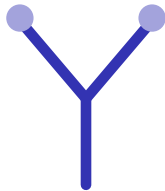


Immunity

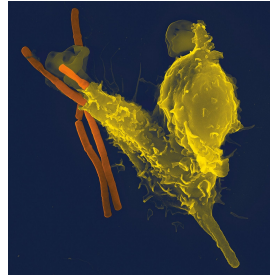
A-Level Biology ■ Topic 11

A-Level Biology



What we will cover

- 1 Phagocytosis
- 2 The primary response
- 3 Memory & immunity
- 4 Antibodies
- 5 Monoclonal antibodies
- 6 Vaccination

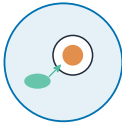


a phagocyte engulfing bacteria

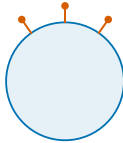
Phagocytosis



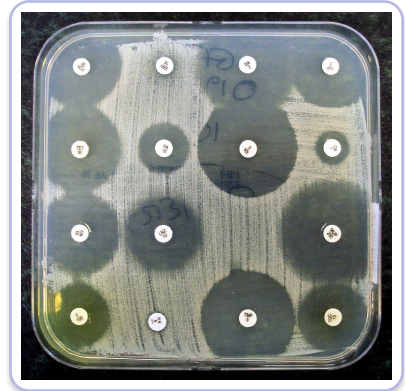
1. engulfs the pathogen



2. digests it with enzymes

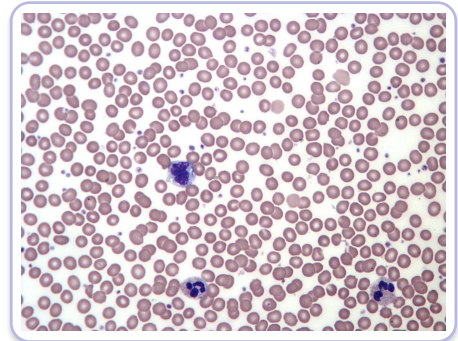
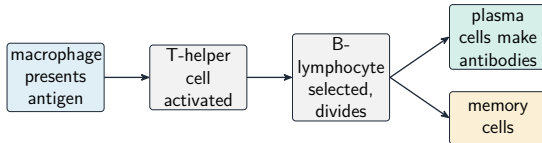


3. displays the antigen



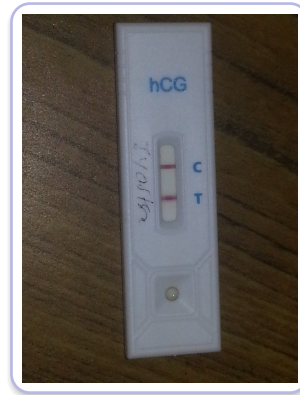
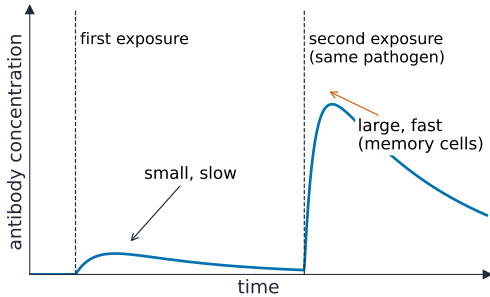
antigens plate

The primary immune response



blood smear

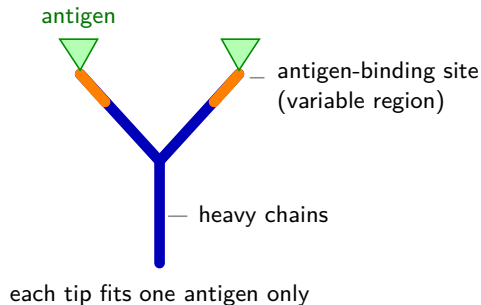
Memory and long-term immunity



test

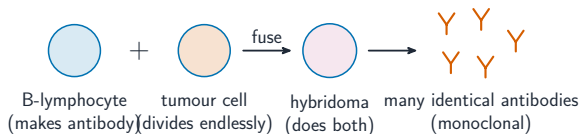
pregnancy

Antibodies



An **antibody** 抗体 is a Y-shaped protein; its two tips (the **variable region** 可变区) bind one antigen only. They clump pathogens, mark them for phagocytes, and block toxins.

Monoclonal antibodies



A **monoclonal antibody** 单克隆抗体 is one identical antibody, made by the **hybridoma** 杂交瘤 method (a B-lymphocyte fused with a tumour cell). Used in **diagnosis** 诊断 (pregnancy tests) and treatment (drug targeting).

Types of immunity

	natural	artificial
passive	after an infection (your body responds)	vaccination (safe dose of antigen)
	antibodies passed from mother to baby	injection of ready-made antibodies

active = your body makes its own antibodies (slow, long-lasting);

passive = ready-made antibodies given (fast, short-lived)

- **active** 主动免疫 – your body makes its own antibodies (slow, **lasting**)
- **passive** 被动免疫 – ready-made antibodies (fast, **short**)

Each can be **natural** 天然 or **artificial** 人工.

Vaccination and herd immunity

the disease cannot pass through vaccinated people



A **vaccine** 疫苗 gives antigens that trigger memory cells – immunity **without** illness.

If enough people are vaccinated, the pathogen cannot spread – **herd immunity** 群体免疫 protects even the unvaccinated.

Worked example – primary vs secondary response

Explain why the second exposure to a pathogen produces a much faster, larger antibody response.

- **Primary:** few B cells carry the right receptor, so clonal expansion takes days.
- They differentiate into **plasma cells** (antibody) and **memory cells**.
- **Secondary:** many memory cells are already circulating, specific to that antigen.
- They become plasma cells at once $\Rightarrow$ **faster, higher, longer** – often no symptoms.

Memory cells are the whole point of vaccination. The lag in the primary response is **clonal expansion** – finding and multiplying the right B cell.

Topic 11 – key takeaways

1

Phagocytosis

engulf, digest, display the antigen

2

Response

select & clone B-cells; plasma & memory cells

3

Memory

secondary response is faster & larger

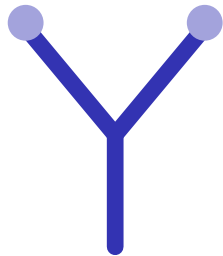
4

Vaccination

builds memory; herd immunity protects all

Check yourself

- 1 What does a phagocyte display after digesting a pathogen?
- 2 Which cells give long-term immunity?
- 3 Which part of an antibody binds the antigen?
- 4 What protects the unvaccinated when most are immune?



Answers 1. the pathogen's antigen 2. memory cells 3. the variable region 4. herd immunity