Human body systems slide deck

Biology 20

Unit D: Human body systems

The food tube and the airway

Food and air travel in separate tubes

- Food travels from the mouth through the stomach to the intestines.
- Air travels from the nose and pharynx through the trachea to the lungs.

Organs on each tube

- The digestive tract includes mouth, esophagus, stomach, and intestines.
- Liver, pancreas, and gall bladder add secretions to that tube.
- The airway runs from the nose and pharynx through the larynx and trachea to the bronchi and alveoli.

Key terms

digestive tract

The food tube from the mouth through the esophagus, stomach, and intestines.

absorption

The movement of digested nutrients from the small intestine into the blood.

peristalsis

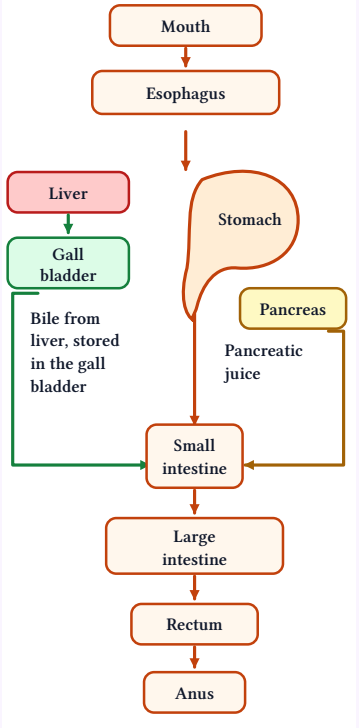
Waves of muscle that push food along the digestive tract.

trachea

The ringed tube that carries air from the throat toward the bronchi and lungs.

A meal moves through the digestive tract

- Chewing in the mouth is a physical breakup of the bite.
- Liver and pancreas join the intestine with secretions.
- Absorption moves nutrients from the intestine into the blood.

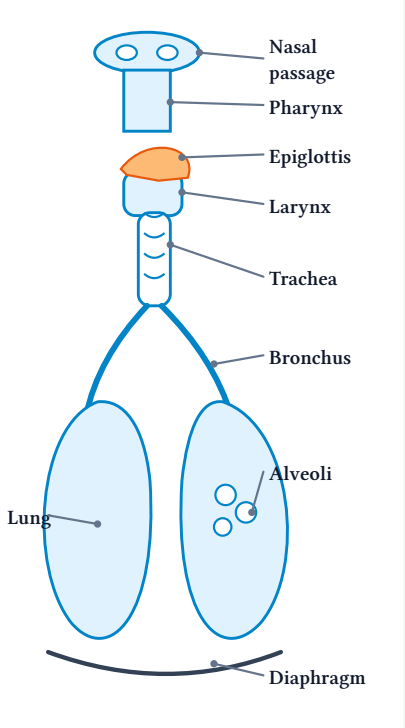


Physical and chemical digestion

- Chewing and stomach churning are physical.
- Enzyme action and bile are chemical, and absorption fills the blood.

Swallowing and the epiglottis

- The epiglottis covers the air-way during a swallow.
- Air returns through the tra-chea once the swallow passes.



Tubes and a meal

- List the food-tube organs and the airway organs.
- Mark one physical step and one chemical step, then name absorption.

The chemical steps have names

- Enzymes finish the splits that absorption depends on.
- The next lesson tests foods and watches an enzyme cleft.

Biology 20

Unit D: Human body systems

Enzymes and food tests

The chain fits the cleft

- Starch is drawn as a chain heading into the enzyme cleft.
- Sugar pieces leave on the far side of that cleft.

Three foods, three enzyme families

- Carbohydrases cut carbohydrates such as starch.
- Lipases cut lipids, and proteases cut proteins.
- Temperature, pH, and the amount of substrate change the rate.

Key terms

enzyme

A protein that speeds a reaction because the substrate fits its shape.

competitive inhibition

A slowdown that happens when a different molecule occupies the enzyme's cleft.

carbohydrase

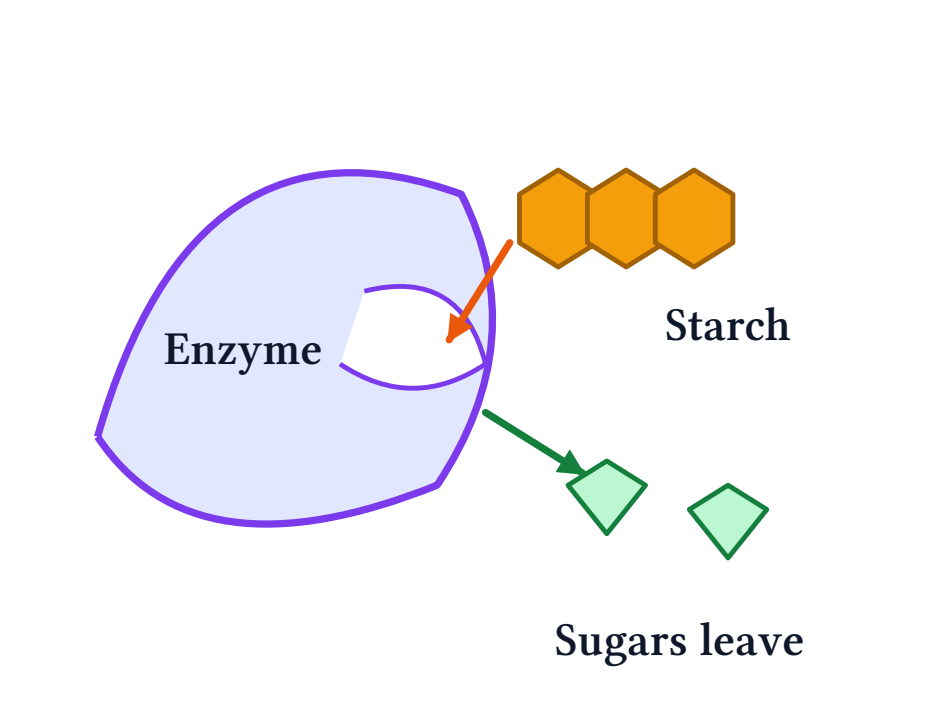
An enzyme that cuts carbohydrates such as starch into sugars.

protease

An enzyme that cuts proteins into smaller peptides and amino acids.

An enzyme at work

- The enzyme shape has a cleft that starch can enter.
- Sugars leave after the bond breaks.
- A molecule parked in the cleft blocks starch.



Pepsin at two pH values

- Pepsin in acid cuts egg-white protein.
- The same protease in a basic tube leaves the cube firmer.

A calorimetry change

- A larger water-temperature rise means more energy left the food.
- Matched mass and matched water make the comparison fair.

Fit and factors

- Match the three enzyme families to starch, fat, and protein.
- Say how pH and competitive inhibition change the cleft.

The airway moves the gases

- Digested food still needs oxygen for the tall ATP path.
- The alveolus is the next exchange surface.

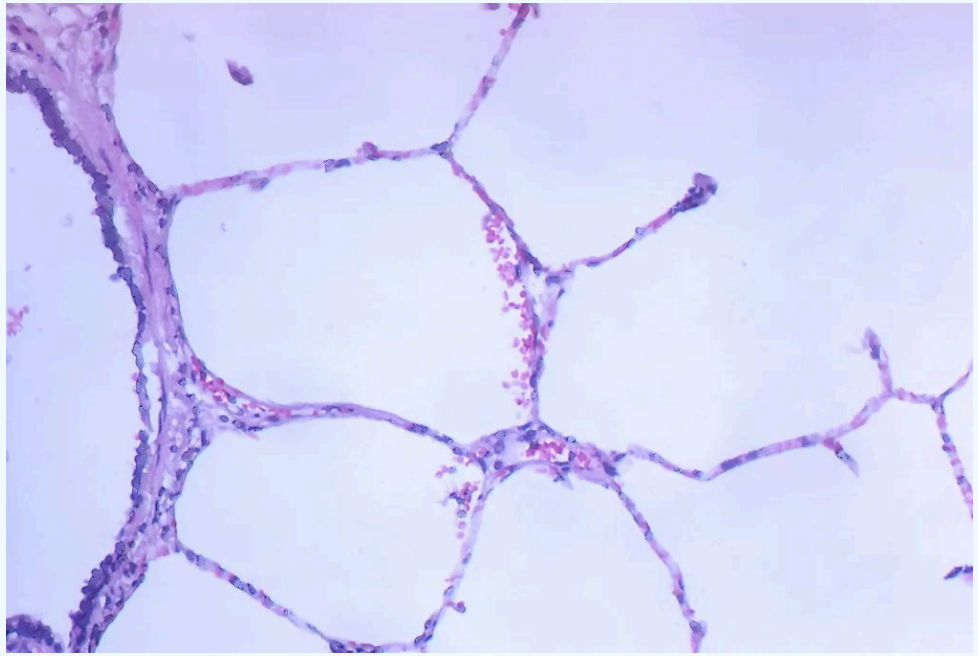
Biology 20

Unit D: Human body systems

Breathing and lung health

Two arrows at a thin wall

- A green oxygen arrow runs from the air sac into the blood.
- An orange carbon dioxide arrow runs from the blood into the air sac.



Breathing and gas exchange

- The diaphragm and rib muscles change the chest size.
- Gas exchange at the alveolus loads oxygen and unloads carbon dioxide.
- Breathing also helps heat leave and helps clear foreign material.

Key terms

alveolus

A thin air sac in the lung where oxygen and carbon dioxide cross with the blood.

gas exchange

The swap of oxygen into blood and carbon dioxide out of blood at the alveolus.

diaphragm

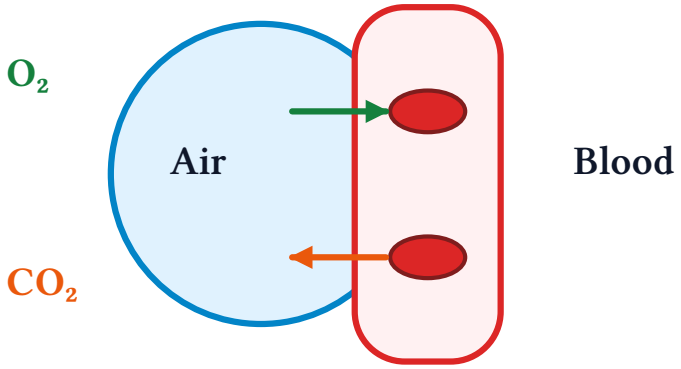
The muscle sheet under the lungs that contracts to enlarge the chest during a breath in.

irradiation

A food treatment that uses radiation to slow spoilage by microbes.

Gases cross at the alveolus

- Oxygen is the arrow aimed at the red blood cells.
- Carbon dioxide is the arrow aimed at the air.
- The caption says the gases cross the shared thin wall.



Gases cross the shared thin wall

Smoking data and technology

- Smoke damages cilia and the walls of alveoli.
- Second-hand smoke exposes people who share the air.

Trusted community sources

- Ranchers and Indigenous hunters have read animal droppings for health clues.
- A respiratory remedy needs a named nation and a community-approved source.

Lungs and sources

- Describe gas exchange and one breathing muscle.
- State one limit of smoking technology and one source rule.

The blood has to move next

- Oxygen that entered the blood still needs a pump.
- The heart circuits are the next map.

Image credits

Yale Rosen from USA, Normal lung, CC BY-SA 2.0

Biology 20

Unit D: Human body systems

The heart and its circuits

Image left is the person’s right

- The blue side of the drawing is labelled person’s right.
- That side sends blood toward the lungs, and the red side sends blood toward the body.

Two pumps in one organ

- The right ventricle feeds the pulmonary circuit to the lungs.
- The left ventricle feeds the systemic circuit to the body.
- Arteries leave the heart, and veins return blood to it.

Key terms

pulmonary circuit

The path that carries blood from the right ventricle to the lungs and back to the left atrium.

systemic circuit

The path that carries blood from the left ventricle through the body and back to the right atrium.

artery

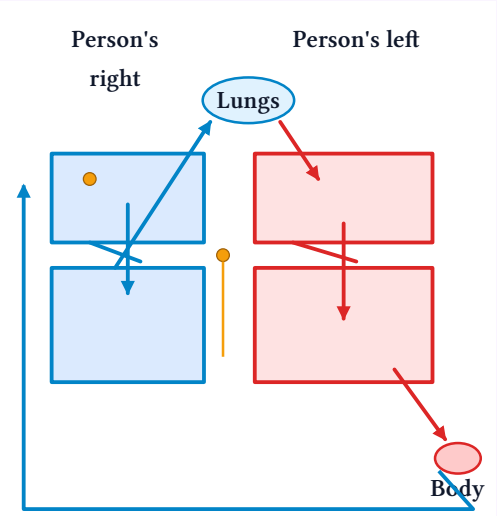
A vessel that carries blood away from the heart, usually under higher pressure.

sinoatrial node

The patch of tissue in the right atrium that starts each heartbeat.

Blood travels two circuits

- Body blood enters the right atrium on the image-left side.
- The right ventricle sends that blood up to the lungs.
- The left ventricle sends high-oxygen blood out to the body.



Blue: low oxygen, toward the lungs

Red: high oxygen, toward the body

Vessel names by direction

- The aorta is an artery leaving the left ventricle.
- The venae cavae are veins entering the right atrium.

Pulse after exercise

- Heart rate rises during the climb.
- The recovery minutes show it settling toward the quiet value.

Two circuits

- Trace the pulmonary circuit from the right ventricle.
- Name the systemic exit and one artery-versus-vein difference.

The fluid in the vessels has parts

- Plasma and cells do the carrying inside these circuits.
- Capillaries are where the exchange with organs happens.

Biology 20

Unit D: Human body systems

Blood and lymph

Three shapes in one liquid

- The red cell is a pale disc, and the white cell shows a nucleus.
- Tiny platelets sit nearby in the same plasma.

Capillaries exchange materials with tissues

- Erythrocytes carry oxygen, and plasma carries dissolved loads.
- Capillaries serve the gut, lungs, kidneys, and muscles.
- The lymphatic system returns fluid that capillaries leave in the tissues.

Key terms

erythrocyte

A red blood cell, shaped like a biconcave disc, that carries oxygen.

lymphatic system

The vessels that collect leftover fluid from tissues and return it toward the blood.

plasma

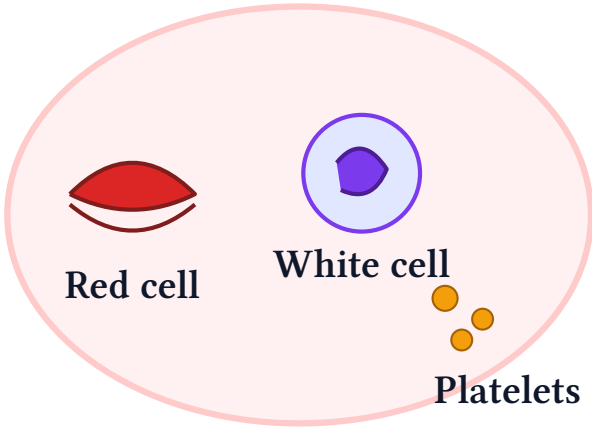
The pale liquid of blood that carries cells, nutrients, wastes, and heat.

platelet

A cell fragment that helps blood clot at a break in a vessel.

Cell shapes and jobs

- The disc is the erythrocyte that carries oxygen.
- The cell with a nucleus is a leucocyte.
- The fragments are platelets, and the liquid is plasma.



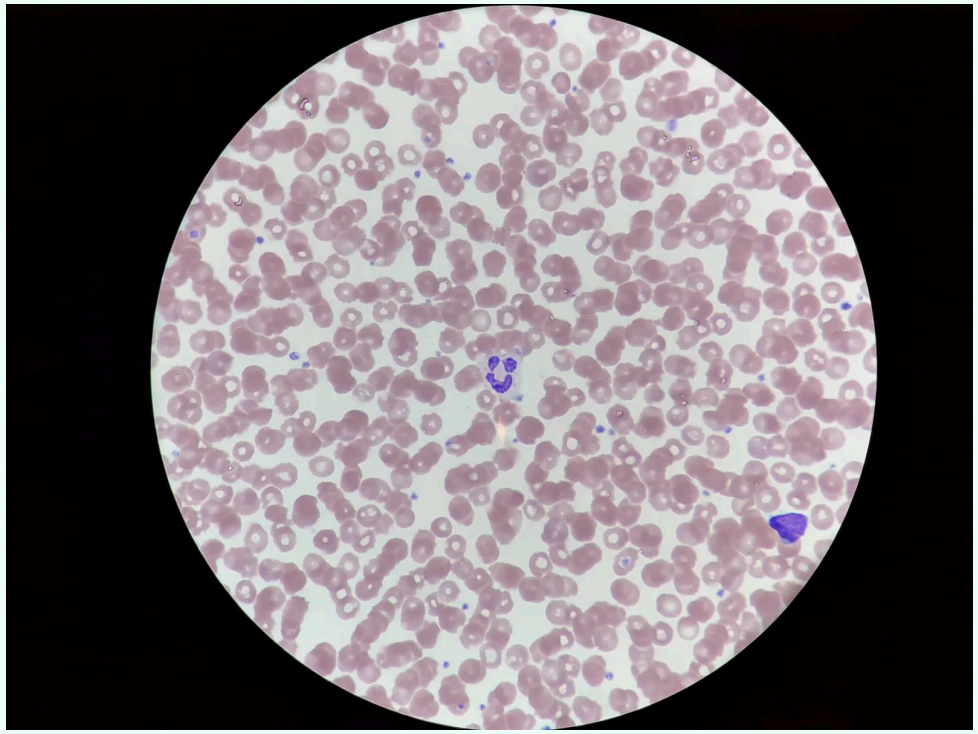
The pale liquid around them is plasma

Four organs, four exchanges

- The lung capillary loads oxygen and unloads carbon dioxide.
- The gut capillary loads nutrients from absorption.

A blood smear

- Red discs should far outnumber white cells on a typical smear.
- A field of mostly white cells is a reason to check the slide region.



Cells and exchange

- Name the four main parts of blood and one job each.
- Describe one capillary exchange and the lymph return.

White cells have specialties

- The nucleated cell in the smear is the start of a larger defence team.
- Blood types are a label on the red cells.

Image credits

Markgirton, Happy neutrophil, CC BY 4.0

Biology 20

Unit D: Human body systems

Defence and blood types

A bacterial infection

- Skin stops most of the bacteria drawn on the surface.
- A macrophage engulfs the one that crossed, and Y shapes leave the B cell.

Cells, then the labels on red cells

- Helper T cells activate B cells and killer T cells.
- Antibodies from B cells match a specific antigen.
- ABO and Rh types are antigens on erythrocytes plus antibodies in plasma.

Key terms

antibody

A Y-shaped protein, released by a B cell, that attaches to a matching antigen.

antigen

A molecule on a cell surface that antibodies or immune cells can recognize.

macrophage

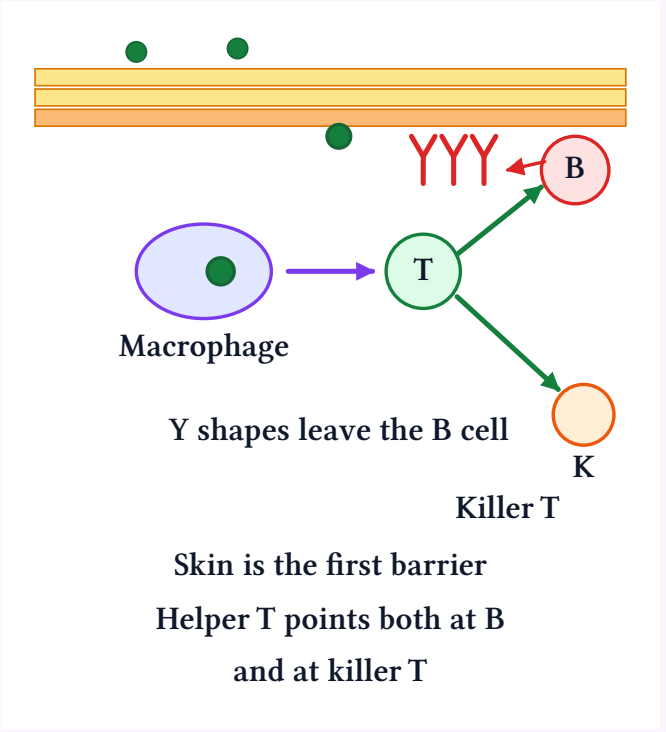
A large white cell that engulfs a pathogen and helps alert helper T cells.

helper T cell

A lymphocyte that coordinates the defence by activating B cells and killer T cells.

Helper and killer T cells

- The macrophage is the cell that engulfs the bacterium.
- The helper T cell points at the B cell and the killer T cell.
- Antibodies are the Y shapes leaving the B cell.



ABO cards before donation

- Write the antigen that sits on the red cell.
- Write the antibody that sits in that type's plasma.

Benefits and limits of a technology

- A vaccine builds memory against an antigen.
- An artificial heart supports pumping and brings surgical risk.

Cells and types

- Order skin, macrophage, helper T, B cell, and killer T.
- Give the antigen and antibody for one ABO type.

Plasma is cleaned downstream

- The kidney keeps the plasma's water and salts in range.
- The nephron is the next structure.

Biology 20

Unit D: Human body systems

The nephron filters plasma

Wide vessel in, narrow vessel out

- The incoming vessel at the capsule is wider than the vessel leaving it.
- Green arrows marked to the blood leave the tubule, and the tube ends at urine.

Steps in kidney function

- The glomerulus filters plasma into Bowman’s capsule.
- Reabsorption along the tubule returns water, glucose, and salts.
- Urine leaves the kidney through the ureter, bladder, and urethra.

Key terms

nephron

The kidney tubule, with its capsule and loop, that filters blood and forms urine.

reabsorption

The return of useful water and solutes from the tubule back into the blood.

glomerulus

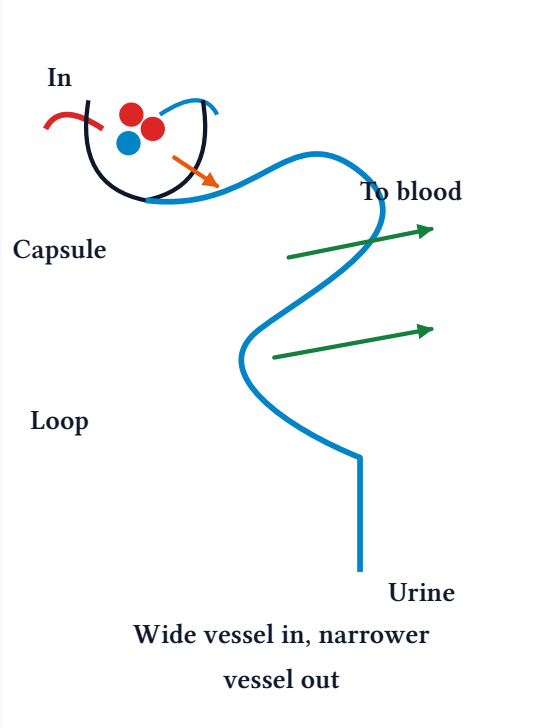
The knot of capillaries inside Bowman’s capsule where filtration begins.

ureter

The tube that carries urine from a kidney to the urinary bladder.

Arrows on the nephron

- Filtration is the step inside the capsule.
- The green arrows are reab-sorption to the blood.
- The end of the tube is urine.



A daily flowchart

- Extra drinking water leads to a larger urine volume.
- Heavy sweat leads the nephron to return more water.

Organs on a diagram

- The kidney sits above the ureter on each side.
- The bladder stores urine before the urethra expels it.

Filter and return

- Place filtration and reabsorption on the nephron.
- Name the organs that store and expel urine.

Hormones change the last duct

- The collecting duct can return more water or let it stay in the urine.
- ADH is the signal the next lesson adds.

Biology 20

Unit D: Human body systems

Kidney regulation and dialysis

Pores appear when ADH arrives

- The left duct is marked little ADH, and its water arrow stays inside.
- The right duct has green pores, and water arrows leave when ADH is present.

Two hormones, two saved materials

- Antidiuretic hormone saves water at the collecting duct.
- Aldosterone saves sodium and supports blood pressure.
- Caffeine and alcohol lead to a larger urine volume.

Key terms

antidiuretic hormone

The hormone, also called ADH, that adds water channels to the collecting duct.

dialysis

A treatment that lets wastes and extra water leave the blood across a membrane when kidneys fail.

aldosterone

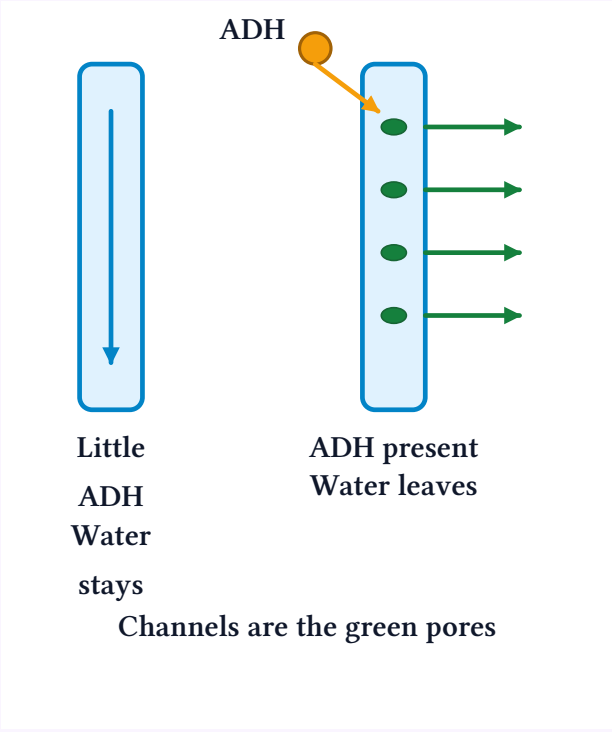
The hormone that increases sodium reabsorption and helps support blood pressure.

collecting duct

The last channel of the nephron, where ADH decides how much water returns to the blood.

ADH changes how much water returns

- Green pores mean antidiuretic hormone is present.
- Water leaving the duct returns to the blood.
- A duct with little hormone keeps the water in the lumen.

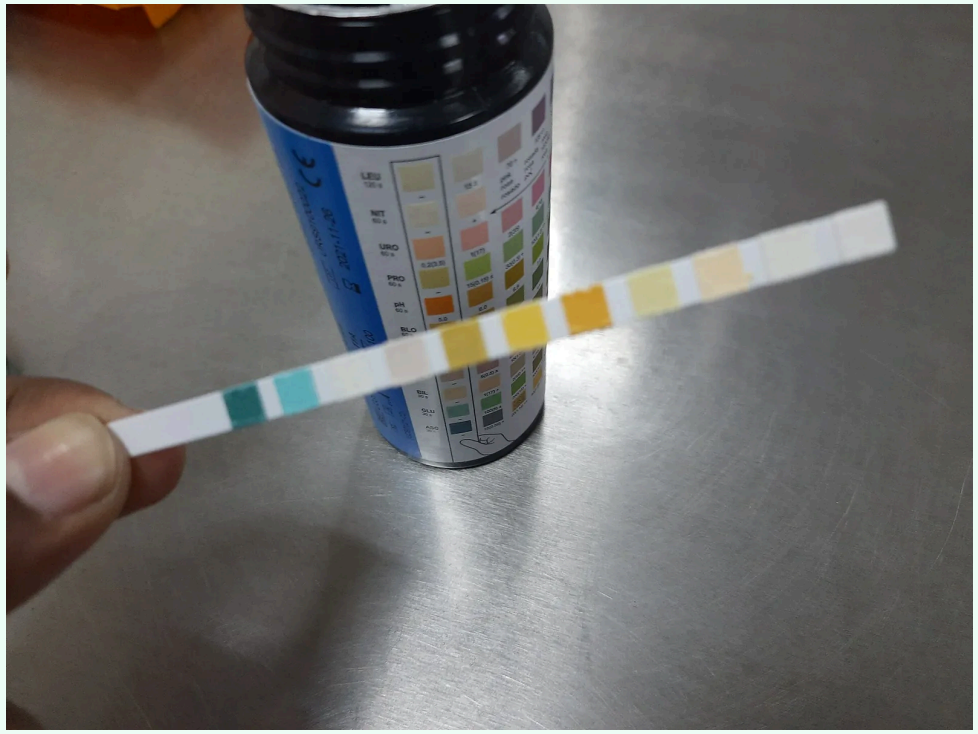


Urine and fluid intake

- A large water intake lowers antidiuretic hormone.
- The duct then keeps water in the urine.

Urine test strips and their limits

- Compare each simulated result with the expected range.
- A single strip is a class model, and a clinical lab uses a tighter method.



Pores and machines

- Compare the duct when antidiuretic hormone is present and when it is scarce.
- Say what dialysis moves out of the blood.

Muscles move the rest of the body

- Smooth, cardiac, and skeletal muscle support these organs.
- The sliding filament is the next mechanism.

Image credits

Ajay Kumar Chaurasiya, Special urine test during urine analysis, CC BY-SA 4.0

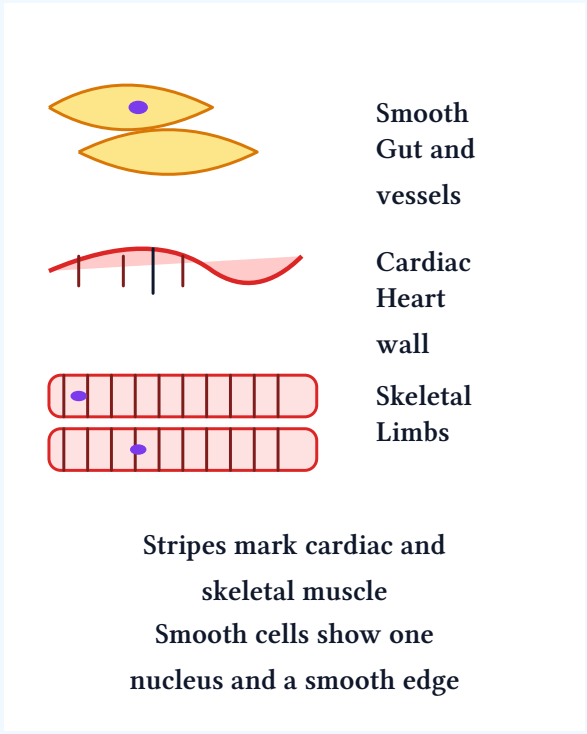
Biology 20

Unit D: Human body systems

Three muscles and the sliding filament

Three shapes under the lens

- Smooth cells taper, with one nucleus, and they serve gut and vessels.
- Cardiac cells branch in the heart wall, and skeletal fibres are long and striped in the limbs.



Each tissue holds up other systems

- Smooth muscle moves food and changes vessel width.
- Cardiac muscle pumps blood through both circuits.
- Skeletal muscle breathes, stands, and walks, and it makes heat.

Key terms

cardiac muscle

The striped, branching muscle of the heart wall that pumps blood.

sarcomere

The repeating unit of a striped muscle fibre, from one Z line to the next.

actin

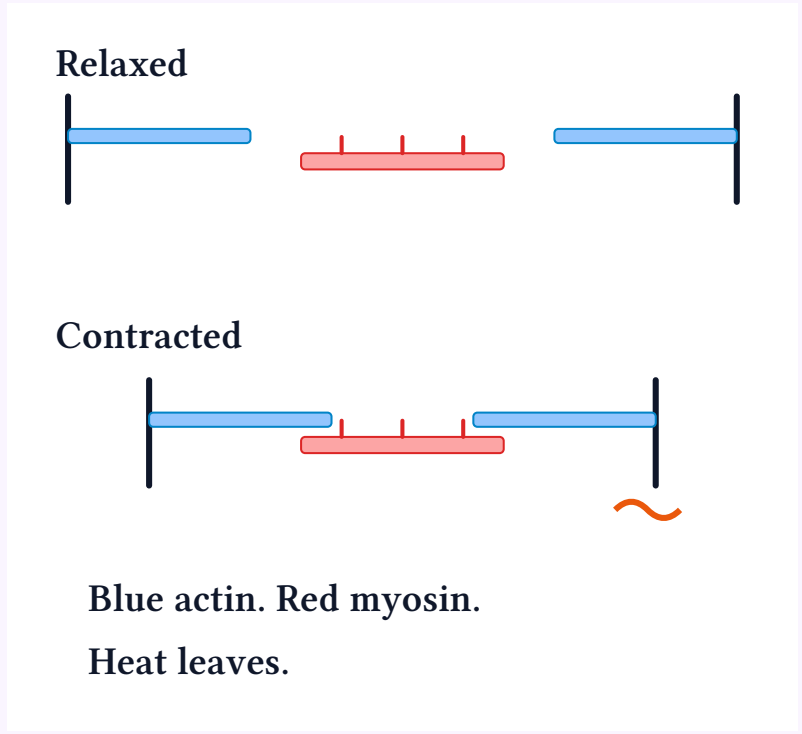
The thin filament, drawn in blue, that slides inward over myosin.

myosin

The thick filament, drawn in red, that pulls on actin during contraction.

The filaments slide and stay long

- Blue actin and red myosin keep their length in both drawings.
- The contracted sarcomere has closer Z lines and more overlap.
- A small heat mark leaves the working sarcomere.



A paper sarcomere

- Record actin length and myosin length before the slide.
- After the Z lines move closer, those lengths read the same.

Tissues and organ jobs

- Peristalsis in the intestine is smooth muscle.
- The heartbeat is cardiac muscle, and a step is skeletal muscle.

Tissue and slide

- Tell the three muscle tissues apart with one visual clue each.
- Describe the sliding filament and the heat that leaves.

More lifts, more heat

- The heat mark on the contracted sarcomere can be measured.
- The next lesson compares one lift with many lifts.

Biology 20

Unit D: Human body systems

Muscle fatigue and care

ATP use in repeated lifts

- The single curl shows one gold ATP circle and one heat wave.
- The repeated curls show a stack of ATP circles and several heat waves.

Muscle force and fatigue

- Each contraction spends ATP and releases some energy as heat.
- Muscle fatigue shows up as a drop in force during repeated work.
- Creatine phosphate can rebuild ATP for a brief burst.

Key terms

muscle fatigue

The drop in force that appears when a muscle's ATP supply lags behind repeated work.

creatine phosphate

A small energy store in muscle that can quickly rebuild ATP for a short burst.

anabolic steroid

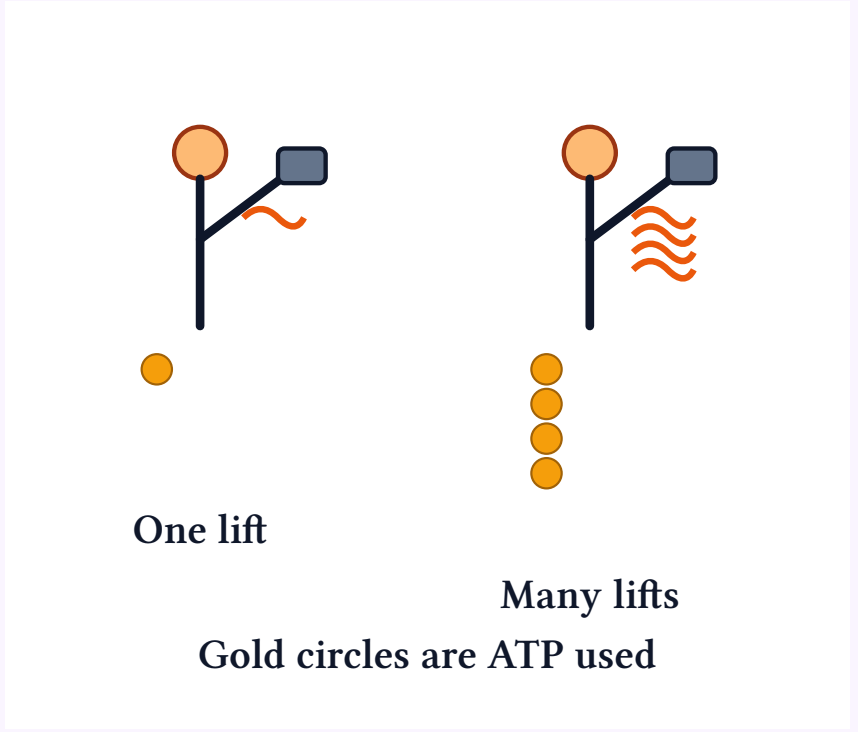
A drug related to testosterone that can increase muscle size and also harm other body systems.

tendonitis

Inflammation of a tendon, often after repeated overload where muscle meets bone.

More ATP use releases more heat

- Gold circles count ATP used, and they stack on the busy side.
- Heat waves increase on that same side.
- The muscle is the same arm in both drawings.



A small heat table

- Ten curls raise skin temperature more than two curls.
- The unit on the table is degrees Celsius.

Injury words and drug limits

- Atrophy is muscle loss from disuse, strain is a tear from overload, and tendonitis is an irritated tendon.
- An anabolic steroid can enlarge muscle and harm the heart, liver, and hormone balance.

Heat and care

- Relate ATP use and heat to repeated lifts.
- Define muscle fatigue and one injury, and name a steroid harm.

Heat still leaves the living system

- The heat waves on the busy arm are energy leaving the body.
- That same idea opened the course in the biosphere.