



Enzyme-Linked Immunosorbent Assay (ELISA) Types and its uses

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DESCRIPTION

Enzyme-Linked Immunosorbent Assay (ELISA) is a widely used biochemical technique that allows for the detection and quantification of specific molecules such as proteins, peptides, antibodies and hormones. This powerful tool has revolutionized the field of diagnostics and research by providing a sensitive, specific and relatively simple method for detecting target molecules in biological samples. It utilizes specific antibodies that can recognize and bind to a particular antigen of interest. The assay involves several key steps, including coating a solid surface with the target antigen, blocking nonspecific binding sites, adding the sample containing the antigen or the antigen of interest, allowing binding to occur washing away unbound molecules and detecting the bound antigen-antibody complexes using an enzyme-linked secondary antibody. The enzyme catalyzes a colorimetric or fluorescent reaction that generates a measurable signal, which is directly proportional to the amount of antigen present in the sample.

Types of ELISA

Direct ELISA: In this format the antigen is directly immobilized on a solid surface such as a microplate. The primary antibody conjugated to an enzyme is added to detect the antigen-antibody complex. This method is relatively simple and quick but it is less sensitive than other formats.

Indirect ELISA: Indirect ELISA involves immobilizing the antigen on the solid surface, similar to direct ELISA. However instead of directly conjugating the primary antibody to an enzyme a secondary enzyme-linked antibody is used to detect the primary antibody-antigen complex. This amplifies the signal and enhances sensitivity.

Sandwich ELISA: In a sandwich ELISA the antigen of interest is captured between two specific antibodies. The first antibody is immobilized on the solid surface and it captures the antigen.

The second antibody conjugated to an enzyme, recognizes a different epitope on the antigen and forms a sandwich complex. This format is highly specific and sensitive.

Competitive ELISA: Competitive ELISA is used to measure the concentration of an antigen in a sample by competition between the sample antigen and a labeled antigen for binding to a limited amount of antibody.

ELISA plays a crucial role in diagnosing diseases, such as HIV, hepatitis, and autoimmune disorders. It can detect the presence of specific antibodies or antigens in patient samples aiding in early detection and monitoring of diseases. ELISA is extensively used in immunological research to study the immune response, antibody production and protein interactions. It enables the quantification of cytokines, growth factors, and other immune-related molecules. It is employed in drug discovery and development processes. It helps in screening potential drug candidates, measuring drug concentrations in biological samples, and evaluating the immune response to therapeutics. ELISA is employed in environmental studies to detect pollutants, toxins, and contaminants in water, soil, and air samples. It aids in assessing the environmental impact and evaluating the effectiveness of remediation efforts. ELISA is a highly sensitive technique that can detect target molecules at very low concentrations. This makes it suitable for detecting trace amounts of antigens or antibodies in various samples, including serum, plasma, urine and tissue extracts. ELISA is highly specific as it relies on the binding between a specific antibody and its corresponding antigen. This specificity ensures minimal cross-reactivity with other molecules present in the sample resulting in accurate and reliable results. ELISA allows for the quantification of target molecules in a sample. By measuring the intensity of the color or fluorescence generated by the enzyme-linked secondary antibody, the concentration of the target molecule can be determined. This makes ELISA a valuable tool for assessing the levels of proteins, hormones, and other analyses in biological samples.

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