

# TOPIC 11.1: ANTIBODY PRODUCTION

## Antigens

All organisms have unique molecules on the surface of cells

- Molecules that trigger immune responses are **antigens**

Antigens act to trigger the production of *specific* antibodies

- **E.g.** Antigens on red blood cells will stimulate antibody production in a person with a different blood group

## Antibodies

Antibodies aid in pathogen destruction by promoting:

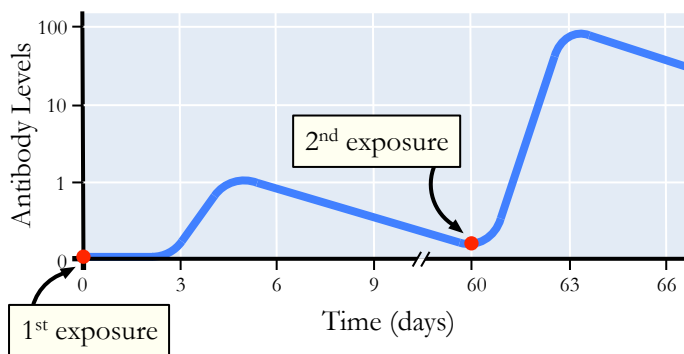
- **P**hagocyte recruitment
- **A**gglutination
- **N**eutralization
- **I**nflammation
- **C**omplement activation



## Immunological Memory

The adaptive immune response includes the production of memory cells following an initial pathogenic infection

- Memory cells persist for years, secreting antibodies
- If re-infection with the same antigen occurs, memory cells can respond faster and with much greater potency
- As a result, disease symptoms do not develop (immunity)



## Vaccination

Vaccines contain attenuated forms of a pathogen (cannot cause the disease, but can stimulate an immune response)

Vaccines induce active immunity by stimulating the presence of memory cells (confers long-term immunity)

When exposed to the actual pathogen, the memory cells will trigger a significantly faster and stronger immune response

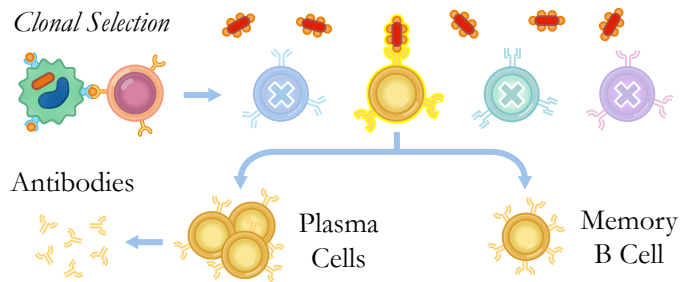
- Periodic booster shots may still be required

**Smallpox** was the first disease eradicated by vaccination

## Clonal Selection

Immune systems must be *challenged* with specific antigens in order to initiate an appropriate *response* (antibody production)

- Macrophages present antigen fragments to T<sub>H</sub> cells
- T<sub>H</sub> cells activate antigen-specific B cells (clonal selection)
- The B cells divide and differentiate into plasma cells that produce large quantities of specific antibodies
- A small proportion differentiate into B memory cells



## Types of Immunity

Immunity can be **active** (able to produce own antibodies):

- Natural active immunity = normal response to infection
- Artificial active immunity = immunity via vaccination

Immunity can be **passive** (acquires antibodies externally):

- Natural passive immunity = via breastfeeding
- Artificial passive immunity = monoclonal antibodies

## Monoclonal Antibodies

Monoclonal antibodies are antibodies that have been derived from a single B cell clone (i.e. identical specific antibodies)

- An animal (e.g. mouse) is injected with a pathogen to stimulate production of specific plasma cells
- The plasma cells are removed and fused with tumor cells capable of endless divisions
- The hybridoma formed will mass-produce the antibody

Monoclonal antibodies for hCG are used to test pregnancy

- Results detected via enzyme-linked immunosorbent assay

