

Immunity

A-Level Biology ■ Topic 11

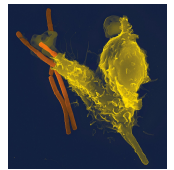
A-Level Biology



Immunity

What we will cover

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



a phagocyte engulfing bacteria

1 Defences

Immunity
└ Defences

Phagocytosis

- a **phagocyte** 吞噬细胞 recognises a pathogen and engulfs it in a vesicle
- the vesicle fuses with a **lysosome** 溶酶体 and the pathogen is digested
- antigens are displayed on the surface

Displaying the antigen links innate defence to the specific response.

Immunity
└ Defences

The primary immune response

Clonal selection 克隆选择: the lymphocyte whose receptor matches the antigen is the one that divides. It produces **plasma cells** 浆细胞 (make antibodies) and **memory cells** 记忆细胞. The first response is slow – days to a peak.

Immunity
└ Defences

Memory and long-term immunity

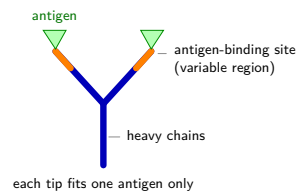
On re-exposure, memory cells divide at once: a faster, larger **secondary response** 二次应答. That is why vaccination works – it creates memory without the disease.

Active immunity makes your own memory cells (infection or vaccine). Passive immunity is borrowed antibodies – immediate, not lasting.

2 Antibodies

Immunity
↳ Antibodies

Antibodies

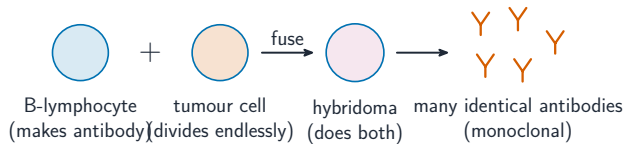


An **antibody** 抗体 is a Y-shaped protein; its two tips (the **variable region** 可变区) bind one antigen only. They clump pathogens, mark them for phagocytes, and block toxins.

Immunity
↳ Antibodies

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).



3 Immunity and vaccination

Immunity
↳ Immunity and vaccination

Types of immunity

- **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.

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

Immunity
↳ Immunity and vaccination

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.

4 Recap

Immunity
↳ Recap

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 ⇒ **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.

Immunity
↳ Recap

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

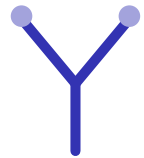
4 Vaccination

builds memory; herd immunity protects all

Immunity
↳ Recap

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