

Antibodies

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Introduction

Antibodies, also called **immunoglobulin**, are protective proteins produced by the immune system in response to the presence of a foreign substance, called an antigen.

Antibodies recognize and latch onto antigens in order to remove them from the body.

A wide range of substances are regarded by the body as **antigens**, including disease-causing organisms and toxic materials such as insect venom.

History

- The earliest reference to antibodies came from **Emil von Behring** and **Shibasabura Kitasato** in 1890.
- The potential for treatment in humans was immediately apparent and Behring was later awarded the Nobel Prize for this work in 1901.
- 1900 **Paul Ehrlich**, who is regarded as one of the **fathers of modern immunology**, proposed the side-chain theory, where he hypothesized that side chain receptors on cells bind to a given pathogen.
- He was the first to propose a model for an antibody molecule in which the antibody was branched and consisted of multiple sites for binding to foreign material, known as antigen, and for the **activation of the complement pathway**.
- **Astrid Fagraeus** in 1948 described that plasma B cells are specifically involved in antibody generation and by 1957 Frank Burnet and David Talmage had developed the clonal selection theory.
- By 1959 **Gerald Edelman** and **Rodney Porter** independently published the molecular structure of antibodies for which they were later jointly awarded the **Nobel Prize in 1972**.
- Invention of **monoclonal antibodies** in 1975 by **Georges Köhler** and **César Milstein**.



Emil von
Behring



Shibasaburo
Kitasato



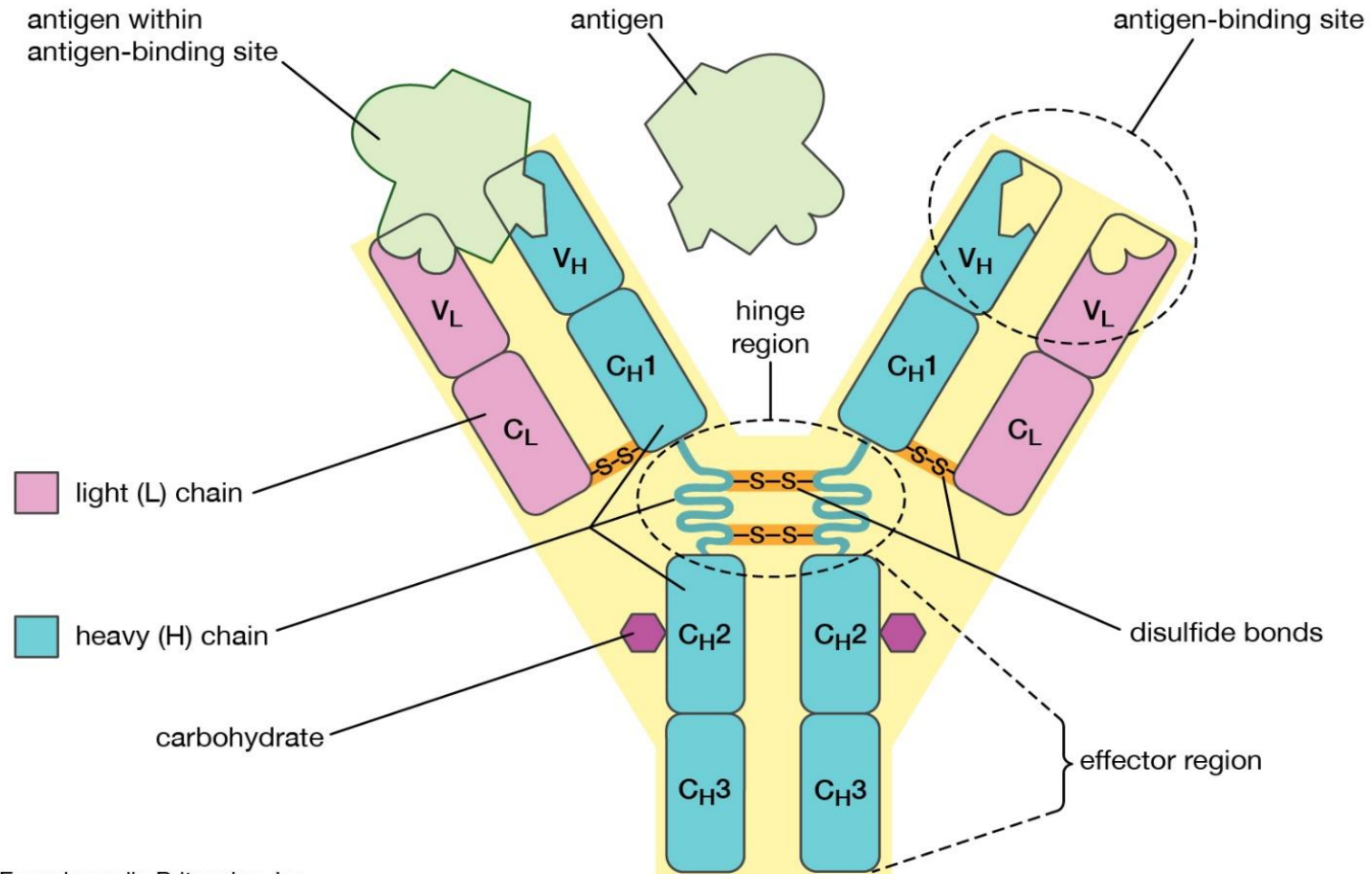
Paul Ehrlich



Structure

- All antibodies share a common structure.
- Antibodies are heavy globular plasma proteins or Glycoproteins(Glucose+ Protein).
- The attached carboxylic group are critically important for function and stability of antibodies.
- Each antibodies are heterodimer with a molecular weight of 150kDa.
- Antibodies all have the same basic structure consisting of two heavy and two light chains forming two Fab arms containing identical domains at either end attached by a flexible hinge region to the stem of the antibody

Basic structure of antibody



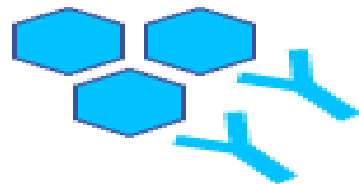
Functions

- Antibodies are secreted into the blood and mucosa, where they bind to and inactivate foreign substances such as pathogens and toxins (neutralization).
- Antibodies activate the complement system to destroy bacterial cells by lysis (punching holes in the cell wall).
- Antibodies facilitate phagocytosis of foreign substances by phagocytic cells (opsonization).

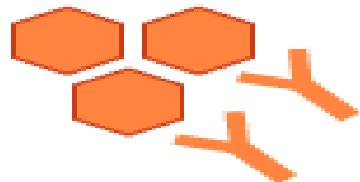
Features of antibodies

- **Specificity of antibodies:** Antibodies precisely recognize toxins and pathogens.
- **Diversity of antibodies:** Antibodies against a variety of antigens preexist in the body.
- **Immunological memory:** Immunological memory is **the ability of the immune system to respond more rapidly and effectively to pathogens that have been encountered previously**, and reflects the preexistence of a clonally expanded population of antigen-specific lymphocytes.
- **Immune tolerance:** Self cells and tissues are not normally attacked.

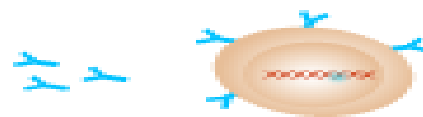
Mumps virus



Measles virus



B cell producing an antibody against measles virus



B cell producing an antibody against mumps virus

THANK YOU
