Z

AQA GCSE BIOLOGY NOTEBOOK

ALL THE KEY CONTENT IN 28 PAGES!

CONTENTS

BIO PAPER 1

BIO PAPER 2

CELL BIOLOGY

EUKARYOTIC AND PROKARYOTIC CELLS

EUKARYOTIC CELLS (ANIMAL & PLANT)

- DNA enclosed in a nucleus.
- Larger (10–100 µm).
- Found in animals, plants, fungi, protists.

Animal Cells (Eukaryotic)

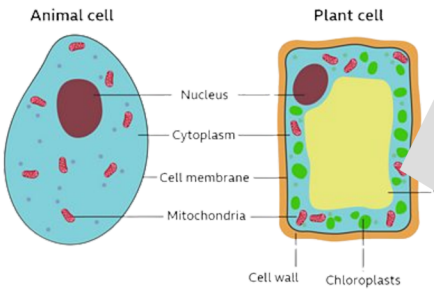
- Nucleus – contains genetic material, controls cell activities.
- Cytoplasm – site of chemical reactions.
- Cell membrane – controls substance movement.
- Mitochondria – site of aerobic respiration.
- Ribosomes – site of protein synthesis.

Plant Cells (Eukaryotic) (Same as animal cells, plus:)

- Cell wall (cellulose) – provides strength.
- Chloroplasts – photosynthesis, contain chlorophyll.
- Permanent vacuole – stores cell sap, maintains structure.

PROKARYOTIC CELLS (BACTERIA)

- Smaller (~1 µm).
- No nucleus – DNA is a single circular strand in cytoplasm.
- May have plasmids (small rings of DNA).
- No mitochondria or chloroplasts.
- Cell wall (peptidoglycan) for support.



SCALE & SIZE OF CELLS

- Cells are very small and require a microscope to be seen.
- Measured in micrometers (µm)
- 1 µm = 0.001 mm = 1 × 10^{-3} m
- Be able to convert between d… units:
- 1 mm = 1000 µm (×1000 to … mm → µm, ÷1000 for µm → mm).
- 1 µm = 1000 nm (×1000 … nm, ÷1000 for nm → µm).

ORDER OF SIZE (FROM SMALLEST TO LARGEST)

- HIV Virus → 100 nm
- Mitochondria & C…roplasts → 1.5 µm
- Cholera Bacteri… m
- Cheek Cell (An… m
- Palisade Mesophyll … 70 µm

◆ Many subcellular structur… cells are the sam… larger … prokaryotic c…

ORDERS O… UNITS

- Used … pare size … tors of 10:
  - 1 … ter → 10^{1}
  - … → 1
  - 1…
- Metric Pre…
  - Centi- (cm)
  - …lli- (mm) → × 0.…
  - …m) → × 0.00… (10^{-9})

HOW … STA…

- Use… small … numbers to avoid …
  - Exam… rsions: 0.0015 → 1.5 × 10^{-3} … 10^{4}
  - … calculations as they … may be …

CELL DIFFERENTIATION

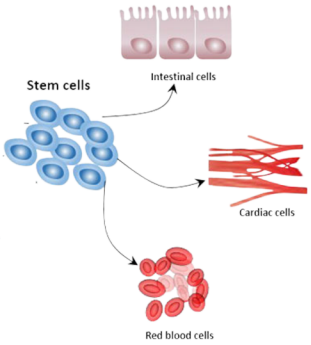
- Process where cells become specialised by switching certain genes on or off.
  Speciali… cells develop struct… ted to their … n.

…ATION IN …

- … early in deve…opment, then stops. In adults, only stem …s (e.g., bone marrow) …n differentiate for repair & replacement.
  Red blood cells lose their nucleus, so cannot divide.

DIFFERENTIATION IN PLANTS

- Occurs throughout life.
- Cells differentiate when positioned but can re-differentiate if moved.



CELL SPECIALISATION (ANIMALS)

SPERM CELL -Function: Co… fertilisation.

- Streamlined head and … s swimmin…
- Mitochondria in mid-piece … es ener… movement.
- Acrosome (head) → contains e… down egg membrane.
- Haploid nucleus … restores normal … ne number after … sation.

NERVE CELL (… E) -Function: Transm… electrical sig… oss the bod…

- Long ax… rries impu… dista… es.
- Dendrite… nect … , muscles, and glan…
- Myelin sh… and spee… npulse transmissio…
- Mitochondria in nerve endings → … energy for neurotransmitter release.

MUSCLE CELL -Function: Contra… uble movement.

- Contains protein filaments → … contraction.
- Lots of mitochondria → release energy for contraction.
- Stores glycogen → energy source for mitochondria.

…LL SPECIALISATION (PLANTS)

…OOT HAIR CELL -Function: Absorbs water and minerals from the soil.

- Large surface area (root hairs) → increases water uptake.
- Thin cell wall → reduces diffusion distance.
- Large vacuole → maintains water movement.
- Mitochondria → provide energy for active transport of minerals.

XYLEM CELL -Function: Transports water and dissolved minerals from roots to leaves.

- Hollow (no organelles/cytoplasm) → free water movement.
- Walls thickened with lignin → provides strength and prevents collapse.
- End walls broken down → forms a continuous column of water.

PHLOEM CELL -Function: Transports sugars (from photosynthesis) around the plant.

- Joined end-to-end → forms continuous tubes.
- Sieve plates (holes in end walls) → allow easy flow of sugars.
- Few subcellular structures → reduces resistance to flow.
- Companion cells with mitochondria → provide energy for active transport.

INFECTION & RESPONS

COMMUNICABLE (INFECTIOUS) DISEASES

- Caused by pathogens → transmissible (e.g. HIV, malaria, TB)

Pathogens include:

🔹 Bacteria → reproduce quickly → release toxins → damage tissue

🔹 Viruses → invade cells → replicate → burst cell → illness

🔹 Fungi → can produce spores → spread to others

🔹 Protists → often parasitic (live in host and cause damage)

Transmission methods:

- 🟢 Direct contact → touching skin/fluids/faeces/infected plant material
- 🟢 By water → dirty/contaminated water
- 🟢 By air → droplet infection (sneezing, coughing → inhaled)

PREVENTING SPREAD OF DISEASE

🧼 Hygiene → wash hands, clean surfaces, cover sneezes

🍽️ Food hygiene → keep food cold, cook thoroughly, use clean utensils

🗑️ Waste disposal → cover bins, remove waste → stop flies (vectors)

🚽 Sanitation → safe water + sewage treatment

💉 Vaccination → triggers immune response → stops pathogen spreading

🪰 Destroy vectors → pesticides/insecticides remove habitats

VIRAL DISEASES

- Not living (no 7 life processes) → no nucleus/cytoplasm/organelle
- Reproduce rapidly → inject DNA/RNA → host cell builds viruses → cell bursts → virus spread

MEASLES

- Symptoms → fever + red rash → may cause blindness/brain damage
- Spread → droplet infection (cough/sneeze) → very contagious
- Prevention → is … childhood vac…

HIV/AIDS

- Symptoms → fl… → virus attacks im… become …)
- Sprea… …od (nee… …rth/brea… …g
- Pre… … → condom sc… …ood, no n… s… …evi… …gs slow…

TOBACCO MOSAIC

- … → plants (tom… …)
- …ured
- …the…
- Sp… …ntact … plan… …n stay in so… ~50 ye…
- …e + TMV-…

BACTERIAL DISEASES

- Bacterial pathogens → infect …lants/animals → produce toxins → …amage cells

Not al… …cteria are harmful → skin (… …e with pathogens) → gut (… …cellulos… …ake Vit K) …2… …e by bin… …ion → …warm + … …r nutrient-…ns

SALMONE…

- Symptoms → … + cramps + vomiting + diarrhoea (toxins irritate …
- Spread … Under… …/contaminated food …gs, chicken) … → UK chicken …d → Cook food thoroughly → Pre…nt raw meat cross-contamination → Hand + surface washing

GONORRHOEA

- Symptoms → Yellow/green discharge + pain urinating + possible infertility/blindness in babies
- Spread → Unprotected sex
- Prevention → Condoms → Antibiotics (some resistance) → Contact tracing & treatment

PROTIST DISEASES

- Eukaryotic, mostly unicellular → few are pathogenic → spread via vector (e.g. mosquito) → infect host

MALARIA OVERVIEW

- Cause → Protist from Plasmodium genus
- Spread → Female Anopheles mosquito (vector)
- Symptoms → Recurrent fever + shaking → due to bursting red blood cells → can be fatal
- Treatment → Antimalarial drugs (less effective due to resistance)
- Prevention →
- Insecticides in buildings → Insecticide-treated nets → Stop mosquito breeding (remove standing water) → Antimalarials for travellers

MALARIA LIFE CYCLE

- Mosquito bites human → parasite enters liver → asexual reproduction → enters blood → infects RBCs → mosquito feeds again → sexual reproduction in mosquito

FUNGAL DISEASES

ROSE BLACK SPOT

- Symptoms → Purple/black spots on leaves → less photosynt… → yellowing + early leaf …
- Spread → Spores via wi…
- Prevention → Use fungicid… Remove & burn infected leav…

HUMAN … SYSTEMS

NON-SPECIFIC D…

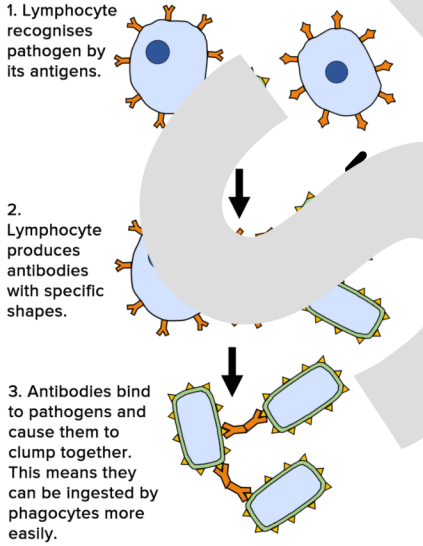
- Skin → barrier + se… … bacteria
- … → hairs + mucus … pathogens … move mucus → …
- Tears … …es destroy path…
- Sto… …acid kills pathogens …a → natural flora outcompete …ns

…YSTEM OVERVIEW

- …od cells (WBCs) → defend a… …ogens via:
- Pha… …s → WBC engulfs + digests …atho…
- …bodi…s → made by lymphocytes → bind …tigens (on pathogen surface) → … agglutination (clumping) → …ocytes digest …toxins → neutralise toxins (from …ceria)

…IBODIES & ANTITOXINS

- Antibodies → Y-shaped → specific to 1 antigen → clump pathogens
- Memory cells → quicker response if reinfected
- Antitoxins → neutralise bacterial toxins



PHOTOSYNTHESIS

- 🔹 Plants = autotrophs → make own food using light, CO_2 + H_2O
- 🔹 Producers in food chains
- 🔹 Endothermic reaction → energy from environment → chloroplasts via light
- 🔹 Takes place in mesophyll cells (contain chlorophyll)
- 🔹 Glucose → used for respiration + to make plant substances
- 🔹 Oxygen → by-product, used in respiration / diffuses out

🧪 EQUATIONS

Word:

- CO_2 + H_2O → (light + chlorophyll) → Glucose + O_2

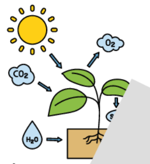
Balanced symbol:

- $6CO_2 + 6H_2O$ → (light + chlorophyll) → $C_6H_{12}O_6 + 6O_2$

🌿 REACTANTS: HOW THEY ENTER

- H_2O → absorbed by roots → xylem → leaves
- CO_2 → diffuses in through stomata

FACTORS AFFECTING PHOTOSYNTHESIS



LIGHT INTENSITY

- ↑ light → ↑ rate (more energy) → un... another factor limits
- Graph: linear ↑ → plateau

CO_2 CONCENTRATION

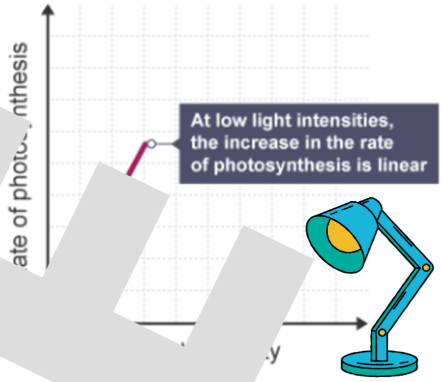
- ↑ CO_2 → ↑ rate (more raw material) → then levels off
- Graph: same pattern as light

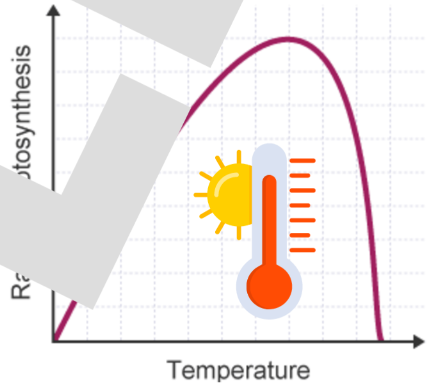
TEMPERATURE

- ↑ temp → ↑ kinetic ene... ...llisions → ↑ rate
- Too high → enzymes denatu...
- Graph: curve with optimum peak

CHLOROPHYLL

- More chloropla...
- ↓ chlorophyll ...o diseas... Mg^{2+}, leaf loss) → ...





BIOENERGETICS

REQUIRED PRACTICAL

Aim → Effect of light intensity on rate of photosynthesis (via oxygen production)

Method:

- → Pondweed in water → lamp a... distance → count bubbles in 3 ... repeat at diff. distances → calcula... mean
- Variables
- → IV = Distance from lamp
- → DV = Bubbles/min
- → CVs = Temp (thermo... ($NaHCO_3$) → same pla... of water

Improvements

- → Use gas syringe for O_2
- → Repeat for accuracy
- → Glass tank or LED to stop te... changes

Results

- → Distanc... ...t intensity ↓ → bubbles/...
- → Grap... ...ve downw...
- → Supp... ...erse s...
- Light ... ...ance

...S OF LI...TING FACTORS

- ...ctor can affect rate of photosynthesis.
- ... ...ease... ...sity, temp or CO_2 increases (until anc... ...tor limit...

INVERSE S... ...AW (HT ONLY)

...te (more light ➜ more photosynthesis)

... ➜ another factor becomes limiting

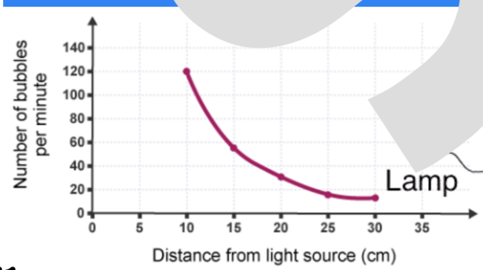
...rse Square La...

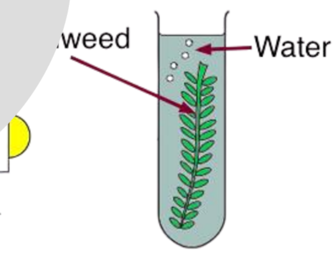
- ...Intensity = 1 / Distance²
- ...nce = 30cm ➜ Light intensity = 1/30² = 0.001 au
- ... lamp ➜ lower intensity

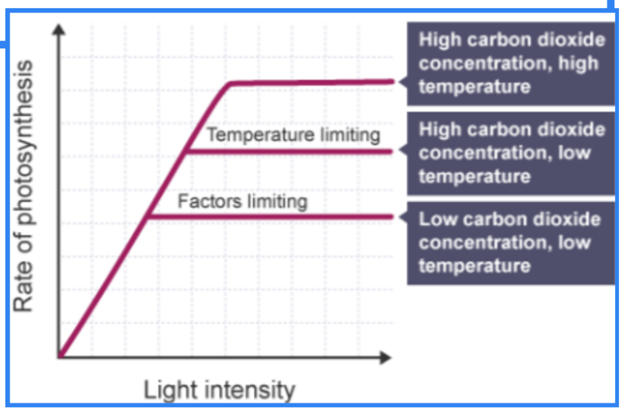
🏡 GROWING ... A GREENHOUSE

...ing factors to boost photosynthesis → increase yield →

- Ligh... artificial lighting, remove shades
- 🌡️ Temp → traps heat, paraffin heaters
- 💨 CO_2 → from heaters
- 💧 Water → irrigation system
- 🦠 Pests/diseases → enclosed space, easier to manage
- 🧪 Nutrients → fertilisers
- Only increase factors until another becomes limiting → avoid wasting money







THE EYE 👁️

- The eye is a sense organ with receptor cells sensitive to light intensity and colour.
- Its role → receive light → focus it on the retina.
- Main functions → 🌓 Adaptation (to light levels) | 🔍 Accommodation (to near/far objects).

🧩 STRUCTURE OF THE EYE

🩸 Sclera – white, tough outer layer protecting the eye.
💧 Cornea – transparent front; refracts (bends) light.
🎯 Iris – controls light entering by adjusting pupil size.
⚫ Pupil – hole allowing light in.
🔄 Lens – transparent disc that changes shape to focus light on retina.
💪 Ciliary muscles + suspensory ligaments – work together to adjust lens shape.
🎥 Retina – contains receptor cells that detect light intensity & colour.
🔌 Optic nerve – carries impulses from retina → brain.

🌓 ADAPTATION TO LIGHT

- Reflex action protects retina from bright light damage.
- → Dim light: pupil dilates (iris relaxes) → more light enters 👀
- → Bright light: pupil constricts (iris contracts) → less light enters ☀️

🔍 ACCOMMODATION (FOCUSING ON NEAR/FAR OBJECTS)

- Lens changes shape to focus light correctly on retina.
- → Near object: ciliary muscles contract | suspensory ligaments loosen | lens thi… refracts more light.
- → Distant object: ciliary muscles re… suspensory ligaments tighten | lens t… refracts less light.

👓 COMMON EYE DEFECTS

- Myopia (short-sightedness) → can't focus on distant objects → image forms in front of retina → corrected with co… (spreads light).
- Hyperopia (long-sighte… near objects → image form… retina → corrected with convex lens … nes light).

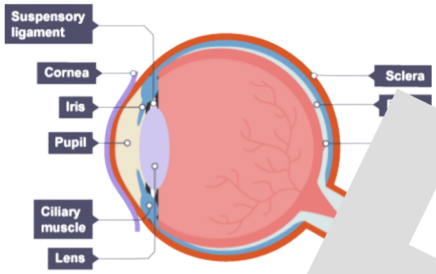
🩺 TREATING EYE DEFECTS

👁️ Contact lenses – sit on cornea | hard … | soft = comfy but … ction risk.
🔪 Laser surgery … es cornea:
- • Myopia → …timmed (less refraction,
- • Hyperop… nea curved … refractio…

⚠️ Risk: infec… vision …
💉 Lens repla… …oral t… artificial one | …sk of retin… damage or sight …

💡 EXAM TIPS

- → Link structure → function (e.… refracts, retina = detects).
- → Describe pupil reflex clearly (br…ght vs dim).
- → Remember near = thick lens, far = thin lens.
- → Be ready to draw ray diagrams for myopia & hyperopia corrections.



CONTROL OF BODY TEMPERATURE

- The body must stay around 37°C for enzymes to work efficiently.
- Heat produced … respiration ⇔ heat lost to s… … = balance mai…
- Controlled by th… thermoregulatory ce… brain.
- → Conte… detecting blood …
- → Sl… xternal te… e and s… ulses t… ain.

💪 …EMP… …O HIGH (COO…

- → Vaso… …els widen → ↑ b… → … lost by radia…: sweat gla… …evaporates, …
- … flat → t… …ed → m… ost.
- 🫀 K… … temperature decrea… …mal (negative …

… WHEN … …S TOO LOW …MING RESPONSES)

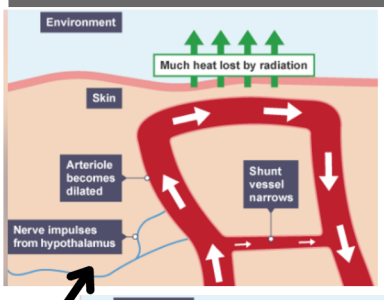
- …onstriction: blood vessels … blood flow near skin …
- → N… …g: conserves body heat.
- …nd up: traps air for …
- …ng: skeletal muscles contract rapidly → respiration releases heat energy.
- 🔥 Result: body temperature increases back to normal.

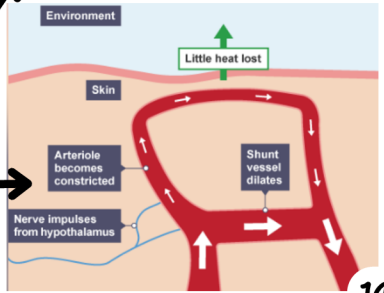
🔁 NEGATIVE FEEDBACK LOOP

Thermoreceptors detect temp change → send signal to brain.
- Effectors (muscles, glands) respond → restore normal body temperature.
- Example: sweating & vasodilation when too hot | shivering & vasoconstriction when too cold.

🧩 KEY TERMS

- Vasodilation → widening of blood vessels to release heat.
- Vasoconstriction → narrowing of blood vessels to conserve heat.



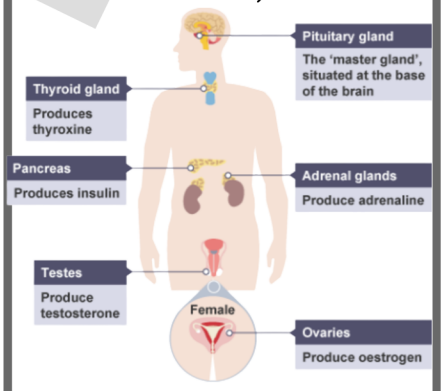


ENDOCRINE SYSTEM

- Glands that secrete hormones directly into the bloodstream → hormones travel in blood → affect target organs.
- Co… …d to nervous system:
- … longer-lasting effects.

…OCRIN… …S & …ES:

- … gla… …ster gland → …ates other …
- Pancr… …n (↓ blood glucose)
- Thyroid → thyroxine (controls meta… & growth)
- Adr… …nds → adrenaline (p… …body for action)
- O… …females) → oestrogen … sex hormone)
- … (males) → testosterone … sex hormone)



PITUITARY GLAND

- Master gland → releases hormones into blood in response to conditions
- → stimulates other glands (e.g. TSH → thyroid → thyroxine)
- Hormones only affect target cells → must have complementary receptors
- Non-target cells = no effect

HORMONE ACTION

- Process: Gland (e.g. pituitary) → releases hormone → carried in blood → binds to receptors on target organ → causes a response

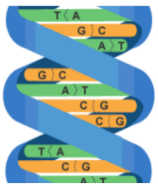
DNA STRUCTURE

DNA = polymer made of repeating units → nucleotides.

- Each nucleotide = phosphate + deoxyribose sugar + base (A T C G) → forms sugar-phosphate backbone + bases inside strand → double helix shape ↻

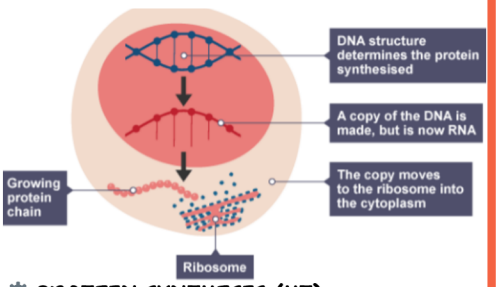
🔗BASE PAIRING

- A ⇔ T | C ⇔ G → held by hydrogen bonds → forms 'rungs' of the DNA ladder → base sequence = genetic code for proteins



🧩 CODING FOR PROTEINS

- 3 bases = 1 amino acid (triplet code) → order of bases → order of amino acids → shape of protein → its function



⚙️ PROTEIN SYNTHESIS (HT)

- Transcription 📄 (in nucleus): DNA unwinds → gene copied to mRNA → mRNA leaves nucleus via pore
- Translation 🏭 (at ribosome): ribosome reads mRNA triplets → tRNA brings matching amino acids → amino acids j by peptide bonds → form protein cho folds into functional protein

🧠 RIBOSOME FUNCTION (HT)

- Ribosome 'reads' mRNA in triplets → each codes for one amino acid → joins them in correct order → chain released → folds into unique shape → specific function

💪 PROTEIN FUNCTIONS (

- Enzymes = biological cat ed reactions) | Hormones = che messengers (e.g. insulin) | Stru proteins = support and strength collagen)

⚡ MUTATIONS (H

- Random DNA nges → can alter amino acid → protein shape changes → may chan
- Types: In + adds h code | De remo code | Sub e → o one amino
- Most mutatio s | some harr (if enzyme no longer fits substrate structural protein weakens)

🧬GENE SWITCHING (NON-CODI

- Not all DNA codes for proteins regions switch genes on or off → control gene expression | Mutations here may alter whether genes are expressed or silenced

GENETIC INHERITANCE

KEY TERMS

- Gamete → sex cell (sperm/egg in animals, pollen/ovum in plants)
- Chromosome → thread of DNA carrying genes, found in nucleus
- Gene → short DNA section codin for a protein
- Allele → different version of t same gene
- Dominant → always expressed (1 copy needed)
- Recessive → only expressed if 2 copies present
- Homozygous → 2 same alleles (e.g. TT or tt)
- Heterozygous → 2 leles (e.g. Tt)
- Genotype → allele com TT, Tt, tt)
- Phenotype → phys characteris (e.g. tall/shor

MONOHYBRI

- Trait cor by 1 ge
- Inherit from each → 2 alle me
- Domi T) in phenoty
- Recessive (e.g both ies are recessiv
- ous dominan
- Phe
- → T
- → tt =
- Capital let inant /

Punnett

how allele combinations in

- Ka ities can be calcula
- e.g. Tt x Tt , Tt, tt → 3 tall : 1 short

t, tt, tt → 1 tall : 1

= homozygous (TT

lways write dominant allele st (e.g. Tt not tT)

ERITED DISORDERS

s passed on via alleles → e.g.: brosis (recessive) / polydactyly (do nant)

YSTIC FIBROSIS (recessive)

- ff = has disorder | Ff = carrier | FF = unaffected
- Ff x Ff → 25% ff / 50% Ff / 25% FF → 1 in 4 chance child has disorder
- Ff x FF → 0% ff (no child with disorder)

Father \ Mother	F	F
F	FF	FF
f	Ff	Ff

Father \ Mother	F	f
F	FF	Ff
f	Ff	ff

INHERITANCE CONT.

POLYGENIC INHERITANCE

- Traits controlled by multiple genes (e.g. eye colour, height)
- Wide range of phenotypes
- Not sh ing Punnett squares
- Calle nic inheritance

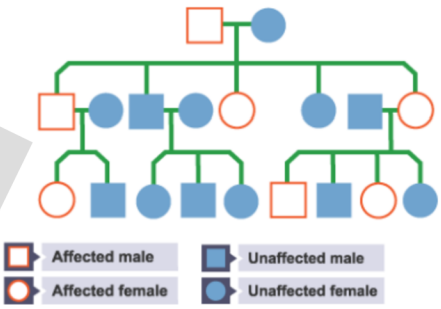
🧠 Tip: w these s are many ge

REES (P s)

- generations
- s = females
- Shad nshaded = unaffecte
- Horizontal line arents / Vertical = offspring
- Use to w carrier status / probabi heritance

PREDI ROBABILITIES (HT)

- res → show genotypes &
- g. 3:1 = 75% dominant trait / essive
- Calcu e chances of phenotype appearing in next generation



INHERITED DISORDERS CONT.

POLYDACTYLY (dominant, allele = D)

- Dd or DD = has disorder | dd = unaffected
- Dd x dd → 50% Dd (child with disorder) / 50% dd (no disorder)

	D	d
d	Dd	dd
d	Dd	dd

🧪 EMBRYO SCREENING

- Done in IVF → genes tested before implantation or from embryo in womb → detect disorders like CF
- For: avoids suffering / saves NHS money / laws stop abuse
- Against: unfair (seen as 'undesirable') / expensive / risk of misuse ('designer babies')

🔧 GENE THERAPY

- Inserts normal allele into DNA → replaces faulty one
- Still developing / not always successful
- Raises ethical issues (unnatural vs easing suffering)

LEVELS OF ORGANISATION

PRODUCERS

- Photosynthetic organisms → make their own food using sunlight → producers of biomass
- Start of every food chain → photosynthesise → make glucose → used for growth + respiration
- In extreme environments → chemoautotrophs (use chemicals instead of light)

FOOD CHAINS

- Show transfer of energy → from Sun → producer → primary consumer → secondary → tertiary
- Arrows = direction of energy flow
- E.g. Grass → Mouse → Owl
- Producer → makes own food
- Primary consumer → eats producer
- Secondary consumer → eats primary consumer

INVESTIGATING ECOSYSTEMS

- Ecology = study of interactions between organisms + environment
- Quadrats (wood/wire square) used to:
- Measure abundance of plants or slow-moving animals
- Record number of species, species richness, % cover
- → % cover = (squares covered ÷ total squares) × 100

TRANSECTS

- Measure species abundance across changing habitats (e.g. hillside, shoreline)
- Place quadrat at regular intervals (e.g. every 5m)
- Record → individual counts / richness / % cover
- Used to link abiotic factor light, altitude) to specie abundance

ABUNDANCE OF ORGANISMS

- You should know how to calculate:
- Mean → Add all values ÷ total quadrats
- Median → Mid e (or average of t values)
- Mode → M on value

FEEDING RE NSHIPS

- Producers bu consumers
- Predators = organisms | Prey en
- Predator–prey cycles:
- More prey → predator ↑ → pre ↓ → predator ↓ → prey ↑ → repeats
- Cycles are out of phase (predator peak follows prey peak)

REQUIRED PRACTICAL 9

AIM: Measure population size of a species and the effect of a factor on its distribution.

MEASURING POPULATION SIZE

- Method Overview: Quadrats used to sample randomly → reduces time + avoids bias.
- Sample must be large enough + representative of the population.
- Steps:
- Lay out area (e.g. 10 m × 10 m).
- Use random number generator to place quadrats.
- Count chosen species in each quadrat.
- Record data in a table.
- Estimate population:
- Population = (total area ÷ area sampled) × total counted

INVESTIGATING EFFE FACTOR ON DISTRIBU

- Using a Transect
- Steps: Place tap ure throug changing habit p a slope)
- Place quadrat val (e.g. every 5 m)
- Count species + meas factor (e. altitude).
- Record lot graph.

Conclusion

- As al dandelio higher alti

DECOMPOSITI

mposers (bacteria, fun ders).

➡️ Returns ls, and nutrients to the (recycling).

- Rate of decay = spe affected by 3 main

FACTORS AY RATE

Temp → Enzymes work st armer temps ↑ rate | enzymes denature ↓ d = reactions slow (e.g. ridge).

- lability → Mi ms need water to secre mes & absorb trien Dry = little/no decay.

en availability → Needed for c respiration | Less oxygen = decay | Some microbes e anaerobically → anaerobic g.

ESTIGATING DECAY

ample: Milk pH at 10°C, 20°C, 30°C over time.

→ Higher temp = faster pH drop = faster decay.

formula: Rate=Change in value/Change in time

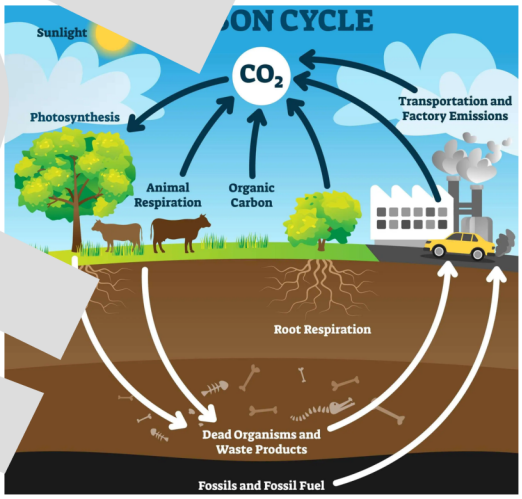
HOW MATERIALS ARE CYCLED

- Materials cycle through biotic + abiotic co ments.
- F (e.g. carbon) are finite, so must be to support new organisms.

CYCLE

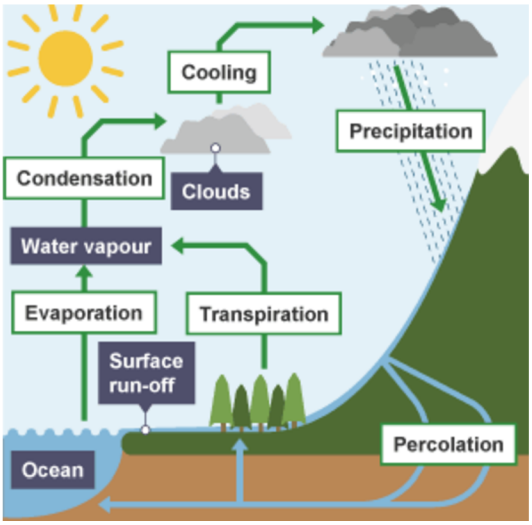
remove nts/alga akes glu orms

- C imal ding
- CO_2 re plants, animals, dec
- Decomposition: bre dead organisms → returns CO_2
- Fossilisation: under pressure and no decomposition → fossil fuels
- Combustion of f s → releases CO_2
- MS: Photo s: removes CO_2
- d sition, combustion: return



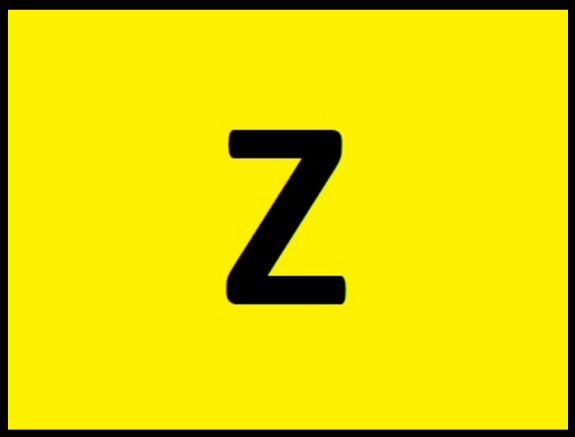
WATER CYCLE

- Evaporation: Sun heats water → liquid to gas
- Transpiration: Water vapour released from leaves
- Condensation: Vapour cools → clouds
- Precipitation: Water falls as rain/snow/sleet
- Run-off, percolation, and root absorption return water to oceans



ROLE OF MICROORGANISMS

- Decomposers (bacteria/fungi) break down waste + dead organisms → return CO_2 + minerals to environment
- During decay: respiration returns CO_2 to atmosphere
- Decomposition recycles materials (e.g. nitrates, magnesium)



MR. ZEE'S RESOURCES