

# Difference Between Epitope and Paratope

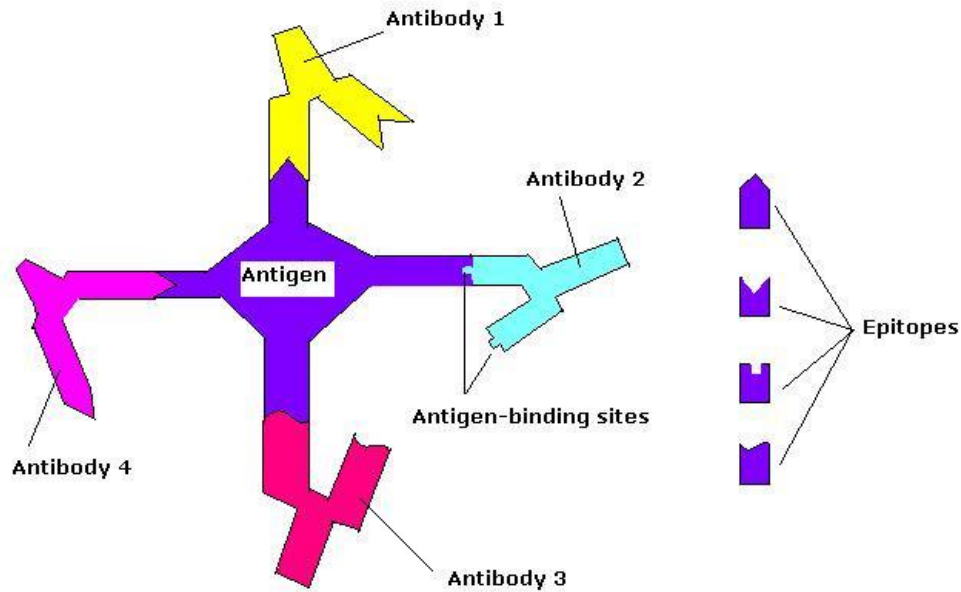
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## Key Difference - Epitope vs Paratope

Immunological reactions take place in response to invasion by foreign bodies, especially [pathogenic infectious](#) organisms. Immune reactions can be of two different types; nonspecific mechanisms and specific mechanisms. Specific immune mechanisms involve a reaction between [antibody](#) and antigen thereby resulting in the destruction of the particular foreign body. Antibody-antigen reactions are mediated by weak interactions such as ionic interactions, hydrophobic interactions, and Van der Waals interactions. The main area of the antibody and the antigen that participates in the reaction is Epitope and Paratope. **The Epitope is the area in the antigen of the foreign body which binds to the antibody whereas the Paratope is the area in the antibody which binds to the antigen.** This is the **key difference** between Epitope and Paratope. Epitope and the Paratope participate in the immune reaction between the antigen and the antibody.

## What is an Epitope?

Antigens are present as receptors in foreign bodies, and they are markers which are identified by the host immune system. An epitope is a particular area in the antigen, which is the specific site in which the antibody binds. This binding initiates the immune response and thereby the result in the destruction of the foreign molecule. Generally, an epitope is composed of an [amino acid](#) sequence of about five to six amino acids in length. Epitopes are tertiary protein structures, and this is confirmed via [x-ray](#) crystallography methods. A single antigen may contain more than one or more epitopes against which antibodies can bind. This enables different antibodies to bind to a single antigen at a time. Binding between the antibody and the epitope occurs at the Antigen Binding Site, which is called a Paratope and is located at the tip of the variable region of the antibody. This Paratope is only capable of binding with one unique epitope.



**Figure 01: Antigen-antibody binding at the Epitope.**

There are two main types of epitopes in the natural context; continuous epitopes and discontinuous epitopes. Continuous epitopes are linear sequences of amino acids whereas discontinuous epitopes are present in particular conformations and folded in different conformations.

Physiologically epitopes are further classified as B reactive epitopes and T reactive epitopes. B reactive epitopes bind with [B cell](#) antibodies. T cell reactive epitopes bind with T cells and participate in immune reactions. Epitope mapping is a new technique where the location of the epitope is identified in order to determine the nature of the antibody binding. By applying epitope mapping techniques, synthetic epitopes can be prepared under in vitro conditions.

## What is a Paratope?

Antibodies are produced by the host cell in response to a foreign invasion by recognizing the antigenic sites. Antibodies are composed of B cells, and they are tertiary proteins termed as immunoglobulins. A paratope also referred to as an antigen-binding site, is a specific area or part of an antibody which recognizes and binds to the epitope region of the antigen. The binding of the paratope to the epitope initiates the immune reaction between the host and the invading bodies. Paratope is a small region of about five to ten amino acids and is 3D (3 dimensional) confirmation.

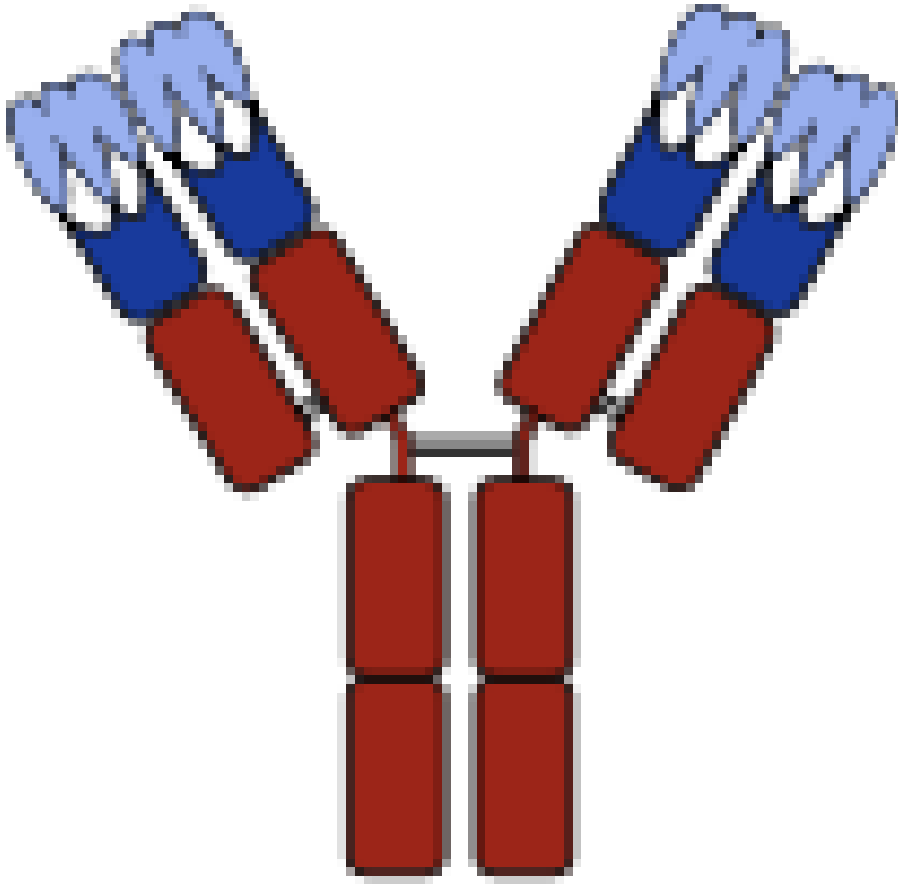


Figure 02: Paratope

The Paratope is situated in the Fab region or the fragment antigen-binding region of the antibody. This contains parts from both the chains; the heavy chain and the light chain of the immunoglobulin structure. Each arm of the Y shape of an antibody monomer is tipped with a paratope, which is a set of the complementarity determining regions.

## What are the Similarities Between Epitope and Paratope?

- Both are made up of amino acid sequences.
- Both participate in antibody-antigen
- The affinity between the two structures depends on the strength of the attraction and repulsion.
- Both structures can be identified using X-ray crystallographic techniques.
- Both structures are capable of forming different interactions such as H bonds, van der Waals forces, ionic interactions and hydrophobic interactions.
- Both are highly specific and sensitive.

# What is the Difference Between Epitope and Paratope?

Epitope vs Paratope	
An epitope is a particular area in the antigen, which is the specific site in which the antibody binds.	Paratope also referred to as an antigen-binding site, is a specific area or part of an antibody which recognizes and binds to the epitope region of the antigen.
Presence	
The epitope is present on antigen (on the foreign body).	Paratope area is present on an antibody of the host.
Site of interactions	
Multiple sites of interactions can be located in epitope area.	A single site is present on paratope to interact with an epitope.
Flexibility	
High in epitope.	Low in paratope.
Types	
Continuous, discontinuous, B reactive epitopes and T reactive epitopes are different types of epitopes.	No types can be seen in paratopes.

## Summary - Epitope vs Paratope

The main area of the antigen and the antibody that participates in the reaction is Epitope and Paratope. The epitope is the area in the antigen of the foreign body which binds to the antibody. The paratope is the area in the antibody which binds to the antigen. Epitopes in antigens and paratopes in antibodies participate in antigen-antibody reactions to produce specific immune reactions against foreign bodies. It is important to study these areas in order to infer the specificity of an immune reaction. Epitope mapping is an evolving technique which enables the researchers to elucidate the position and the structure of epitopes. Thereby specific monoclonal antibodies can be produced to target the epitope under in vitro conditions.

## Reference:

1. "Structural Biochemistry/Protein function/Epitope." Structural Biochemistry/Protein function/Epitope - Wikibooks, open books for an open world, en.wikibooks.org/wiki/Structural\_Biochemistry/Protein\_function/Epitope. Accessed 02 Oct. 2017.
2. "What is an Epitope." Pacific Immunology. Accessed 02 Oct. 2017. [Available here](#)

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