

Exercise walk-through

11.2

Antibodies and vaccination

A-Level Biology

Types of immunity

■ **active** – your body makes its own antibodies (slow, **lasting**)

■ **passive** – ready-made antibodies (fast, **short**)

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

	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

Vaccination and herd immunity

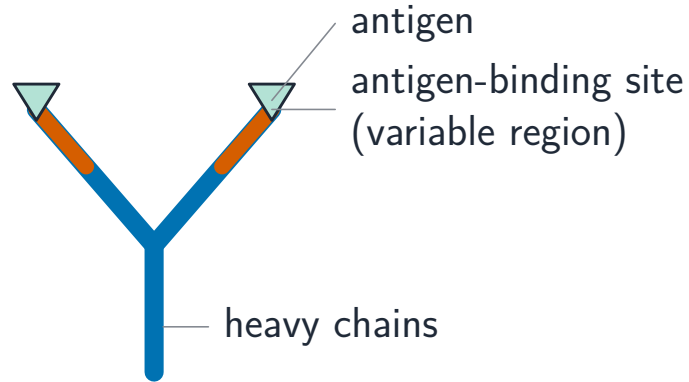
the disease cannot pass through vaccinated people



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

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

Antibodies, continued



each tip fits one antigen only

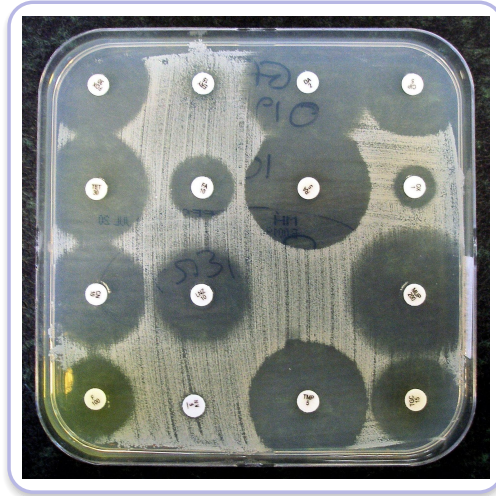
An antibody is Y-shaped; the two tips are the variable regions that bind one specific antigen

What an antibody actually does

the shape	Y-shaped, with two antigen-binding sites shape is complementary to one antigen	whose
neutralising	sticks to antigens, blocking the pathogen from binding to a host cell	
agglutination	clumps pathogens together, so they are easier to engulf and cannot spread	
opsonisation	marks pathogens so phagocytes recognise and engulf them	
and toxins	antibodies bind bacterial toxins, rendering them harmless	
natural immunity and artificial immunity	acquired by infection or by vaccine; active means your own cells made the antibodies, passive means they were given to you	

Breast milk is **natural passive**; a vaccine is **artificial active**; an antivenom is **artificial passive**.
Both axes are asked together.

Antigens: self and non-self



Clear zones on a culture plate: the immune system recognises non-self antigens and attacks foreign cells

Exercises 2.1-2.2

2.1 State the part of an antibody that binds the antigen, and explain why it binds only one antigen. [2]

2.2 State one difference between active and passive immunity. [1]

Exercises 2.1·2.2

2.1 State the part of an antibody that binds the antigen, and explain why it binds only one antigen. [2]

2.1

- the variable region / antigen-binding site; its shape is complementary to one antigen only
-

2.2 State one difference between active and passive immunity. [1]

2.2

- active immunity is made by your own body and is long-lasting; passive immunity uses ready-made antibodies and is short-lived

Exercises 3.1·3.2

3.1 Which is an example of **passive natural** immunity?

[1]

☐

A recovering from chickenpox

B being given a vaccine

C antibodies passing from a mother to her baby in breast milk

D being injected with ready-made antibodies

3.2 Why does passive immunity not last long?

[1]

☐

A the antibodies are the wrong shape

B no memory cells are produced

C the antigens are destroyed

D phagocytes remove the antibodies

Exercises 3.1-3.2

3.1 Which is an example of **passive natural** immunity?

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3.1 C

- Antibodies passing from mother to baby = passive (ready-made) and natural

3.2 Why does passive immunity not last long?

[1]

☐

A the antibodies are the wrong shape

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D phagocytes remove the antibodies

3.2 B

- No memory cells are made, so the immunity is short-lived

Exercise 3.3

3.3 (a) Outline how monoclonal antibodies are produced by the hybridoma method. [3]

(b) State **one** use of monoclonal antibodies in medicine and explain how their specificity is important. [2]

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3.3

(a)

- an animal is given the antigen so it makes B-lymphocytes producing the wanted antibody; these are fused with tumour cells to form hybridomas; the hybridomas both make the antibody and divide endlessly, giving many identical antibodies

(b)

- e.g. diagnosis (pregnancy test) or carrying drugs to cancer cells; the antibody binds only the target molecule/cell, so it is specific and does not affect others

Exercise 3.4

3.4 Explain how a vaccination programme can protect even people who have not been vaccinated. [3]

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3.4

- vaccinating enough people means the pathogen cannot pass easily between them; so it cannot reach the unvaccinated people – this is herd immunity