Peristalsis

- In **PERISTALSIS**, the longitudinal and circular muscles work in tandem to cause wave-like contractions that move food down the alimentary canal.



- MASTIGATEN is where for pisciple, down by the mechanical action of the teeth and tongue.
- **SALIVA** is important because:
 - It contains amylase (ptyalin) which breaks down starch.
 - It contains water and mucin which softens food.
 - It contains **LYSOZYME** an amylase, that breaks down carbohydrates remaining on the teeth, preventing decay.
 - It contains bicarbonate ions that neutralise acid produced by microorganisms on the teeth.
 - Chemicals in saliva help the taste buds detect food.
 - 1.5 litres of saliva is produced a day.
- The tongue rolls the food into a **BOLUS**.
- The movement of the bolus is assisted by lubrication, resulting from the mucus produced by the cells lining the oesophagus.
- Swallowing involves several reflex actions:
 - Stop breathing.
 - Trachea is pulled back to close the opening.

- The NASAL PASSAGES warm air to body temperature. The membranes of the nasal passage humidify the air.
- The nasal passages are lined with goblet cells and ciliated cells.
- **GOBLET CELLS** secrete mucus, which moistens the air and traps airborne dust and bacteria.
- **CILIATED CELLS** are lined with very fine hair-like structures called **CILIA**, which beat upwards, directing mucus to the back of the mouth. This is swallowed and any potential pathogens are destroyed by stomach acid.
- Air is then drawn into the **PHARYNX** at the back of the mouth.
- The air is then drawn into the **TRACHEA**, which runs from the larynx to the lungs. It is permanently held open by 'C-shaped' rings of cartilage.
- At its lower end, the trachea divides into the left and right **BRONCHI**.
- The bronchi then divide several times to produce **BRONCHIOLES**, which then continue to divide to produce the **BRONCHIAL TREE**.
- The bronchial tree terminates into the **ALVEOLAR DUCTS**.
- Each alveolar duct is terminated with a hollow sack called **ALVEOLI**, which have a dense network of capillaries associated with it. Alveoli are the point of gas exchange.



- **VENTILATION** is the exchange of air between the lungs and the atmosphere; it is achieved by the physical act of breathing.
- GAS EXCHANGE is the exchange of oxygen and carbon dioxide in the alveoli and the bloodstream; it occurs passively via diffusion.
- **CELLULAR RESPIRATION** is the release of ATP from organic molecules; it is greatly enhanced by the presence of oxygen (aerobic respiration).
- ALVEOLI are made of single layer of flattened cells (thin wall) so diffusion distance is small.
- Have a rich capillary network that helps to maintain concentration gradient.
- Increased SA:V ratio: high numbers of spherically-shaped alveoli optimise surface area for gas exchange.
- Moist: some cells in the lining secrete fluid to allow gases to dissolve and to prevent alveoli from collapsing (through cohesion).

Control of Breathing

- The body has two methods of regulating breathing:
- 1. The **RESPIRATORY CENTRE** of the brain, which measures the carbon dioxide concentration in the cerebrospinal tissue fluid in the brain. This fluid is determined by carbon dioxide in the blood. Therefore if carbon dioxide is increased, there will be a decrease in pH, and the body will increase breathing to gather more oxygen. Sensors in the aorta and carotid arteries that monitor carbon dioxide concentrations, as well as blood pH. When oxygen is very low, an alarm is sent to the **MEDULLA**, and the body will increase its breathing rate.
- 2. **STRETCH RECEPTORS** in the intercostal muscles register the rate and depth of breathing and relay this information to the respiratory centre to regulate breathing rate.



Movement of Oxygen and Carbon Dioxide In and Out of the Respiratory System



Excretory System

- **EXCRETION** is the removal from the body of the waste products of metabolic activities.
- Includes the urinary system, lungs, skin and liver.



- **RENAL ARTERY** carries blood to the kidneys interful from the heart via the aorta.
- RENALVE Contraction of the Renew of the rest of the
- **URETUR** transports urine from the kitchey to the bladder.
- **BLADDER** stores urine.
- **URETHRA** transports and excretes urine from the bladder to outside of the organism.
- Each kidney receives blood at a very high pressure via the renal artery. Inside the kidney the artery divides into capillaries with little loss in blood pressure.
- The capillary carries blood to a tiny cup shaped structure called the **BOWMAN'S CAPSULE**, which collects the filtrate.
- The Bowman's Capsule is the beginning of a 3 cm tube called a **NEPHRON**.



- The **STYLE** is the structure that supports the stigma.
- The **BRACT** is a specialised leaf or leaf-like part, usually situated at the base of a flower or inflorescence.
- The **CALYX** is the outermost group of floral parts; the sepals.
- The female parts of the flower together are called the CARPEL. This is comprised of the stigma, style and ovary.



Pollination

- wint first be transfer ed the anthers to the stigma, and Before fertilisation can occur, poller this is known as **PQLL**
- Plants rarely solved mate, but capter for do so. Usually one plant receives pollen from other plants in a process known as cross-pollination.
- SELF-POLLINATION is where pollen is transferred within the same flower or plant. This doesn't allow for genetic change, but ensures the development of fertile seeds. Many plants utilise this as a last resort if cross-fertilisation doesn't occur.
- It is the transfer of pollen grains from the anther to the stigma of the same flower or another flower born on the same plant.
- It does not require any external agency.
- Bother anthers and stigmas mature at the same time.
- It can occur even when the flower is closed.
- Produces homozygous offsprings.
- Does not introduce any variations.
- **CROSS-POLLINATION** involves the transfer of pollen from one plant to another and usually involves an active vector (e.g. insects such as bees) or a transporting medium (e.g. wind).
- It is the transfer of pollen grains from the anther of one flower to the stigma of another flower borne on a different plant of the same species.
- An external agent (wind, water, insects, etc.) is always required.

- **VARIATION** within a species can provide some individuals with an increased chance of survival. Meiosis ensures variation.
- In humans, **FERTILISATION** occurs when a haploid gamete from each parent fuse together to form a diploid zygote.
- There are many different genetic combinations possible depending on which sperm fertilises the ovum. This is another source of genetic variation that can give sexually reproducing organisms an increased chance of survival.
- A **ZYGOTE**, which is a fertilised ovum, contains 23 paternal chromosomes and 23 maternal chromosomes. Each pair of chromosomes will consist of a chromosome from each parent.
- The zygote divides rapidly by mitosis to form an embryo that will also use this type of cell division to develop and grow.

Gametogenesis

- **GAMETOGENESIS** is the process by which diploid oocytes or spermatocytes undergo meiosis to form mature haploid gametes (sperm and ova).



- **OOGENESIS** is the process by which the female gametes (ova) are created.
- OVA are haploid and have only one copy of each gene. It achieves its haploid state while conserving as much cytoplasm as possible.
- The process begins during foetal development, when a large number of oocytes are formed by mitosis.
- These cells begin meiosis but are arrested in Prophase I until puberty.
- At puberty, some follicles continue to develop each month in response to FSH secretion.
- These follicles complete the first meiotic division to form two cells of unequal size.
- The cell with less cytoplasm is a **POLAR BODY**, which degenerates, while the larger cell forms a secondary oocyte.
- The **SECONDARY OOCYTE** is released from the ovary (ruptured follicle develops into **CORPUS LUTEUM**) and, if fertilisation occurs, will complete meiosis.
- The second meiotic division will produce an ovum and a second polar body.
- When two or more follicles mature, fraternal twins or triplets may be born.
- **OVULATION** is the release of a secondary oocyte from the ovaries.

- **FORESKIN** protects the glans penis.
- COWPER'S GLAND produces a lubricant.



Female Reproductive System

- FALLOPIAN TUBE serves as a passage through which eggs pass on their way from the ovaries to the uterus. The oviduct is lined with ciliated cells, which waft the ovum alor grinside the oviduct and into the uterus.
- OVARY produce eggs (ova) and produce the female sex homogen estrogen and progesterone.
- UTERUS nourishes a fertilised egg. It is a myslum a soft lining, and is where a baby develops until birth.
- f the uterus that wider - CERVIX is the neek (entirine) during childbirth to allow passage of a nuscle at the lower on for the uterus and keeps the baby in place until birth. baby. It is a ring of
- VAGINA is a muscular tube that serves as a passage for a baby in childbirth, serves as a passage for menstrual flow from uterus to outside the body, and receives a man's penis during copulation.
- VULVA consists of labia major and labia minor, which are protective folds. The clitoris is highly sensitive and is involved in female sexual response. Bartholin's glands secrete lubricating mucus into the opening of the vagina during sexual excitement.
 - a fallopian tubes a fallopian tubes b ovaries b ovaries c uterus d cervix e vagina f vulva
- -**URETHRA** passes urine out of the body from the bladder.

- Progesterone maintains the endometrium, as well as reduces uterine contractions and maternal immune response (no antibodies against foetus).
- Both oestrogen and progesterone levels drop near time of birth.



Foetal Circulation

- **FOETAL CIRCULATION** is different to normal minute circulation as exchange does not occur in the lungs and nutrients are not consumed by eating.
- FORAMEN OVALE is the hole in septum between at $\frac{1}{2}$. It allows blood to move from the right atrium to the placent atrium only bypesting the lungs and allows the oxygenated blood from the placent to be delivered to the rody.
- The **DUCTUS ARTERIOSUS** is a connection between the pulmonary artery and aorta. This duct acts to direct blood away from the lungs and into the systemic circulation. At birth, this arterial duct (between two arteries) closes when cells grow over the opening.
- The **DUCTUS VENOSUS** receives blood from the umbilical vein and directs it to the posterior and inferior vena cava. This venous duct acts as a liver bypass and moves blood into the foetal systemic circulation.
- **UMBILICAL VEIN** joins to vena cava. It carries oxygenated blood with maternal nutrients from the placenta to the foetus.
- UMBILICAL ARTERY carries deoxygenated blood with foetal waste from the foetus to the placenta. They receive blood from the foetal heart via the dorsal aorta and both iliac arteries of the legs where they branch off to the umbilical cord.

BIOLOGY TERM 4 NOTES: EVOLUTION

Introduction to Evolution

- **EVOLUTION** is the gradual process of change throughout time and by which living things change and diversify over time. The changes that take place occur slowly, over millions of years, and represent different species gradually developing in different and changing environments.
- The theory of biological evolution rests on the basis that the earth is of an immense age: around 4.5 billion to 6 billion years old.
- Naturalists have wondered at the diversity of living things as there are great varieties in shape, size and ecological role, there are estimated 3 million to 20 million different living species and much of the natural world's biodiversity has vanished through extinction.
- 99% of all species that ever lived are now extinct.
- Charles Darwin offered an explanation as to what caused such great diversity and why many species have died out based on careful observations:
 - 1. Physical traits and behaviours enable organisms to survive and reproduce (fitness).
 - 2. Fitness results from adaptations.
 - 3. Darwin reasoned that adaptations result from natural selection that results in evolution.

- Fossils have been discovered that show a similarly be species that exist today modern day species on a featy be traced back to or gothe fossil record to a common ancestor.
- FOSSILS are the remains and impressions of ancient life, both plant and animal. They range in size from microscopic organisms and structures to dinosaur skeletons and complete woolly mammoths. The skeletons of extinct races of man are also considered fossils.
- An environment favourable to the growth and later preservation of organisms is required for the occurrence of fossils. Two conditions are almost always present:

1. **POSSESSION OF HARD PARTS**, either internal or external, such as bones, teeth,

scales, shells or wood, these parts remain after the rest of the organism has decayed.

Organisms such as jellyfish or worms leave little record.

2. **QUICK BURIAL** of the dead organism, so that it is protected against weathering, bacterial action and scavengers. Traces and impressions of organisms also need quick burial to preserve them.

- Fossils form when organism is buried in sediment quickly, calcium in bone or other hard tissue must mineralise and surrounding sediment must harden to form rock.
- Usually animal/plant remains decay or are scavenged or destroyed by erosion.

- A fossil forms in the following steps:

1. DEATH

2. **BURIAL AND PRESERVATION**: the organism can only become a fossil if it is covered over by sediments quickly. The soft body parts decay and rot very soon after death, carried out by bacteria and scavengers. The hard body parts such as bones are all that remains. Limestone and clays are the best rock types for preserving fossils.

3. **COMPACTION AND REPLACEMENT:** over time, the body is buried under more and more layers of sediments. Hard body parts such as bone and teeth are replaced by new minerals such as calcite or quartz or pyrite, known as **PETRIFICATION**. The weight of the rocks above will compact the sediments further.

4. **UPLIFT**: in time, the rocks become pushed up to form a mountain such.

5. **EROSION AND EXPOSURE**: after many millions of years, the rocks may become worn down enough to reveal the fossil at the surface. The best places to find fossils is where the rocks have recently been lifted up or exposed (cliffs, quarries or road cuttings).

Modes of Fossilisation

- ORIGINAL PRESERVATION is where the more durable parts of some organisms as old as 70 million years have been preserved in their original appearance and composition.
- Petrification is the conversion to stone by **PERMINERALISATION** the filling of pores by mineral matter dissolved in groundwater.
- **REPLACEMENT** is the substitution of mineral mater from the groundwater for the original organic matter. Every detail of the surface is preserved Making a 'false' replica or **PSEUDOMORPH**
- CARRENATEON or DISTILLATION She loss of volatile elements of the organism and the concentration of carbon which outlines the original form of the organism.
- MOULD is when an organic structure embedded in a rock later disappears and an empty space having the exact shape of the object is formed. A thin mould, such as a leaf, is called an IMPRINT.
- If a natural mould is later filled with mineral matter, a CAST is produced.

Cast Fossil



 Shells dissolved and became pith casts.





 Shells were replaced by organic substances or the pith casts were filled up



- HOMOLOGOUS STRUCTURES (structural similarities) between different species suggest relatedness. This implies that the homologous structures are evidence for similar genes which have been inherited from a common ancestor, such as a pentadactyl limb.



- Some species have body parts that they do not use called **VESTIGIAL ORGANS**.
- Scientists believe that organisms with vestigial structures are related to those that have the structure developed or functional.
- For example, snakes have vestigial legs relating them to lizards. Whales have vestigial legs relating them to mammals. Humans have a vestigial appendix from when they ate a diet containing greater amount of plant material.

- **GENETIC DRIFT** is the change in the frequency of an allele in a population due to random sampling of organisms. The alleles in the offspring are a sample of those in the parents, and chance has a role in determining whether a given individual survives and reproduces.
- MACROEVOLUTION is a term used to describe the emergence of a new species as a result of micro-evolutionary change and separated gene pools.
- For example, the population of Finches on the Galapagos Islands demonstrates macroevolution. There are 13 different species, each of which is adapted to the particular environment in which it lives.
- It is believed that these species originated from an ancestral type a smallish, ground-dwelling bird, with a cone-shaped beak adapted for crushing seeds.
- Macroevolution leads to speciation.
- Due to competition, these original ancestral types would spread out. This would result in the occupation of a variety of environments. Those finches with variations most suited to the new environment would survive to reproduce maturity, hence passing on the different and successful variation to the offspring.
- These gradual changes would continue to occur over a long period of time, resulting in the development of new species derived initially from the original ancestral type.
- These species would have fundamental differences such that when placed with other species, also related to the common ancestral type, they would not interbreed.
- This forms the basis of **NATURAL SELECTION**, where living spormens are related and come from a common ancestor, species change overtile, preces over reproduce (more young are born than can survive to reproductive maturity), there will be variation among individuals, with some variations being better suited to be environment that others, there will be competition among offspring for resources and the individual that have favourable variations will be able to survive and hence reach reproductive maturity. These favourable characteristics will then be passed on from generation to generation.

Speciation

- **SPECIATION** is the formation of new and distinct species in the course of evolution.
- Speciation involves the splitting of a single evolutionary lineage into two or more genetically independent ones.
- In eukaryotic species there are two important processes that occur during speciation:
 - 1. The splitting up of one gene pool into two or more separated gene pools (genetic separation).
 - 2. The diversification of one phenotypic form into many (phenotypic differentiation).
- Many hypotheses are given for the start of this process, mainly differing in the role of geographic isolation and the origin of reproductive isolation.
- Selective pressures may act on two populations (light, dissolved oxygen, current).

- Modern humans vary in skin colour, hair colour and eye colour.



- **DIVERGENT EVOLUTION** is the evolution of different forms in the same lineage when exposed to different selective pressures.
- It is the accumulation of differences between groups which can lead to the formation of new species, usually a result of diffusion of the same species to different and io atel environments which blocks the gene flow among the distinct populations arowing differentiated fixation of characteristics through genetic drift and natural selection.

