

ANTIGENS: characteristics, antigenic determinants, antigen processing and presentation

Q1. Write short note on antigenic variation.

Antigenic variation refers to the mechanism by which an infectious agent such as a protozoan, bacterium or virus alters its surface proteins in order to evade a host immune response.

Each year people are hit by new strains of influenza virus, which have mutated so they are no longer destroyed by the antibodies and T-cells that we developed to a previous infection.

Features:

- i) Antigenic variation not only enables immune evasion by the pathogen, but also allows the microbes to cause re-infection.
- ii) If the pathogen can alter its surface antigens, it can evade the host's acquired immune system. This will allow the pathogen to re-infect the host while the immune system generates new antibodies to target the newly identified antigen.
- iii) Antigenic variation can occur by altering a variety of surface molecules including proteins and carbohydrates.
- iv) Molecular mechanisms behind antigenic variation—gene conversion, site-specific DNA inversions, hypermutation etc.

EXAMPLE—

Example of antigenic variation	Mode of variation
In Bacteria	<i>Neisseria meningitidis</i> (gonococcus) vary their pili (protein polymers made up of subunits called pilin which play a critical role in bacterial adhesion, they are antigens which stimulate a vigorous host immune response).
In Protozoa	In order to protect itself from host defenses, <i>Trypanosoma brucei</i> decorates itself with a dense, homogeneous coat ($\sim 10^7$ molecules) of glycoprotein known as the variant surface glycoprotein (VSG).
In virus	In infections with influenza and HIV the recurrence occurs due to the production of virions that are resistant to the neutralizing antibodies of the host. These viruses have a structural plasticity that enables them to tolerate changes in amino acids in their structural proteins while still retaining their infectivity. There is a lot of diversity in the ability of viruses to exhibit such plasticity.

Q2. What is serotype? Give example

A serotype or serovar is a distinct variation within a species of bacteria or virus or among immune cells of different individuals. Example- 3 serotypes found in poliovirus and the number is nearly 100 in rhinovirus.

Q3. What is epitope?

Definition—

Antigenic determinants or epitopes are the immunologically active regions of an immunogen that bind to antigen-specific membrane receptors on lymphocytes or to secreted antibodies.

For a protein, an antibody binds to a unit which is about 3 to 6 amino acids whilst for a carbohydrate it is about 5 to 6 sugar residues. Antibody is elicited to epitopes in the amino-terminal portion, whereas the T-cells respond only to epitopes in the carboxy-terminal portion.

Pattern—

Pattern of antigen	Features
Protein antigens	An epitope may involve elements of the primary, secondary, tertiary and even quaternary structure
Polysaccharide antigen	Extensive side chain branching via glycosidic bonds affects the overall three-dimensional conformation of individual epitopes