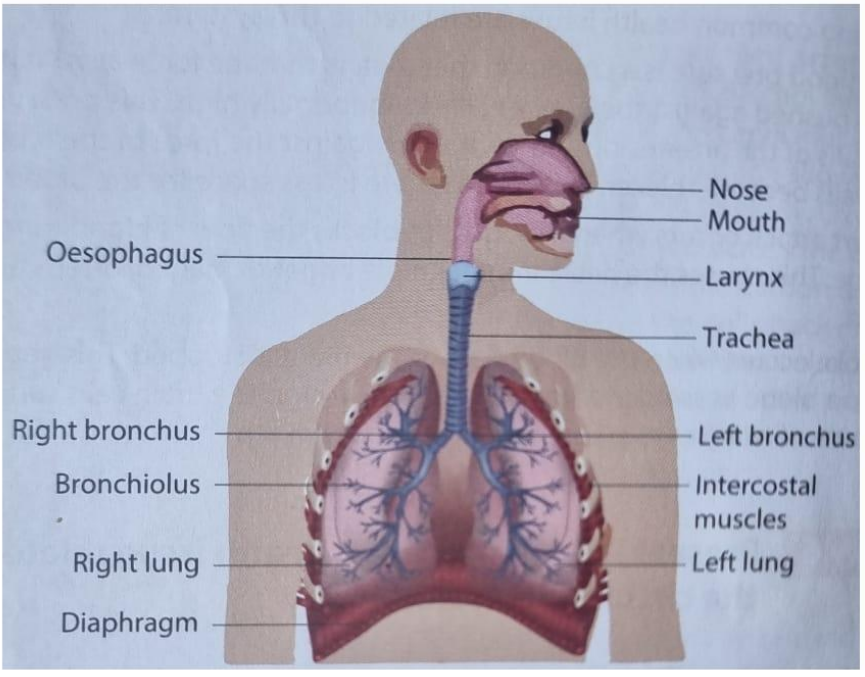
Circulation and Respiration:

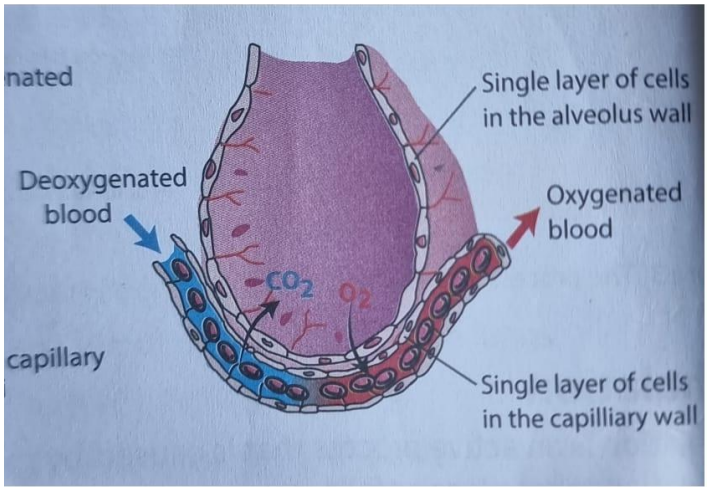
- The respiratory system is used for:
    - Breathing
    - Gaseous exchange
    - Respiration
- The circulatory system is used for:
    - Used for circulating blood between the heart and the lungs, and between the heart and the body
    - Works with the respiratory system to transport essential gases to and from all cells in the body
- Simplified steps of the process:
    - Lungs inhale oxygen during breathing
    - Oxygen diffuses into bloodstream
    - Oxygenated blood returns to heart
    - Heart pumps oxygenated blood to rest of the body
    - Oxygen diffuses from bloodstream into body cells
    - Carbon dioxide diffuses from body cells into bloodstream
    - Deoxygenated blood transported to heart
    - Heart pumps deoxygenated blood to lungs
    - Carbon dioxide diffuses out bloodstream into lungs
    - Lungs exhale carbon dioxide during breathing
- Respiratory System:
    - Structure:



- Functions of components in the respiratory system:
  - Nose:
    - Entrance for air
    - Filters air
  - Mouth:
    - Alternate entrance for air
    - Filters air less than the nose
  - Oesophagus:
    - Part of the digestive system
  - Larynx:
    - Voice box (used to produce sound)
    - Protects airway
  - Trachea:
    - Windpipe
    - Passage for air between larynx and bronchi
  - Bronchi:
    - Main branches that extend from the trachea
    - Divide into smaller bronchioles
    - Transport air into lung tissue
  - Bronchioles:
    - Divide into smaller airways and lead to the alveoli, where gaseous exchange occurs
  - Intercostal Muscles:
    - Help expand and contract the thoracic cavity (chest cavity) during breathing
    - Allow for air movement in and out of the lungs
  - Lungs:
    - Respiration organs
    - Allow for exchange of oxygen and carbon dioxide with bloodstream
  - Diaphragm:
    - Dome-shaped muscle
    - Contracts and relaxes during breathing, allowing the thoracic cavity to expand and contract
    - Changes volume and pressure in thoracic cavity

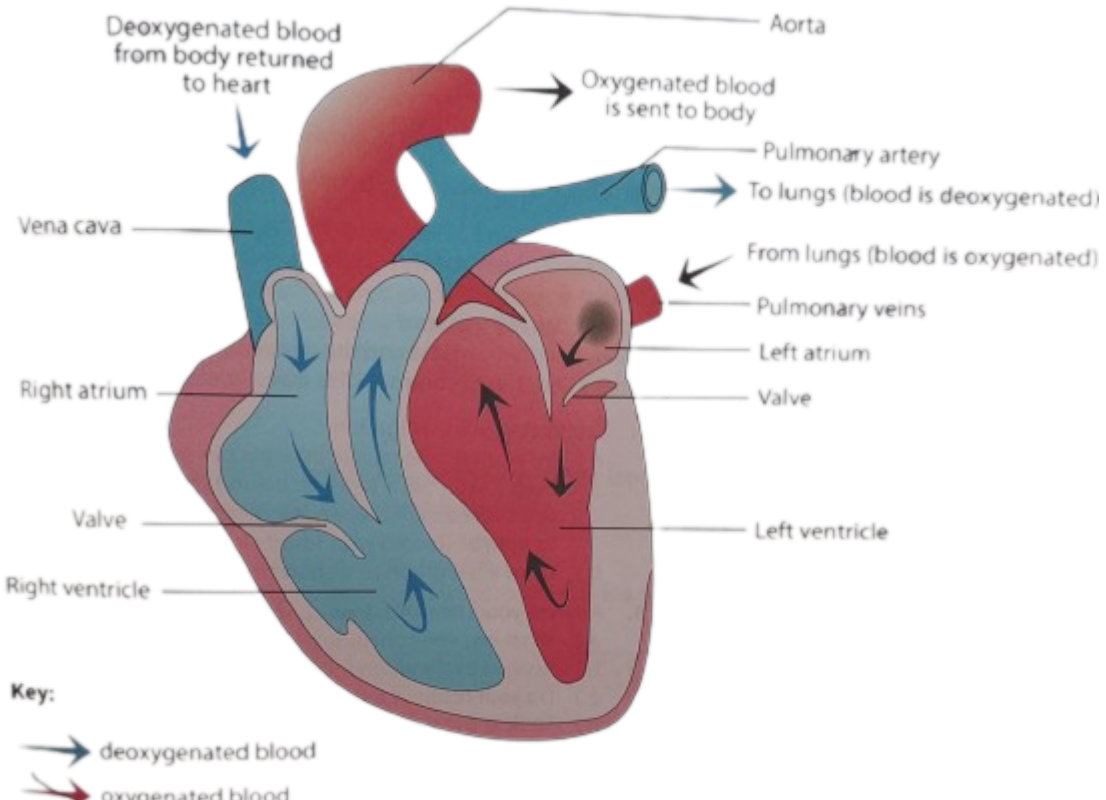
- How oxygen flows through your respiratory system:
  - Enters through mouth/nostrils → trachea → bronchioles → alveoli → capillaries
- How inhalation works:
  - It is an active process (requires active involvement of certain muscles)
  - The diaphragm contracts and moves downwards
  - Intercostal muscles contract and ribcage moves upwards
  - Volume of thoracic cavity increases
  - Air pressure in thoracic cavity decreases (making it lower than atmospheric air pressure)
  - Air with oxygen flows down air passages into lungs
- How exhalation works:
  - It is a passive process (doesn't require active involvement of certain muscles)
  - Diaphragm relaxes and moves upwards (returning to its original position)
  - Intercostal muscles relax and ribcage moves down to original position
  - Volume of thoracic cavity decreases
  - Air pressure in thoracic cavity increases (making it higher than atmospheric air pressure)
  - Air containing carbon dioxide is forced out the lungs
- Gaseous exchange:
  - Involves diffusion of gases
    - Diffusion is the movement from an area of high concentration to an area of low concentration
  - Occurs in:
    - Lungs
      - When gases are between alveoli and surrounding capillaries
    - Body cells
      - When gases diffuse from capillaries into cells and vice versa
  - Diffusion is a passive process
  - Oxygen diffuses into capillaries in the alveoli

        - Requires a concentration difference between oxygen in the blood and oxygen in the lungs
    - Oxygen molecules move down a diffusion gradient
        - Diffusion gradient is the difference in concentration or pressure that causes particles to move
        - In gaseous exchange, it's the difference between oxygen in the lungs and oxygen in the blood that drives oxygen movement
        - A bigger difference means faster diffusion
        - Continuous flow of deoxygenated blood and fresh oxygen maintains the diffusion gradient



- Above is a cross-section of an alveolus:
    - An alveolus is a tiny air sac in the lungs where gas exchange occurs, allowing oxygen to enter the bloodstream and carbon dioxide to be expelled
    - Note the capillary wall and the alveolus wall are only 1 cell layer thick
        - This assists in diffusion because:
            - There is a shorter diffusion distance
            - There is an increased surface area for diffusion to occur on
            - It is more permeable, allowing the gases to pass through easily
    - Deoxygenated blood passes through the capillary alongside the alveolus

        - Carbon dioxide from the blood diffuses into the alveolus where it has a lower concentration
        - The alveolus has high oxygen concentration, while the blood has low oxygen concentration
        - Oxygen diffuses from the alveolus into the blood
        - The capillary now carries oxygenated blood, while waste carbon dioxide is exhaled from the lungs during exhalation
- Circulatory System:
    - Circulation is the process of the heart pumping blood throughout the body in blood vessels
    - Our circulatory system has two parts and is called a double circulatory system
    - Structure/main components:
        - Heart
            - Muscular organ that pumps blood around the body
        - Blood vessels
            - Contains blood
            - Blood vessels that transport blood *away* from the heart are called arteries
            - Blood vessels that transport blood *to* the heart are called veins
        - Blood
    - Internal Structure of the Heart:



- Note that the right atrium is on the left hand side, and vice versa
    - The diagram can sometimes be flipped, but we have some ways to tell which way it is:
        - The aorta comes out of the left ventricle
        - The left ventricle wall is a lot wider
        - The venae cavae enter the right atrium
- Functions of each part:
    - Vena cava:
        - There are 2 venae cavae, but only one is shown on the diagram
            - The superior vena cava is found on the top of the heart and carries deoxygenated blood from the upper body to the right atrium
            - The inferior vena cava is found on the bottom of the heart and carries deoxygenated blood from the lower body to the right atrium
    - Right and left atria:
        - Receive blood from veins and act as holding chambers before pumping it into the ventricles
    - Valves:
        - Ensure the blood flows only one way (preventing backward flow)
    - Right and left ventricles:
        - Pump blood out of the heart
        - Right ventricle pumps deoxygenated blood to the lungs through the pulmonary artery
        - Left ventricle pumps oxygenated blood to the body through the aorta
    - Pulmonary veins:
        - Carry oxygenated blood from the lungs to the left atrium
    - Pulmonary arteries:

        - Transport deoxygenated blood from the right ventricle to the lungs for oxygenation
    - Aorta:
        - Carries oxygenated blood from the left ventricle to supply oxygen to all parts of the body
- Table summarising the different blood vessels:

Characteristics	**Arteries**	**Veins**	**Capillaries**
Direction of blood flow	From the heart	To the heart	To and from the heart
Type of blood transported	Deoxygenated	Oxygenated	Both oxygenated and deoxygenated
Thickness of walls	Thick	Thin	1 cell layer thick
Blood pressure in vessels	High	Low	Low

- Heart Rate:
    - The number of times your heart beats per minute
    - The faster the heart rate, the harder the heart is contracting to circulate blood
    - It may increase/decrease due to some factors:
        - Exercise increases your heart rate
        - Fear can increase your heart rate
        - Stimulants (caffeine, adrenaline etc.) can increase your heart rate
- Gaseous exchange in the body cells:
    - Oxygenated blood leaves the heart through the aorta and branches into arteries
    - Arteries further branch into capillaries, allowing contact with body cells
    - Blood, with higher oxygen concentration, diffuses from capillaries into cells

        - Cells, with higher carbon dioxide concentration, diffuse carbon dioxide through capillary walls into the blood
        - Capillaries merge to form veins, which transport blood back to the right side of the heart
        - Veins have thinner walls compared to arteries and operate at lower pressure due to distance from the heart's pumping action
    - Respiration:
        - Occurs within mitochondria
        - Raw materials required for respiration are transported via the circulatory system
        - Blood transports oxygen and glucose which diffuse into the cells, and into the mitochondria
        - The word equation for respiration is:
            - Glucose + oxygen → carbon dioxide + water + energy
    - Circulation of oxygenated blood:
        - Most veins carry deoxygenated blood, however there is one exception:
            - Veins carrying blood from the lungs to the heart carry oxygenated blood
        - Oxygenated blood enters the left atrium
            - It then flows into the left ventricle
            - The left ventricle has thick walls
                - The walls contract to pump blood out through the aorta (largest artery in the body)
                - Thick walls help withstand the high pressure blood is transported at to the aorta
            - Blood then travels through blood vessels to all body parts
    - Circulation of deoxygenated blood:
        - Deoxygenated blood enters the right atrium, and is then pumped into the right ventricle
        - The right ventricle pumps the carbon dioxide rich blood to the lungs

            - The carbon dioxide then diffuses into the lungs
        - It is then exhaled out the body
- Some potential health issues:
    - High blood pressure (hypertension)
        - May lead to rupture of a blood vessel in a vital organ, and death
    - Heart attack
        - Can be caused by smoking and high cholesterol diets
        - Happens when the coronary artery is blocked off (this stops the heart from receiving oxygen)
    - Stroke
        - The brain's blood supply is disrupted
        - Can cause paralysis
    - Asthma
        - Inflamed airways (air can't get in properly)
    - Lung cancer
        - Tumours caused by excessive smoking
    - Bronchitis
        - Mucus blocks the airways, causing infection
- Causes of some circulatory and respiratory health issues:
    - Smoking
        - It contains poisonous substances like carbon monoxide
            - Carbon monoxide reduces the ability of blood to transport oxygen
        - It can cause reduced lung function because:
            - Airways narrow
            - Airway resistance increases
        - Carcinogens (toxic substances) enter your body
    - Alcohol
        - Affects how oxygen in the blood is transported
        - Can either speed up or slow down normal heart rate
    - High cholesterol diet
        - Causes fat and cholesterol to build up on the artery walls, which narrows the arteries and can lead to strokes and heart attacks

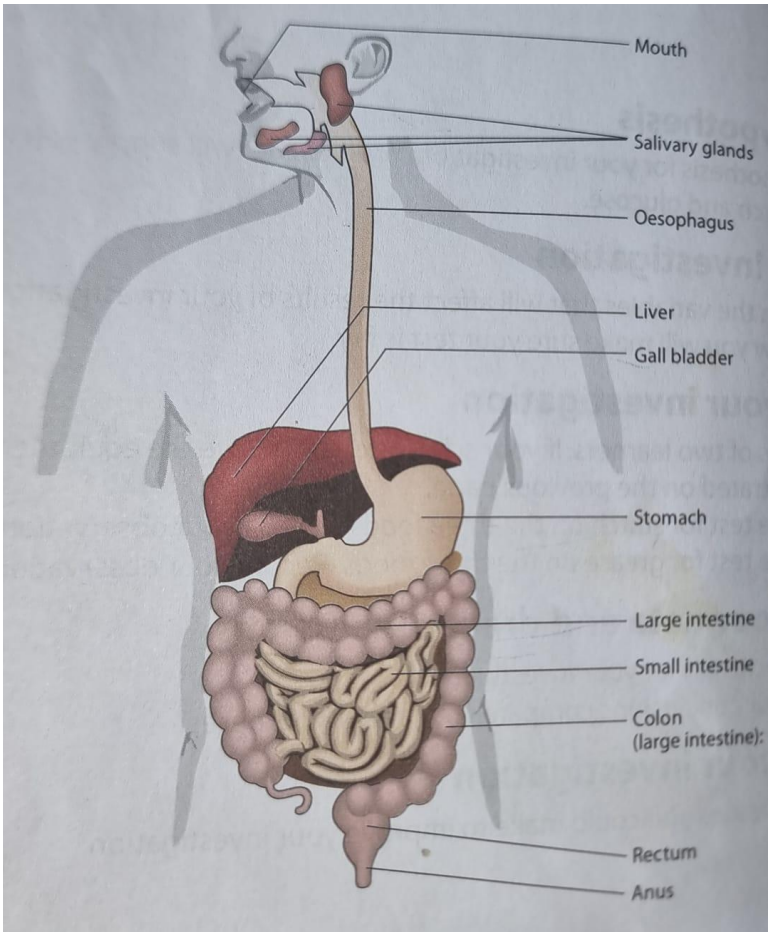
Digestion:

- Healthy diet:
    - Food contains essential nutrients that keeps us healthy
    - We need to balance our diet by including many food types in our meals
    - There are 5 main groups of food:
        - Grains (e.g. bread and cereal)
        - Dairy (e.g. milk and cheese)
        - Protein (e.g. beef and chicken)
        - Vegetables/fruits (e.g. carrots and bananas)
        - Fats and oils (e.g. avocados and butter)
            - Fats and oils should only be consumed in small amounts
    - Water is also very important in the diet, because:
        - Most of the body is water
        - All chemical reactions in your body take place in water
        - Water is a solvent for nutrients, wastes and gases
            - A solvent is a liquid that dissolves substances to form solutions
        - Water transports nutrients and waste products in the body
        - Water helps with digestion
        - Water allows our blood cells to grow and survive
    - Different types of nutrients and their functions:
        - Carbohydrates
            - Sugars/starch provide energy for the body
            - Examples:
                - Sugars (fruit; sugar cane; vegetables etc.)
                - Starch (pasta; rice; potatoes; corn etc.)
        - Proteins
            - Growth and repair of cells
            - Form part of cell membranes
            - Examples:
                - Fish; eggs; milk; meat; nuts; chickpeas; yoghurt etc,

- Fats and Oils
    - Absorb fat-soluble vitamins
    - Form part of cell membranes
    - Stored as reserve energy sources
    - Insulating material under skin
    - Protects organs (e.g. eyes and kidneys)
    - Examples:
        - Oil; nuts; seeds; butter etc.
- Vitamins
    - Needed in small amounts
    - Different vitamins have different functions:
        - Vitamin A is good for eyesight
        - Vitamin C is good for your immune system
        - Vitamin E protects cells and acts as an antioxidant
    - Examples:
        - Vitamin A (carrots; yellow fruit; liver etc.)
        - Vitamin C (citrus; tomatoes; guavas; berries etc.)
        - Vitamin E (spinach; eggs; avocado etc.)
- Minerals
    - Needed in small amounts
    - Some minerals have different functions:
        - Calcium makes your bones and teeth strong, as well as assisting in blood clotting and how the heart works
        - Iron helps produce red blood cells and transports oxygen in the body
    - Examples:
        - Calcium (milk; cheese; broccoli etc.)
        - Iron (red meats; fish; raisins; legumes etc.)
- Fibre
    - Promotes movement of food through your digestive system
    - Assists in bowel movements by keeping faeces compacted

                - Prevents constipation, haemorrhoids and colon cancer
                - Examples:
                    - Bran in bread; fruit; vegetables; whole-wheat cereals
    - Disorders of the digestive system:
        - Obesity
            - Having too much body fat
            - Caused by eating too much bad food or doing too little exercise
        - Tooth decay
            - Too much sugar and bad oral hygiene (not brushing teeth)
        - Diabetes
            - When the body can't control amount of sugar in the blood
            - Caused by eating too much sugar or too little exercise
            - Can also be genetic
        - Constipation
            - When faeces are hard to excrete
            - Caused by not enough fibre and water
            - Can lead to haemorrhoids/colon cancer
        - Ulcers
            - Sores inside mouth and intestines
            - Caused by wounds that don't heal properly
                - Can be a sign of vitamin C deficiency
        - Diarrhoea
            - When someone has more than 5 bowel movements/watery faeces a day
            - Caused by additives in the diet (e.g. artificial sweeteners)
- Alimentary Canal and Digestion:
    - Four processes take place in the digestive system:
        - Ingestion
            - Intake of food
        - Digestion

        - Mechanical/chemical processes which convert food into nutrients
    - Absorption
        - When soluble nutrients are taken up by the bloodstream
    - Egestion
        - When undigested food called faeces is passed out the body
- Parts of the digestive system:



    - Mouth:
        - Where ingestion takes place
        - The teeth crush the food and the tongue mixes it with saliva to swallow it
    - Salivary glands:
        - Produce saliva
    - Oesophagus:
        - Made up of muscles

        - The muscles contract and relax to push the food down
        - These muscle movements are called peristalsis
- Liver:
    - Largest gland in the body
    - Breaks down substances and forms bile
        - Bile helps with digestion
- Gall bladder:
    - Stores bile
- Stomach:
    - Muscular walls contract and churn the contents of the stomach
        - This breaks up the food so enzymes can act on it
        - Enzymes are proteins that speed up chemical reactions
    - The lining of the alimentary canal secretes enzymes that break down food
- Large intestine:
    - Absorbs water from waste back into the blood
    - Makes waste compact to form faeces
    - Mucous glands produce mucous to smoothen the faeces for easier excretion
- Small intestine:
    - Intestinal glands produce intestinal juice containing enzymes, which break down the food into substances to be absorbed by the body
    - Small intestine walls are lined with villi which absorb nutrients
- Colon:
    - Stores waste before egestion
- Rectum:
    - Temporarily stores waste before excretion
- Anus:
    - Egests/excretes waste

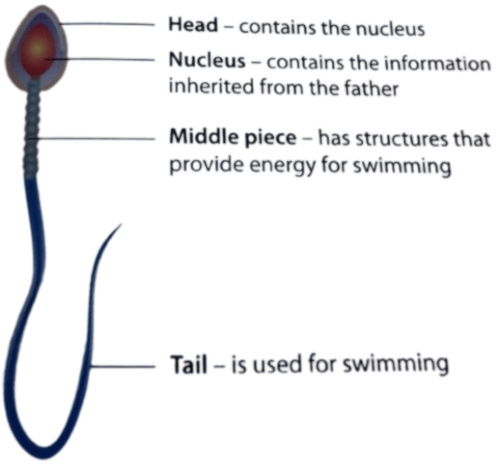
- Types of Digestion:
    - Mechanical Digestion:
        - Large pieces of food are broken down mechanically into small particles
        - Takes place in the mouth, oesophagus, stomach and small intestine
            - In the mouth the food is crushed and mashed by the teeth
                - The tongue pushes the food onto the palate where it is further broken down
            - In the oesophagus the food undergoes peristalsis which breaks down the food
            - In the stomach, the churning movement also breaks down food
            - In the small intestine, the bile breaks fats into small drops
    - Chemical Digestion:
        - Small particles are converted into nutrients
        - Takes place in the mouth, stomach and small intestine
            - In the mouth the salivary glands produce saliva
                - The saliva contains enzymes which breaks down starch in the food
            - In the stomach, the stomach acid contains enzymes which convert food into substances that are soluble in water (to be absorbed into the bloodstream)
            - In the small intestine, enzymes are produced by intestinal glands
- Absorption:
    - Once food has been broken down, it can be absorbed
    - Absorption is when nutrients are taken into the bloodstream
    - The small intestine contains millions of finger-like structures called villi on the inner wall, which contain blood vessels to absorb the nutrients

Human Reproduction:

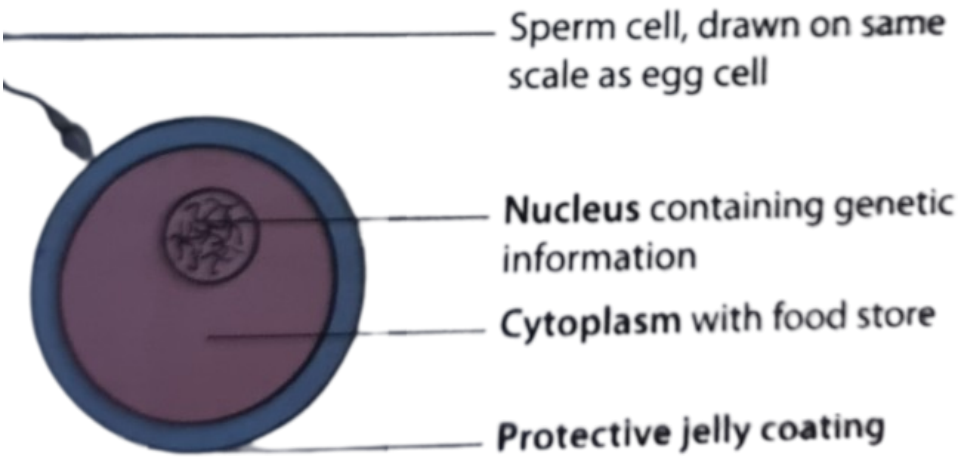
- Reproductive System Overview:
    - Function:
        - Produces sex cells
            - Male sex cells are sperm cells
            - Female sex cells are egg cells
        - These 2 sex cells combine to create babies
    - Structure:
        - The main 3 components:
            - Testes
                - Produce sperm cells
            - Ovaries
                - Produce egg cells
            - Uterus
                - Where the baby develops before birth
    - Main Processes:
        - Sexual intercourse involves the man placing his penis inside the woman's vagina
        - Ejaculation occurs when the penis releases sperm cells into the woman's vagina
        - Ovulation happens once a month, when an egg cell is released into the woman's fallopian tubes
        - Fertilization occurs when a sperm cell fuses with the egg cell
        - If fertilization does not occur, the lining of the uterus is released through the vagina, known as menstruation
        - After fertilization, the fertilized egg undergoes cell division and growth
        - The fertilized egg moves to the uterus and attaches itself to the uterine lining, called implantation, resulting in pregnancy
        - The baby develops in the uterus and is born after 40 weeks of pregnancy
        - The baby grows and matures into an adult capable of reproduction

    - Common health Issues:
        - Infertility
            - When someone can't produce a baby
            - Males can experience infertility due to:
                - Low sperm production
                - Abnormal sperm function
                - Something is blocked, preventing the travel of sperm
                - Smoking
            - Females can experience infertility due to:
                - Menopause
                    - Menopause is when the woman runs out of eggs (usually in her 40s or 50s)
                - Damage to the oviducts
                - Sperm cannot pass through the cervix
                - Structure of the uterus is abnormal
        - Foetal alcohol syndrome
            - Birth defect which occurs when the mother consumes alcohol during pregnancy
        - STDs (sexually transmitted diseases)
            - Involves infectious organisms transmitting between partners
- Purpose of Reproduction
    - To produce more organisms and prevent extinction
    - Ensures survival of a species
- Asexual Reproduction
    - Only one parent involved
        - The children are completely identical to the parent
    - Often found in plants
        - Parts of the plant can grow into a new plant
    - Simple organisms can reproduce by splitting in two
- Sexual Reproduction
    - Two parents involved
        - They have reproductive organs that produce gametes (sperm cells and egg cells)

- When an egg cell is fertilised by a sperm cell, it divides and forms a ball made of cells
    - This develops into the embryo
- Sperm Cells:
    - Contain DNA from the father (DNA contains genetic information)

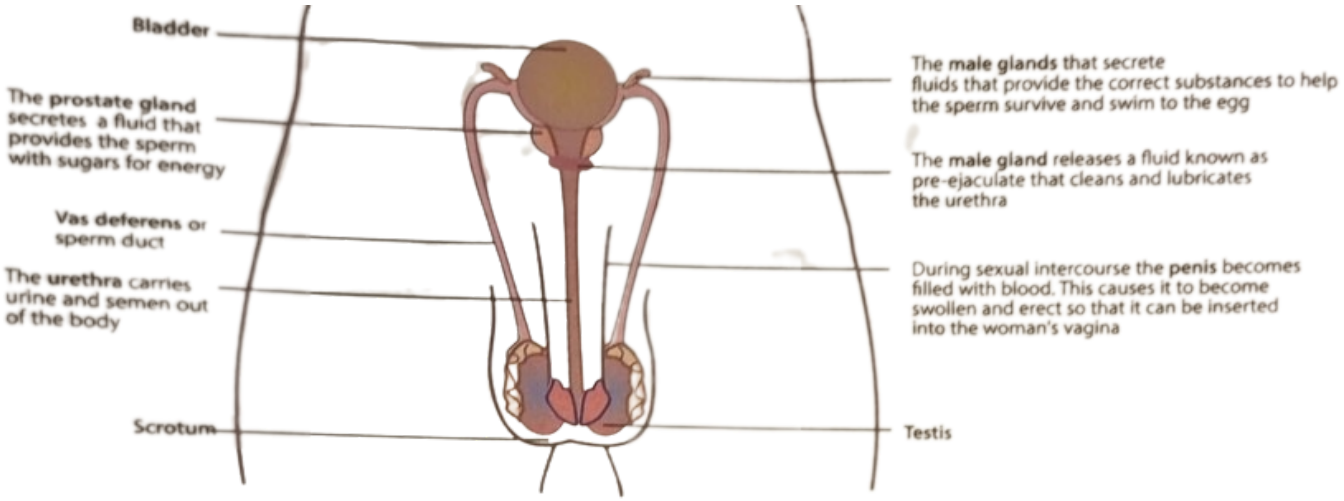


    - Sperm contains X or Y chromosomes
        - XY = male
        - Sperm determines the sex of the child
        - Sperm contains 23 of the 46 chromosomes in a child
- Egg Cells:
    - An egg is also called an ovum
    - Contain DNA from the mother
    - Below is a diagram of an egg cell being fertilised



        - Only contains X chromosomes
            - XX = female
            - Egg contains 23 of 46 chromosomes in the child
    - When an egg cell and a sperm cell join:
        - The egg now contains DNA from both parents
        - This means the baby will have characteristics of both parents
- Puberty:
    - Experienced between 10-18 years old
    - Changes happen to the body, including sexual organs
        - Testes make sperm and ovaries make eggs
    - Pituitary Gland:
        - Small gland at the base of the brain
        - Produces hormones (chemicals that change how quickly or slowly an organ functions)
        - The hormones make the reproductive organs active which then produce sex hormones
        - Testes produce testosterone and ovaries produce oestrogen
    - Physical Changes:
        - Also called secondary sexual characteristics
        - Men:
            - Pimples can develop
            - Facial hair grows
            - Voice deepens
            - Shoulders get broader, body gets muscular
            - Hair grows on body, including armpits
            - Sex organs and pubic hairs grow
            - Testes produce sperm
        - Women:
            - Pimples can develop
            - Hair grows in armpits
            - Breasts enlarge
            - Hips widen (to prepare for childbirth)
            - Ovulation/menstruation begin happening
            - Pubic hair grows

    - Emotional Changes:
        - Mood swings can sometimes happen
        - Low self-esteem can develop
        - Aggression and depression can develop
- Reproductive Organs
    - Male Organs:
        - Function:
            - Produce and store sperm
            - Place sperm in the female
        - Diagram:



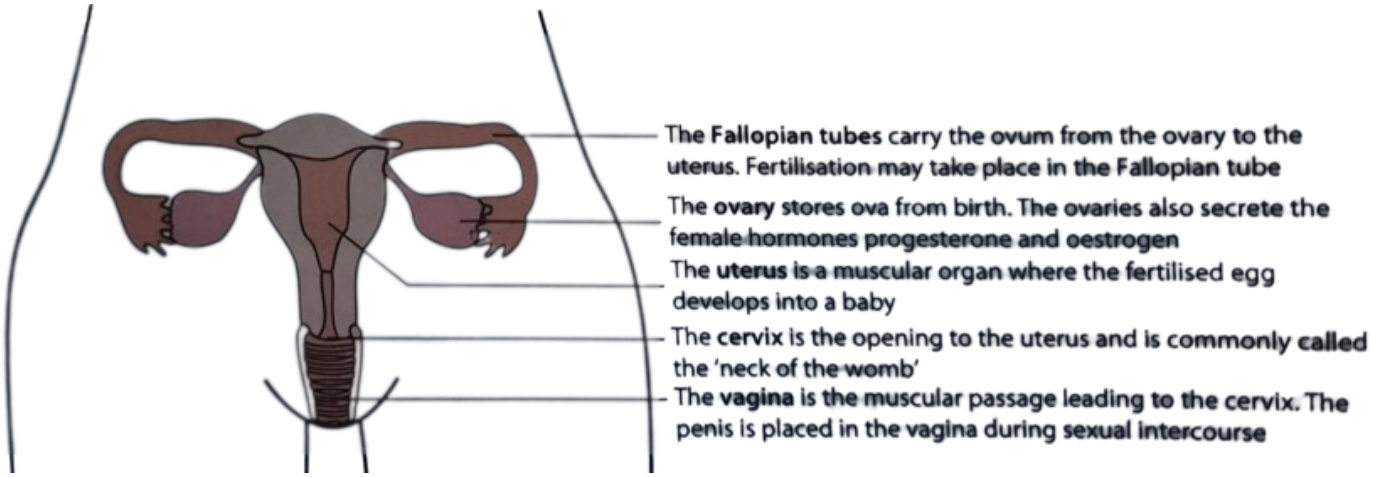
        - Function of each part:

Part	**Function**
Penis	Allows for the passage of urine and semen. Becomes erect when blood is pumped into it
Sperm duct/vas deferens	A tube that carries sperm from the testes to the urethra
Testis (plural: testes)	Responsible for producing sperm cells and testosterone, the primary male sex hormone
Scrotum	Sac-like structure that houses and protects the testes. Regulates the temperature of the testes to ensure proper sperm production

Urethra	Tube that runs through the penis. Passageway for both urine and semen to exit the body
Male glands	Release fluids containing food for sperm
Bladder	Not part of the reproductive system, but stores urine
Prostate gland	Walnut-sized gland which secretes fluids that nourish/protect sperm, contributing to semen
Ureter	Not part of the reproductive system, but it's a tube that carries urine from the kidneys to the bladder
Erectile tissue	Sponge-like tissue. Fills with blood during arousal, causing enlargement and firmness
Epididymis	Coiled tube behind each testicle. Storage and maturation site for sperm cells, allowing them to gain mobility and the ability to fertilise an egg. Absorbs mature sperm into body

- Path of Sperm:
  - Travels along the sperm duct from the testes
  - Mixes with fluids from male glands to create semen
  - Moves through the urethra

- Female Organs:
  - Function:
    - Make egg cells
    - Provide a suitable environment for a baby to develop
  - Diagram:



  - Function of each part:

Part	**Function**
Vagina	Canal that connects the uterus to the outside of the body. It allows for sex and childbirth
Uterus/womb	Muscular organ where a baby grows during pregnancy
Ovaries	Produce eggs and hormones in females
Oviducts/fallopian tubes	Carry eggs from the ovaries to the uterus. Where fertilisation happens. Lined with hairs that sweep the egg along
Cervix	Lower part of uterus that connects to the vagina. Controls the flow of menstrual blood and allows sperm to enter uterus during sex

Endometrium	Lining of the uterus that either nourishes the embryo or is shed during menstruation

        - Path of the Egg:
            - Released from an ovary once a month
            - Travels along the oviduct/fallopian tube to the uterus (swept along by hairs)
            - If it isn't fertilised it breaks down on its way to the vagina
            - The egg passes out the body
- Stages of Reproduction:
    - Ovulation:
        - When, once a month, an egg is released from one of the ovaries
    - Menstruation:
        - What happens during menstruation:
            - Lining of uterus thickens (developing a layer of blood vessels) while egg develops in the ovary
            - The thickened lining prepares for a fertilised egg and provides a suitable environment for the baby to grow
            - The thick lining remains for about a week after ovulation
            - If the egg isn't fertilised, it's passed from the body through the vagina
            - Menstruation occurs a few days later, which involves the breakdown and shedding of the thick uterine lining
            - Menstruation lasts for 4-7 days.
        - The Menstrual Cycle:
            - Lasts roughly 28 days with 3 stages
            - Stage 1: Menstruation
                - The uterus lining thickens with blood vessels and mucus to support baby development
                - If the woman isn't pregnant the lining leaves her body through the vagina, creating bleeding

        - The first day menstruation happens is the first day of the menstrual cycle
    - Stage 2: Ovulation
        - At roughly Day 7 once menstruation is finished, the uterus lining thickens again
        - Ovulation occurs on Day 14, and an egg is released by the ovary into the fallopian tube
    - Stage 3: Movement of the Egg along the Oviduct
        - The egg is moved to the uterus by cilia (the thin hairs) through the oviduct
        - If the egg fuses with a sperm cell during this movement the woman can fall pregnant
        - At roughly Day 22, the uterus wall is thick and ready for a fertilised egg
- Copulation:
    - Where the egg and sperm are brought together
    - Also called sex or intercourse
    - The process:
        - Male penis becomes erect
        - Female vagina becomes moist
        - Penis is placed in vagina, and moved back and forth
        - This eventually causes ejaculation, and semen is pumped into the vagina
- Fertilisation:
    - Sperm travels into the oviducts and one single sperm may join the egg
    - A zygote is created when the egg is fertilised
- Implantation:
    - The egg grows to form a ball of cells and moves into the uterus
    - It sinks into the uterus lining and is now called an embryo
    - For the first 2 months of pregnancy, it stays an embryo

    - The Placenta:
        - For the last 7 months of pregnancy the embryo is called a foetus
        - The foetus attaches to the uterus wall via the placenta
            - Placenta provides it with food, water and oxygen via the mother's blood
            - Waste materials e.g. carbon dioxide are also removed through the placenta
        - The foetus is joined to the placenta by the umbilical cord which carries the blood between the mother and the foetus
        - If the mother smokes, drinks or does drugs, the foetus indirectly does too
    - Pregnancy:
        - When a woman carries a developing baby in her womb/uterus
        - The time period between fertilisation and birth is gestation
            - The human gestation period is typically 40 weeks
        - The woman doesn't have periods when pregnant because the uterus layer is thickened
- Contraception:
    - Used to prevent fertilisation/pregnancy
    - Also called birth control
    - Condoms:
        - Rubber sheaths placed on the penis before sex
            - A barrier which stops sperm from leaving and harmful organisms like STDs from entering
    - The pill:
        - Can be synthetic oestrogen:
            - Prevents ovulation
            - This means no eggs are released and menstruation doesn't happen
        - Can also be synthetic progesterone:
            - Cuts down production of the uterus lining
            - Slows down movement of sperm