

11.1 The immune system

Name: _____ Class: _____ Date: _____

Total: 12 marks

Objective

Build the skills to answer exam questions on **the immune system** — **phagocytes** 吞噬细胞, **antigens** 抗原, the **primary immune response** 初次免疫反应, and **memory cells** 记忆细胞.

You must be able to:

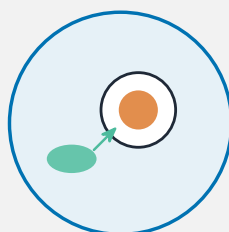
- describe the mode of action of phagocytes and explain self vs non-self antigens
- describe the primary immune response (macrophages, B- and T-lymphocytes)
- explain the role of memory cells in the secondary response and long-term immunity

1 Worked examples

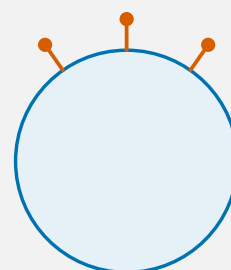
■ Phagocytes



1. engulfs the pathogen



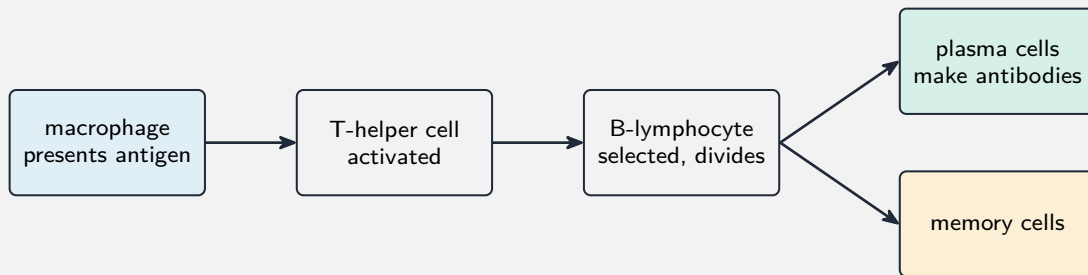
2. digests it with enzymes



3. displays the antigen

Phagocytosis: the phagocyte engulfs the pathogen, digests it, then displays its antigen

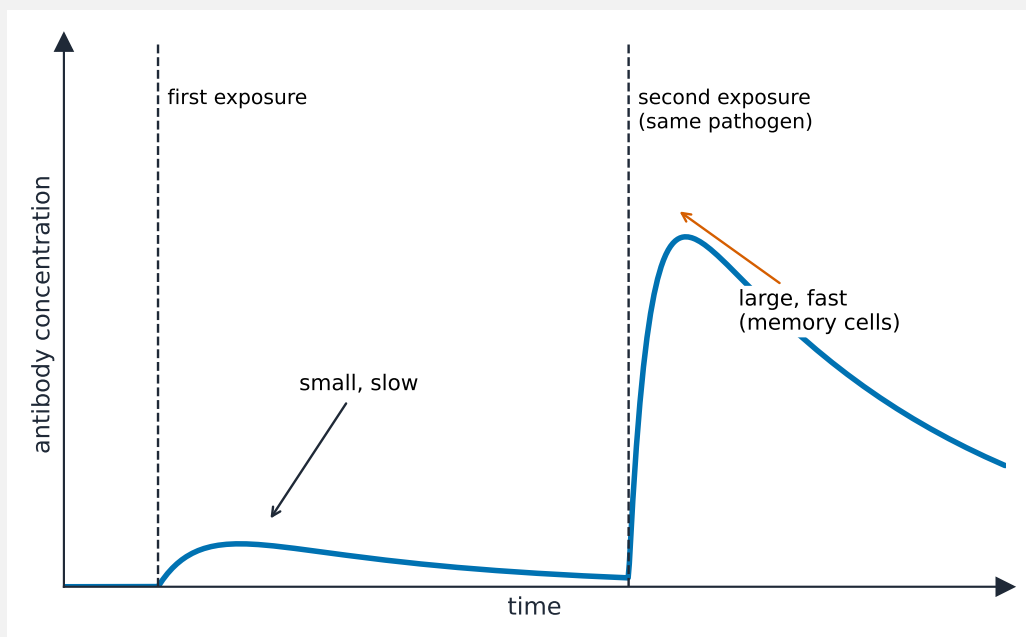
A phagocyte (macrophage or neutrophil) destroys a pathogen by **phagocytosis** 吞噬作用: it engulfs the pathogen, digests it with enzymes, then displays its **antigen**. A **self antigen** is the body's own marker (ignored); a **non-self antigen** is foreign (triggers a response).



Only the B-lymphocyte matching the antigen is selected and cloned into plasma cells and memory cells

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.

■ Memory cells and the secondary response



The secondary response is faster and larger because memory cells are ready

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

2 Practice

2.1 State what an antigen is, and the difference between a self and a non-self antigen.[2]

2.2 Name the cells that (a) make antibodies and (b) remain to give long-term immunity. [2]

3 Exam-style questions

3.1 What does a macrophage do **after** digesting a pathogen? [1]

- **A** makes antibodies
 - **B** displays the pathogen's antigen on its surface
 - **C** becomes a memory cell
 - **D** divides to form plasma cells
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3.2 Why is the secondary immune response faster than the primary response? [1]

- **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
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3.3 Describe the sequence of events in the primary immune response, from a macrophage presenting an antigen to the production of antibodies. [4]

3.4 Explain why a person who has recovered from a disease is often immune to that same disease for many years. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **11.1 The immune system** past-paper sheet in the Library, or try these in **Practice mode**:

- 9700/11 N25 —Q40 (immune response)
- 9700/12 N25 —Q39 (phagocytes and lymphocytes)

Solutions

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

2.2 (a) plasma cells; (b) memory cells.

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

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

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

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