- Adults live on land and have lungs
- Reptiles
  - Scaly skin
  - Lay waterproof & scaly shelled eggs
  - (Limbs)
- Birds
  - Have feathers
  - Forelimbs become wings
  - Lay hard shell eggs
  - Endothermic
  - Have a beak
  - Heart has four chambers
- Mammals
  - Have hair
  - Have a placenta
  - Have mammary glands to feed young
  - Endothermic
  - Have a diaphragm
  - Heart has four chambers
  - Have four types of teeth
  - External eggs

Phylum Arthropods

- Several pairs of jointed legs
- Waterproof exoskeleton
- Insects
  - Three pairs of legs
  - Two pairs of wings
  - Breathe through tracheae
  - Three body segments: head, thorax and abdomen
- Crustaceans
  - > 4 pairs of legs
  - Breathe through gills
  - Antennae
- Arachnids
  - 4 pairs of legs
  - Breathe through gills called book lungs
  - 2 body segments: head & thorax
  - No antenna
- Myriapods
  - Many body segments
  - Tracheae
  - Each segment has legs

Ch9 Transport in animals

Double circulatory system

- Blood passes through the heart twice
- In one complete circuit
- Pulmonary system + systemic system
- Adv
  - Raise pressure / flow rate of oxygenated blood before sending it off to the rest of the body
  - Allows different pressure in different loops
  - Prevents mixing of oxygenated and deoxygenated blood
  - Higher metabolic rate
  - Allows animals to be large
- Dis
  - High energy cost

Reasons for difference in thickness of walls

- Ventricles vs atria
  - Ventricles need to pump blood out of the heart
  - Atria only need to receive blood
  - Thicker walls in ventricles
- Left vs right ventricle
  - Right ventricle only pumps blood to the lungs, close to the heart
  - Left ventricle pumps blood all around the body
  - Require high pressure to overcome resistance
  - Thicker walls in left ventricle to contain more cardiac muscle

Factors of CHD

- Smoking cigarettes: cigarette contains nicotine
- Diet: high in salt, saturated fat, cholesterol
- Obesity
- Stress
- Genes

Treatment of CHD

- Statin to reduce cholesterol levels in blood
- Aspirin to reduce the risk of blood clots forming inside blood vessels
- Coronary bypass operation: damaged coronary artery replaced with a length of blood vessel from another part of the body
- Stent, a mesh tube to keep it open
- Angioplasty: tiny balloon inflated by water to push artery open
- Heart transplant: risk of rejection

Heart beat rate

Ch11 Respiration

Requirement of energy
- Muscle contraction for movement
- Anabolic reaction e.g. protein synthesis
- Cell division to repair and grow
- Active transport
- Transmit nerve impulses
- Sensitivity
- Generate heat for thermal homeostasis
- (transport in phloem)

Anaerobic respiration
- Yeast and plants
  - $C_6H_{12}O_6$ ----> $2C_2H_5OH + 2CO_2$
- Animals
  - $C_6H_{12}O_6$ ----> $2C_3H_6O_3$

Aerobic respiration	Anaerobic respiration
Uses O_2	Does not use O_2
No alcohol / lactic acid	Alcohol in yeasts & plants, lactic acid in muscles
Large amount of energy released	Much less amount of energy released
CO_2 made	CO_2 made only in yeasts and plants

Adaptation of nose to breathing
- Nasal cavity is separated from oral cavity by palate to allow breathing during eating
- Nasal hairs in nostrils trap dust particles in the air
- On surface of turbinal bones
  - Goblet cells secrete mucus containing water and mucus to moisten and warm air
  - Cilia move mucus to the back of the throat

Adaptation of trachea to breathing
- Supported by C-shaped cartilages
  - To prevent collapsing
  - To keep it open to allow free flow of air
  - To give it flexibility
- Goblet cells and ciliated cells also present
- At top
  - Epiglottis closes trachea when bolus touches palates and is about to be swallowed
  - Larynx containing vocal cords make sounds

Adaptation of alveoli to gas exchange
- Thin walls to allow fast diffusion of O_2 molecules to blood

Ch13 Coordination and Response

Stimuli

- Changes in an organism's environment
- Sensed by receptor cells

Coordination

- The way in which receptors pick up stimuli
- Then pass information on to effectors to respond

Adaptation of neurones

- Axon: stretch out from the cell body to carry messages very quickly
- Dendrites: to pick up electrical signals from other neurones
- Myelin: insulate nerve fibres so nerve fibres carry impulses much faster

Involuntary actions / reflex action

- Automatic
- Fast
- Unconscious
- Innate / not learnt
- Conscious region of the brain not involved
- Stimulus always leads to the same response
- Very quick so fast response

Travel of nerve impulses

- At a synapse: junction between two neurones
- Nerve impulses in presynaptic neurone arrives at nerve ending
- Ca^{2+} transporter opens and Ca^{2+} flows in cytoplasm
- Vesicles containing neurotransmitters move to synaptic cleft
- Vesicles fuse with cell membrane and release the contents by exocytosis
- Neurotransmitters diffuse through the cleft and bind to receptor molecules, complementary shape
- Triggers action potential at dendrites of postsynaptic neurone
- Nerve impulses in postsynaptic neurone

Sensory organs

- Groups of receptor cells
- Responding to specific stimuli
- Mechano-: mechanical pain
- Thigmo-: touch
- Thermo-: heat / temperature
- Hydro-: water
- Chemo-: chemicals
- Photo-: light

- Binds to opioid receptors causing increased release of dopamine
- Addiction due to the euphoria feeling, so withdrawal symptoms will develop if not taking it
  - Sleeplessness / insomnia
  - Fatigue
  - Hallucination
  - Muscle cramp
  - Nausea
  - Vomiting
  - Aggression
  - Rapid heart rate
- Depressant
  - Slows down brain functions
    - Increase reaction time
    - Reduce self control
    - Reduces pain and breathing
- Social problems
  - Addicted people lose the ability to be part of normal society
  - Unemployed
  - Criminal activities in order to obtain money to buy their next dose
  - Spread of pathogens e.g. HIV by needle sharing

Alcohol

- Depressant
  - Slows down nerve impulses
  - Lengthens reaction time, so may cause more traffic accidents
- Short-term effects
  - Blurred vision
  - Increase aggression
  - Unconsciousness, coma
  - Vomiting while unconscious, causing suffocation
  - Reduce self-control
- Long-term effects
  - Addiction: alcoholism
  - Cirrhosis: damage to liver as fibres grow in the liver
  - Damage brain functions by osmotic water loss
    - Loss of memory
    - Confusion
    - Inhibits ADH secretion, a lot of dilute urine produced, dehydration
  - Cancer in tongue and oesophagus
  - Irritated intestines, causing indigestion, nausea, diarrhoea and ulcers

Anabolic steroids

- Hormones e.g. testosterone, oestrogen and progesterone
- Stimulate proteins synthesis, therefore muscle development

delivered wrongly	away and lost
Often have nectaries at the base of petals	No nectaries

Adv of self pollination (from the same flower, or same plant)

- High chance of pollination / fertilisation --> fast growth of population
- No need for agent of pollination
- Little wastage of pollen
- Little variation --> maintain advantageous features --> all plants adapt to the same environment
- Useful if plants are isolated
- Mutation will be the only source of variation
- Mutation has a low chance to be expressed

Adv of cross pollination (different plants of the same species)

- Lower competition, colonise new areas as seeds can be dispersed away
- More genetic variation --> easy to evolve and adapt to changing conditions --> can have disease / pest resistant genes --> some of the population may survive from diseases / pests
- Less chance of inherited disease
- Reduce chance of extinction
- Seeds can be dormant and survive through harsh conditions

Plant fertilisation

- Pollen grain lands on stigma and begins to grow a tube
- Pollen tube grows down the style
- It moves down towards the ovule and secretes enzymes to digest a pathway through the style
- Pollen tube grows through the micropyle, a hole surrounded by integuments, into the ovule inside ovary
- Pollen nucleus enters the ovule and fuses with ovule nucleus a.k.a. fertilisation to form a zygote

Seeds

- Zygote --> embryo
- Integuments of ovule --> testa, it is hard to stop damage and entry of pathogens
- Placenta (join to the ovary) --> hilum
- Radicle to grow into a root
- Plummule to grow into a shoot
- Cotyledons contain starch and protein
- Water drawn out to be dormant to survive harsh conditions e.g. cold & drought
- Germination
  - Water enters, seed swells, bursts the testa
  - Amylase and protease started working

Ch17 Reproduction in human

Male reproductive system

- Testes: make sperm(atozoa)
- Scrotum: surrounds testes outside the body, lower temperature for sperm production
- Sperm duct / vas deferens: carry sperm from the testes to urethra
- Prostate gland: at where sperm ducts join the urethra, to make a fluid which sperm swim in

Sperm cell

- Acrosome: a vesicle containing enzymes to digest the jelly coat surrounding the egg cell
- Nucleus: contains the haploid nucleus
- Mitochondria: carry out aerobic respiration to release energy for swimming
- Flagellum: produce swimming movements

Human fertilisation and embryo development

- Ovulation
- The released egg is caught in the funnel-shaped opening of the oviduct (Fallopian tube)
- The funnel has cilia which waft the egg into oviduct
- Peristalsis to move the egg in the oviduct
- Sperm reaches the egg
  - Ejaculation: sperm are pushed out of penis into the vagina in semen
  - Sperm travel up through the cervix through the uterus and into the oviduct
- One sperm has its head enters the egg after acrosome digest the jelly coat, leaving tail outside
- Fertilisation: nuclei fuse to form zygote
- The egg membrane becomes impermeable / hardens, other sperm die
- Implantation
  - Fertilised zygote divides by mitosis to from an embryo, a ball of cells
  - The embryo reach the uterus and sinks into the endometrium
- Cell specialisation to increase complexity
- After 11 weeks of fertilisation, all organs are developed, embryo --> fetus
- Later development to increase size

Uterus

- Placenta
  - Connects the embryo to the uterus wall
  - Exchange substances between mother's and embryo's blood by diffusion
    - Wastes to mother's blood
    - Nutrients to fetus's blood
  - Wall of it separates fetus's blood and mother's blood
- Umbilical cord
  - Joins the fetus to the placenta
- Amniotic fluid surrounded by amniotic sac
  - Protects the embryo from mechanical damage by lubricating

- Supports it
- Maintains temperature
- Provides sterile environment
- Allows movement
- Swallow of certain nutrients in fluid

Ante-natal care

- Ca^{2+} in diet: to form the growing fetus's bones
- $Fe^{2/3+}$ in diet: produce a lot of extra Hb
- Extra carbohydrate: extra energy to move around heavier
- Extra protein: to form growing fetus's new cells
- No smoking
  - Nicotine & CO can enter the baby's blood
  - Increase risk of miscarriage
  - Cause the baby to grow more slowly
  - Lower birth weight
  - Fetus brain damage
  - Increased risk of lung infection in infants
  - Infants develop addiction
- No alcohol
- Vaccinated with rubella virus in puberty
  - Rubella can cross the placenta
  - Cause the baby to born with deaf or other disabilities

Birth

- Labour
  - Strong muscles in the uterus wall start to contract
  - Cervix dilates
  - Vaginal wall stretch
  - Amniotic sac breaks
  - Amniotic fluid releases
- Afterbirth
  - Placenta falls away from the uterus wall and passes out through the vagina
  - The umbilical cord is tied, cut and clamped and forms the baby's navel

Adv of breast feeding

- Contains antibody, passive immunity
- Creates bonding with mother
- No pathogens, less risk of infection
- Cheap
- Nutrient change with children development
- No preparation / convenient
- Easy to digest
- Less risk of allergic effect

- It doesn't degenerate so quickly
- Continues to secrete progesterone

Natural methods of birth control

- Abstinence: mentally ineffective
- Rhythm control
  - Predict menstrual cycle and avoid intercourse around ovulation, not reliable
  - Using body temperature monitoring & cervical mucus

Chemical methods

- Spermicide
  - Not always reliable
  - Easy to use
  - Need to be used in combination with barriers
- Sex hormones
  - Contains progesterone and oestrogen
  - Very effective
  - May forget to take it everyday
  - Side effects
- IUD (intrauterine device)
  - Coil in uterus prevents implantation
  - No protection against STI
- IUS (intrauterine system)
  - Slowly releases hormone to prevent implantation

Mechanical methods

- Condom
  - Thin rubber covering over penis to prevent sperm entering the vagina
  - Safe & easy
  - Prevent STI
- Femidom
  - Thin sheath lines the vagina to prevent entry of sperm
- Diaphragm / cap
  - Circular slightly domed piece of rubber inserted into the vagina and covers the cervix
  - To stop sperm enter

Surgical methods

- In man (vasectomy)
  - Sperm ducts are cut / tied
  - Stopping sperm from travelling from the testes to the penis
- In woman (female sterilisation)
  - Oviducts are cut / tied
  - Stopping eggs from travelling down the oviducts
- Effective

Ch20 Ecology

Ecology
- The study of the interaction
- Between living organisms
- And their environment

Population
- A group of organisms
- Of one species
- Living in the same area at the same time

Ecosystem
- All of the organisms
- And their environment
- Interacting together in a given area

Community
- All of the organisms
- Of different species
- In an ecosystem

Niche
- The role of an organism in an ecosystem

Producers
- Autotrophs
- Make own organic nutrients
- Carry out photosynthesis using energy from Sun
- / carry out chemosynthesis using energy from oxidation of chemicals

Consumers
- Heterotrophs
- Get its energy / nutrients by feeding on other organisms
- Herbivore
  - Get energy from plants
  - 1˚ consumer
- Carnivore
  - Get energy from other animals
  - Higher level consumers
- Omnivore
  - Get energy from both plants & animals