IB BIOLOGY | B3.2 | SL AND HL

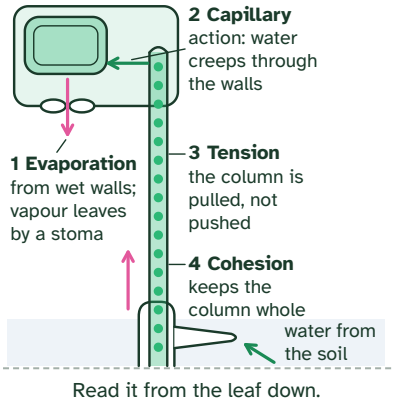
REVISION ON TWO PAGES

Fluids under *pressure*

What to know, what to draw and what to say. Nothing else.

THE ONE IDEA

Fluids flow from high pressure to low. Each vessel is built for the pressure it carries: thick to withstand it, thin to exchange.



Read it from the leaf down.

B3.2.7 START HERE

Water is *pulled* up from the top

- **Transpiration**: water evaporates from the wet walls of leaf cells and leaves through the stomata. The walls refill by **capillary action**, drawing water out of the xylem.
- That puts the xylem water under **tension** (a negative pressure potential), which draws the whole column up. **Cohesion** keeps the column continuous.
- The energy is the sun's: the plant spends **none of its own** lifting water.

THE PULL, FROM THE LEAF DOWN

Every Cool Tree Climbs

E Evaporation from the wet cell walls	**C** Capillary action through the walls	**T** Tension xylem water pulled	**C** Cohesion keeps the column whole

B3.2.8

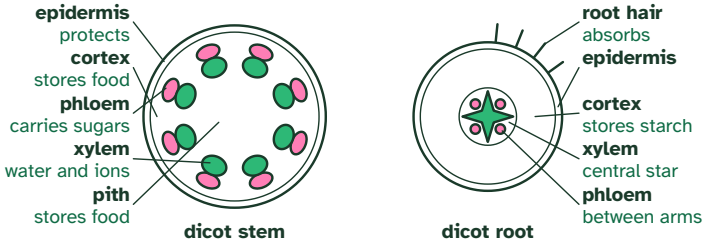
Xylem: built for *tension*

- Vessels are **dead**, empty tubes.
- **No contents, no end walls:** water flows **unimpeded**.
- **Lignified walls: lignin** stops them collapsing under tension.
- **Pits**, gaps in the lignin: water passes in and out sideways.

B3.2.9 and 10 SKILLS: PLAN DIAGRAMS

Stem and root in *section*

- **Stem:** a **ring of vascular bundles**; in each, phloem outside, xylem inside.
- **Root:** one **central core**: xylem a star, phloem between its arms.



Outlines only, no cells; annotate each tissue. Stem, outside in: *Eat Cake, Pass Xmas Pudding*.

B3.2.1, 2, 3 and 5

Arteries, capillaries, *veins*



artery thick wall, narrow lumen | **vein** thin wall, wide lumen | **capillary** one cell thick

Micrographs: judge the wall against the lumen.

	ARTERY	CAPILLARY	VEIN
Job	Away from the heart at **high pressure**.	Exchange with the tissues.	Back to the heart at low pressure.
Wall	Thick layers of **muscle** and **elastic fibres**.	One cell thick; some with **fenestrations**.	Thin and **flexible**, little muscle.
Lumen	Narrow, usually round.	5 to 10 μm, much branched.	Wide, often flattened.
So	Withstands pressure; **elastic recoil** maintains it.	**Large surface area**, short diffusion path.	Muscles squeeze it; **valves** stop backflow.

B3.2.4 SKILLS

Taking a *pulse*

- Feel the **radial** (wrist) or **carotid** (neck) pulse.
- **Two fingertips**, never the thumb: it has a pulse.
- Scale to **beats a minute**; check against a smartwatch.

18 × 4 beats in 15 s

72 beats a minute

B3.2.6

When a coronary artery *blocks*

STEP 1 **Atheroma** Fatty plaque narrows the lumen.

STEP 2 **Thrombus** A clot forms on a cracked plaque.

STEP 3 **Occlusion** Muscle beyond dies: a **heart attack**.

- **Risks:** high LDL, smoking, high blood pressure, inactivity, obesity.
- **Data:** r runs from –1 to +1. A strong correlation (saturated fat and CHD) **does not prove a cause**; a weak one can count against a hypothesis.

Tissue fluid, the *heart* and the phloem

B3.2.11 to 13 HIGHER LEVEL

Tissue fluid: *out and back*

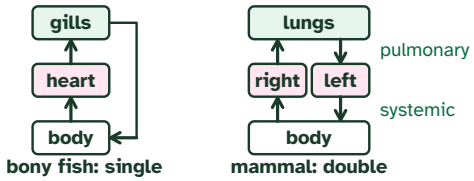
- **Out:** arteriole pressure forces plasma out: **pressure filtration**.
- **Back:** pressure is lower at the venule end: most **drains back**.
- **Excess** enters lymph vessels (gaps, **valves**), then veins in the neck.

Plasma in the capillary	**Many proteins**, red cells, platelets.
Tissue fluid round the cells	**Very few proteins**, no red cells. Cells take O_2 and glucose; give CO_2.

B3.2.14 HIGHER LEVEL

One loop or *two*

- **Bony fish:** heart **once** a circuit; low pressure to the body.
- **Mammal:** **pumped again after the lungs**; high pressure.



B3.2.15 HIGHER LEVEL

The heart, *part by part*

- **Cardiac muscle:** branched, intercalated discs; **myogenic**.
- The **SA node** (pacemaker), in the right atrium, starts each beat.
- **Atria** receive from veins; **ventricles** pump into arteries.
- A **septum** parts the sides; **coronary arteries** feed the wall.

VALVES, IN BLOOD ORDER — *Tiny Penguins Bake Apples*

T Tricuspid right AV	**P** Pulmonary semilunar	**B** Bicuspid left AV	**A** Aortic semilunar

B3.2.16 HIGHER LEVEL: LEFT SIDE, FROM THE SA NODE

One *cardiac cycle*

ALL **Atria** Contract first.	VALVES **Ventricle** Bicuspid shuts.	SWING **Squeeze** All valves shut.
OPEN **Outflow** Aortic opens.	SHUT **Slackens** Aortic shuts.	FILL **Fills** Bicuspid opens.

- Systolic over diastolic: about **120/80 mmHg**.

B3.2.17 HIGHER LEVEL

Root *pressure*

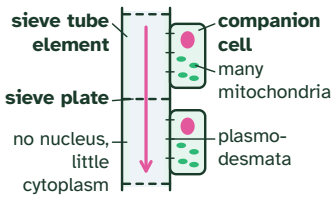
- Root cells pump mineral ions into the xylem by **active transport**.
- Water follows by **osmosis**, building a **positive pressure potential** that pushes it up a few metres.
- **When** transpiration fails: humid air, or spring before leaves open.

B3.2.18 HIGHER LEVEL

Phloem: *source to sink*

- **Sieve tubes: sieve plates**, few organelles, **no nucleus**: little blocks the flow.
- **Companion cells:** mitochondria make ATP to **load sucrose**; plasmodesmata link the two.
- Water follows by osmosis at a **source**; **mass flow** takes sap to a **sink**, up or down, to be unloaded.

Lazy Otters Push Fish Upstream: load, osmosis, pressure, flow, unload



WATCH OUT

Six mistakes that *cost marks*

- ✕ **The plant does not pump water up the xylem.** Evaporation pulls it.
- ✕ **Arteries are named by direction, not oxygen.** The pulmonary artery carries oxygen-poor blood.
- ✕ **The pulse is a pressure wave,** not blood rushing past.
- ✕ **Correlation is not causation.** A clue, never a proof.
- ✕ **Tissue fluid is not blood.** No red cells, very few proteins.
- ✕ **Pressure moves the valves,** not muscles. Cords only stop the flaps turning inside out.

COVER THE SHEET

Can you *answer these?*

1. Explain how transpiration draws water up the xylem.
2. Outline three adaptations of xylem vessels.
3. Draw plan diagrams of a dicot stem and root.
4. Distinguish an artery from a vein in a micrograph.
5. Describe how to measure a resting heart rate.
6. Outline how a coronary artery becomes occluded.
7. Explain how tissue fluid forms and returns. HL
8. Compare single and double circulation. HL
9. Describe one cardiac cycle, naming each valve. HL
10. Explain how root pressure is generated. HL
11. Explain how companion cells aid translocation. HL

IN THE EXAM

Name the pressure: tension (negative) pulls xylem water up; root pressure and loaded phloem sap are **positive** and push. Then say what sets up the difference.

GO FURTHER

Animated figures, a dry lab and a marked Check are in the full guide online.