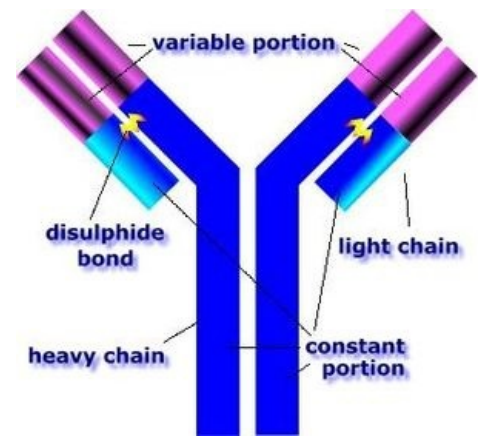


# Formation and function of antibodies

Antibodies are necessary in providing immunity against pathogens and assisting other parts of the immune system

## Antibodies

- Antibodies are **gamma globulins** (20% of total plasma proteins)
- Each B-cell clone makes antibody molecules with a specific antigen-binding site
- The antigen-binding site binds to the membrane and serve as receptors for antigens specific to its site
- When an antigen binds to the receptors of the antibody on the B-cell, the B-cell activates to multiply and mature into memory cells or into an antibody-secreting cells, which produce antibodies with the same antigen-binding site
- Antibodies are made of **light and heavy polypeptide chains** - each heavy chain is paralleled by a light chain at one of its ends
- The light chain and part of the heavy chains form the **variable region**; the remainder of the heavy chains form the **constant region**
- The **variable region** is different in each specific antibody and attaches specifically to an antigen
- The **constant region** determines the other properties of the antibody e.g: diffusivity in tissues, adherence, attachment to the complement complex, etc.
- Each antibody is specific to a particular antigen due to complementary amino acid sequences
- Different parts of the variable regions are produced due to separate gene segments (**VDJ sequences**), which are recombined during B-cell differentiation



Structure of an antibody

## Classes of Antibodies

### IgG

- They are bivalent antibodies and comprise 75% of all antibodies
- They are produced during the secondary response, identifies micro-organisms for phagocytosis, activates complement system and binds to macrophage receptors
- IgG-coated foreign cells are attacked by killer cells
- IgG can pass from mother to foetus via the placenta

### IgA

- They are present in secretions (milk, saliva, tears, respiratory and intestinal secretions)
- They are dimeric
- They agglutinate infectious agents in secretions as well as having anti-viral action

### IgM

- They have 10 binding sites
- Activates complement
- All B-cells initially make IgM antibodies
- Stimulates phagocytosis and complement reaction

### IgE

- They have 10 binding sites and bind to receptors on the surface of mast cells and basophils
- They trigger the secretion of serotonin and histamine by these cells, which increase the permeability of vessels for leukocytes, antibodies and complement components during inflammation

### IgD

- They are rarely secreted by B-cells

## Functions of Antibodies

Due to the multivalent nature of the antibodies and the multiple antigen sites on most pathogens, antibodies can inactivate antigens in many ways:-

- Agglutination** - bacteria are bonded through their antigens into a clump

- **Precipitation** - soluble antigens and the binded antibodies become insoluble and precipitate
- **Neutralisation** - antibodies cover the toxic site of the antigen
- **Lysis** - few antibodies are potent enough to directly attack the pathogen membrane and rupture the cell

## Effects of the Complement System

- When an antibody binds with an antigen, a specific site on the constant region of the antibody binds with the **C1 molecule** of the complement system and activates this system (one antigen-antibody complex can activate many C1 molecules)
- The C1 molecule (enzyme) activates increasing numbers of other enzymes in the system (amplification)
- Multiple end-products have different effects on the pathogens e.g: opsonisation followed by phagocytosis, lysis, agglutination, neutralisation of viruses, chemotaxis, activation of mast cells and basophils and inflammatory effects

## Links

### Bibliography

HALL, John E. *Guyton and Hall Textbook of Medical Physiology*. 11th Edition edition. 2006. ISBN 978-1-4160-4574-8.