

## Immune response

### Phagocytes

Made in the white bone marrow

1. Neutrophils circulate in the blood- engulf bacteria by phagocytosis and destroy with lysosomes
2. Macrophages accumulate in organs- engulf and partially digest bacteria leaving antigens intact and pacing on the outer surface of macrophages cell membrane in antigen presentation

### Lymphocytes

B-lymphocytes- Develop in the bone marrow

produce antibodies

they are glycoproteins that are programmed to produce one specific type of antibody, the antibodies are attached to the cell membrane to form receptors for a foreign antigen, for every antigen that enters the body there will be some mature B-cells that will recognise it

T-Lymphocytes- develop in thymus gland

develop t cell receptors on their cell membranes

recognise antigens when present on cell membrane of another cell

They develop into T-helper and T-killer cells

### Sequence of events in the primary immune response

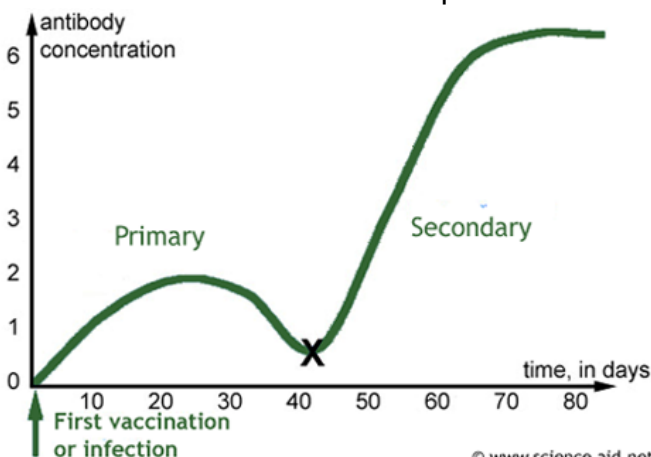
1. Macrophages partially engulf some pathogens leaving antigens
2. Antigen presentation occurs
3. Specific binding of T killer cells with receptors
4. Clonal selection-T cells clone by mitosis
5. some killer T cells destroy infected body cells by binding to antigens and secreting chemicals
6. other T cells develop into memory cells for future recognition
7. T-helper cells bind to presented antigens and undergo clonal selection
8. they secrete cytokines, stimulating phagocytes and b lymphocytes to divide
9. b cells have specific receptors and are stimulated to divide
10. some form memory cells other plasma cells
11. plasma cells produce antibodies which attach to the complementary antigen

### Secondary response

pathogen enters for a second time

memory cells remain in body and recognise the antigen divide to form plasma cells and antibodies

This occurs much faster and to produce more antibodies than the primary response



## Antibodies

4 polypeptide chains 2 heavy and 2 light  
attached by disulphide bonds

Y shaped

Variable region- antigen binding site

Constant region- bind to receptors on membranes of phagocytes

Hinge region- allows movement, a degree of flexibility

## Actions

### Neutralisation

- antibodies bind to the binding site on the pathogens surface making it unable to bind to the bodies cells

### Agglutination

- antibodies bind to binding sites on many pathogens clumping them together and stopping them from being able to enter a host cell

## Immunity

	<b>Active</b>	<b>Passive</b>
<b>Natural</b>	production of memory cells due to exposure of a disease long term immunity	ready made antibodies from mother to child short term as no memory cells
<b>Artificial</b>	injection of a weakened form of a pathogen causes body to produce antibodies and memory cells long term immunity	injection of ready made antigens provide short term immunity

## Influenza

new strains form due to mutations each new strain has different surface antigens so immunity to one type doesn't result in immunity to all.

## Responses by government

- Monitoring new disease
- identifying new viruses
- isolation of infected people
- travel restrictions to infected areas
- sharing of information between countries
- public health education
- production of new vaccines
- vaccination of susceptible people
- research into new anti-viral drugs

## New medicines

### Microorganisms

bacteria and fungi produce antibiotics against competing bacteria, sponges secrete toxic chemicals to protect them these can be used as anti cancer drugs

### Plants

many plants from tropical rainforests produce chemicals to protect them