BHARATHIDASAN UNIVERSITY

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Programme: M.Sc., Biomedical Science

Course Code: 18BMS59C17

Course Title: Immune & Molecular Diagnostics

Unit-II

Serodiagnostics

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Unit II:

Serodiagnostics- Define Acute & Convalescent sera, collection of serum specimen, storage, preparation of dilutions. Serodiagnosis of various infectious diseases- Detection of antibodies to microbial antigen- Syphilis, typhoid, streptococci infections, HIV, Hepatitis B and C- Comments on respective clinically specific antigens, Clinical significance of autoantibodies in the diagnosis of autoimmune diseases.

PRESENTATION: 2

SERODIAGNOSIS OF VARIOUS INFECTIOUS DISEASE

Importance:

1. Early Detection:

Serological tests can provide early indications of infection, often before clinical symptoms appear. This is particularly important for diseases where **timely treatment can significantly affect outcomes**.

2. Monitoring Immune Response:

By measuring antibody levels in acute and convalescent sera, healthcare providers can assess the immune response to infections and determine **whether a patient is recovering**.

3. Epidemiological Studies

Serodiagnosis is essential for **tracking the spread of infectious diseases** within populations and understanding the **prevalence of specific pathogens**.

4. Confirmation of Diagnosis:

In some cases, serological tests are the **only method available** for confirming certain infections, especially when direct detection methods (like culture) are not feasible.

Common Serological Tests

1. **Enzyme-Linked Immunosorbent Assay (ELISA):** Widely used for detecting antibodies against various pathogens, including **HIV, hepatitis viruses**, and many others. ELISA tests are sensitive and can process multiple samples simultaneously.

2. **Western Blotting:** Often used as a confirmatory test for **HIV**. It detects specific proteins in a sample and is known for its specificity.

3. Immunofluorescence Assays: Used to detect **antibodies in serum** by labeling them with **fluorescent dyes**. This method is particularly useful for diagnosing **infections like syphilis and certain viral infections**.

4. Rapid Diagnostic Tests: These are point-of-care tests that can provide quick results, often within minutes. They are commonly used for diseases like **malaria and COVID-19**.

5. Complement Fixation Tests: Used historically for diagnosing infections such as syphilis and certain viral infections. These tests **measure the ability of antibodies to fix complement in the presence of specific antigens.**

Applications in Specific Infectious Diseases

1. **Viral Infections: HIV**: Serological tests detect antibodies against HIV, confirming infection.

2. **Hepatitis:** Various serological tests identify antibodies (e.g., anti-HCV) and antigens (e.g., HBsAg) related to hepatitis viruses.

3. **Bacterial Infections: Syphilis**: The rapid plasma reagin (RPR) test and the Treponema pallidum particle agglutination (TP-PA) test are commonly used.

4. **Typhoid Fever**: The Widal test detects antibodies against Salmonella typhi.

5. **Parasitic Infections: Toxoplasmosis**: Detection of specific **IgG and IgM** antibodies indicates infection.

6. **Malaria:** Serological tests can identify antibodies against **Plasmodium species.**

7. **Fungal Infections: Cryptococcosis**: Detection of **cryptococcal antigen** in **serum or cerebrospinal fluid (CSF)** is crucial for diagnosis.

8. **Autoimmune Diseases:** Some serological tests can help **differentiate between infectious diseases and autoimmune conditions,** where similar symptoms may occur.

DETECTION OF ANTIBODIES TO MICROBIAL ANTIGEN

- The detection of antibodies to microbial antigens is a critical aspect of diagnosing infectious diseases.
- This process involves **identifying specific antibodies produced by the immune system** in response to infections caused by bacteria, viruses, fungi, or parasites.

1. Syphilis (*Treponema pallidum*)

- **Treponemal Antigens:**

Specific antigens such as **TpN15, TpN17, and TpN47** are proteins derived from the bacterium *Treponema pallidum*. These are used in serological tests (e.g., FTA-ABS, TPHA) to detect antibodies specific to the pathogen.

- **Cardiolipin:**

Though not specific to *Treponema pallidum*, cardiolipin is used in non-treponemal tests (e.g., RPR, VDRL) **to detect reagin antibodies** produced **in response to cell damage caused by syphilis.**

Electron micrograph image of *T. pallidum*, highlighted in gold.

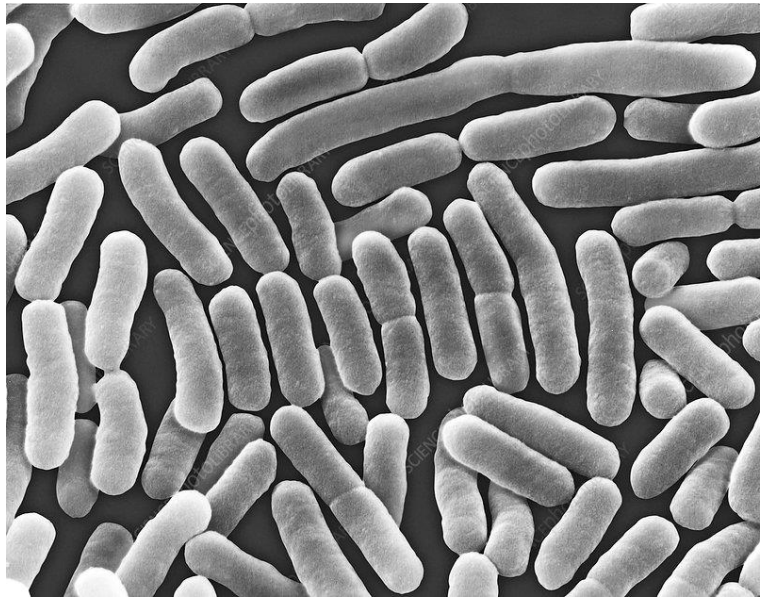
2. Typhoid Fever (*Salmonella typhi*)

- **O and H Antigens:**

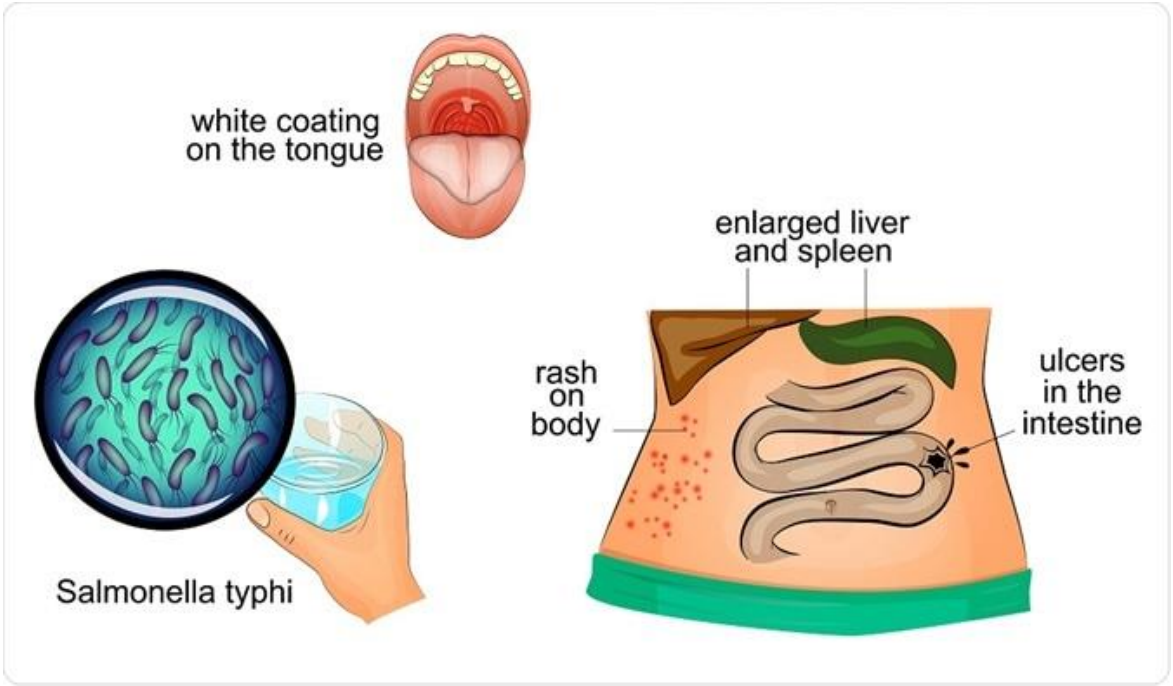
The O (somatic) antigen and H (flagellar) antigen are used in the **Widal** test, which detects agglutinating antibodies against these antigens. The **O antigen** is a part of the lipopolysaccharide layer of the **bacterial cell wall**, while the **H antigen** is a protein associated with the **bacterial flagella**.

- **Vi Antigen:**

The **Vi capsular polysaccharide antigen** is another important antigen used in diagnosing typhoid fever, especially in the Vi serology tests.

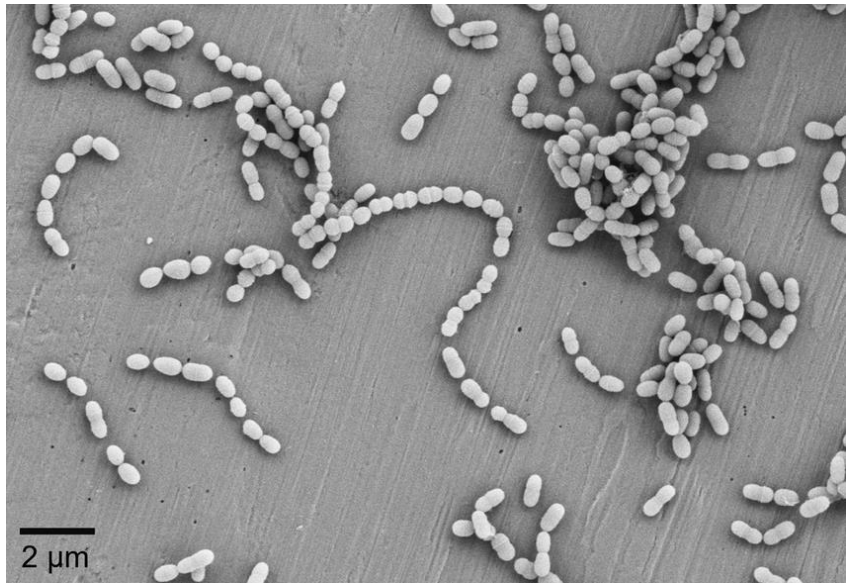


Electron microscopy of ***Salmonella typhi***



3. Streptococcal Infections (Streptococcus species)

- **M Protein:** A major virulence factor of *Streptococcus pyogenes*, M protein is used **to identify the strain type**. It helps the bacteria evade phagocytosis and is linked to post-infectious sequelae like rheumatic fever.
- **Group-Specific Carbohydrate Antigens:** Streptococci are classified into groups (A, B, C, etc.) based on their carbohydrate antigens. **Group A carbohydrate (Lancefield group A) is found in *Streptococcus pyogenes***, and **Group B is in *Streptococcus agalactiae***.
- **Streptolysin O and DNase B:** Antibodies against streptolysin O (ASO) and DNase B are markers used to diagnose recent streptococcal infections.



Electron microscopy of *Streptococcus mutans*

4. HIV (Human Immunodeficiency Virus)

- **p24 Antigen:**

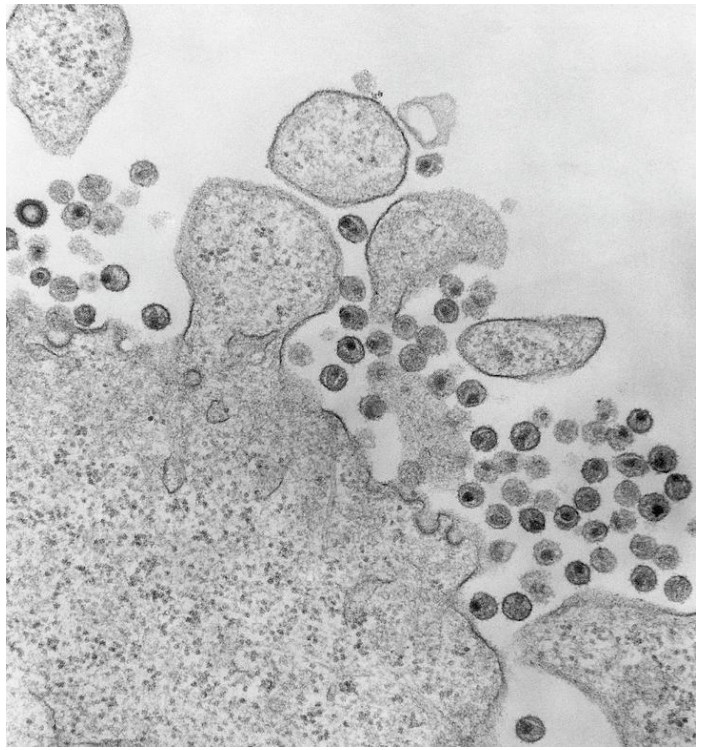
The **p24 protein is a core structural protein of HIV**. It is one of the first antigens to appear in the blood after HIV infection, and its detection is used in early diagnosis.

- **gp120 and gp41 Antigens:**

These are **envelope glycoproteins** used for the attachment of the virus to host cells. They are commonly targeted in both diagnostic assays and vaccine development.

- **Gag, Pol, and Env Proteins:**

These are **gene products from the virus** and are often used in Western blot tests to confirm HIV infection.



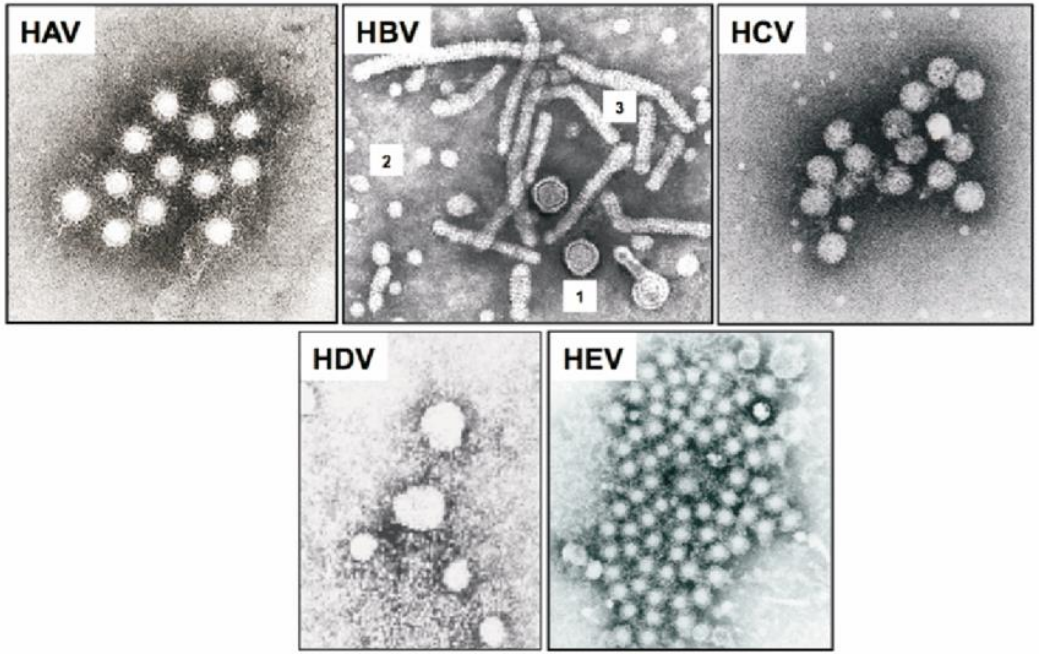
TEM Of Aids Virus Particles Around Infected T-cell

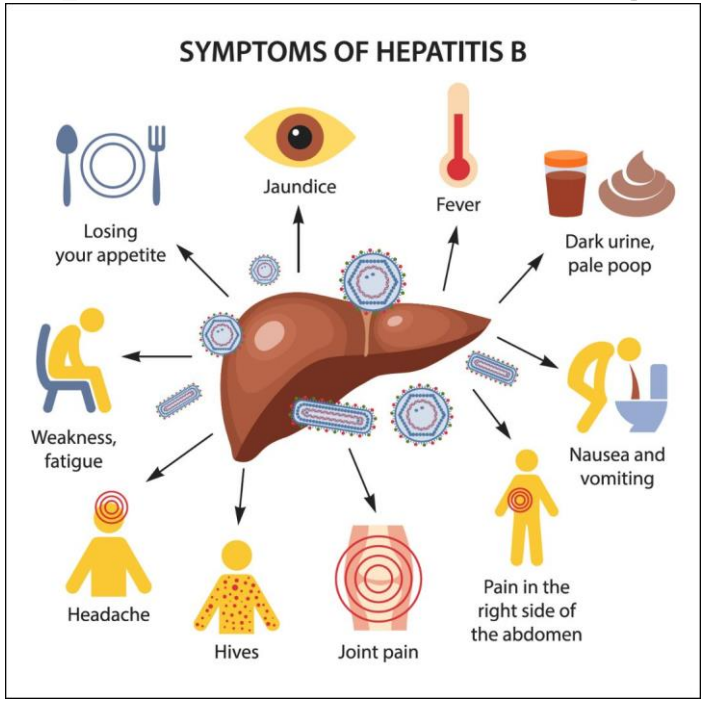
5. Hepatitis B (HBV)

- **HBsAg (Hepatitis B Surface Antigen):** The most important marker for diagnosing an active HBV infection. It is the **first serological marker** to appear and indicates that the person is infectious.
- **HBeAg (Hepatitis B e Antigen):** Indicates active replication of the virus and high infectivity. It is used to assess the **severity of an infection**.
- **HBcAg (Hepatitis B Core Antigen):** Not commonly measured directly in the blood, but anti-HBc antibodies **(IgM and IgG) are markers of current or past infection**.

6. Hepatitis C (HCV)

- **Core Antigen:** The HCV core antigen appears early in infection and can be detected even before antibodies form. It is a useful marker for early diagnosis.
- **NS3, NS4, NS5 Proteins:** Non-structural proteins of the virus that are used in diagnostic tests to confirm infection and to genotype the virus for appropriate treatment strategies.





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