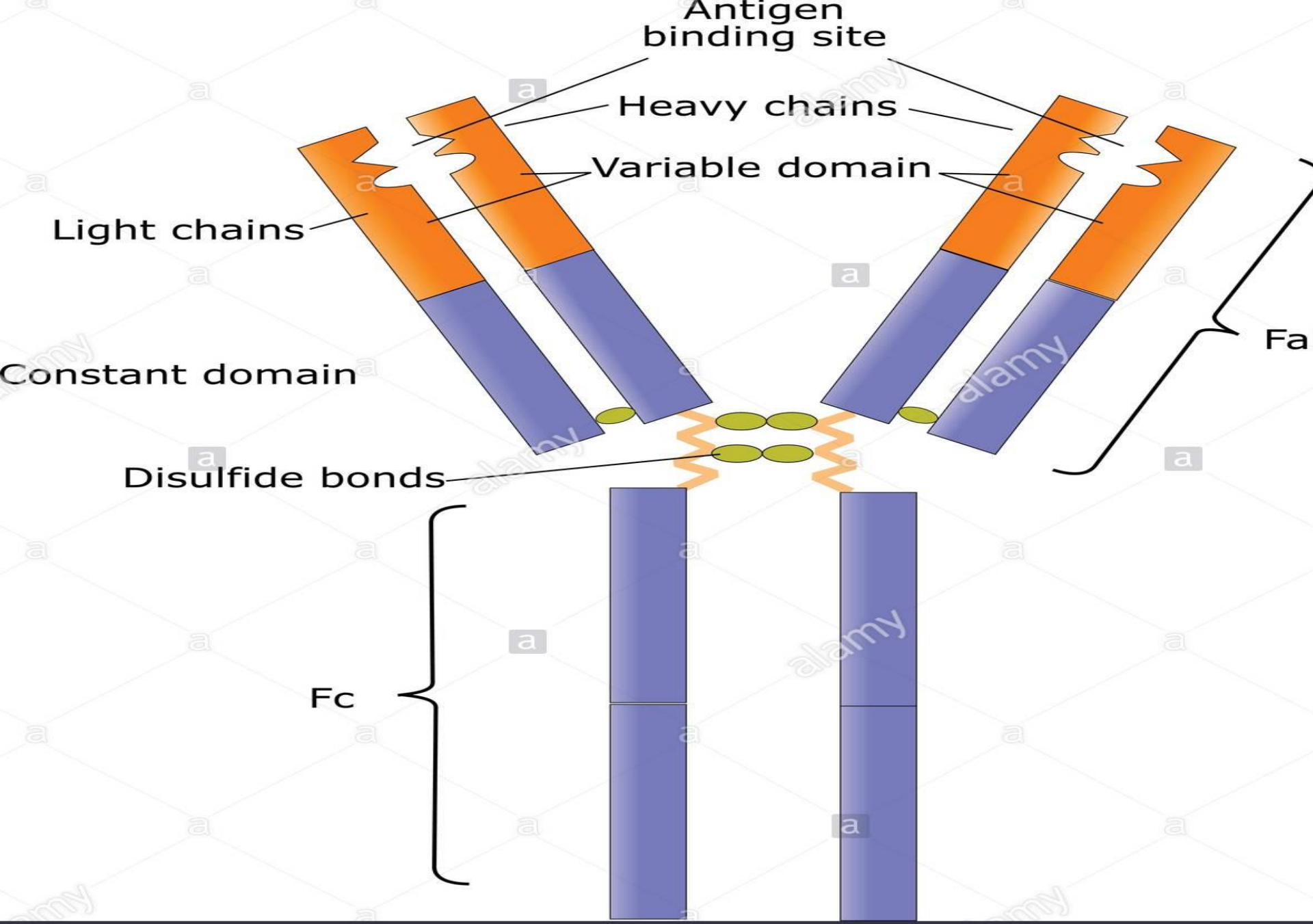
IMMUNOGLOBULINS

Immunoglobulins
, also known as antibodies,
are glycoprotein molecules produced by plasma cells (white blood cells).
They act as a critical part of the immune response by specifically recognizing and binding to particular antigens,
such as bacteria or viruses, and aiding in their destruction.



. BASIC STRUCTURE OF IMMUNOGLOBULINS

Different immunoglobulins can differ structurally, they all are built from the same basic units.

Heavy and Light Chains

All immunoglobulins have a four chain structure as their basic unit. They are composed of two identical light chains and two identical heavy chains

Disulfide bonds

Inter-chain disulfide bonds

The heavy and light chains and the two heavy chains are held together by inter-chain disulfide bonds and by non-covalent interactions The number of inter-chain disulfide bonds varies among different immunoglobulin molecules.

Intra-chain disulfide binds

Within each of the polypeptide chains there are also intra-chain disulfide bonds

Variable (V) and Constant (C) Regions

When the amino acid sequences of many different heavy chains and light chains were compared, it became clear that both the heavy and light chain could be divided into two regions based on variability in the amino acid sequences. These are the:

Light Chain - V_L (110 amino acids) and C_L (330-440 amino acids)

Heavy Chain - V_H (110 amino acids) and C_H (330-440 amino acids)

Hinge Region

This is the region at which the arms of the antibody molecule forms a Y. It is called the hinge region because there is some flexibility in the molecule at this point.

Domains

Three dimensional images of the immunoglobulin molecule show that it is folded into globular regions each of which contains an intra-chain disulfide bond .

These regions are called domains.

Light Chain Domains - V_L and C_L

Heavy Chain Domains - V_H, C_{H1} - C_{H3} (or C_{H4})

Oligosaccharides

Carbohydrates are attached to the C_{H2} domain in most immunoglobulins. However, in some cases carbohydrates may also be attached at other locations.

Immunoglobulin classes

The immunoglobulins can be divided into five different classes, based on differences in the amino acid sequences in the constant region of the heavy chains

- IgG - Gamma heavy chains
- IgM - Mu heavy chains
- IgA - Alpha heavy chains
- IgD - Delta heavy chains
- IgE - Epsilon heavy chains

Immunoglobulin Subclasses

The classes of immunoglobulins can de divided into subclasses based on small differences in the amino acid sequences in the constant region of the heavy chains.

All immunoglobulins within a subclass will have very similar heavy chain constant region amino acid sequences.

- IgG Subclasses
- IgG1 - Gamma 1 heavy chains
- IgG2 - Gamma 2 heavy chains
- IgG3 - Gamma 3 heavy chains
- IgG4 - Gamma 4 heavy chains
- IgA Subclasses
- IgA1 - Alpha 1 heavy chains
- IgA2 - Alpha 2 heavy chains

Immunoglobulin Types

Immunoglobulins can also be classified by the type of light chain that they have. Light chain types are based on differences in the amino acid sequence in the constant region of the light chain.

Kappa light chains

Lambda light chains

Immunoglobulin Subtypes

The light chains can also be divided into subtypes based on differences in the amino acid sequences in the constant region of the light chain.

Lambda subtypes

- Lambda 1
- Lambda 2
- Lambda 3
- Lambda 4

GENERAL FUNCTIONS OF IMMUNOGLOBULINS

Antigen binding

Immunoglobulins bind specifically to one or a few closely related antigens.

Each immunoglobulin actually binds to a specific antigenic determinant.

Antigen binding by antibodies is the primary function of antibodies and can result in protection of the host.

The valency of antibody refers to the number of antigenic determinants that an individual antibody molecule can bind. The valency of all antibodies is at least two.

Effector Functions

The immunoglobulins mediate a variety of effector functions. Such effector functions include:

- Fixation of complement - This results in lysis of cells and release of biologically active molecules

•Binding to various cell types - Phagocytic cells, lymphocytes, platelets, mast cells, and basophils have receptors that bind immunoglobulins.

•Some immunoglobulins also bind to receptors on placental trophoblasts, for transfering the immunoglobulin across the placenta.

• the transferred maternal antibodies provide immunity to the fetus and newborn