Pathogens and the first lines of defence

60 minutes • C3.2.1, C3.2.2, C3.2.3 • Chapters 1, 2, 3

What pathogens are, how the skin and mucous membranes keep most of them out, and how a clot seals a cut

BY THE END, STUDENTS CAN

- [ ] Name the four kinds of pathogen and say how careful observation led to the control of infectious disease C3.2.1
- [ ] Explain how skin and mucous membranes act as a physical and chemical barrier C3.2.2
- [ ] Explain how platelets and the clotting cascade seal a cut C3.2.3

TIMING

0–5	5 min	**Do now: what keeps you healthy?**	
5–15	10 min	**Four kinds of pathogen**	
15–27	12 min	**Reading the evidence**	
27–37	10 min	**The wall**	
37–52	15 min	**Seal the cut**	
52–60	8 min	**Exit**	
	60 min	**One lesson**	

STARTER

5 min

Do now: what keeps you healthy?

On a mini whiteboard, list every way the body stops a microbe causing disease. Pairs merge lists. Keep them for the plenary.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 Four kinds of pathogen

CHAPTER 01 IN THE SLIDES

Tap the parts of the figure in turn: Virus: HIV, Bacterium: Vibrio cholerae, Fungus: Candida albicans and Protist: Plasmodium falciparum.

> **Predict box:** One group of microbes is often listed beside bacteria and fungi, yet no member is known to cause disease in humans. Which? Hands up or mini whiteboards first.
>
> **Answer C: Archaea, which are prokaryotes like bacteria**

02 The first line is a wall

CHAPTER 02 IN THE SLIDES

Switch the figure through Skin and Airway lining, and have the class say what will change before each.

> **Predict box:** A person with a severe burn is at high risk of infection. The best reason is: Hands up or mini whiteboards first.
>
> **Answer B: A burn removes the physical barrier, so microbes can get straight in**

03 A cut seals itself

CHAPTER 03 IN THE SLIDES

Step through the figure (5 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A **cut** breaks the skin and the vessel under it. Blood leaks out and microbes could get in.
2. **Platelets** stick to the damaged vessel and to each other, a first plug.
3. Platelets and damaged cells release **clotting factors**.
4. The factors start a **cascade**: thrombin forms, and thrombin converts soluble fibrinogen to insoluble fibrin.
5. Fibrin fibres make a **mesh** that traps red blood cells: a clot, which dries into a scab.

Play the animation, A cut and the clot. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. A **cut** breaks the skin and a small blood vessel under it. Blood leaks out, and microbes could get in.
2. **Platelets** (cell fragments) stick to the damaged vessel wall and to each other. They make a first plug, and the bleeding slows.
3. The platelets and the damaged cells release **clotting factors** (the purple dots).
4. The factors start a **cascade** of reactions. It makes **thrombin**, and thrombin converts soluble **fibrinogen** into insoluble **fibrin**.
5. Fibrin threads make a **mesh** that traps red blood cells: a **clot**. The bleeding has stopped, and the clot will dry into a scab.

> **Predict box:** Fibrinogen is dissolved in your blood plasma all the time. Why does your blood not clot inside healthy vessels? Hands up or mini whiteboards first.
>
> **Answer B: Thrombin is made only after platelets and damaged tissue release clotting factors**

> **Remember it:** Penguins Frequently Catch Minnows (Platelets, Factors, Cascade, Mesh).

THE LESSON

10 min

Four kinds of pathogen

Chapter 1's predict box first (which group is not known to cause human disease), then its figure: tap all four. Ask which are cells and which are not, and how that will matter for antibiotics later.

12 min

Reading the evidence

The cholera map activity: students see where deaths cluster and propose a cause before the pump is named. Link to chapter 1's box on John Snow and Ignaz Semmelweis: careful observation led to control before anyone had seen the pathogens.

10 min

The wall

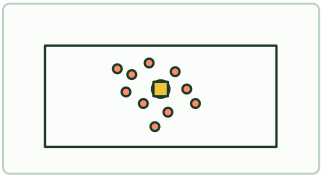
Chapter 2's predict box, then its switch between skin and airway. Students sort six barriers (keratin, sweat, sebum, mucus, cilia, stomach acid) as physical or chemical.

15 min

Seal the cut

Chapter 3's predict box, then its figure through all five steps. Then the human chain activity. Turn over the mnemonic tiles.

ACTIVITIES

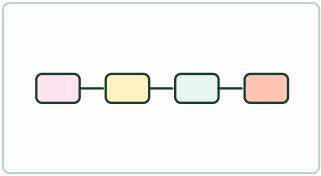


PRACTICAL

The cholera map

Give each pair a street map with the deaths from one outbreak marked as dots and the water pumps marked as squares (a version of John Snow's 1854 map that you redraw, or a made-up one). Pairs find the pattern, propose a cause, and say what further evidence they would want. Then reveal the pump and discuss how an observation led to action before the bacterium was known.

Needs: one map for each pair, coloured pencils.



ROLE PLAY

The human chain

Eight students are the steps of the clotting story: platelets, clotting factors, prothrombin, thrombin, fibrinogen, fibrin, red cells and the scab. They stand in order holding cards and hand a ball (the signal) down the line. The class says what each does. Swap roles and repeat with the platelets absent to see what stops.

Needs: eight role cards and a ball.

PLENARY

8 min

Exit

Which would be more serious for infection: losing your skin over a hand-sized area, or losing your platelets? Explain in three sentences.

WHAT STUDENTS GET WRONG

"All microbes are germs that make us ill." Most are harmless, and many help, like the bacteria of the gut. A pathogen is one that causes disease.

"Platelets are cells." They are fragments of cells, made in the bone marrow. They have no nucleus.

STRETCH AND SUPPORT

Support: a table with the four pathogen types, one example of each, and a column for "cell or not".

Stretch: why were Semmelweis's results not believed at first, and what would change a scientific community's mind?

IN THE GUIDE

1 Four kinds of pathogen
2 The first line is a wall
3 A cut seals itself
All The whole guide, with the figures that play
PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on C3.2 each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=C3.2&level=SL&paper=quiz&marks=15&src=ep

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on C3.2, built from its key terms and ready to print
- A pub quiz with rounds on C3.2, to present or run with no projector
- An escape room built from the question bank on C3.2

ALREADY ON THE SITE FOR C3.2

- Quiz: Defence Against Disease (HL)
- Quiz: Defence Against Disease
- Revision map: C3.2 Defence against disease, to fill in
- Exam questions: C3.2 in the exam maker, a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- C2.2–C3.2 Neural Signalling, Body Systems & Defence
- C3.2–D1.3 Defence Against Disease & Mutations

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.