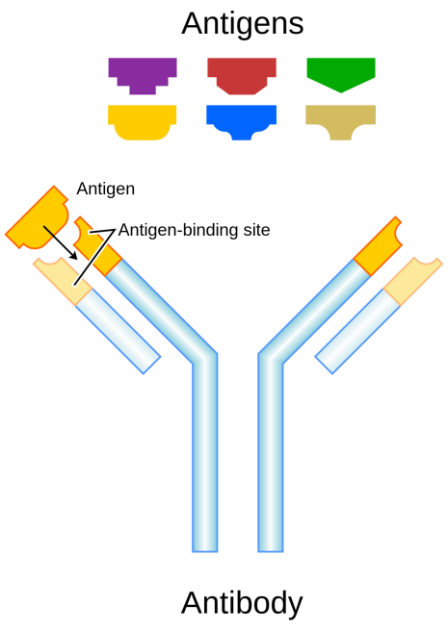
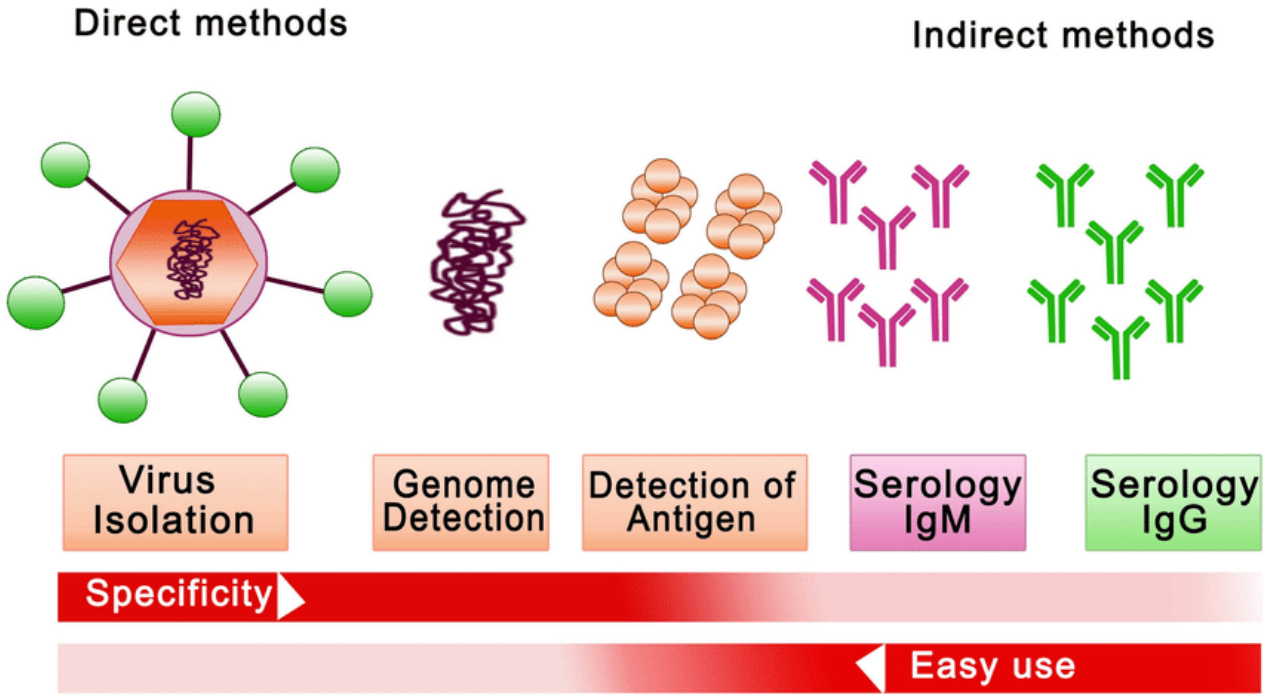
Serological Assays for Viruses

Shilpa Deshpande Kaistha
Department of Biotechnology
School of Life Sciences & Biotechnology
CSJM University Kanpur

Serological Assays Principle





A.N, Anoopkumar & E M, Aneesh. (2021). Environmental epidemiology and neurological manifestations of dengue serotypes with special inference on molecular trends, virus detection, and pathogenicity. Environment, Development and Sustainability. 23. 10.1007/s10668-020-01161-7.

Serological Diagnostics

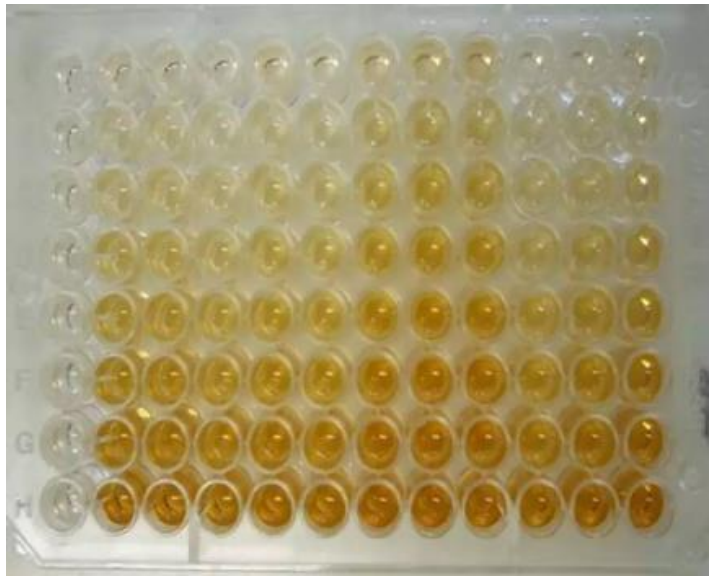
- Qualitative detection of presence/absence of antiviral antibodies
- Quantification of total antiviral antibodies by titer
  - ½, ¼,1/8….
- Classical Assays
  - Virus Neutralization Assay
  - Haemagglutinin Inhibition Assay
  - Complement Fixation Assay
- Modern (Labeled Antibodies)
  - RIA
  - EIA, ELISA
- Serological profiling
  - Western Blotting

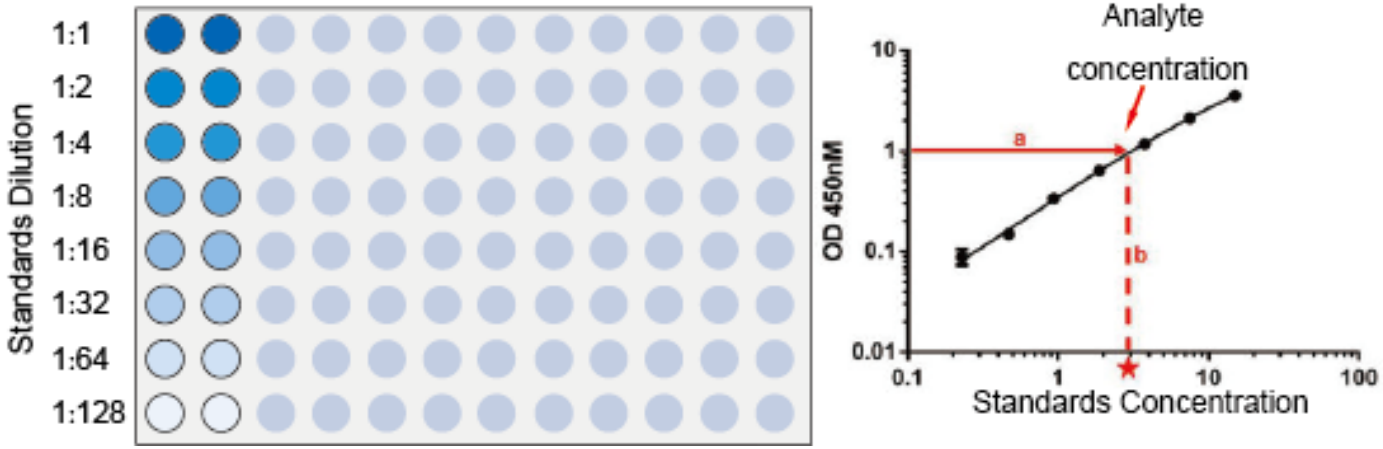
Viral Serology

- Viral serology activities involve
  - virus detection,
  - quantifying viral antigens, and
  - confirming the presence of virus or specific antibodies targeted against the virus, confirming contact with the pathogen.
- Viral serology can be used for
  - screening,
  - diagnosis,
  - monitoring infections
  - to assess immunity, acquired naturally or after vaccination.

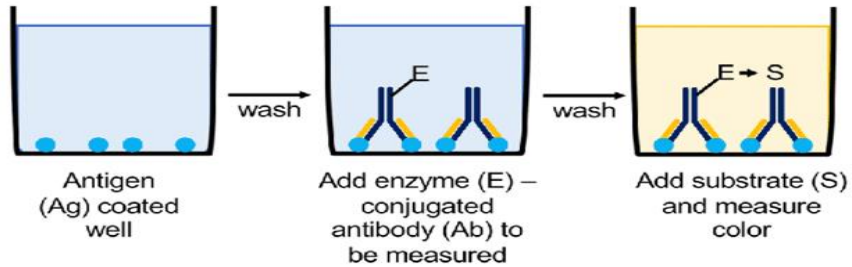
ELISA: Enzyme Linked Immunosorbent Assay

- 1971. Peter Perlman and Eva Engvall,Stockholm University invented ELISA
- 1975. Generation of Monoclonal Antibody: Kohler and Milstein

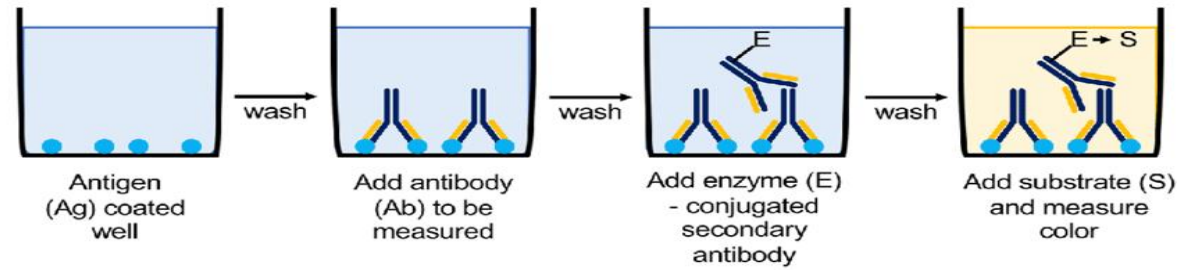




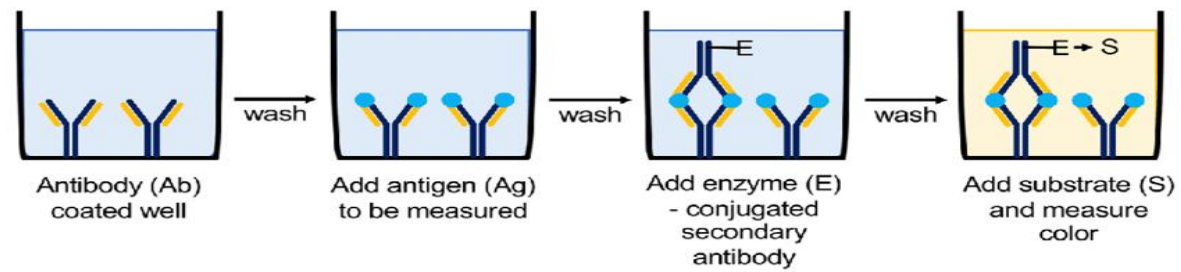
(a) Direct ELISA



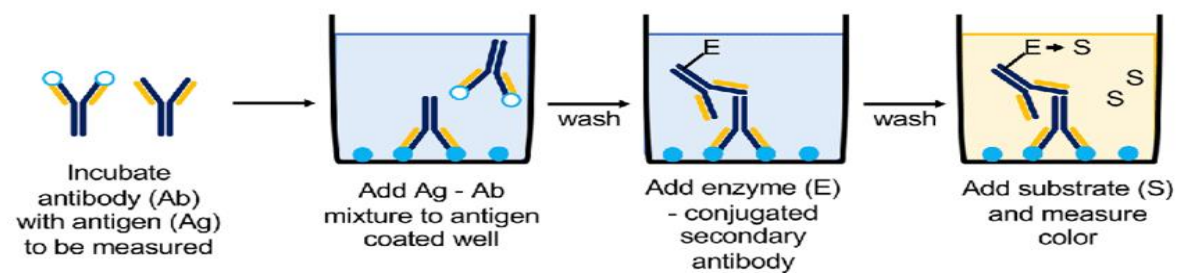
(b) Indirect ELISA

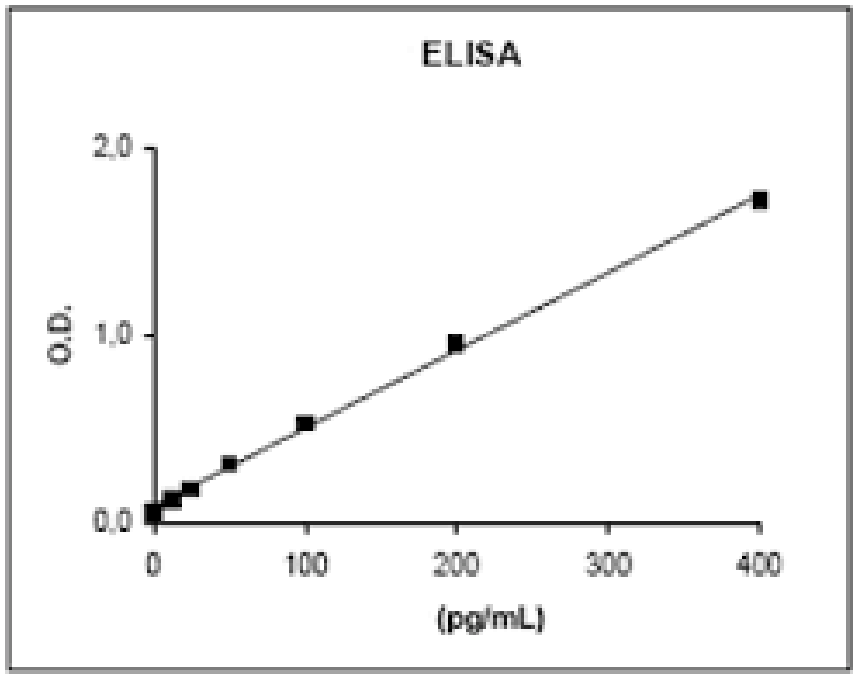


(c) Sandwich ELISA

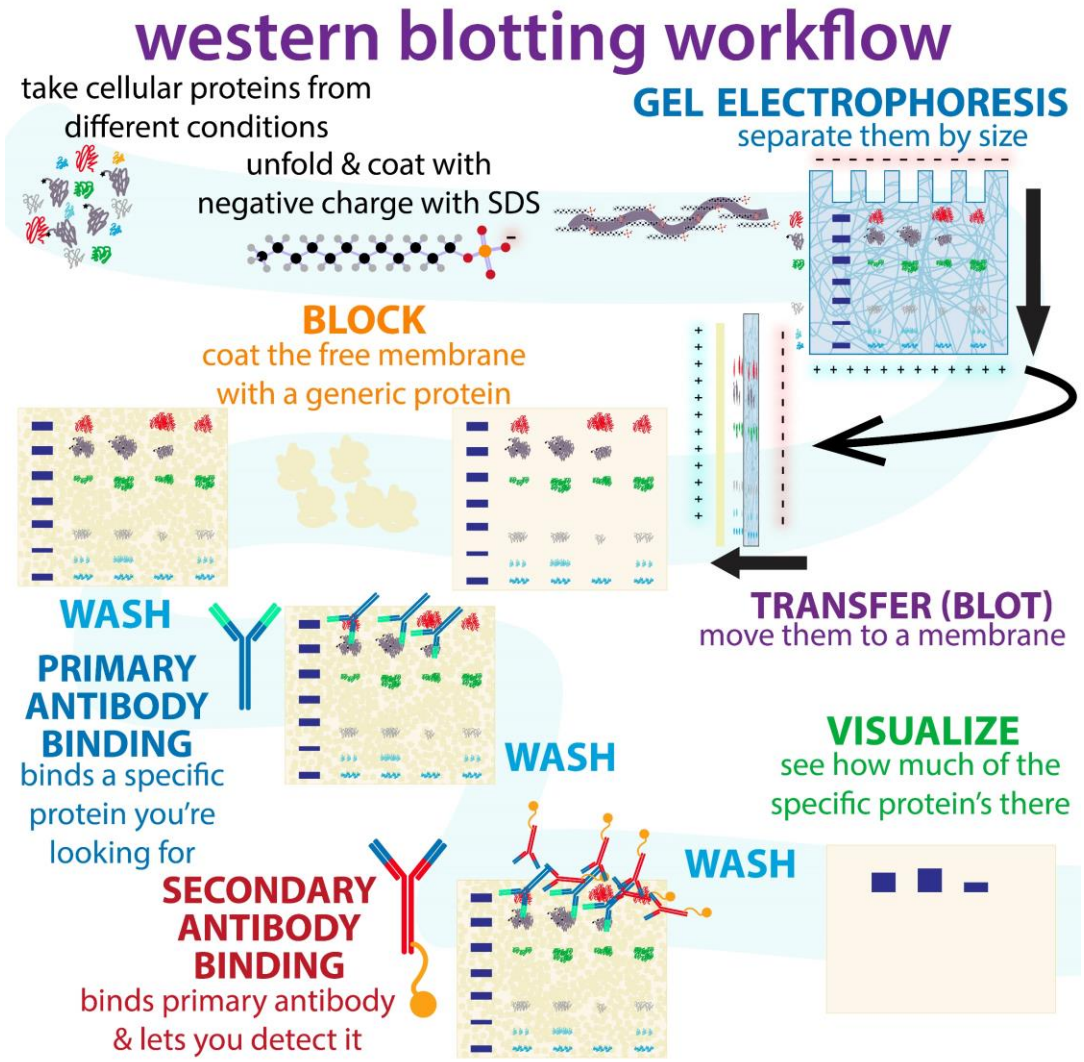


(d) Competitive ELISA





Western Blotting (Wikipedia)

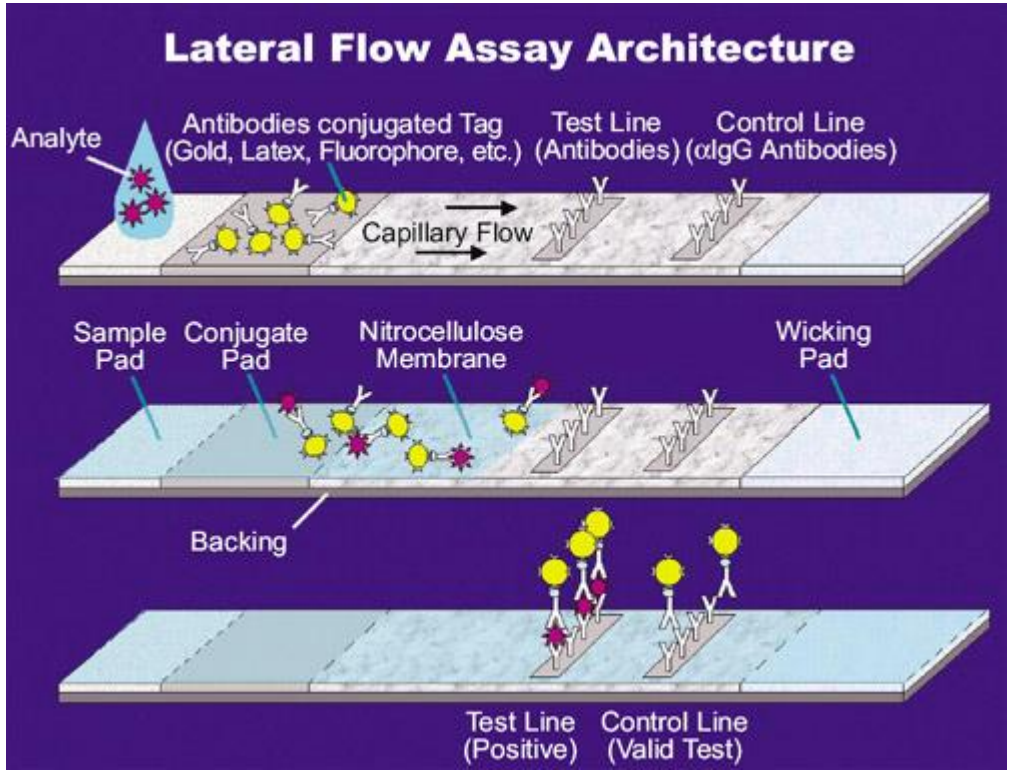


The term "western blot" was given by W. Neal Burnette in 1981

- Western blot technique uses three elements to achieve its task of separating a specific protein from a complex: Separation by size,
- Electroblotting: transfer of protein to a solid support, and
- Detection (ELISA): marking target protein using a primary and secondary antibody to visualize
- The secondary antibody is visualized through various methods such as staining, immunofluorescence, and radioactivity, allowing indirect detection of the specific target protein.

Lateral Immunochromatography Assay

- A **lateral flow test** (**LFT**), is an assay also known as a **lateral flow device** (**LFD**), **lateral flow immunochromatographic assay**, or **rapid test**.
- It is a simple device intended to detect the presence of a target substance in a liquid sample without the need for specialized and costly equipment.
- LFTs are widely used in medical diagnostics in the home, at the point of care, and in the laboratory. (Wikipedia)



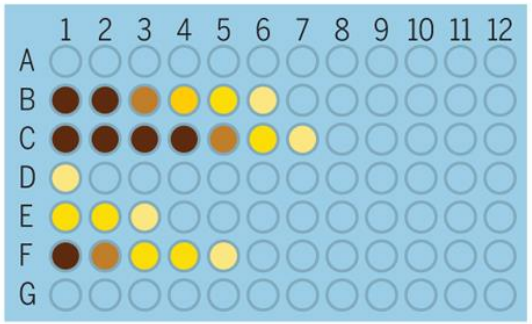
Weiss, Alan (1 November 1999). "Concurrent engineering for lateral-flow diagnostics". *IVD Technology*. Archived from the original on 2014-04-15.

COVID serology assay

Quantitative and binary readouts in serology assays

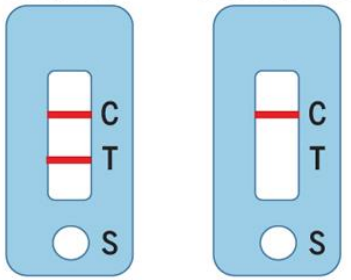
Quantitative and binary serology tests can provide important information about infection.

Quantitative assays [e.g., enzyme-linked immunosorbent assay (ELISA)]



Titers	Protected?
Negative	No
Titer 1:12,150	Yes
Titer 1:36,450	Yes
Titer 1:50	No
Titer 1:450	No
Titer 1:4050	Yes
Negative	No

Assay with binary result (e.g., lateral flow assay)



Result	Quantitative titer	Yes or no
Linked to protection?	A quantitative titer can be linked to protection	A positive result can be loosely associated with protection
Could predict protection duration?	Yes	No
Scalability	Moderate	High
Ease of use	Performed in specialized laboratories	Easy to use, even as point-of-care test

Florian Krammer, Viviana Simon ,Serology assays to manage COVID-19.Science368,1060-1061(2020).DOI:10.1126/science.abc1227