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DEPARTMENT OF BIOMEDICAL ENGINEERING

VII Semester

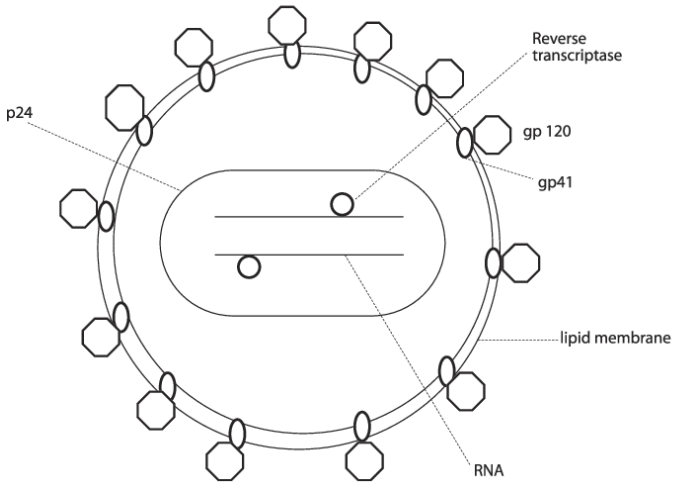
OBT357 BIOTECHNOLOGY IN HEALTH CARE

UNIT- 2 CLINICAL DISEASES

2.5 Communicable diseases: HIV / AIDS, Influenza, Swine flu

2.5.1 HIV / AIDS:

- HIV (Human Immunodeficiency Virus) is a virus that attacks the body's immune system, specifically targeting CD4 cells (T cells), which are crucial for fighting infections.
- If left untreated, HIV can lead to AIDS (Acquired Immunodeficiency Syndrome), the most advanced stage of HIV infection, where the immune system is severely damaged, making the body vulnerable to opportunistic infections and certain cancers.
- HIV/AIDS is a communicable disease primarily transmitted through bodily fluids. As of 2025, advancements in treatment have made HIV a manageable chronic condition, allowing many people to live long, healthy lives, but it remains a global health challenge with no cure.



This diagram is a simplified structural representation of HIV (Human Immunodeficiency Virus), showing only the significant components. Its functions are

1. Infects and targets immune cells
2. Produces new viruses
3. Gradually destroys immune function

2.5.1.1 Causes of HIV / AIDS:

- HIV is caused by the human immunodeficiency virus, a retrovirus that integrates its genetic material into the host's DNA.
- The virus primarily targets CD4 T cells, gradually destroying them and weakening the immune system.
- AIDS develops when the CD4 cell count falls below 200 cells per cubic millimetre of blood or when opportunistic infections or cancers occur.
- Transmission occurs through the exchange of certain bodily fluids from an infected person:
  - ✓ Sexual contact: Unprotected anal, vaginal, or oral sex with an infected person, especially if there are sores or tears in the mucous membranes.
  - ✓ Blood exposure: Sharing needles, syringes, or other drug injection equipment; receiving contaminated blood transfusions or organ transplants (rare in screened systems); accidental needlestick injuries.
  - ✓ Mother-to-child transmission: During pregnancy, childbirth, or breastfeeding.
  - ✓ Other routes: Exposure to infected blood, semen, vaginal fluids, rectal fluids, or breast milk through mucous membranes or damaged tissue. HIV is not transmitted through casual contact such as hugging, shaking hands, sharing food, or insect bites. Risk factors include having multiple sexual partners, other STIs, substance use, and unsafe medical practices.

2.5.1.2 Symptoms of HIV/AIDS:

Symptoms of HIV/AIDS vary by stage of infection:

- **Acute HIV (Primary Infection):** Occurs 2-4 weeks after exposure. Flu-like symptoms including fever, chills, rash, night sweats, muscle aches, sore

throat, fatigue, swollen lymph nodes, and mouth ulcers. Some may be asymptomatic.

- **Chronic HIV (Clinical Latency**): Can last for years with few or no symptoms. The virus continues to replicate, slowly damaging the immune system.
- **Symptomatic HIV**: As the immune system weakens, symptoms may include persistent fever, fatigue, weight loss, diarrhea, oral thrush, shingles, and pneumonia.
- **AIDS:** Severe symptoms from opportunistic infections and cancers, such as rapid weight loss, recurring fever, extreme fatigue, prolonged swelling of lymph glands, diarrhea lasting over a week, sores in the mouth/genitals/anus, pneumonia, skin blotches, depression, memory loss, and neurological disorders.

2.5.1.2 Diagnosis of HIV/AIDS:

Diagnosis involves testing for HIV antibodies, antigens, or viral RNA:

- **Antibody Tests**: Detect antibodies in blood or saliva; window period 23-90 days.
- **Antigen/Antibody Tests**: Detect p24 antigen and antibodies; window period 18-45 days.
- **Nucleic Acid Tests (NATs):** Detect viral RNA; window period 10-33 days; used for early detection or confirmation.
- **Self-Tests and Rapid Tests**: Provide results in 20-30 minutes; confirmatory testing required for positives. For infants born to HIV-positive mothers, virological testing is needed. Post-diagnosis, CD4 count, viral load, and drug resistance tests guide treatment. Routine screening is recommended for ages 13-64, with more frequent testing for high-risk groups.

2.5.1.3 Treatment of HIV/AIDS:

There is no cure for HIV, but antiretroviral therapy (ART) manages the virus effectively:

- ART Regimens: Combination of drugs from classes like NRTIs (e.g., tenofovir), NNRTIs (e.g., efavirenz), PIs (e.g., darunavir), INSTIs (e.g.,

dolutegravir), entry inhibitors (e.g., maraviroc), and others. Taken daily to suppress viral load to undetectable levels.

- ❖ Goals: Achieve undetectable viral load (<50 copies/mL), restore CD4 count, prevent transmission (U=U: Undetectable = Un transmittable).
- ❖ Advanced Treatments: Long-acting injectables like cabotegravir and lenacapavir (FDA-approved for prevention in 2025).
- ❖ Management of Complications: Treatment for opportunistic infections, cancers, and side effects (e.g., nausea, bone loss).
- ❖ Monitoring: Regular viral load and CD4 tests; adherence is crucial to avoid resistance.

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2.5.2 Influenza (Seasonal flu) & Swine flu (H1N1):

Influenza, commonly known as the flu, is a highly contagious respiratory illness caused by influenza viruses. **Swine flu** is a specific type of influenza caused by a particular strain of the virus (H1N1). While both are part of the same family, the term "swine flu" gained prominence during the 2009 pandemic due to its initial origin in pigs.

2.5.2.1 Causes

Influenza and **Swine flu** are caused by **Influenza viruses** in the *Orthomyxoviridae* family.

- ❖ **Seasonal Influenza:** Caused mainly by **Influenza A and B viruses**.
- ❖ **Swine flu (H1N1):** A subtype of **Influenza A (H1N1)** virus that originated in pigs but now spreads between humans.
- ❖ **Genetic nature:** Enveloped RNA viruses, with surface proteins **Hemagglutinin (H)** and **Neuraminidase (N)**.
- ❖ **Transmission:**
    - ✓ **Airborne droplets** from coughing, sneezing, or talking.
    - ✓ **Direct contact** with contaminated surfaces followed by touching mouth/nose/eyes.
    - ✓ **Close contact** with an infected person.

2.5.2.2. Symptoms:

Symptoms develop **1–4 days** after exposure (incubation period):

General Influenza symptoms:

- Sudden high fever
- Chills
- Cough (usually dry)
- Sore throat
- Runny or blocked nose
- Headache
- Muscle aches and joint pain
- Extreme fatigue
- Loss of appetite

Swine flu:

- Similar to seasonal flu but often more severe.
- May also cause:
    - ✓ Vomiting
    - ✓ Diarrhea
    - ✓ Chest pain
- In severe cases: pneumonia, respiratory failure, or death (especially in high-risk groups).

2.5.2.3. Diagnosis

Clinical diagnosis

- ❖ Based on **symptoms** + history of contact or outbreak in the community.

Laboratory diagnosis

- ❖ **Rapid Influenza Diagnostic Tests (RIDTs)** – detect antigens in nasal/throat swabs.

- **RT-PCR (Reverse transcriptase polymerase chain reaction)** – gold standard, detects viral RNA and subtype (H1N1, H3N2, etc.).
- **Viral culture** – used for research and surveillance.
- **Serology** – detects antibodies (retrospective).

2.5.2.4. Treatment

Supportive care

- Rest
- Plenty of fluids
- Fever control (paracetamol; avoid aspirin in children due to Reye's syndrome)

Antiviral drugs

- **Oseltamivir (Tamiflu)** – oral neuraminidase inhibitor.
- **Zanamivir (Relenza)** – inhaled neuraminidase inhibitor.
- Best results if started within **48 hours** of symptom onset.
- Reduces duration and severity.

For severe cases

- Hospitalization for oxygen support or ventilation.
- Management of secondary bacterial infections with antibiotics.

2.5.2.5. Prevention

Personal hygiene

- Wash hands frequently with soap and water.
- Use alcohol-based hand sanitizers.
- Avoid touching face (mouth, eyes, nose).

Respiratory etiquette

- Cover mouth and nose with tissue/elbow when coughing/sneezing.
- Wear a mask if sick or in crowded places.

Vaccination

- Annual influenza vaccine (inactivated or live attenuated) – updated yearly to match circulating strains.
- H1N1 is included in most seasonal flu vaccines.

Isolation and public health measures

- Stay home when sick to prevent spread.
- Isolate confirmed cases during outbreaks.
- Close schools or gatherings in severe epidemics.

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