraception	Preventing sexual intercourse from leading to fertilisation and pregnancy.
<b>Condom</b>	Worn on the penis, they prevent sperm from entering the vagina. Also prevent STDs.
<b>Diaphragm or cap</b>	Placed over the cervix at the top of the vagina. Prevent sperm entering uterus, do not prevent STDs.
<b>Contraceptive pill / implant</b>	Uses hormones to prevent ovulation. Does not prevent STDs.
<b>Assisted reproductive technology (ART)</b>	Using hormones and other methods to increase the chance of pregnancy.
<b>Clomifene therapy</b>	Clomifene increases the levels of FSH and LH to make egg successful ovulation more likely.



<b>In vitro fertilisation (IVF)</b>	Sperm is extracted from a man, and eggs from a woman. The eggs are fertilised in a laboratory and one or more is placed into the uterus.
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### 5. Controlling blood glucose

<b>Homeostasis</b>	Maintaining constant conditions in the body, such as temperature or blood glucose concentration.
<b>Blood glucose concentration</b>	The concentration (amount) of glucose in the blood. Both too high and too low are dangerous.
<b>Glycogen</b>	A stored form of glucose made by joining glucose molecules together in long chains.
<b>Insulin</b>	<b>Role:</b> To reduce blood glucose concentration. <b>Endocrine gland:</b> Pancreas <b>Target organ:</b> Liver and muscles which convert glucose into glycogen.
<b>Glucagon</b>	<b>Role:</b> To increase blood glucose concentration. <b>Endocrine gland:</b> Pancreas <b>Target organ:</b> Liver and muscles which convert glycogen back into glucose.



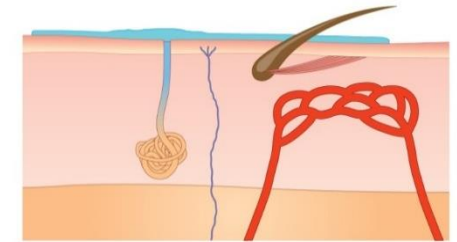
### 6. Diabetes

<b>Diabetes</b>	A disease in which the body cannot quickly reduce blood glucose concentrations after eating.
<b>Type 1 diabetes</b>	Diabetes caused when a person's pancreas can't produce insulin.
<b>Treating type 1 diabetes</b>	Insulin injections.
<b>Type 2 diabetes</b>	Diabetes caused when a person does not produce enough insulin (because of very high glucose levels) or stops responding to insulin.
<b>Risk factors for type 2 diabetes</b>	Obesity and inactivity (lack of exercise).
<b>Treating type 2 diabetes</b>	Low-sugar diet, increased exercise, medication to make the body more sensitive to insulin.
<b>Measuring obesity</b>	Body mass index above 30: $BMI = \text{mass in kg} / \text{height in metres}^2$ High waist:hip ratio $\text{Waist:hip ratio} = \text{waist} / \text{hip}$

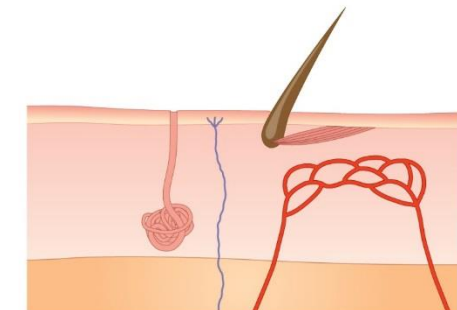
### 7. Thermoregulation

<b>Hypothermia</b>	An abnormally (typically dangerously) low body temperature.
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<b>thermoregulation</b>	A process that allows your body to maintain its core internal temperature.
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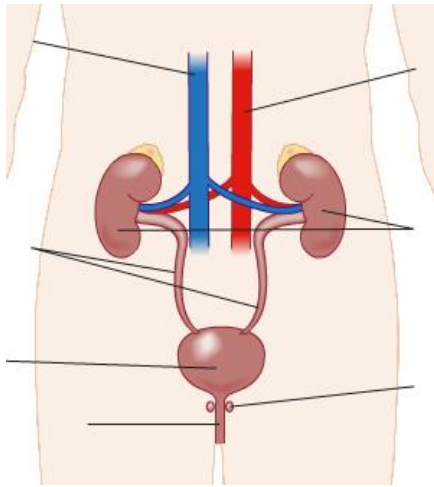


<b>Hypothalamus</b>	A region of the brain that coordinates controlling body temperature.
<b>Dermis</b>	The thick layer of living tissue below the epidermis which forms the true skin.
<b>Shivering</b>	Muscles begin to shake in small movements, creating warmth by expending energy.
<b>Erector Muscle</b>	A tiny muscle connected to each hair follicle.
<b>Vasodilation</b>	The dilatation of blood vessels, which decreases blood pressure, increasing heat loss.
<b>Vasoconstriction</b>	The constriction of blood vessels, which increases blood pressure, decreasing heat loss.
<b>Sweating</b>	This causes heat loss through evaporation.

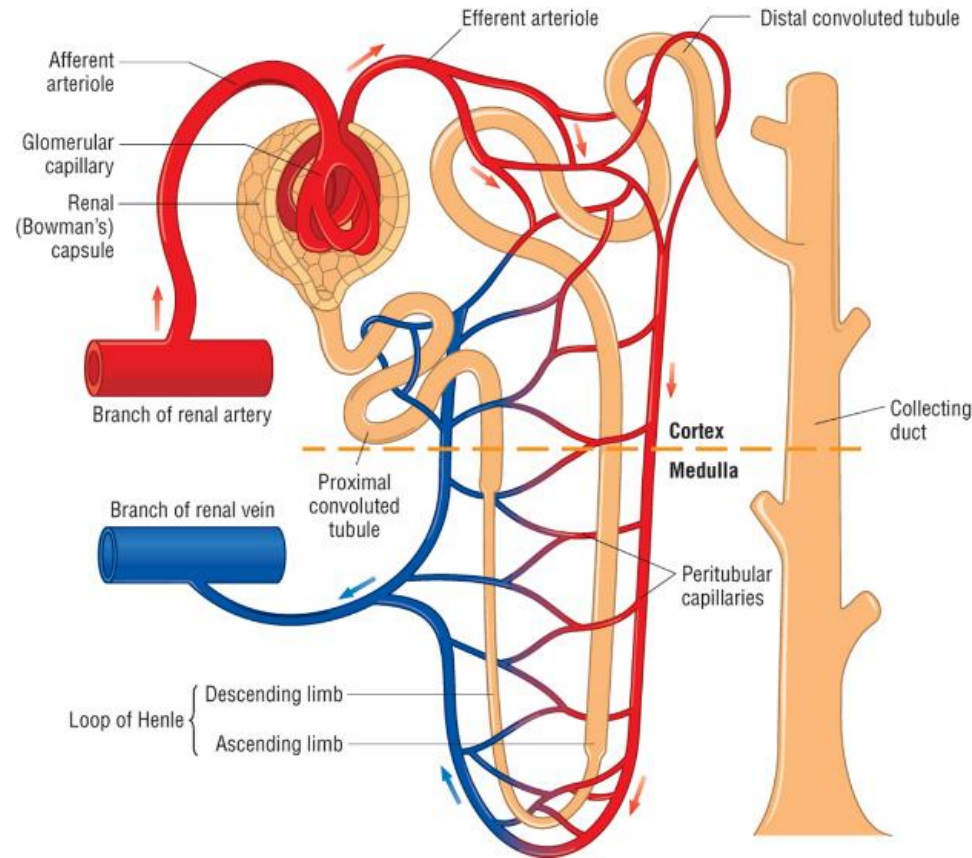


### 8. Osmoregulation

<b>Osmoregulation</b>	The maintenance of constant osmotic pressure in the fluids of an organism by the control of water and salt concentrations.
<b>Urinary system</b>	Consists of the kidneys, ureters, bladder, and the urethra.
<b>Urea</b>	The main nitrogenous breakdown product of protein metabolism in mammals and is excreted in urine.
<b>Kidneys</b>	They maintain the bodies overall fluid balance. regulating and filtering minerals from blood.

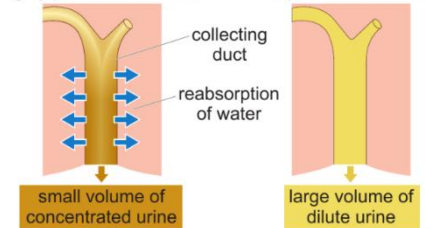


<b>Kidney failure</b>	They kidneys have stopped working well enough for you to survive without dialysis or a kidney transplant.
<b>Kidney dialysis</b>	It often involves diverting blood to a machine to be cleaned.
<b>Organ donation</b>	Giving an organ to someone else who needs a transplant.



<b>Loop of Henle</b>	A long loop in the medulla of the kidney, from which water and salts are resorbed into the blood.
<b>Collecting duct</b>	A duct that receives and concentrates urine from the distal convoluted tubule.
<b>Pituitary gland</b>	Releases hormones which are involved in osmoregulation.
<b>ADH (antidiuretic hormone)</b>	It tells your kidneys how much water to conserve. <i>Decrease in water intake &gt; Increase in ADH &gt; Decrease in urine output.</i>
<b>Permeability</b>	How easily liquid and gas passes through something.

ADH present: collecting duct highly permeable to water      no ADH: collecting duct is not permeable to water



### 9. The kidneys

<b>Nephrons</b>	Is the basic structural and functional unit of the kidney
<b>Glomerulus</b>	A cluster of capillaries around the end of a kidney tubule.
<b>Bowman's capsule</b>	A cup-like sack at the beginning of the tubular component of a nephron.
<b>Ultrafiltration</b>	It is the non-specific filtration of the blood under high pressure and occurs in the Bowman's capsule of the nephron

<b>Selective Reabsorption</b>	The absorption of some of the components of the glomerular filtrate back into the blood as the filtrate flows through the nephrons of the kidney.
<b>First convoluted tubule</b>	Selective reabsorption of glucose and some minerals.
<b>Active transport</b>	Using energy to move substances from low to high concentration (up a concentration gradient).