Heinemann
Biology 1 - Summary

ALSO refer to Heinemann Student Workbook for:
Essential knowledge summary.

UNIT 2
Area of Study 1 – Adaptations of organisms

On completion of this unit the student should be able to explain and analyse the relationship between environmental factors, and adaptations and distribution of living things.

CHAPTER 13 – Environmental factors and adaptations

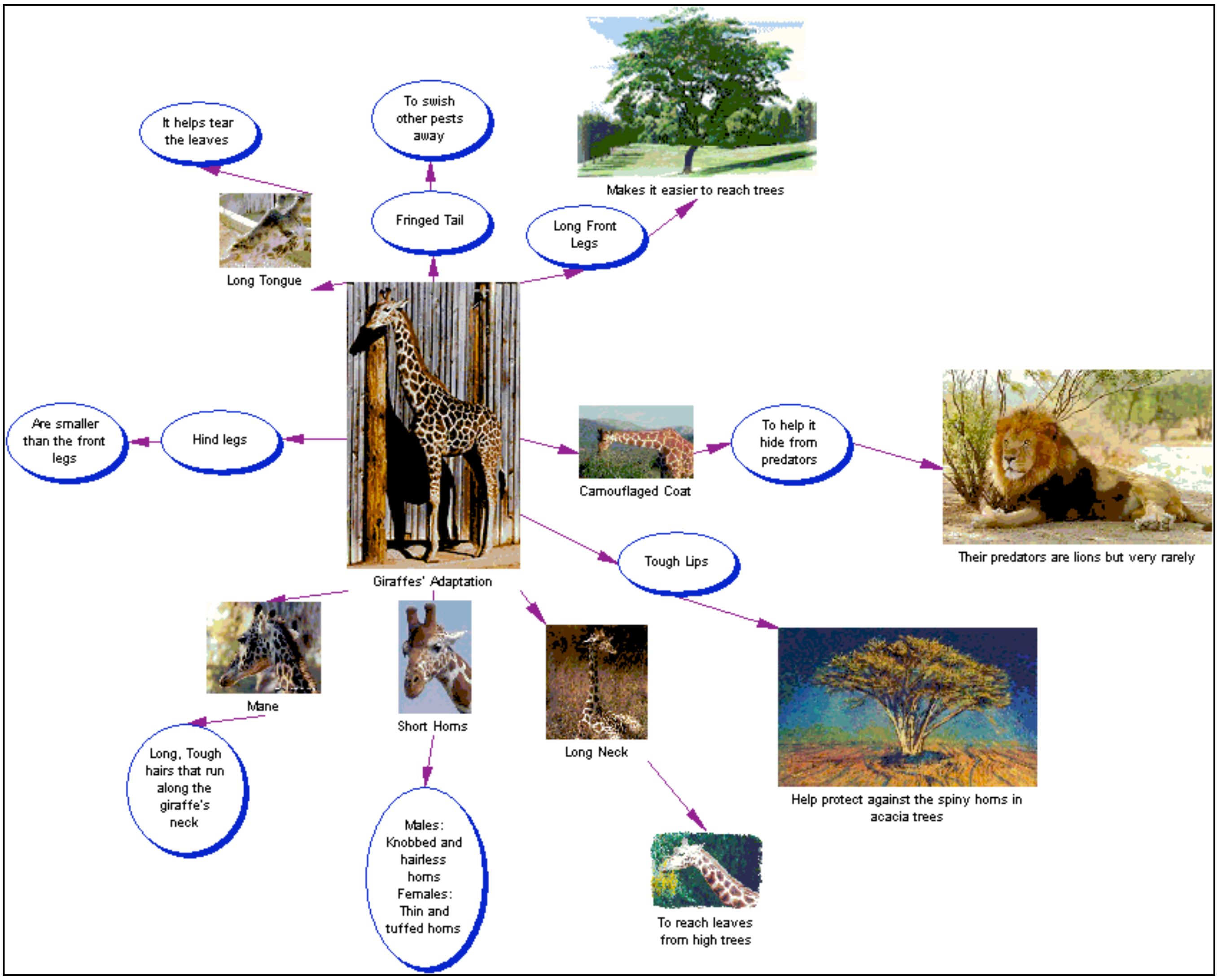
KEY KNOWLEDGE

- Environmental factors determine where organisms live
- Adaptations of organisms enable survival, reproduction, and use of resources
- Adaptations include structural, physiological and behavioural features

Challenge to survival

Organisms can only live in an environment which has conditions within its tolerance range.
The environment of an organism consists of abiotic (non-living) and biotic factors (living). A requirement in limited supply is called a limiting factor to the organisms survival. Distribution is where an organism lives.
Different organisms have different physiological, anatomical and behavioural adaptations (inherited characteristic) that enable them to survive.
Adaptation (evolutionary) different to 'adapt' (individual organism acclimatise).

Adaptations can be structural (eg. shell on turtle), physiological (eg. Sweating) or behavioural (eg. Fly south for the winter).

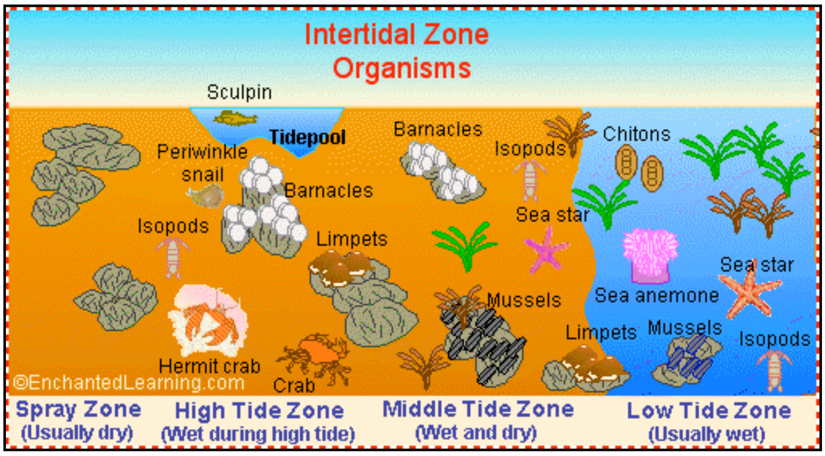


QUESTIONS 1,3 p.245

<u>Living in water</u>

Abiotic factors: pH, Temperature (colder deeper), Light (darker and bluer deeper).
Organisms show adaptations to suit conditions.
Hydrophyte is a plant that grows in or on water.
Seashore is a good example of the adaptations organisms have made and the abiotic factors that limit and organisms distribution.

- Subtidal, intertidal, spray zone, supratidal zone.



Mangroves show adaptations to their environment.

- Aerial roots to get oxygen

QUESTIONS 4a,5,7 p.251

Living in extreme terrestrial environments

Animals:

To survive in deserts animals need to regulate body temperature, water and salt balance.

- Reptiles show behavioural adaptations to regulate body temperature.
- Some animals go into torpor (inactive or dormant) or hibernation to wait out the tough times.
- Hibernation is an extended torpor triggered by things like food scarcity.

Plants:

Xerophytes is a plant that grows in hot dry environments. They show many adaptations to their arid environment.

- Thick cuticle (waxy layer) and hairs reduce water loss.
- Fewer stomata to reduce water loss.
- Lower leaf surface area and orient leaves away from direct sunlight.
- Halophyte: salt loving plants regulate water loss and salt accumulation.

QUESTIONS 8, 9, 10 p.258

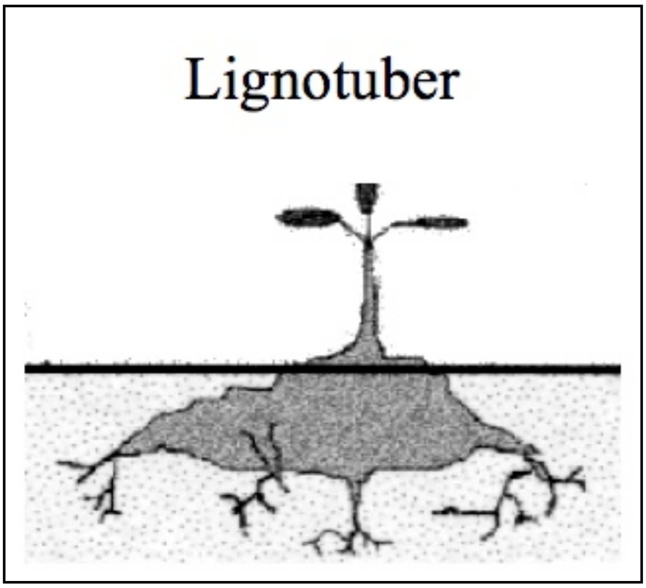
Surviving a major disturbance

Fire:

Leaves burn but the outer bark acts as insulation protecting the cambium layer that produces regenerative growth and the epicormic buds which allow sprouting and regrowth.

Lignotubers – subterranean buds which regenerate when the aerial parts of a plant die.

Some plants produce hard seeds that only crack open when there is a fire.



QUESTIONS 12-14 p.260

CHAPTER REVIEW QUESTIONS 1-13 p.261

CHAPTER 14 – Plant tropisms and hormonal control

KEY KNOWLEDGE

- Regulation in plants
- Hormonal pathways
- Environmental Cues

Environmental Cues

Plants grow wherever the seed germinates and they have evolved to deal with the varying environmental conditions they experience. The environment also provides many cues to a plants growth and development.

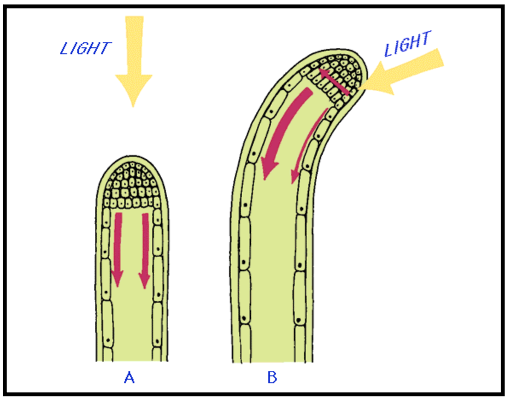
Hormones

Plants use hormones to send messages, however, they don't have many hormones and they are not as highly specific as animal hormones. Plants don't have endocrine glands and hormones are produced by cells receiving environmental stimuli.
If the direction of a growth response is related to the direction the stimulus came from it is called a **tropism**. Hormones are responsible for many tropisms:

- Phototropism: growth in response to light
- Geotropism: growth in response to gravity.
- Apical dominance: one stem grows big and strong and up (trunk).

Auxins

Responsible for phototropism as it causes cells furthest from the light source to elongate resulting in shoot tip bending.
Auxin also responsible for geotropism, root grow down and negative geotropism, stems growing away from gravity ie. Up.
Apical dominance also caused by auxin.



Gibberellins

Promote cell elongation and the growth of the entire plant.

Cytokinins

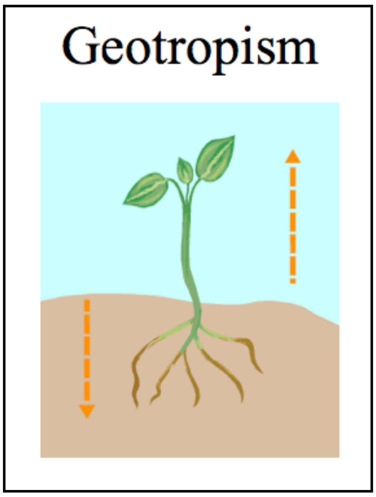
With auxin responsible for cell division and cell differentiation. More cytokinin than auxin – stems and leaves grow. More auxin than cytokinin roots grow.

Abscisic Acid

Growth-inhibiting hormone responsible for the dropping of fruit and leaves. Also controls stomatal opening and closing.

Ethylene (gas)

Results in fruit ripening, increase cellular respiration, converts starch and oil into sugar.



QUESTIONS 1,2,4 p.268

Responding to the environment

Plants respond to physical and chemical factors in their environment such as:

- Light: Phototropism (plants grow towards light), Photoperiod (Length of Day/Night) affects flowering – some plants need long days others need long nights.
- Gravity: Shoots are negatively geotropic, Roots are positively geotropic.
- Touch: Thigmotropism is growth that occurs as a result of contact. Eg. Vines coiling around things.
- Movements and plant rhythms:
    - Sleep movements: Flower petals close at night, Stomata close at night. Results from turgor (amount of liquid) in cells.
    - Solar tracking: Leaves follow light.
    - Nodding in seedlings to help shoot get to surface.
    - Contractile movements to get bulb into deeper soil.
    - Rapid response: Some carnivorous plants are capable of rapid movements in response to touch.
- Temperature: affects enzymes and plants have an optimal temperature range.
    - Seed dormancy: Seeds are triggered to germinate in spring after winter/a period of expose to the cold (vernalisation).
    - Bud dormancy: Some plants become dormant over winter.

Thigmotropism

QUESTIONS 5,6,7,9 p.275

CHAPTER REVIEW QUESTIONS 1-15 p.276

CHAPTER 15 – Regulatory mechanisms in animals

KEY KNOWLEDGE

- Regulation of cells, tissues and organ systems by hormonal and nervous mechanisms
- Hormones: intercellular messengers that modify the activity of specific receptor cells
- The nervous system allows for rapid responses
- Neurons: excitable cells that conduct impulses along their axon membranes

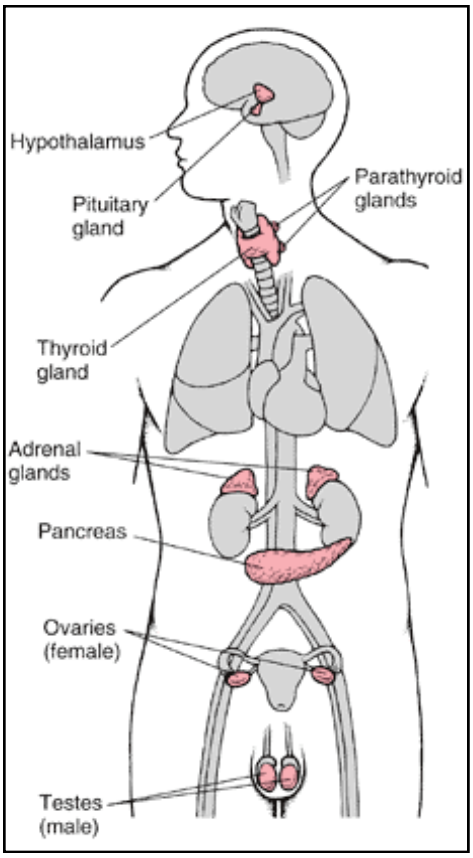
Regulatory pathways

Animals coordinate the activities of their cells, and respond to outside stimuli using both their nervous and endocrine (hormonal) systems.
Responses often occur to achieve homeostasis – a stable internal environment.
Negative feedback systems are stimulus-response models
(STIMULUS→Receptor→Control Centre→Effector→RESPONSE)
that result in the reduction of the effect of the stimulus.

QUESTIONS 1,2 p.279

Hormonal Pathways

Hormones are produced in one part of an organism, then they travel in the internal transport system to transmit their signal to target cells which have a specific receptor.
Hormones are highly specific and are only released when there is a particular stimulus and only target very specific cells.
Hormones are generally slower than nervous system response as they travel to their target organs in the bloodstream.



Types of Hormones

- Fat based: synthesised from fatty acids which are small and lipid-soluble and can therefore pass through the plasma membrane.
- Protein based: synthesised from amino acids are water-soluble so can't pass through the plasma membrane.

Endocrine Glands

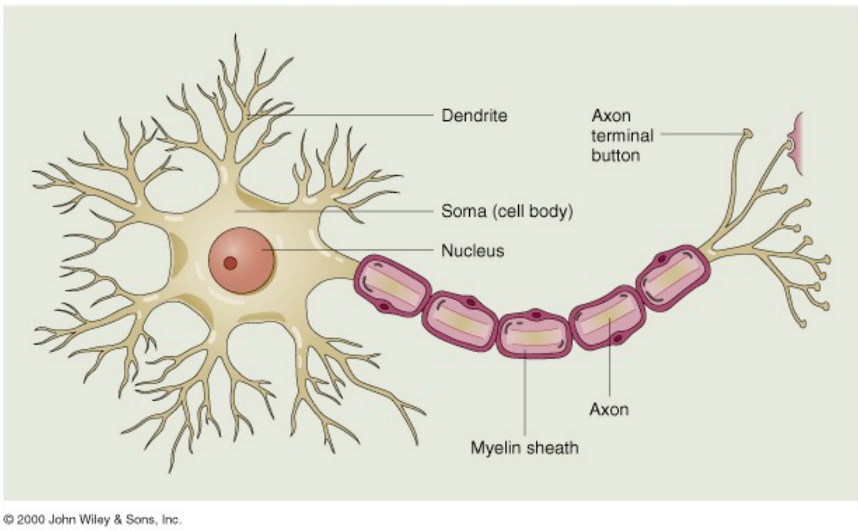
Pituitary, Thyroid, Adrenal, Ovaries, Testes.
Pituitary gland although small is involved in about half of all hormone activity in mammals.

QUESTIONS 3-5 p.284

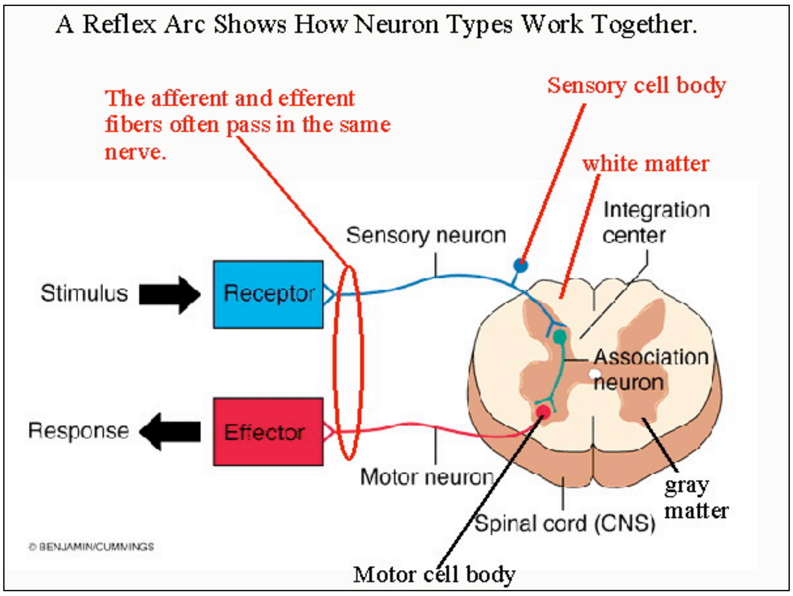
Nervous Systems

Nervous system is composed of neurons which send electrical messages to specific effector cells via other neurons. Dendrites collect message, which then passes along axon and is passed on from axon terminals. Axon insulated by myelin sheath.

Nervous responses are very quick however they require more energy than hormonal responses.



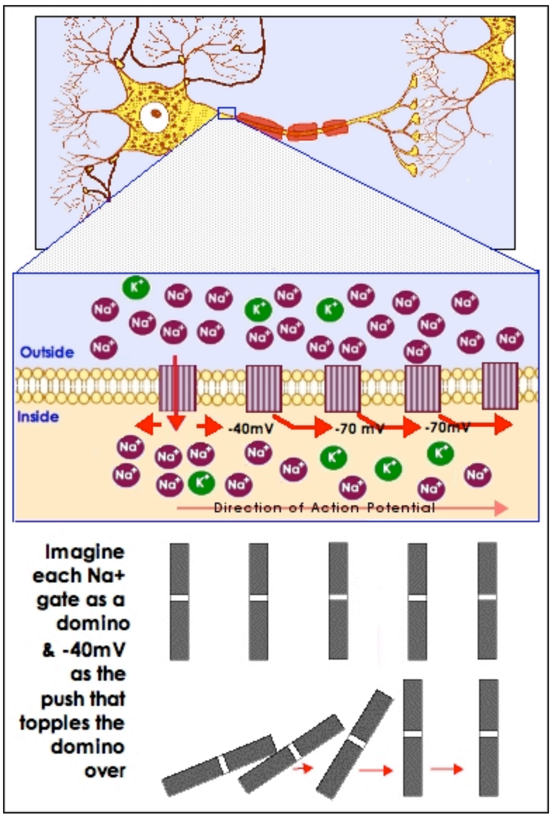
In mammals the nervous system can be broken into 2 parts the central nervous system (CNS) composed of the brain and spinal cord, and the peripheral nervous system (PNS) which encompasses the rest of the neurons in the body.



<u>Reflex responses</u>
Reflexes are very quick, unconscious, and automatic responses to stimuli.

Generally involves a sensory neuron which receives the stimulus, an interneuron which passes the message on to, a motor neuron which generates a response from a muscle.
Many reflex actions are very complicated and involve a number of neural pathways to achieve the desired response.

<u>Human Nervous System</u>
CNS: Spinal Cord & Brain (includes parts such as cerebral cortex, hypothalamus, cerebellum & brainstem).
PNS: sensory neurons, motor neurons which can be somatic (voluntary) or autonomic (involuntary).
Autonomic nervous system: Unconscious responses. Can be split into the sympathetic division which generally increases energy use, and the parasympathetic division which works to conserve energy. Third part of Autonomic nervous system is the enteric nervous system which controls the functions of the gut.



<u>Major Sense Organs</u>
Vision: Photoreceptors collect light information.
Hearing: Sound waves detected by mechanoreceptors.
Taste and Smell: Chemoreceptors detect the different chemicals in food and the air.

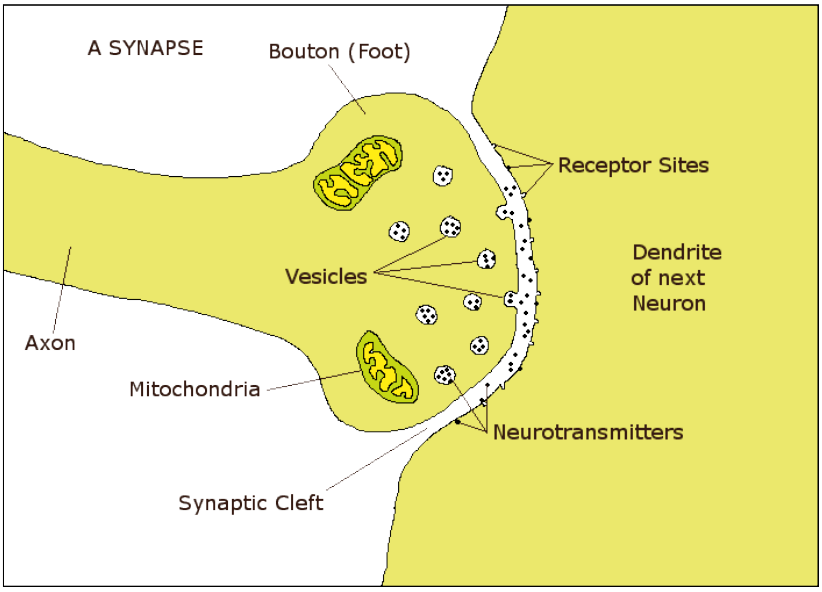
<u>Functioning Neurons</u>
In the body neurons are bundled together to form a nerve.
Neurons send messages electrically. To do this they need to:

1. Generate an impulse (action potential) via sensory neurons.

Stimulation of sensory neurons causes them to become slightly more negative (depolarised) if this is big enough an action potential is generated.

2. Conduct the impulse along the axon.
Na^+ and K^+ ions flow into and out of the neuron through protein channels in a wave along the axon.

3. Transmit the signal across synapses.
When the action potential arrives at the axon terminal it triggers the release of vesicles containing neurotransmitters. These small molecules cross the small space between neurons (synapse) to bind to specific receptors to continue the message.



QUESTIONS 7-15 p.296
CHAPTER REVIEW QUESTIONS 1-12 p.297

CHAPTER 16 – Temperature regulation and water balance

KEY KNOWLEDGE
- Strategies of temperature regulation in different animals
- Mechanisms involved in temperature regulation
- Water balance mechanisms in aquatic and terrestrial animals
- Links between water balance, salt balance, temperature regulation and excretion

Temperature and water balance in vascular plants
Temperature slightly regulated in that, for example, plants in hot environments have adapted to have small leaves which due to the lower SA:V absorb less heat.
Water balance controlled somewhat by the fact that evaporation drives transpiration and thus regulates the amount of water in a plant.

Body temperature in animals
- Ectothermic animals get heat from the environment.
- Endothermic animals generate and maintain their own heat.
- Herterothermic animals are basically ectotherms which sometimes behave as endotherms.

QUESTIONS 1-4 p.302

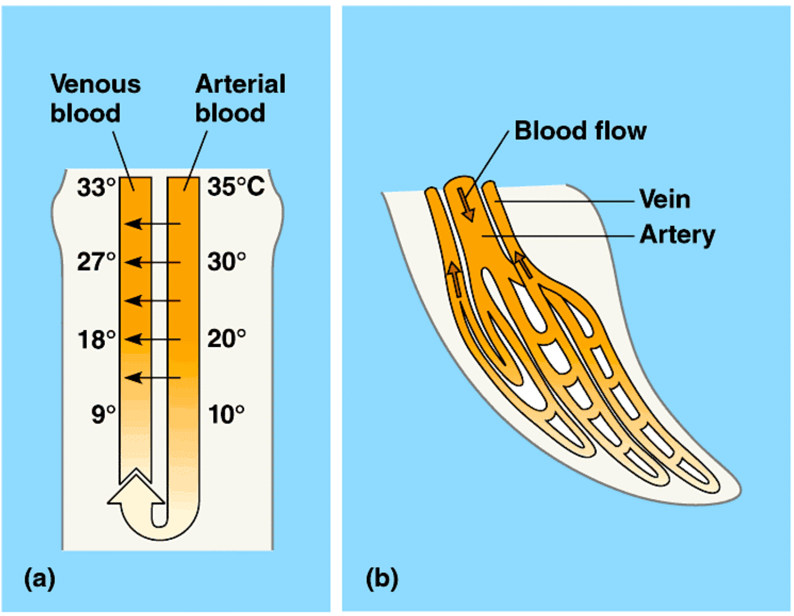
Temperature-regulating pathways
When the hypothalamus receives an abnormal (high or low) blood temperature stimulus it initiates a complex negative feedback response.
Skin temperature receptors can also trigger regulatory responses.

Regulatory responses
Too hot:

- Sweating & panting increase evaporation which cools animals down.
- Dilation of blood vessels in the skin.
- Get out of sun (humans take clothes off).
- Decrease metabolic heat production.

Too cold:

- Constriction of blood vessels in the skin.
- Insulation: fur, feathers, fat trap warm air near the skin. Can be increased by making hair stand on end (not great in humans – not enough hair).
- Counter current arrangement of blood vessels results in reduced heat loss.
- Penguins huddle together.
- Get into sun (humans put clothes on).
- Increase metabolic heat production: shiver.
- Increase cellular activity in brown fat.
- Hibernate to reduce metabolic demands.

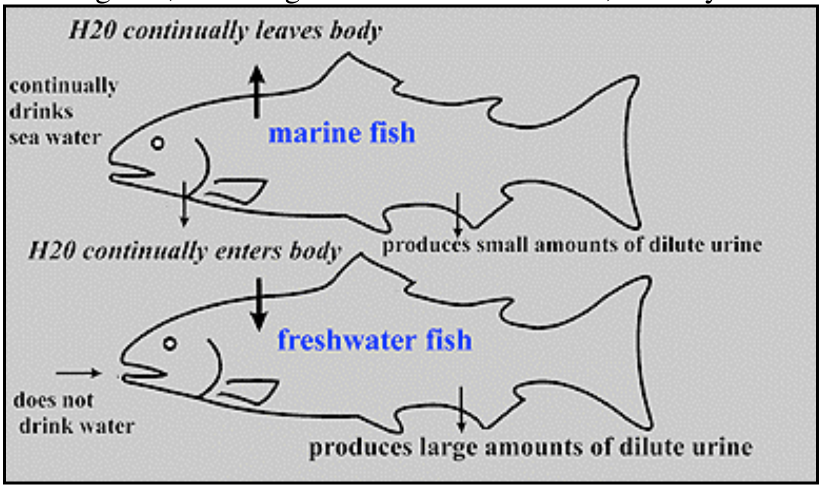


QUESTIONS 6-10 p.308

Water balance and salt levels
Water balance is necessary to control salt concentrations that need to stay in narrow limits.

Aquatic animals
Freshwater fish have adapted to losing salt (diffusion) and gaining water (osmosis) by rarely drinking water, excreting lots of dilute urine, actively absorbing salts.

Marine fish have adapted to gaining salt (diffusion) and losing water (osmosis) by drinking lots, excreting small amounts of urine, actively excreting salts.



Marine invertebrates and cartilaginous fishes (sharks & rays) maintain body fluids with an osmotic concentration nearly equal to that of seawater.

<u>Terrestrial animals</u>

Lose water by evaporation and during the removal of nitrogenous waste.
Water loss is regulated in the kidneys by the hormone ADH.
Excrete urea or uric acid. Concentrate urea in kidney before excreting.

QUESTIONS 11,12,14 p.315
CHAPTER REVIEW QUESTIONS 1-12 p.316

CHAPTER 17 – Animal behaviour

KEY KNOWLEDGE

- Adaptations of animals include behaviours, characteristics that increase the individual's chance of survival and reproduction.
- Animals forage or hunt for food, fight for resources, defend territories, raise offspring and live in social groups.
- Some behaviours are innate (instinctive) and others are learned.

<u>What is behaviour?</u>

Coordinated activities of an animal that are produced in response to stimuli. Behaviour can be individual (movement or physiological) or social (interacting with others). Natural selection had resulted in patterns of behaviour that increase survival.

<u>Innate behaviour</u>

Innate behaviour is NOT learned. These behaviours occur in response to specific stimuli called releasers (or sign stimuli).

QUESTIONS 1,2,3,5 p.322

Learning

Learning is the modification of a behaviour based on previous experience – it requires memory.

- Imprinting: learn about a particular stimulus during a certain stage of development.
- Habituation: Gradual reduction of a response (usually innate) as an animal becomes accustomed to it.
- Associative learning: Associating a signal with an innate response to trigger the behaviour (also known as classical conditioning eg. Pavolv's dogs).
- Trial-and-error learning: Learning from your mistakes
- Observational learning: Watching and learning from others.
- Insight learning: Problem solving – requires complex brains.

QUESTIONS 6-10 p.325

Behaviour for maintenance

Behaviour patterns of animals enable them to maintain their well-being and survival.
- Rhythmic activities: Daily cycle of activity is known as a circadian rhythm.
- Movement: To get food etc.
- Feeding behaviour: Different in different animals.
- Avoiding being caught: Balance between feeding and not being food.
- Homeostatic behaviour: Keeping a stable internal environment – eg. Get out of sun.
- Grooming and Preening: Birds do it to remain aerodynamic.
- Home-building: Shelter etc.
- Territorial behaviour: reduce competition for resources.

QUESTIONS 11,12,14,16 p.330

Communication and living together
- Chemical communication by pheromones: mark territory, attract a mate, etc.
- Visual signals: peacock!
- Sounds as signals: human speech!
- Communication by touch: grooming others.
- Social behaviour: communication in groups and can involve Dominance.
- Culture: passing information from generation to generation.

QUESTIONS 17,19,20,21 p.335

CHAPTER REVIEW QUESTIONS 1-15 p.336

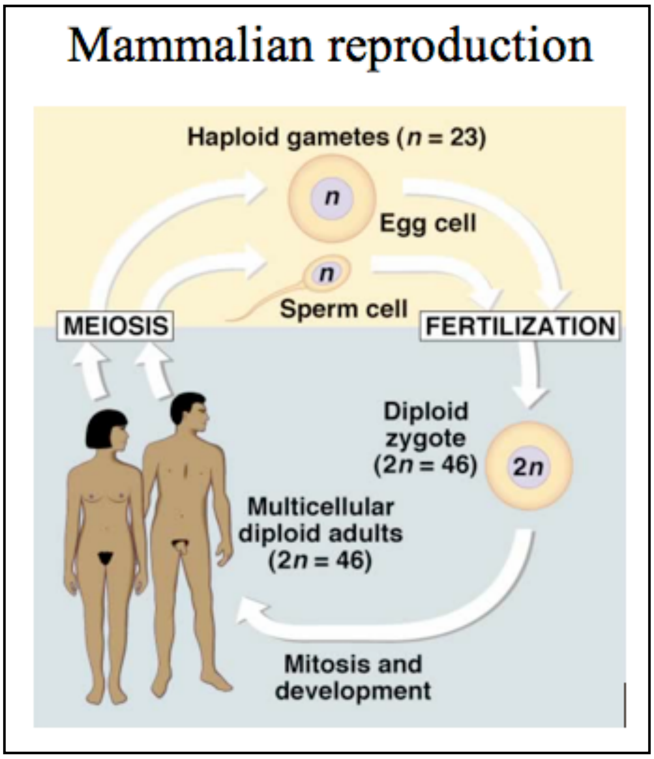
CHAPTER 18 – Life cycles and reproductive strategies

KEY KNOWLEDGE

- Plant and animal life cycles
- Strategies of reproduction in plants and animals
- Adaptations in reproductive systems
- Intervention in human reproduction

Reproductive strategies in animals

A diploid cell/organism has two sets (n) of genetic information, thus is 2n.
A haploid cell/organism has one set (n) of genetic information, thus is n.
Two haploid cells/gametes fuse to form a diploid organism.



Animals show a WIDE variety of different reproductive strategies!

- Fertilisation strategies:
    - Fertilisation can be external – some aquatic animals release millions of eggs and sperm into the same area of water.
    - Fertilisation can be internal – in land animals the male deposits sperm in the female reproductive tract.
- Provision of nutrients:
    - Indirect development: Newly formed tiny organism must feed to provide food for further growth and involves an intermediate free living larval form before adult for is reached via metamorphosis.
    - Direct development: Individual is hatched or born in essentially adult form. Birds, Us.
- Timing of reproduction:
    - External fertilisation is coordinated to occur at the same time in a region.
    - Timing of production of gametes and seasonal breeding (animals 'on heat').
    - Timing of implantation of blastocyst: can be delayed if a female falls pregnant too soon after giving birth.
- Reproductive behaviour: Physical appearances, courtship behaviour, dominant male. All about selecting a 'high-quality' mate – good genes.
- Protection of embryos and parental care.
    - Varies greatly from none (eg. Aquatic animals releasing gametes), to some (laying eggs in spots where there are no predators), to lots (mammals nourished by milk).

QUESTIONS 1-4,7 p.348

Intervening in Human Reproduction

In vitro fertilisation (IVF) – fertilisation occurs in the lab – success rates are LOW.

Prenatal testing

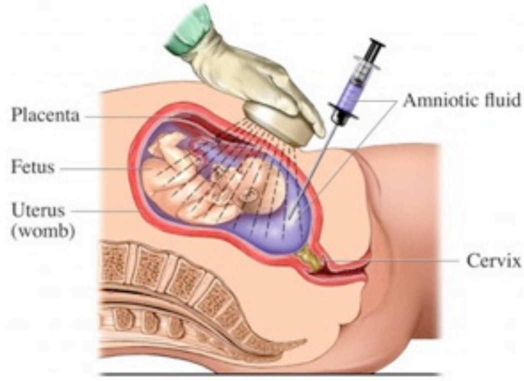
- Testing eggs – In humans meiosis produces 1 egg and other polar bodies. The polar bodies can be genetically tested.

- Test embryo – a cell (stem cell) can be removed from the blastocyst very early on before specialisation.
- Amniocentesis – remove fluid from around fetus and test skin cells in it.
- Chorionic villus sampling (CVS) – remove a small sample of fetal tissue to test.

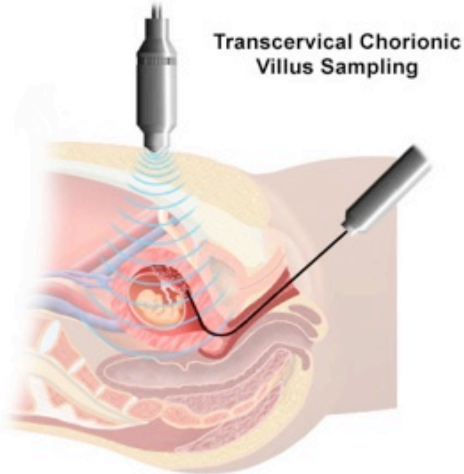
3D Ultrasound

2D Ultrasound

Amniocentesis



Chorionic Villus Sampling



- Ultrasound is a safe prenatal test – uses reflected sound waves. Eg. [Will Isaac]

Premature births – modern medicine can keep babies alive. Birth control also a form of intervention.

QUESTIONS 10 p.353

Reproductive strategies in plants

Plants use self-fertilisation (asexual reproduction), cross-fertilisation and no fertilisation.
Self fertilisation is good because you don't need a mate but bad as it reduces genetic variation – opposite true of cross-fertilisation.
Provision of resources to plant embryos is also variable.

QUESTIONS 13,14 p.356
CHAPTER REVIEW QUESTIONS 1-10 p.357

UNIT 2
Area of Study 2 – Dynamic ecosystems

On completion of this unit the student should be able to describe the finely balanced relationships of living organisms and their environment, which together form ecosystems. You should be able to design, conduct and report on a field investigation related to the interactions between living things and their environment and explain how ecosystems change over time.

<u>CHAPTER 19 – Living in an ecosystem</u>

KEY KNOWLEDGE

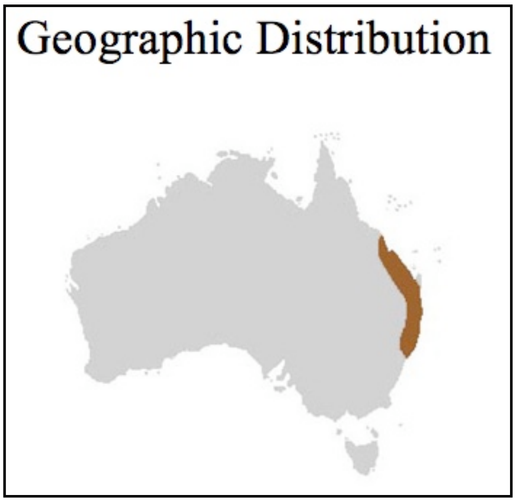
- Organisms live in biological communities, interacting with one another and their physical environment
- This network of complex and finely balanced relationships forms a self-sustaining ecological system (ecosystem), with inputs and outputs
- The global network of ecosystems constitutes the Earth's biosphere

<u>Living together</u>
Organisms interact with their biotic and abiotic environment.
A population is a group of organisms from one species
A community is an ecological grouping of different species that live together and interact. The richness of a community depends on the type of habitat.
An ecosystem is a community of organisms together with their physical surroundings.
The biosphere is the global ecosystem – composed of smaller ecosystems.
Ecosystems are self-sustaining!

QUESTIONS 1,3 p.369

<u>Places to live</u>
Geographic distribution is all the places where a species can be found.
Habitat is where an organism lives. A microhabitat is a local area within a habitat which has a slightly different environment.
A niche is the particular environment where a species is likely to persist indefinitely.

QUESTIONS 7,8 p.375



Naming ecosystems
Names based on abiotic environment: Marine, rock pool, Freshwater, lake.
Names based on the dominant organisms of the community: Oyster community, saltbush ecosystem.
Names based on the structure of the plant community: open-forest, grassland.
Biomes: A biome is a broad category defined on the basis of climate – rainforest, desert.

QUESTIONS 10,12 p.379

Studying ecosystems and communities
Quadrat is a square, rectangular or circular patch which is studied.

Transect is a line used to look at change along the line. Rock pool, sand dune, grassland, open-forest.

QUESTIONS 13,14,16 p.381
CHAPTER REVIEW QUESTIONS 1-10 p.382

CHAPTER 20 – A web of interactions

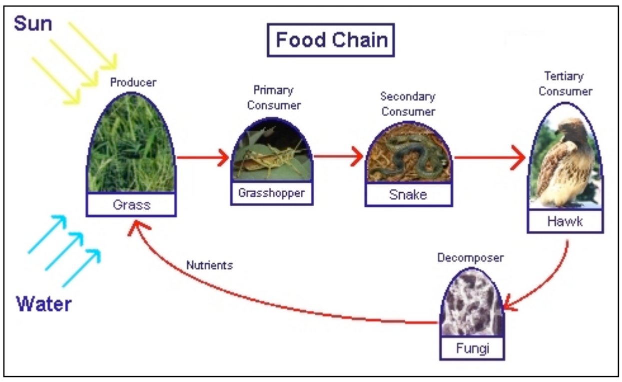
KEY KNOWLEDGE

- Living organisms are linked to each other through a variety of interrelationships, especially feeding relationships, which result in food webs in ecosystems
- Organisms of different species influence one another by being part of each other's environment. They compete with one another and may have close, symbiotic partnerships
- Relationships in ecosystems can be complex and finely balanced

Feeding relationships in ecosystems
The most important way that organisms need one another is for food, as a source of energy.

QUESTIONS 1,2 p.387

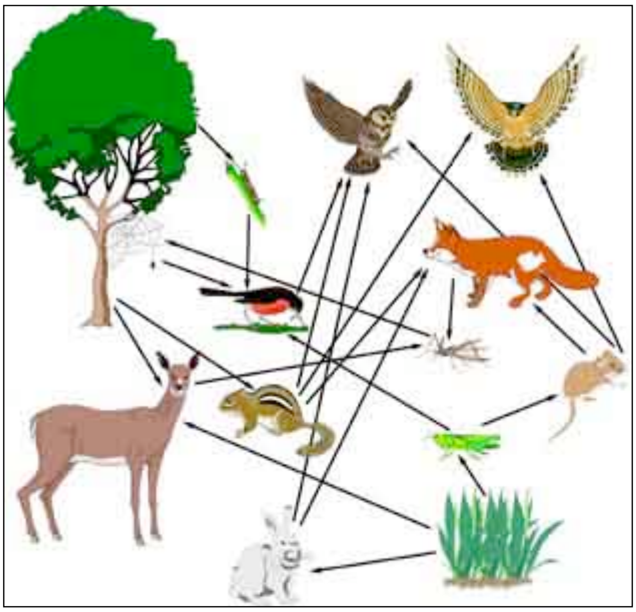
Food Chains – Who eats who?
The sequence of who eats who in an ecosystem is a food chain.
Producers are autotrophs (make their own food) and are the first link in a food chain.



All other organisms are heterotrophs so are called consumers.
Six + types of consumer:

- Herbivore – eats plants.
- Carnivores – eat other consumers (eat live prey are predators) and can be first-order, second-order, or third-order.
- Parasites – live and feed on other organisms causing them harm.
- Scavengers – consume dead animals.
- Detritivores – eat small particles of dead plant and animal matter that accumulates as detritus, they also eat waste products (faeces).
- Decomposers – consumers that break down dead material.

Different food chains exist involving different consumers.



QUESTIONS 4,5,8 p.391

Food webs and trophic levels →
Food webs are a series of food chains linked together.
Each feeding level in a food web is called a trophic level. Producer→1st Order Consumer→2nd Order Consumer etc.

QUESTIONS 9b,10,11 p.394

Competition between species
Inter-specific competition is a struggle between organisms of different species for the same resources and can limit a species distribution.

Interactions of the close kind
Symbiosis: When different species live together in a close partnership.
Mutualism: Symbiotic relationship where both organisms benefit.
Commensalism: Symbiotic relationship where one organism benefits but the other neither benefits or is harmed.
Parasitism: Symbiotic relationship where one organism benefits and the other is harmed.

Pollination by animals
Pollination of flowers by pollinators (animals) is not symbiosis as they don't live together.

QUESTIONS 12,14 p.401
CHAPTER REVIEW QUESTIONS 1-13 p.402

CHAPTER 21 – Movement of energy and matter in ecosystems

KEY KNOWLEDGE

- An ecosystem is an ecological system with inputs and outputs
- Energy flows into and out of the system one way, through food chains, while matter cycles between the non-living and living components
- Human activities, such as resource use and disposal of wastes, can alter the balance of the functioning of ecosystems at a local or global scale

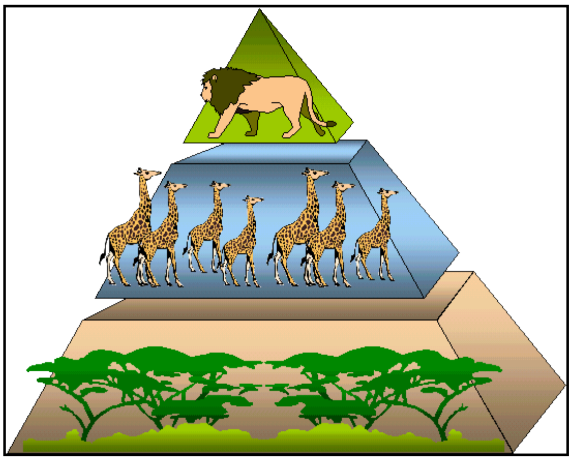
Dependence on energy transfer

All consumers (like us) depend on producers, most of whom get their energy from the sun.

The rate at which producers convert light energy to chemical energy as new plant growth is called **primary productivity**. Some of this is used up in cellular respiration but the rest forms the plants tissue – the rate of accumulation of tissue is called **net primary productivity**.

The amount of a plant that accumulates is called plant **biomass** (measured in dry weight g/m^2). Productivity is measured in g/m^2 per year.

QUESTIONS 1,2 p.407

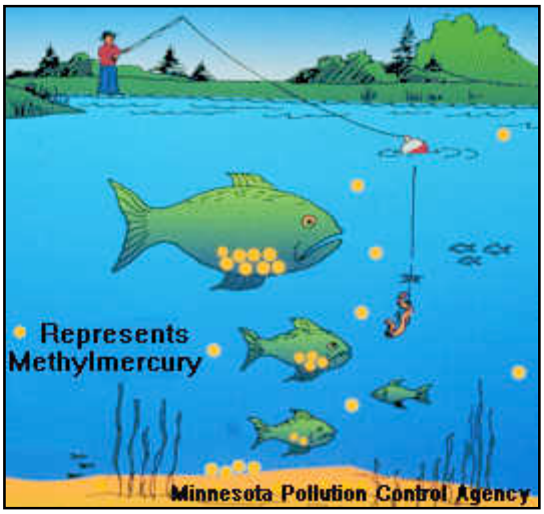


Decline of energy along food chains

With each transfer of energy along a food chain (producer → herbivore → carnivore) there is a decline in the amount of energy available as some is lost at each step.

Eg: only 10% of the plant a cow eats is converted into new tissue so when humans eat a cow they only have 10% of the energy of the original plant available to them and they only use a small portion of it again.

This can be shown using ecological pyramids and explains why food chains can only have 4-5 trophic levels.



Humans energy and food chains

Natural food chains can only support a world population of about 10-200 million people.

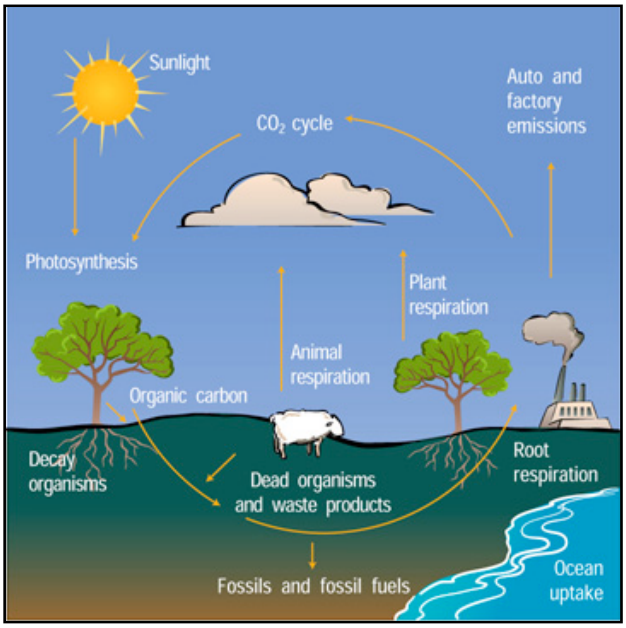
Agriculture and increasing primary productivity has enabled the population to dramatically increase (now 6000 million).

QUESTIONS 3-5 p.410

How matter moves through ecosystems
Matter also moves through food chains and a good example is the movement of toxins or poisons as they can accumulate up a food chain – called **bioaccumulation**.

QUESTIONS 7,8 p.414

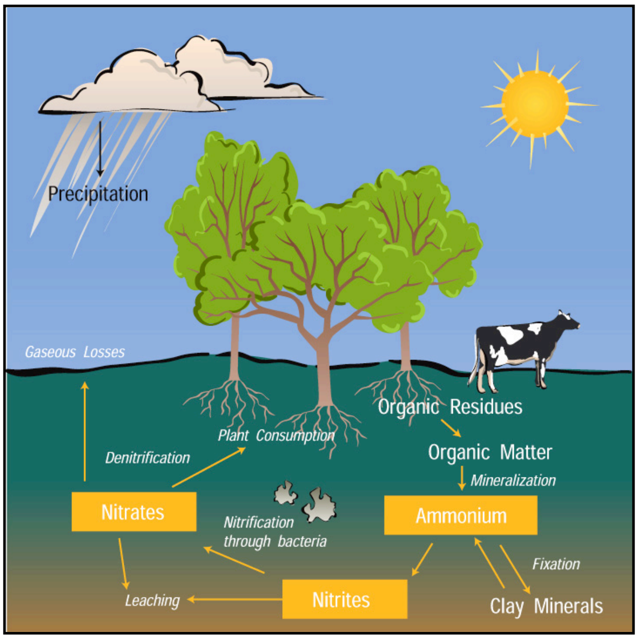
Recycling – new from old
Energy is continually lost from ecosystems as heat but it (energy) is constantly replaced by the sun. Nutrients and matter are not replaced and as such must be constantly recycled.



Biogeochemical cycles
Biogeochemical cycles refer to the movement of a chemical element within an ecosystem.

CARBON CYCLE
Since the industrial revolution the amount of CO_2 has increased has upset the carbon cycle and increased the greenhouse effect.

QUESTIONS 9,10,11 p.417



NITROGEN CYCLE
Nitrogen is needed for proteins. Nitrogen absorption is dependent on nitrogen fixation by bacteria:
$N_2 \rightarrow NH_3$ called ammonification
$NH_3 \rightarrow NO_2$ or NO_3 called nitrification
Other bacteria release nitrogen back into the air via denitrification.

Phosphorus is required in greater quantities in organisms but there is less of it on earth. The phosphorus cycle is very slow as it involves the weathering of rocks.

Water cycle: Evaporation, Transpiration, Rain, etc.

QUESTIONS 14,17,18 p.423
CHAPTER REVIEW QUESTIONS 1-15 p.424

CHAPTER 22 – Population dynamics

KEY KNOWLEDGE

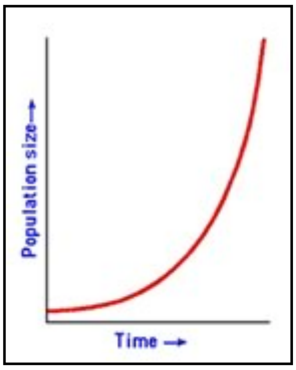
- An understanding of the dynamics of populations, and the factors that control their abundance and distribution, is essential to the management of natural populations as well as introduced pest species
- Populations will grow or decline depending on the birth and death rate, and the migration into and out of the population
- The size of a population will be a maximum at the carrying capacity of the environment when the limits of resources are reached

Managing populations

A population is a number of organisms of the same species that live in a defined geographical area. Populations of organisms can explode to huge numbers or decline to the point of extinction.
Populations and ecosystems have to be managed in a way that is sustainable.

The factors that determine the distribution and abundance of organisms are:

- The characteristics of the environment.
- The characteristics of the organism.
- The interactions between organisms.



QUESTIONS 1,2,3 p.430

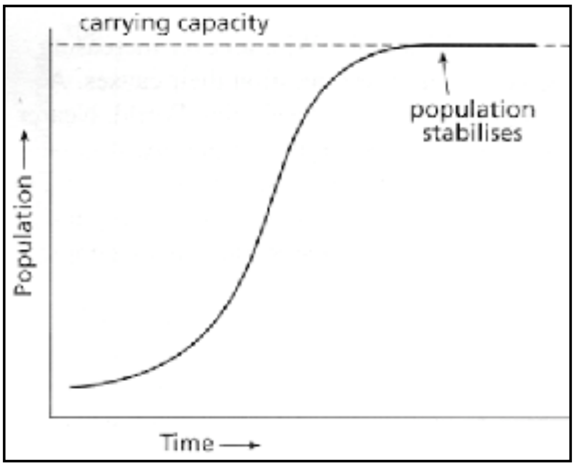
What determines the size of populations?

Size is affected by four factors: Birth, Death, Immigration & Emigration.
Population change = (birth - deaths) + (immigrants - emigrants)
The theoretical growth of a population which increases its numbers by the same amount every cycle is exponential.

Under the right conditions, some bacteria can divide once every 20 minutes. If there were no other factors involved, a single bacterium could divide 80 times in a day. This would lead to 2^{80} bacterial cells, that is 1,208,925,819,614,629,200,000,000 cells (~1.2×10^{24} cells).

All populations have the potential for exponential growth but fortunately they are all affected by a limiting factor Eg. Food.

Populations eventually reach a constant size called the carrying capacity of the ecosystem.
In the real world populations rarely fit these exact mathematical models.



Population explosions
Sometimes species undergo population explosions:

- Reproduction (many new offspring)
- Abiotic environment (lots of food)
- Predator control (lack of predators)
- Dispersal (spreading into new areas)

QUESTIONS 4,6,7 p.430

The introduction of a new species
Many introduced species become serious pests. Eg. Cane toad, rabbit.
Biological control (using natural predator or parasite) is the preferred method for pest control. Eg. Prickly pear controlled by a moth.
Biological control gone wrong – Cane toad – no predators in Australia – do ecological research first!!

QUESTIONS 8(pick 1 species), 9, 10 p.443
CHAPTER REVIEW QUESTIONS 1-15 p.444

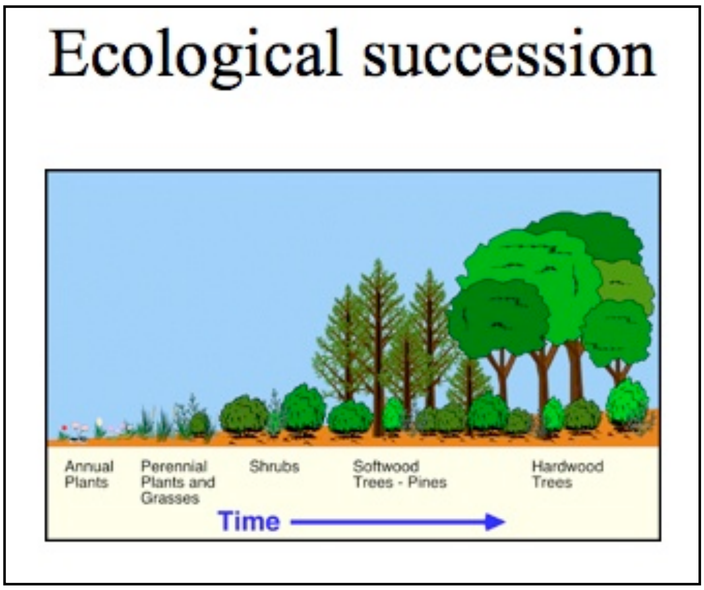
CHAPTER 23 – Change in ecosystems

KEY KNOWLEDGE

- Ecosystems are subject to natural change on a daily, seasonal and long-term scale
- Human activities, such as habitat destruction, resource use and waste disposal are also changing ecosystems. Human activities affect not only individual species but the functioning of whole ecosystems
- Impacts can be felt at a local or global scale

The nature of change in ecosystems
Ecosystems change all the time – high tide/low tide, warm/cold, wet/dry, flood/drought.
Many changes are cyclical eg. Light/dark, summer/autumn/winter/spring.
These changes affect the organisms that live in them. Eg. Migration.

QUESTIONS 1,2,3 p.450



Succession
Succession is the orderly sequences of change in an ecosystem, in which one

biological community is gradually replaced by another as the environment changes. Eutrophication is an example of succession where an aquatic system changes from one that is less fertile to one that is richer in nutrients. Another example is the gradual conversion of a pond to a scrub-land.

- Primary succession commences with the colonisation of a bare area, previously un-colonised.
- Secondary succession follows disturbance (like deforestation) of an existing biological community.

After a long period of succession a community may become a climax community where the composition is relatively stable and natural change is unlikely as long as environmental conditions remain the same. Rarely if ever occurs due to fires, floods etc.

QUESTIONS 5,6,9 p.454

Human activity
Aboriginals had an affect on the Australian ecosystem (fire-stick farming) but nowhere near as great as European settlement (land clearing, urbanisation etc.)!

QUESTIONS 11 p.458

Human activity and sustainability of ecosystems today
Going from hunter/gatherers to farming has had a huge affect on human population which in turn is impacting on the biosphere.

- Land clearing – destroys habitat, land degradation, salinity
- Hunting
- Introduced species
- Planting a monoculture reduces biodiversity

QUESTIONS 12,13,14,15 p.463

Environmental pollution
Pollution: Spoiling and poisoning of any part of the environment caused by human activities.
Water pollution:
- Organic wastes
- Microorganisms
- Chemicals

Air pollution:
- Smoke and smog
- Ozone hole

QUESTIONS 17,19,20,21,22 p.465

Saving ecosystems
Why save species:
- Aesthetic value: Natural landscapes are nice as are animals.

- Ecological value: We rely on a healthy ecosystem to survive! Plants for oxygen, plants & animals for food etc. We are at the top of food chains!
- Practical value: 25% of medicines contain plant compounds!

Why save habitats:

- Protect a diversity of organisms
- Help save species

We must practice sustainable use of the earth's resources – resources should be used no faster than they can regenerate.

QUESTIONS 23,24 p.469
CHAPTER REVIEW QUESTIONS 1-16 p.470