Matter and energy in living systems slide deck

Science 14

Unit C: Matter and energy in living systems

Food labels and diets

Two lunches, two labels

- A packaged soup and a homemade bowl can look like the same meal.
- The label on the package lists sodium, fat and calories per serving.

Nutrients and two diet patterns

- A nutrient is a substance in food the body uses, such as protein or fat.
- A mixed diet includes animal foods and plants. A vegetarian diet is built from plants, sometimes with dairy or eggs.

Key terms

nutrient

A substance in food that the body uses, such as protein, carbohydrate, fat, vitamins or minerals.

mixed diet

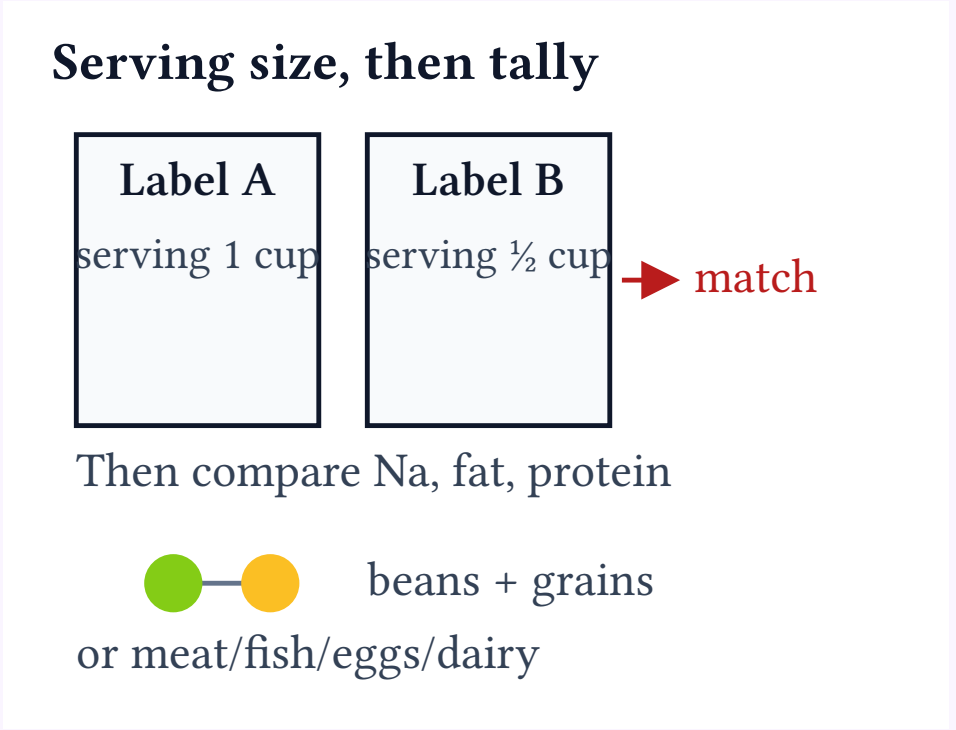
A pattern of eating that includes foods from animals and from plants.

vegetarian diet

A pattern of eating built from plant foods, sometimes with dairy or eggs, and planned so nutrient needs are met.

Serving size, then the nutrient tally

- Match the serving sizes first, then compare sodium, fat, and protein.
- Beans with grains can cover protein in a vegetarian pattern. Meat, fish, eggs, or dairy can cover it in a mixed pattern.



Two cups of soup

- The label says 700 mg of sodium in one cup.
- Two cups are two servings, so the sodium is 1400 mg.

Crackers and soup

- Five crackers are one serving and one cup of soup is another.
- Write both serving sizes before you compare the sodium.

Sodium and blood pressure

- A high-sodium pattern raises the sodium you eat in a day.
- That pattern is linked with higher blood pressure.

Bring a label, leave with a tally

- The serving size tells you how much food the sodium and fat numbers belong to.
- A diet works when the day’s foods cover protein and the other nutrients the body uses.

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From the intestine into the blood

Blood sugar rises after lunch

- Lunch leaves the plate, and later the blood sugar number rises.
- The intestine passes food molecules into the blood.

Digestion and circulation

- Digestion breaks food into smaller molecules the intestine can absorb.
- The heart pumps the blood that receives those molecules, and the lungs refresh its gases.

Key terms

digestion

The breakdown of food into smaller molecules the body can absorb.

absorption

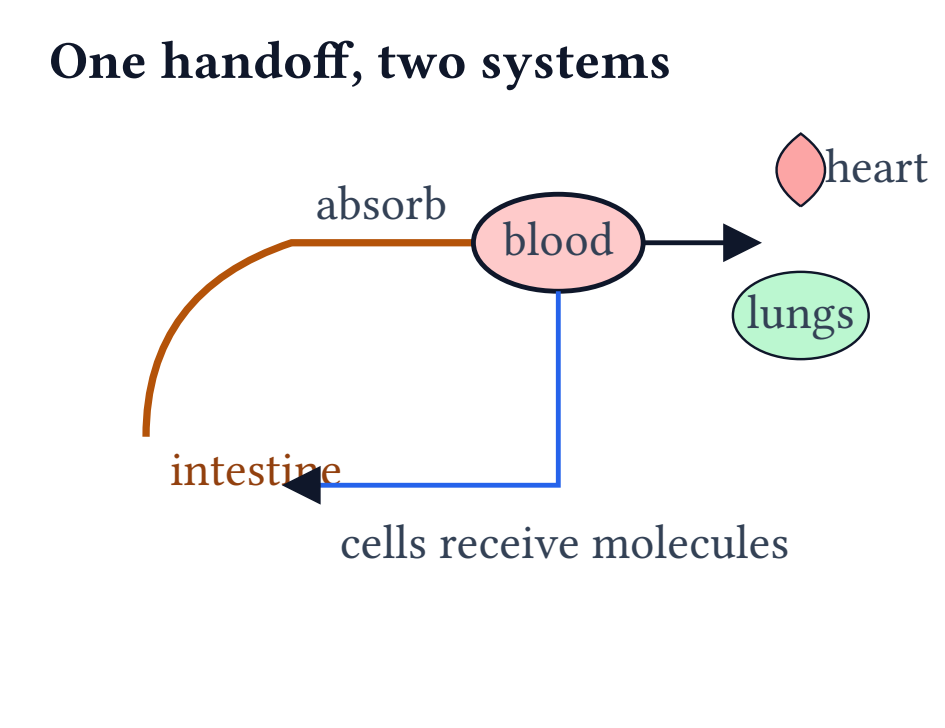
The movement of those molecules from the intestine into the blood.

circulatory system

The heart, blood and vessels that carry materials, including the products of digestion, around the body.

One handoff, two systems

- The intestine absorbs molecules into the blood.
- The heart and lungs move and refresh that blood so cells can receive the molecules.



A glucose drink

- The sugar starts in the cup.
- The intestine absorbs it, and blood sugar rises.

Blood sugar after a meal

- A rise in blood sugar is evidence of absorption.
- The molecules crossed from the intestine into the blood.

Starch in bread

- A slice of bread contains starch.
- Describe the path from the intestine into the blood.

Digestion and circulation

- One arrow for absorption, one arrow for blood flow, one note for the lungs.
- Harvey, Beaumont, and Pavlov studied pieces of this route. The route itself is the idea to keep.

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Homeostasis and medical technology

Salt and blood pressure

- A salty meal is followed by a rise in blood pressure in many people.
- A sugary meal is followed by insulin release that brings blood sugar back down.

Homeostasis and two tools

- Homeostasis is the body keeping an internal balance after a meal or a change.
- A stethoscope helps someone listen. A pacemaker helps the heart keep a useful rhythm.

Key terms

homeostasis

The body's maintenance of internal balance, with the digestive and circulatory systems adjusting to each other.

insulin

A hormone that helps lower blood sugar after it rises.

pacemaker

A device that helps the heart keep a useful rhythm when the heart's own signal needs support.

Tools that see or support the balance

- A stethoscope lets a listener hear the heart. An endoscope shows the inside of the digestive tract.
- Dialysis filters the blood when kidneys need support. A pacemaker supports heart rhythm.



Juice and insulin

- Blood sugar rises after the juice.
- Insulin helps move sugar out of the blood toward the earlier level.

A normal swing

- Blood sugar rises after a meal and then falls.
- That swing is part of ordinary balance.

Disorders and medical devices

- Absorbing salt can raise blood pressure.
- A pacemaker can support heart rhythm when the heart needs that help.

A disorder and its system

- Name the body system, what went out of balance, and the evidence you used.
- Take personal health worries to a trusted adult or a clinician.

Image credits

Jonas@sodratornet.se, Dialog-dialysis-machine-b-braun, CC BY-SA 4.0

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Microscopes and cells

A cork slice and a living droplet

- Robert Hooke saw box-like spaces in cork and called them cells.
- Antony van Leeuwenhoek saw living microscopic organisms moving in water.

Cell theory and the membrane

- Cell theory says living things are made of cells, and cells come from cells.
- The cell membrane is the boundary that controls what enters and leaves.

Key terms

cell theory

The explanation that living things are made of cells and that cells come from existing cells.

cell membrane

The thin boundary that controls what enters and leaves the cell.

chloroplast

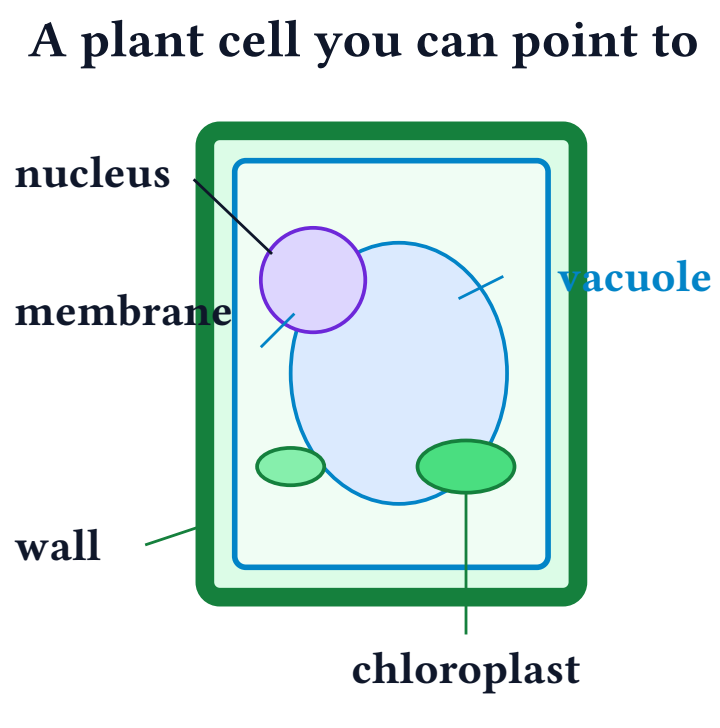
The plant cell part where photosynthesis captures light energy in glucose.

mitochondrion

The cell part where respiration releases usable energy from food molecules.

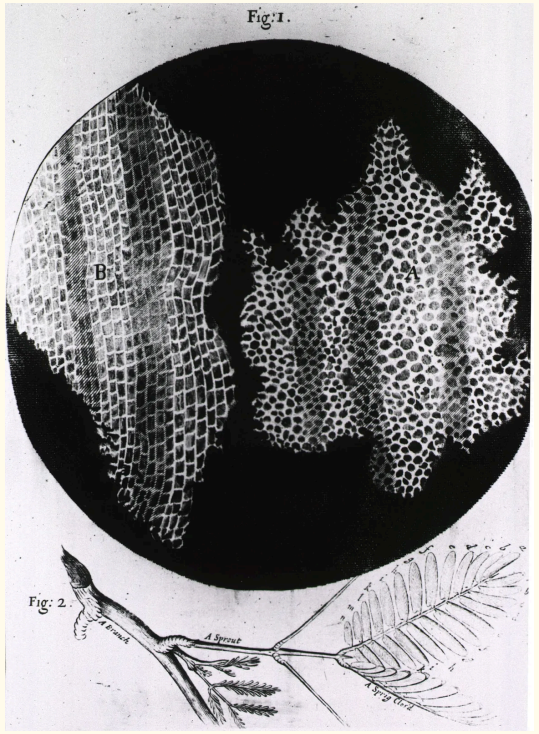
Cell parts and functions

- The nucleus holds the genetic instructions.
- The cell membrane controls what enters and leaves. The cell wall holds a plant cell up.



Hooke's cork

- A cork slice shows box-like spaces under the microscope.
- Say what Hooke contributed and what later observations added.



Leeuwenhoek's samples

- He saw living microscopic organisms moving in water.
- The full cell-theory claims grew as more observations were gathered.

Two claims and a pioneer

- State the two cell-theory claims used in this course.
- Name one pioneer who made cells visible with a microscope.

Slide labels and model critique

- Label a part when you can point to it on the slide or the diagram.
- A chloroplast on an animal cell is the error to catch.

Image credits

National Library of Medicine, Magnified view of cork tissue, public domain

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Photosynthesis and respiration

Photosynthesis and respiration in daily life

- The leaf stores sunlight in glucose.
- The walker releases energy from food molecules with each breath.

Photosynthesis and respiration

- Photosynthesis stores light energy in glucose and releases oxygen.
- Cellular respiration releases usable energy from glucose in the mitochondrion.

Key terms

photosynthesis

The process in which plants store light energy in glucose, using carbon dioxide and water and releasing oxygen.

cellular respiration

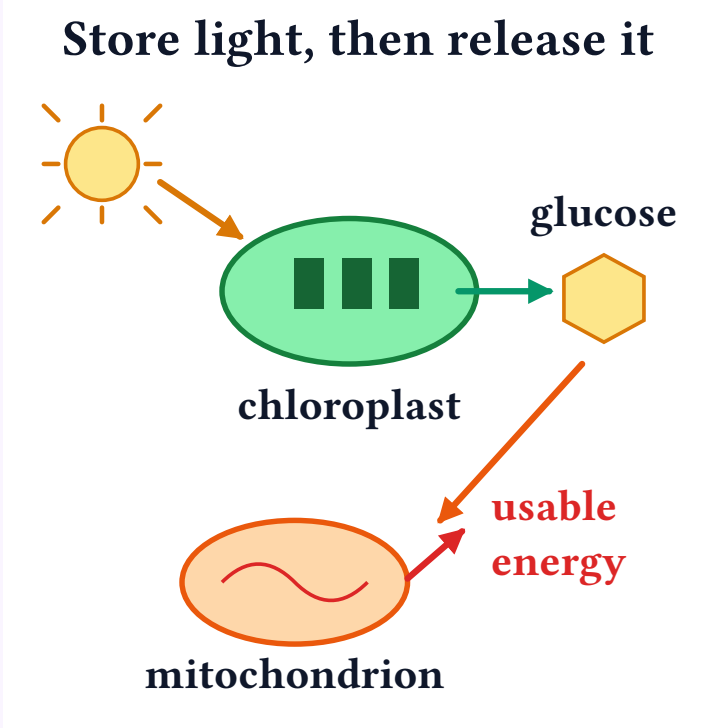
The process that releases usable energy from glucose, using oxygen and producing carbon dioxide and water.

life function

A job common to living systems: energy conversion, response, growth, reproduction, or managing thermal energy.

Energy storage and release

- Chloroplasts store light energy in glucose.
- Mitochondria release usable energy from glucose.



Where the energy sits

- A leaf is in the sun and a person is on a walk.
- Say where the energy in glucose comes from and where it is released.

Which process has the light

- Photosynthesis has light on the incoming side.
- Respiration starts with glucose and oxygen.

The word equation

- Write the word equation for photosynthesis from memory.
- Say what the arrow in that equation means.

Pair the equation with the organ

- Glucose is the stored form that links the leaf and the muscle.
- Sweat lets heat leave the skin. Hibernation and dormancy save energy through a hard season.

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Cell shapes and health monitors

Skin and nerve cells

- Skin cells are flat so they can cover a large area.
- Nerve cells are long so a signal can travel a long distance.

Stomata and a blood pressure cuff

- Stomata are tiny openings in a leaf that regulate gases and water.
- A blood pressure cuff measures the pressure of blood in the arteries.

Key terms

stomata

Tiny openings in a leaf that regulate gas exchange and water loss.

blood pressure cuff

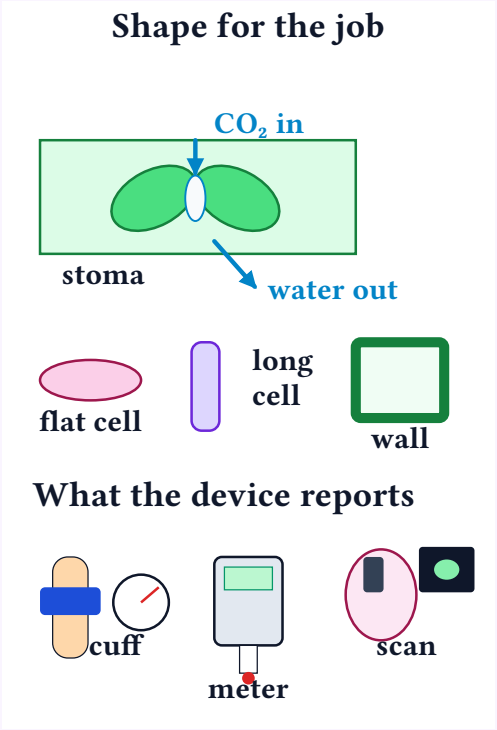
A device that measures the pressure of blood in the arteries.

blood glucose monitor

A device that measures the sugar level in a small blood sample.

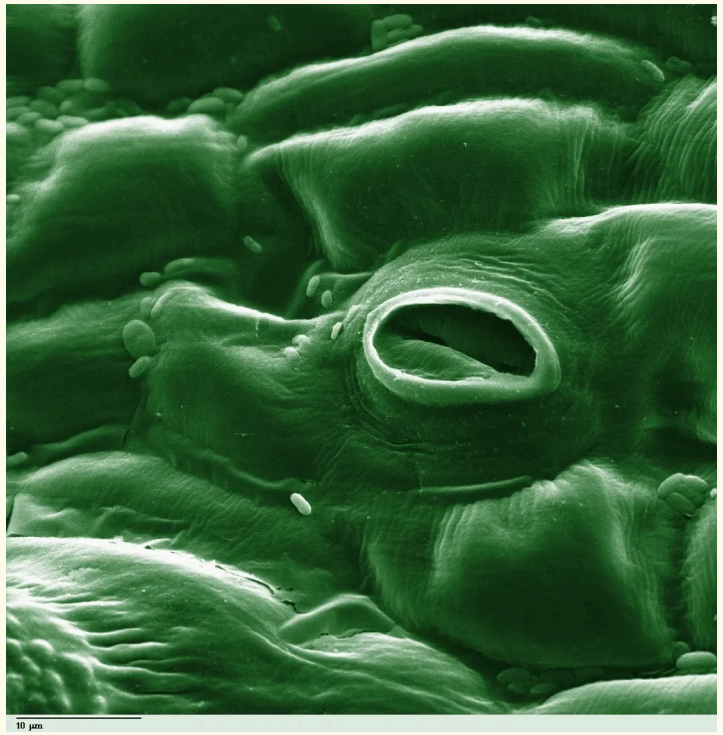
Cell shape and medical devices

- Stomata, walls, flat cells and long cells are adaptations you can point to.
- A cuff gives a blood pressure number. A glucose meter gives a blood sugar number. Ultra-sound makes a picture.



Openings in a leaf

- Stomata let gases move for photosynthesis.
- They also regulate water leaving the leaf.



A sealed leaf surface

- A sealed surface would block gas exchange.
- Stomata let the leaf handle water and gases together.

Three structures

- Match stomata, a nerve cell, and a sugar beet with a job.
- Use water and gases, signals, and stored energy in the match.

Cell investigation variables

- The cell's shape and the device's display are both answers to a life function.
- Exercise heart-rate trials name manipulated, responding and controlled variables.

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