Scenario C
Human Infectious Virus (HIV)

Summary of Experiment

A researcher will be studying blood and breast milk obtained from patients infected with HIV. The purpose is to study the effect of vitamin supplements on the expression of HIV in breast milk. 5 mL samples of blood and 50mL of breast milk will be collected and stored in a -70 C Freezer until ready for testing. 1mL of whole milk was transferred to a cryovial for long-term storage (duration of the study). The remaining breast milk is transferred into a 15mL conical centrifuge tube and centrifuged at low speed for 20 minutes. The fat layer is removed carefully using a glass pipette and discarded in the sink. The breast milk fluid (supernatant) layer is then aspirated using a different glass pipette and aliquoted in 0.5mL, 1.0mL, and 1.5mL volumes into 5mL cryovials. Add 1mL of PBS (phosphate buffered saline solution) to the 15mL conical tube with the cell pellet and gently resuspend the pellet by disrupting it with a sterile long toothpick and then gently inverting. The resuspended cells are transferred into a 1.5mL microcentrifuge tube and centrifuge at high speed for 3 minutes. The supernatant is discarded into the sink being careful not to dislodge the pellet when disposing of the liquid. DNA is extracted from breast-milk pellets by using a commercial DNA blood mini kit supplied by donors. The HIV viral DNA titer is measured using a TaqMan realtime polymerase chain reaction (PCR) technology. A similar process is used for detecting HIV viral load in the blood as well. A donated sequence detector is used for PCR amplification, acquisition, and data analysis.

Equipment

- Laminate bench top (old, cracked, some holes and peeling up in some places)
- Basic centrifuge (no sealed rotor or safety cups)
- Vortexer
- Incubator 37^{o}C
- 250 mL plastic conical centrifuge tubes used to store breast milk
- Alcohol flame candle (for sterilizing wire loops and fixing glass slides)
- Glass flasks
- Glass Pasteur pippettes
- Glass vacutainers with rubber septum are used to collect and store blood samples
- Sink for disposing of liquid waste and hand washing
- Plastic bag for collecting solid waste (no trash can)
- TaqMan primer
- DNA mini kits
- Microcentrifuge tubes
- cryovials

Lab Environment

- Open window ventilation (screens fitted to window but some screens have unrepaired holes)
- Ceramic tiled floor

Please Note: The information contained in these pages is intended for training purposes ONLY.

- Humid environment
- Urban setting
- Crowded laboratory with limited work space

PPE

- Lab coats are worn in the lab and occasionally taken home for laundry
- Surgical masks and gloves are worn occasionally

Personnel Practices

- No vaccination or occupational health services available
- Hand washing done occasionally
- Lab waste is untreated and collected by municipal (local government) waste services
- Occasional (~weekly) cleaning done by a building custodian.
- Needles are capped and thrown in the regular trash
- Food and drink are stored in the same refrigerator with lab supplies and reagents

Security Practices

- Interior doors are unlocked and propped open during the day
- Exterior doors are only locked at night
- Cultures not secured or inventoried
- No personnel verification program

Agent Facts

Infectious Dose: Unknown, but thought to be around 500 – 10,000 viral particles for percutaneous route and much higher for contact with non-intact skin or mucosal membranes.

Stability:

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 2% glutaraldehyde, formaldehyde, ethanol

PHYSICAL INACTIVATION: Effectiveness of 56·C - 60·C heat in destroying HIV in serum not certain, however, heating small volumes of serum for 30 min at 56·C before serologic testing reduces residual infectivity to below detectable levels

SURVIVAL OUTSIDE HOST: Drying in environment causes rapid (within several hours) 90-99% reduction in HIV concentration

Incubation Period: Epidemiologic evidence suggests that duration from exposure to onset of symptoms has a minimum range from 6 months to more than 7 years.

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Mortality Rate: 100% of untreated patients will die from various complications related to compromise of the immune system within 10 years. Patients can be treated and survive with HIV as a chronic infection. However, the treatment can be expensive and there is evidence that some strains of HIV will mutate and develop resistance to the treatments.

Morbidity:

Duration of Illness: Initial infection produces flu-like symptoms. An HIV positive patient can be asymptomatic for many years before developing the disease. Untreated patients may survive 6-10 years post-infection, with illness worsening towards the end of this period.
Severity of Illness: High.
Duration of Infection: Lifetime
Long term effects after infection: Active disease can be triggered at any time after the establishment of a latent infection, though the probability of developing active disease is higher 1-2 years after infection, in immune compromised patients, small children, young adults, and the very old.

Allergen (yes/no): No

Carcinogenic/mutagenic (yes/no): Potentially

Abortogenic (yes/no): No

Toxin Production (yes/no): No

Immune Suppression (yes/no): Yes

Ability to Mutate in Host or Environment (yes/no): Yes

Infection Mitigation Measures:

For human pathogens

Immunization: No. (Various experimental vaccines have been developed)
Prophylaxis: Anti-HIV drugs
Post Infection Treatment: Anti-HIV drugs
Existence of Diagnostic tests: Yes.

Routes of Infection:

Inhalation: No

Ingestion: No

Percutaneous: Yes

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Contact: Possible (fluid contact with damaged skin or mucosal membranes)

Vector-Borne: No

Sexual Transmission: Yes

Vertical Transmission: Yes

Communicability: HIV is a virus that only infects humans. Studies indicate that it replicates only in a certain subset of human T-lymphocytes. Infections occur primarily through contact with infected body fluids, sexual transmission, during child birth, blood transfusions, and sharing intravenous needles. Efforts are underway to engineer animal models that will be able to be infected with the virus.

Human to Human: Yes

Human to Animal: No Evidence

Animal to Animal: No Evidence

Animal to Human: No Evidence (although some theories on the emergence of HIV involve animal to human transmission through fluid contact)

Multiple Species: No

Where is it present: Worldwide.

Perception of malicious use: LOW

Culture: Virus isolation and culture is possible in a relatively simple diagnostic laboratory using fresh peripheral blood cells from healthy donors or suitable culture lines such as T-lymphomas. This procedure is typically not used in diagnosis as it is tedious and lengthy in comparison with other diagnostic techniques. It is mainly used in characterizing viruses.