

Learning Intention:

To learn about the two different types of immunity and the strategies that can be used to generate them

Success Criteria:

- I can state the difference between natural and artificial immunity
- I can explain the active and passive strategies for acquiring immunity
- I can explain vaccination programs and their role in maintaining herd immunity.

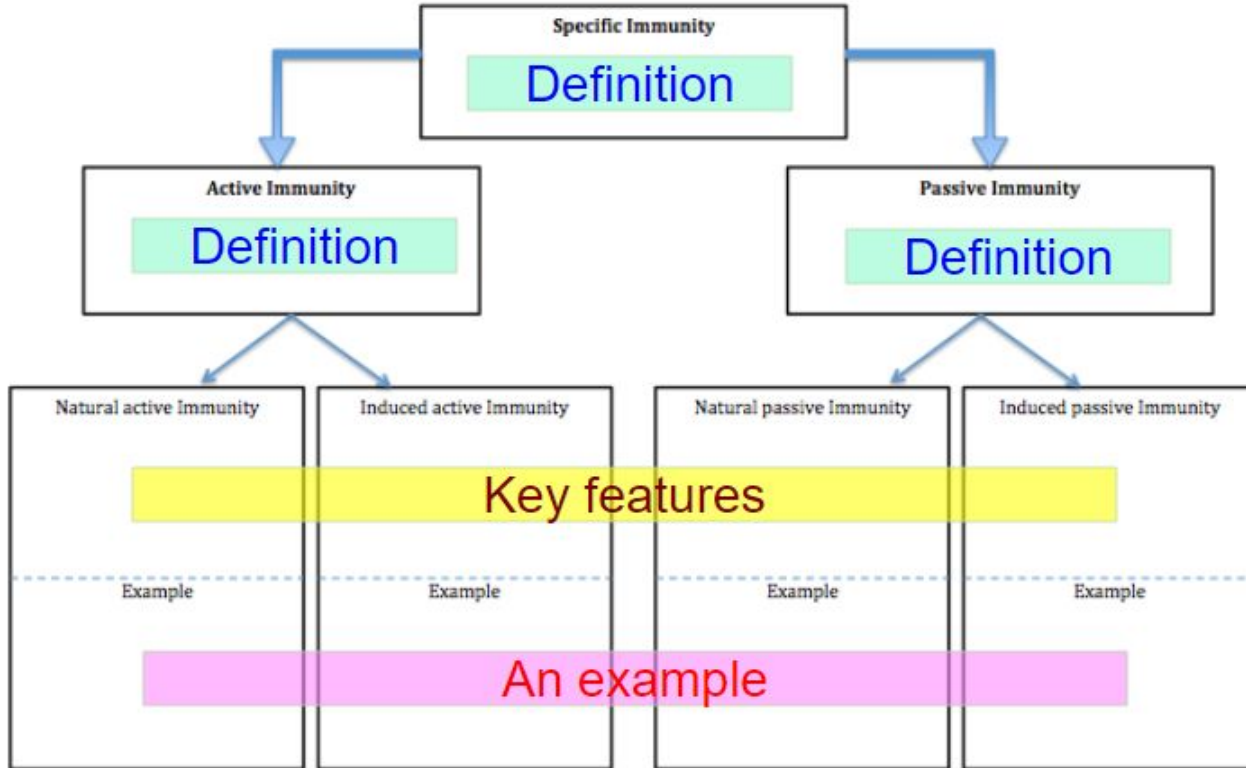


Study design dot point

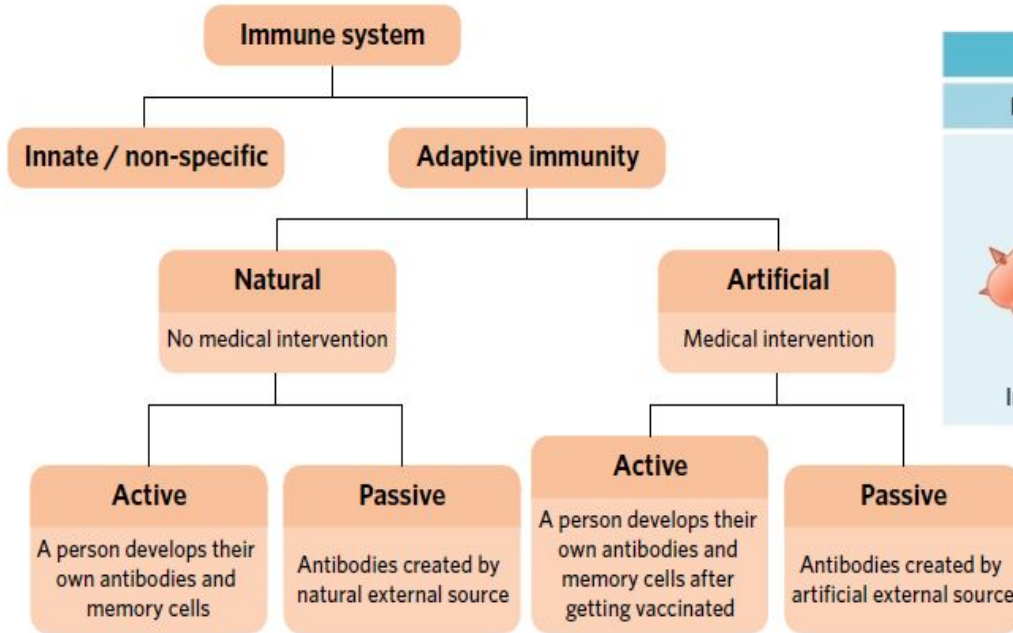
- the difference between natural and artificial immunity and active and passive strategies for acquiring immunity
- vaccination programs and their role in maintaining herd immunity for a specific disease in a human population




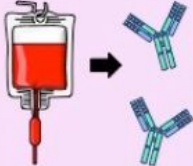
Activity to be done during the lesson

Fill out your graphic organizer (today's "notes") and submit to me by the end of class.



Different types of Immunity



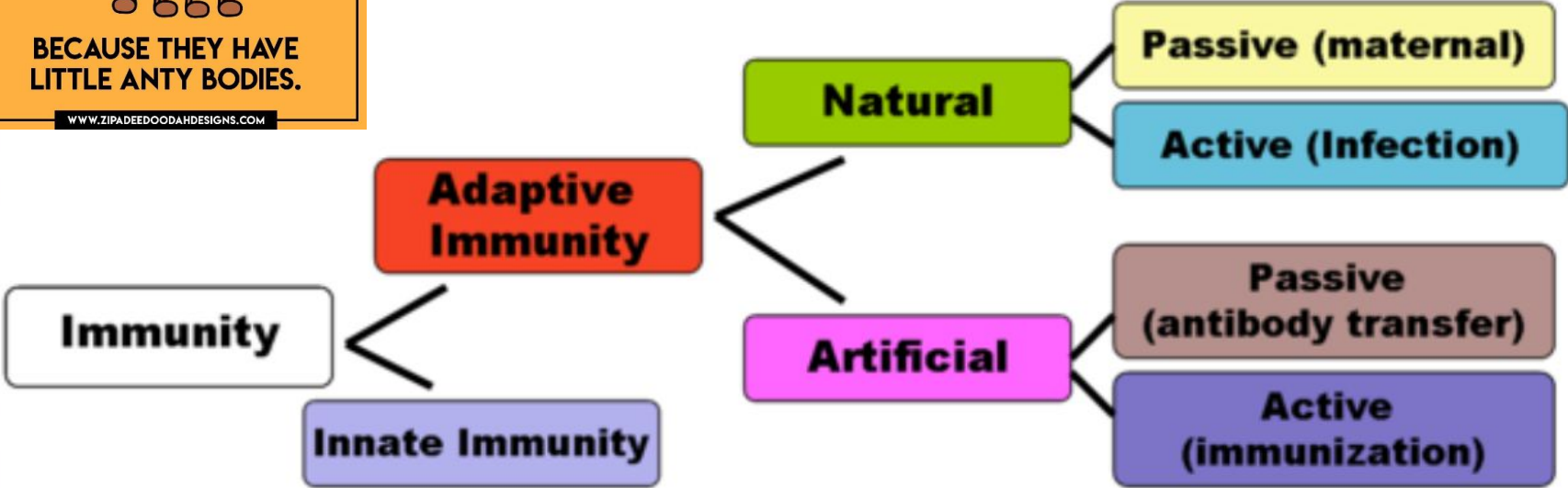
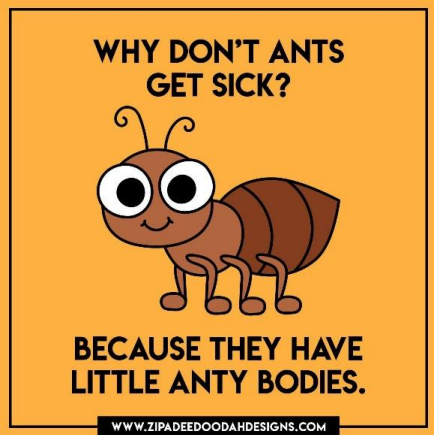
ACTIVE IMMUNITY		PASSIVE IMMUNITY	
Natural	Artificial	Natural	Artificial
			
Infection	Vaccination	Maternal antibodies	Monoclonal antibodies

Active and Passive immunity

Active immunity	Passive immunity
<ul style="list-style-type: none">• Adaptive immune response to antigen occurs in the individual.• The individual's immune system is activated against the antigen and achieves immunological memory.• Immunity can be maintained by stimulating memory cells, i.e. with booster vaccinations.• Immunity develops over weeks.	<ul style="list-style-type: none">• Adaptive immune response occurs in another organism that is exposed to the antigen and antibodies are then transferred to a recipient.• The recipient's immune system is not activated against the antigen and does not achieve immunological memory.• Immunity cannot be maintained.• Immunity is immediate.

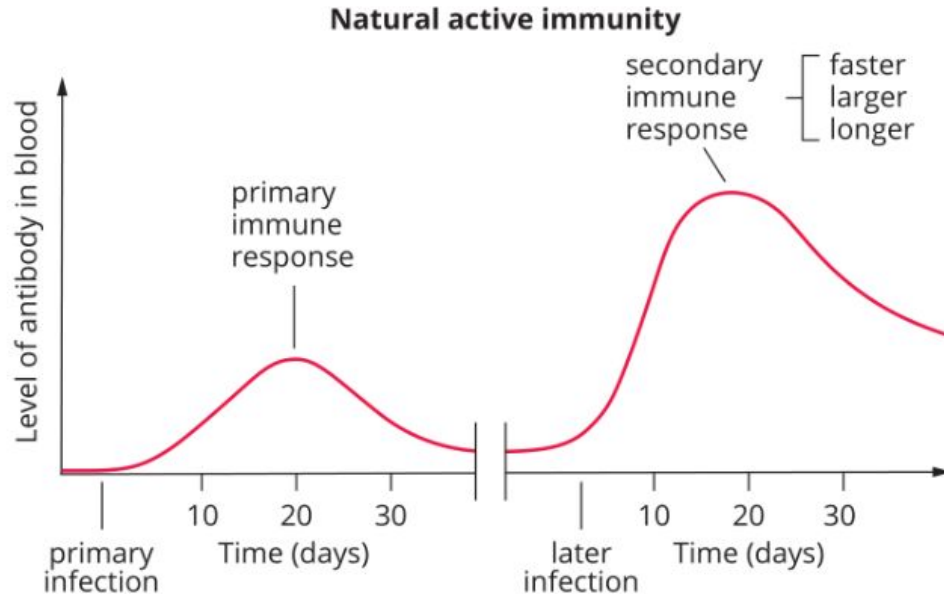
Immunity can develop naturally through exposure to a pathogen, or be induced artificially through purposeful introduction of antigens or antibodies into the body. Both active and passive immunity can arise **naturally or artificially**.

Method of achieving Immunity



Natural Active Immunity

Protection against a disease formed without medical intervention. Natural active immunity is created when an individual's own immune system encounters a pathogen and mounts a response against it, creating antibodies and memory cells specific to that pathogen. If exposed to the same antigen again in the future, the immune system will recognise it immediately, and a secondary immune response will occur. Secondary immune responses are much faster and stronger than primary immune responses, and are therefore more likely to minimise disease.



Natural passive immunity

Natural passive immunity is created when an individual acquires antibodies from a 'natural', non medical external source. Two methods of acquiring natural passive Immunity:

1. Breastfeeding
2. Placenta

It involves the passive transfer of antibodies from mother to foetus through the placenta prior to birth (these antibodies are **immunoglobulin G (IgG)**), and from mother to baby through breastfeeding. These maternal antibodies provide protection to the baby for weeks or months, while its own immune system is developing.



Artificial Active Immunity

Protection against a disease created by antibodies and memory cells produced by an individual's own immune system after medical intervention. Organisms are indirectly exposed to the pathogen through vaccination.

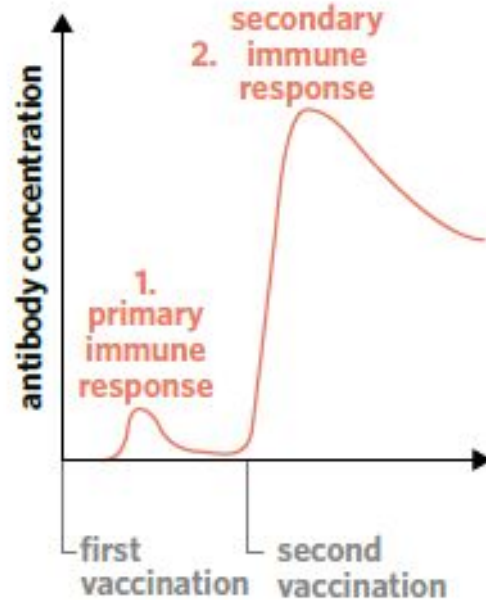
Vaccines have components that resemble antigens but do not cause symptoms of disease. These components can sometimes be attenuated (weakened) or inactivated (dead) pathogens, toxoids (toxins that have been altered so they can't cause disease), specific proteins from the surface of pathogens, or RNA that enters immune cells and causes them to make pathogen-like proteins.



Phases of artificial active immunity

There are two main phases to forming artificial active immunity:

- 1. The primary immune response:** The reaction of the adaptive immune system to an antigen it has not previously been exposed to. A moderate number of antibodies and memory cells are formed.
- 2. The secondary immune response:** The heightened reaction of the adaptive immune system to an antigen it has previously been exposed to. The memory cells created by the first vaccine quickly recognise the antigen in the vaccine and mount a rapid, large secondary immune response. This results in the generation of a large number of antibodies and memory cells that go on to create long-lasting immunity.



The formation of artificial active immunity via vaccination

Artificial Passive Immunity

When an individual acquires antibodies from an external source via a medical intervention (either via an injection or an infusion). For example, people who have been bitten by a snake are given an antivenom which contains antibodies designed to neutralise the venom.

Over time these antibodies degrade until they've all disappeared and the immunity they created has gone because the antibodies they receive will not trigger production of the memory cells responsible for immunological memory.

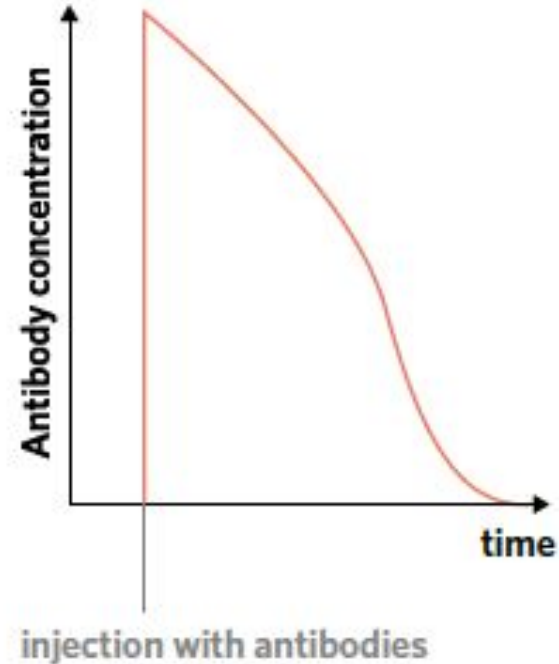


Figure 7 The formation of artificial passive immunity via antibody injection

Herd immunity

Herd immunity is achieved when the majority of people in a community are immune to a particular pathogen, helping to prevent the spread of the pathogen to those who haven't been vaccinated or who haven't already been infected with the pathogen. Herd immunity is often achieved through high rates of vaccination.

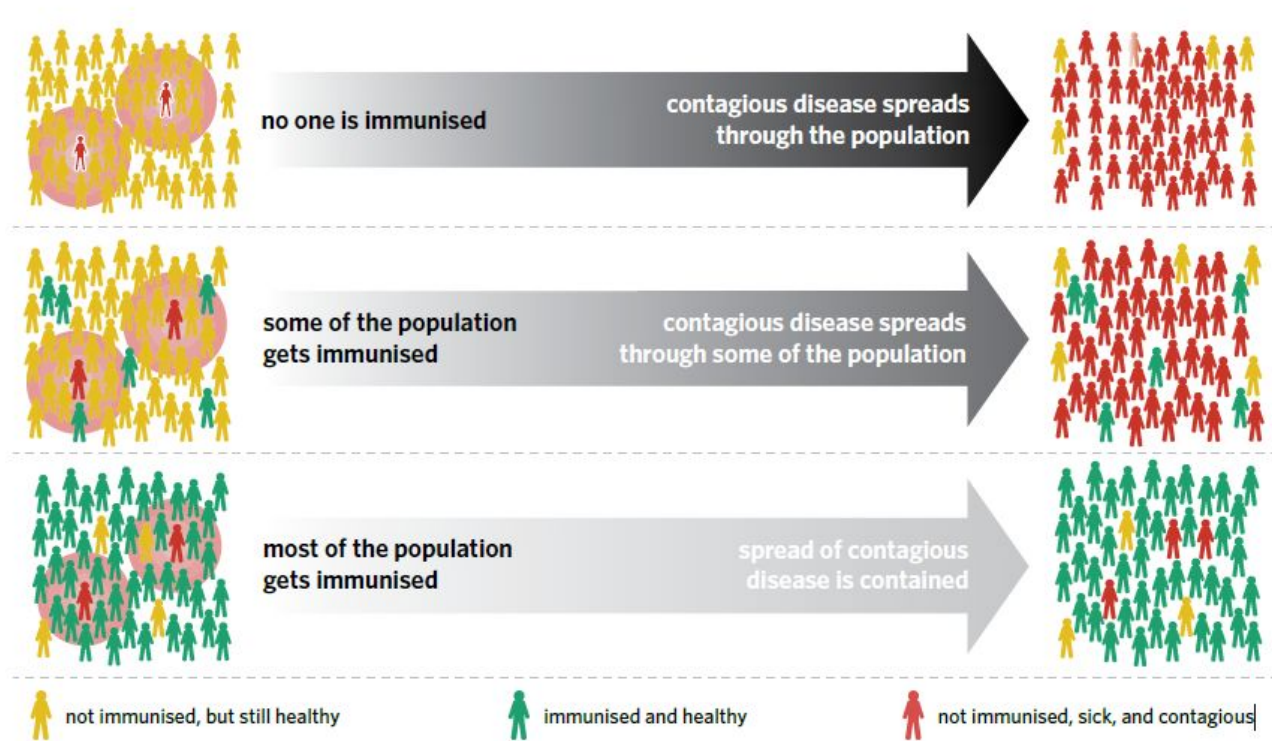


Figure 10 Herd immunity protects vulnerable people by reducing the number of potential pathogen hosts and containing the spread of disease.

Worked example

Q. Explain the difference between active and passive immunity.

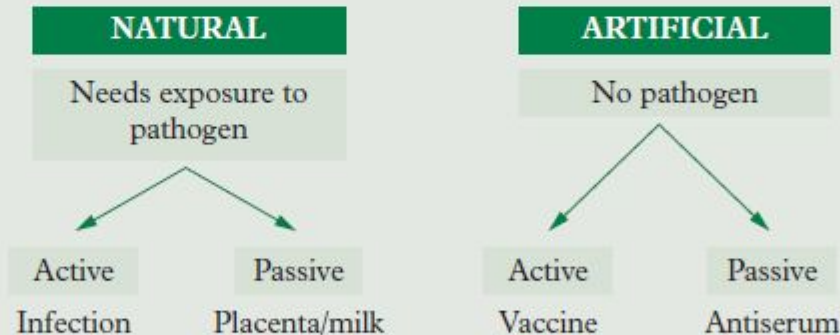
Ans. Active immunity involves an individual's own adaptive immune response. It takes time to develop, but the immunological memory that results can last for many years, even a lifetime. Passive immunity involves the transfer of antibodies produced by another organism. This type of immunity is immediate, but will only protect the recipient for a few weeks or months because it does not result in immunological memory.

Comparison

	Medical intervention?	Source of antibodies	Example
Natural active immunity	✗	Individual's own immune system	Getting chickenpox and being immune to it afterwards
Natural passive immunity	✗	External	Antibodies passing from mother to child in breast milk or across the placenta
Artificial active immunity	✓	Individual's own immune system	Vaccines
Artificial passive immunity	✓	External	Antivenom

Summary

- Natural immunity occurs when an organism is exposed to a pathogen and naturally recovers and forms immunity.
- Artificial immunity is provided when an organism is vaccinated against a pathogen. The vaccination contains antigens and adjuvants.
- Active immunity occurs when an organism produces memory cells against an antigen.
- Passive immunity occurs when an organism is provided with antibodies from another source, and no memory cells are produced. This can be natural through a mother's milk, or artificial through antiserum to a snake or spider bite.



Reflection

Edrolo 8A Q1-4, 11-13
Biozone worksheet 26