

Exercise walk-through

The immune system ■ 11.1

eXercise

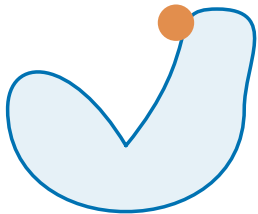
You must be able to

- describe the mode of action of phagocytes and explain self vs non-self antigens
- describe the primary immune response (macrophages, B- and T-lymphocytes)
- explain the role of memory cells in the secondary response and long-term immunity

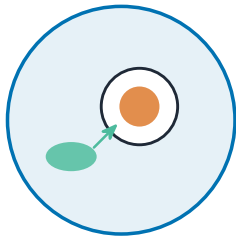
Method — Phagocytes

A phagocyte (macrophage or neutrophil) destroys a pathogen by **phagocytosis** 吞噬作用: it engulfs the pathogen, digests it with enzymes, then displays its **antigen**. A **self antigen** is the body's own marker (ignored); a **non-self antigen** is foreign (triggers a response).

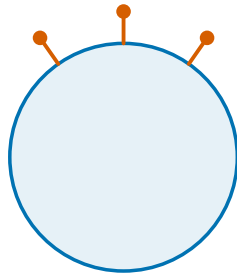
Method — Phagocytes



1. engulfs the
pathogen



2. digests it
with enzymes

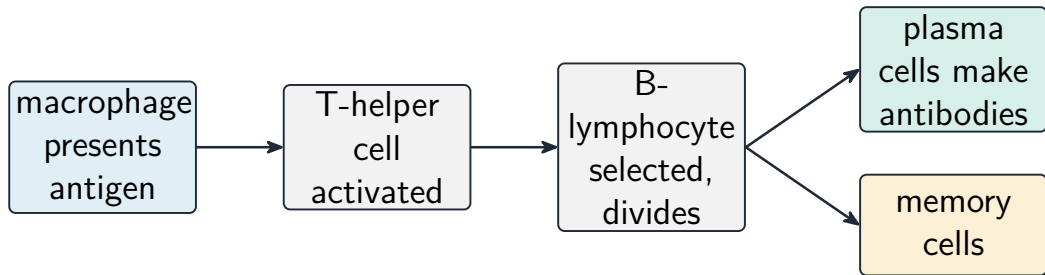


3. displays the
antigen

Method — The primary immune response

A macrophage presents the antigen; a matching **T-helper cell** 辅助性 T 细胞 activates the matching **B-lymphocyte**, which divides into **plasma cells** 浆细胞 (make **antibodies** 抗体) and **memory cells**. **T-killer cells** destroy infected body cells.

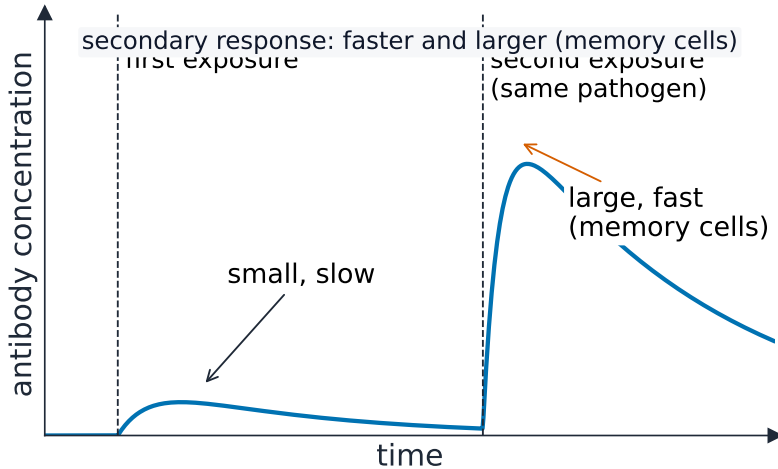
Method — The primary immune response



Method — Memory cells and the secondary response

Memory cells stay for years; a second exposure to the **same** pathogen gives a faster, larger secondary response, destroying it before illness.

Method — Memory cells and the secondary response



Practice 2.1 ■ 2 marks

State what an antigen is, and the difference between a self and a non-self antigen.

Solution 2.1

Method: Phagocytes

Worked steps

an antigen is a molecule (usually a protein) on a cell surface that the immune system recognises **B1**; a self antigen is the body's own (ignored), a non-self antigen is foreign and triggers a response **B1**.

Practice 2.2 ■ 2 marks

Name the cells that (a) make antibodies and (b) remain to give long-term immunity.

Solution 2.2

Method: The primary immune response

Worked steps

(a) plasma cells **B1**; (b) memory cells **B1**.

Exam-style 3.1 ■ 1 mark

What does a macrophage do **after** digesting a pathogen?

- A** makes antibodies
- B** displays the pathogen's antigen on its surface
- C** becomes a memory cell
- D** divides to form plasma cells

Solution 3.1

- A makes antibodies
- B displays the pathogen's antigen on its surface** 
- C becomes a memory cell
- D divides to form plasma cells

Worked steps

- B. A macrophage displays the antigen to alert other immune cells.

Exam-style 3.2 ■ 1 mark

Why is the secondary immune response faster than the primary response?

- A** there are more pathogens
- B** memory cells are already present and respond quickly
- C** phagocytes work faster the second time
- D** the antigen has changed shape

Solution 3.2

Method: Memory cells and the secondary response

- A there are more pathogens
- B memory cells are already present and respond quickly** 
- C phagocytes work faster the second time
- D the antigen has changed shape

Worked steps

B. Memory cells are already present, giving a quicker, larger response.

Exam-style 3.3 ■ 4 marks

Describe the sequence of events in the primary immune response, from a macrophage presenting an antigen to the production of antibodies.

Solution 3.3

Method: The primary immune response

Worked steps

a macrophage engulfs the pathogen and displays its antigen **B1**; a T-helper cell with a matching receptor is activated **B1**; it activates the matching B-lymphocyte, which divides **B1**; into plasma cells that secrete antibodies **B1**.

Exam-style 3.4 ■ 2 marks

Explain why a person who has recovered from a disease is often immune to that same disease for many years.

Solution 3.4

Method: Memory cells and the secondary response

Worked steps

memory cells made in the first infection remain in the body **M1**; they respond rapidly and strongly if the same pathogen returns, destroying it before illness **A1**.