

BT601 (Virology)

Final Term (Spring-2023)

Current + Past Questions

Solved By Bella

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Objectives

1. Father of microbiology is **Antony van Leuwenhoek**
2. First discovered term vaccine is **Edward Jenner**
3. Who discovered first cell line is **carrel**.
4. Immunodiffusion is performed using _____ **1 %** agarose
5. Tissue sample stored at degree for years- **80°C**
6. Toroviruse belong to a family is **Coronaviridae**.
7. Biggest virus name
8. Virus infection cell release **interferon**.
9. Smallest virus name **Picorna virus**.
10. Misfiled of protein is known as **prions**.
11. **Mad cow disease** is caused by prions.
12. Mutation is _____ in HIV. **Very high**
13. Viruses store their genetic information into _____ types of genome. **Six**
14. Nucleic acid of virus is ____ **Capsid**
15. All kingdoms can be infected by **viruses**
16. **Scanning Electron Microscopy** contain information about the composition of the sample.
17. Live vaccines are used to protect against **Rubella, Rotavirus**.
18. All virus family contain the suffix **viridae**.
19. They are composed solely, **single-stranded RNA**.
20. Enveloped viruses is **Paramyxoviruses, Reteroviruses, Arenavirus**
21. **Creutzfeldt-Jakob disease** caused by prions.
22. An icosahedral is a polygon with **12 vertices (corner)**, and **30 edges**.

23. Protein shell of virus is called the **capsid**.

24. Classification of animal viruses on the basis of essential **lipids**

25. The Sela Filter Made up of **porcelain**.

26. Specimens should be transported in proper **medium**

27. Serum proteins that react with **antigen-antibody complexes**.

28. A **vaccine** is a **biological** preparation that provides active **acquired immunity** to a particular disease.

29. The host cell takes in the viral particle through the process of **endocytosis**.

Subjective

What do you know about the structure of M-13?

M-13 PHAGE

- ▪ Simple genome
- ▪ 6.4kb
- ▪ Single stranded
- ▪ Positive sense
- ▪ Circular DNA encoding ten genes
- ▪ Icosahedral symmetry
- ▪ Capsid can be expanded by protein subunits
- ▪ Hence, genomic size can also be increased

Viral neutralization test

Serological method that detects the presence of viral neutralizing antibodies. The antibodies bind to viral particles. Monoclonal and polyclonal antibodies. Block viral infectivity no cell infection.

What are the types of complementation?

Mutants to functional groups resulting production of one or both parent viruses. One of the viruses provides functional gene product allows functional analysis of unknown mutations.

Types of complementation:

- Allelic (intragenic) complementation where different mutants have defects in same protein.
- Non-allelic (intergenic) results from mutants with defects in different genes.

Difference between the principles of Scanning Electron Microscopy and transmission Electron Microscopy?

SEM

An electron gun produces a finely focused beam of electrons called the primary electron beam. These electrons pass through electromagnetic lenses and are directed over the surface of the

specimen. The primary electron beam knocks electrons out of the surface of the specimen, and the secondary electrons thus produced are transmitted to an electron collector, amplified, and used to produce an image of viewing screen or photographic plate. The image is called a scanning electron micrograph.

TEM

Focused beam of electrons from an electron gun passes through the ultrathin section of the specimen. Beam is focused on a small area of the specimen by an electromagnetic condenser lens. Instead of being placed on a glass slide, the specimen is usually placed on a copper mesh grid.

Name 3 disease cause by Peribunyaviridae?

1. Rift Valley fever
2. La Crosse encephalitis
3. California encephalitis

Write at least 3 functions of capsids.

- Protection of genome
- Prevent digestion by cellular enzymes
- In cytoplasm helps to introduce genome in host cell
- Bind to cell surface

The function of terminate in genome packing of bacteriophage.

In bacteriophages, the terminate protein plays a critical role in the packaging of the viral genome into the capsid. Terminate works in concert with other viral proteins to recognize and bind to specific DNA sequences, initiating the process of genome packing. Once initiated, terminate helps to regulate the process of DNA packaging, ensuring that the genome is correctly aligned and compacted within the capsid structure.

What are microscopes? Explain the types of microscopes.

Microscopes are devices that use lenses to magnify objects and allow scientists and researchers to observe things that are too small to be seen with the naked eye. There are several types of microscopes, including:

- **Optical microscopes**: Use visible light to magnify objects and can be further divided into compound, stereo/dissecting and fluorescence optical microscopes.
- **Electron microscopes**: Use beams of electrons to magnify objects and can be further divided into transmission and scanning electron microscopes.
- **Scanning probe microscopes**: Use a probe to scan over the sample surface and allow visualization at the atomic and molecular scale.

Write the genome section of bunyavirus based on the formation of protein.

The genome of bunyaviruses consists of three segments of single-stranded RNA. These segments encode the viral nucleocapsid (N) protein, glycoproteins (Gn and Gc) and the

RNA-dependent RNA polymerase (RdRp), respectively. The viral genome is coated with the N protein, forming a central helical structure. The Gn and Gc glycoproteins form spikes on the outer surface of the viral particle, allowing it to attach to and infect host cells. The RdRp protein is responsible for replication of the viral genome, enabling the virus to produce new copies of itself within infected cells.

Write the differences between PrPSc and PrPres.

PrPres

Protease-resistant PrPSc-like protein (PrPres) is an isoform of PrPc which is structurally altered and converted into a misfolded proteinase K-resistant form in vitro.

PrPSc

The infectious isoform of PrP, known as PrPSc, is able to convert normal PrPC proteins into the infectious isoform by changing their conformation, or shape; this, in turn, alters the way the proteins interconnect. PrPSc always causes prion disease.

How do viruses infect the human body?

Viruses infect the human body by entering and attaching to host cells, using the cell's machinery to replicate and produce new virus particles. Some viruses cause direct damage to the cells they infect, while others trigger an immune response that causes inflammation and damage to surrounding tissues. The specific mechanisms and symptoms of viral infection can vary depending on the type of virus and the affected body tissues.

What do you know about the structure of bacteriophages?

Bacteriophages, also known as phages, are viruses that infect bacteria. They have a unique structure consisting of a head, which contains the genetic material of the virus, and a tail, which is used to attach and inject the genetic material into the host bacteria. Some bacteriophages also have additional structures such as tail fibers, which help them to locate and bind to specific host cells. The head and tail of bacteriophages are made up of protein subunits that self-assemble to form the virus particle.

What is Prions?

- Neither have DNA or RNA
- Abnormal or mutated form of protein
- Causes several lethal diseases
- Misfolded proteins
- Prions for proteinaceous infectious particle
- Characterize several fatal neurodegenerative diseases in animals and humans

What is the centrifugal technique? Write its principle and its type.

Centrifugal technique:

The centrifugal technique is a laboratory process that separates materials based on density using centrifugal force.

Principle:

The principle behind centrifugation is that the denser components of a mixture will migrate towards the bottom of a centrifuge tube when rotate at high speeds, while the lighter components will remain towards the top.

Types of centrifugation:

There are two types of centrifugation:

Differential centrifugation, in which particles of different sizes and densities are separated by varying degrees of centrifugal force.

Density gradient centrifugation, in which particles are separated based on their buoyant density in a solution with a continuous gradient of increasing or decreasing density.

Three filtration method?

Three common filtration methods are:

- 1) **Vacuum filtration**: uses vacuum pressure to draw the mixture through a filter to separate the solid from the liquid.
- 2) **Gravity filtration**: relies on gravity to pull the liquid through the filter paper and leave solid particles behind.
- 3) **Pressure filtration**: uses a pump to apply pressure to the mixture, forcing it through the filter and separating the solid from the liquid.

What is the purpose of strand amplify?

The purpose of strand amplification is to increase the amount of a specific DNA sequence in a sample, making it easier to detect and analyze. By amplifying the target sequence, DNA testing becomes more sensitive, accurate, and efficient. Strand amplification can be achieved through various techniques, including polymerase chain reaction (PCR) and loop-mediated isothermal amplification (LAMP). These methods are often used in molecular biology research, medical diagnostics, and forensic science.

Role of Scientist in Tobacco Mosaic Virus?

Scientists have played a critical role in the discovery and understanding of Tobacco Mosaic Virus (TMV). They have conducted experiments on the virus to learn about its genetic material, replication mechanism, transmission methods, and its impacts on plants. Through their research, they have identified control measures for the virus and developed new techniques to limit its impact on crop yields. Today, scientists continue to study TMV and other plant viruses to develop new methods to control their spread.

How many ways in which viruses work to produce infection in human body?

There are three main ways in which viruses work to produce an infection in the human body:

1. **Direct cell damage**: Some viruses damage or destroy the cells they infect, leading to symptoms such as tissue damage, inflammation, and cell death.
2. **Replication and spread**: Viruses can replicate and spread rapidly within the body, using the host's own cells to produce new viruses. This can cause a range of symptoms, from mild to life-threatening.

3. **Immune system response:** When the body detects a viral infection, the immune system responds by producing antibodies to fight the virus. Sometimes, this immune response can also cause symptoms such as fever, fatigue, or muscle aches.

Working of virus to affect the host cell?

When viruses attack host cells, they replicate inside the host to produce new viral particles and use the host's metabolism, which can damage or destroy the host cell. The process can trigger host defence mechanisms that may cause tissue damage, contributing to the symptoms of the disease. Consequently, the damage can cause pathological effects, which could result in inflammation, tissue damage, cell death, and organ dysfunction, having grave implications for the host's health.

Viruses transmitted in plant method?

Viruses can be transmitted in plants through different methods. Some of the common methods include:

1. **Vector transmission:** Insects or other plant-feeding animals can pick up a virus while feeding on an infected plant and then transmit it to a healthy plant.
2. **Seed transmission:** Seeds from an infected plant can carry the virus and infect new plants when they germinate.
3. **Grafting:** When a scion from an infected plant is grafted onto a healthy plant, the virus can be transmitted to the healthy plant.
4. **Mechanical transmission:** Contamination by infected sap, pruning tools, machinery, or other means can cause the virus to spread to new plants.

Symmetry of the phage?

Phages can exhibit different types of symmetry including icosahedral, helical, and complex symmetry. Icosahedral symmetry is characterized by a polyhedral shape with 20 triangular faces and 12 vertices. Helical symmetry involves a cylindrical or rod-like shape with a spiral arrangement of protein subunits. Complex symmetry consists of a variety of shapes and structures. The symmetry of the phage depends on the arrangement of its protein subunits, which determines its shape and structural characteristics.

Principle of hem agglutination?

The principle of hemagglutination is based on the ability of certain viruses, bacteria, or antibodies to cause the clumping together (agglutination) of red blood cells (erythrocytes) in a vial or on a slide. The process occurs when antigen molecules on the surface of red blood cells bind to antibodies or lectins (molecules that bind specifically to sugar molecules on the surface of the cells). The degree of agglutination can be used to determine the concentration of viruses or antibodies present in a sample. Hemagglutination is commonly used in diagnostic tests for viral infections, such as influenza and mumps.

Three examples of vertical transfer of viruses?

Vertical transfer of viruses refers to the transmission of viruses from a parent to its offspring, either prenatally, during birth or after birth through breastfeeding.

1. HIV

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2. Zika virus
3. Herpes simplex virus

What is Microscopy?

Microscopy is a scientific technique that uses microscopes to observe and analyze the structure and characteristics of objects too small to see with the naked eye. It is widely used in biology, medicine, materials science, and other fields. Microscopes include optical, electron, and scanning probe microscopes, each with unique applications.

Function of antibiotics and trypsin?

Function of antibiotics:

- Kill or inhibit the growth of bacteria, fungi, or other microorganisms.
- Disrupt essential cellular processes of microorganisms.
- Used to treat infections caused by bacteria and microorganisms.
- Different types of antibiotics target different bacterial components.
- Each antibiotic has a specific mechanism of action.

Function of trypsin:

- Digestive enzyme that breaks down proteins into smaller peptides.
- Produced by pancreas and released into the small intestine.
- Helps to digest proteins and absorb essential nutrients.
- Plays a role in regulating protein synthesis and degradation in the body.
- Used in research and biotechnology to dissociate adherent cells from culture surfaces.

Principle of centrifugation?

The principle of centrifugation is based on the application of a centrifugal force to separate particles or components of a mixture based on their size, shape, and density. When a mixture is spun in a centrifuge at high speed, the denser and larger particles or components move towards the bottom of the centrifuge tube, while the lighter and smaller components remain on top. The speed and duration of centrifugation is dependent on the characteristics of the mixture and the desired separation. Centrifugation is a widely used technique in biology, chemistry, and other fields to isolate and purify molecules, cells, and organelles.

5 parts with function of light microscopy.

Light microscopy is a technique that uses visible light to observe and study the structure and characteristics of microscopic objects. The main parts of a light microscope and their functions include:

1. **Eyepiece:** Contains a lens that magnifies the image produced by the objective lens.
2. **Objective lens:** Contains one or more lenses that produce the initial magnified image of the specimen.

3. **Stage**: Supports the specimen being observed.

4. **Focus knob**: Adjusts the distance between the objective lens and the stage to bring the specimen into focus.

5. **Light source**: Provides illumination of the specimen for better visibility.

Characteristics of virus?

Following are the general properties of viruses

- Non living structure
- Non cellular
- Contain a protein coat known as capsid
- Contain the nucleic acid core containing DNA or RNA
- Can produce in host cells
- Some virus may have spikes to help attach to the host cells

Latent occult virus infection with examples?

The pathogenic viruses having the ability to lie dormant (or latent) within host cell; called lysogenic part of lifecycle.

- Enveloped viruses
- Paramyxoviruses, Retroviruses, Arena-virus
- No disruption of cellular functions
- Promotes shredding of viral Antigens from the cell surface

Examples: Three examples;

- i. HSV
- ii. Adenovirus
- iii. SSPE

Replication of retroviruses?

Retrovirus replication pattern:

Once inside the host cell cytoplasm, the virus uses its own RT enzyme to produce DNA from its RNA genome. The reverse of the usual pattern, thus retro (backwards) The new DNA is then incorporated into the host cell genome by an integrase enzyme referred to as a provirus. The host cell then treats the viral DNA as part of its own genome, transcribing and translating the viral genes along with the cell's own genes. The proteins are produced which are required to assemble new copies of the virus. It is difficult to detect the virus until it has infected the host. Infection will persist indefinitely.

- The gag gene --- capsid protein – The pol gene --- molecules of reverse
- Transcriptase – The enveloped gene --- molecules of the envelope protein.

What are the types of pathogenesis in interaction of virus and host cells?

- Inapparent
- Apparent
- Acute

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- Sub acute
- Chronic
- Latency

Baltimore Classification?

Baltimore system of classification 1971

- Type of nucleic acid
- Mode of replication
- Host organism
- Diseases caused

Cell culture?

Cell culture was first successfully undertaken by Ross Harrison in 1907. Cell culture is the process cells which cells are grown under controlled conditions, generally outside their natural environment. After the cells of interest have been isolated from living tissue, they can subsequently be maintained under carefully controlled conditions.

Difference interference contrast microscopy?

DIC also known as Nomarski interference contrast microscopy. It is used to enhance the contrast in unstained, transparent samples. DIC works on the principle of interferometry to gain information about the optical path length.

Application:

DIC is a more expensive, label-free microscopy technique with a high sensitivity to thin cellular material, even when it is located within thick tissue. It is useful for rendering contrast in transparent samples and gives brilliant pseudo-3D relief shading images.

Write a note picorna virus genome?

Picorna virus

- A picornavirus is a virus belonging to the family Picornaviridae, and order Picornavirales
- Picornaviruses are non-enveloped viruses that represent a large family of small, cytoplasmic, plus-strand RNA (~7.5kb) viruses .
- 30-nm icosahedral capsid the smallest virus i.e. Picornavirus contains 4000-6000 nucleotides
- Genetic information codes 1500 to 2000 amino acids or 10 to 15 proteins

Define apoptosis?

Programmed cell death during cell development and cell killing by immune system. This is a tightly regulated process and relies on complex molecule cascades for its control, and at last, shrinkage, condensation of chromatin, DNA fragmentation and blabbing.

How activation of apoptosis is done by viruses?

Immune effector cells like CTL's and NK cells release lytic granules, and they act on target cells by two mechanisms:

Mechanism 1

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- Release of cytokinins such as perforin: peptide related to C9, forms a polyperforin, and affects permeability of cell membrane.
- Granzyme: serine proteases, affect cell pores.

Mechanism 2

- CTLs express a ligand that binds on the surface on the target cell
- Triggers apoptosis
- Triggers cascade to initiate apoptosis

How do phage replicate?

Phage's can be replicate through 2 cycles:

Lysogenic Cycle

- A lysogen or lysogenic bacterium is a bacterial cell in which a phage exists as DNA in its dormant state (prophage).

Lytic Cycle

- Lytic cycle (virulent phage)
- Release of virus bursts and kills host cells (lysis)

Comparison between Lytic vs. Lysogenic Cycle?

Lytic Cycle

- Lytic cycle (virulent phage)
- Release of virus bursts and kills host cells (lysis)

Lysogenic Cycle

- Lysogenic cycle (temperate phage) viral DNA integrates into the host genome (provirus) can be transmitted to daughter cells.
- Can initiate a lytic cycle in response to environmental signals (stress)

Write down the steps of Lysogenic Cycle and Lytic Cycle?

Lysogenic Cycle

1. Viral genome enters cells
2. Viral Genome integrates into host cell genome
3. Host DNA polymerase copies viral chromosomes
4. Host cell divides and viral chromosomes divide into daughter cells
5. When virus is triggered, viral genome detaches and enters lytic cell

Lytic Cycle

1. Attachment
2. Entry of phage DNA and degradation of host DNA
3. Synthesis of viral genomes and proteins
4. Assembly (Phage assembly)
 - Head
 - Tail

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- Tail Fibres
5. Release

What are the advantages and limitations of Lysogenic Cycle and Lytic Cycle?

Lysogenic Cycle

Many more viruses can be made because the viral genome is passed onto future generation of host cells. However, replication takes longer because it is dependent on the host cell's replication.

Lytic Cycle

Replication of new viruses are fast. However, the host is also immediately killed, preventing the viral genome from passing onto the next generation of host cells.

What is the mode and mechanism of transmission of plant viruses?

Modes of transmission of plant viruses

To transmit from one plant to another plant and from one plant cell to another, plant viruses must be used strategies that are usually different from animal viruses. Plants do not move, so plant transmission usually involves vectors (such as insects).

- Insect – This forms the largest and most significant vector group and particularly includes Aphids, Whiteflies, Hoppers, Beetles, etc.
- Through sap, e.g., TMV, potato virus
- Nematodes e.g. Tobacco ring spot virus
- Through seed

Mechanism of Plant resistance to viruses

There are approximately 450 species of plant pathogenic viruses, which cause a range of diseases. The plant shows two types of antiviral defence resistance mechanisms are

- R gene mediated
- RNA Silencing

Rotter tube cultures?

Grown in test tubes and rotated during incubation.

Procedure

Tissue explants placed in test tubes. A small amount of plasma and agar is distributed over the inside the surface of the tube, so fragments stay in place. As the tube is rotated 8 to 12 rpm. Tissue explants submerged in nutrient media, only a portion of time. Some cells don't grow satisfactorily if entirely submerged. Other cells, especially those cultivated through many transfers, will stick to glass surfaces and grow when completely submerged.

Types of Interferons?

Type I:

- (1) Interferon alpha = maximal antiviral activity
- (2) Interferon Beta = intermediate antiviral activity

Type II:

Interferon Gamma = more Lymphokines than antiviral

Regulation of Interferon Expression?

- It is not expressed in a normal resting cell
- Labile repressors bind to promoter elements, block transcription and production of labile suppressors drop in viral
- Infection and allows in viral infection and allows interferon synthesis to occur

Clinical Uses of Interferon?

IFN-A:

- Treatment of viral infections: condylomata acuminata and chronic hepa B and C.
- Prophylactic or therapeutic agent in immunocomp. Hosts (VZV, HSV 1 and 2)
- Prophylaxis vs CMV in renal transplant
- Treatment of AIDS-associated Kaposi's sarcoma and hairy cell leukaemia

IFN-G:

- Immunostimulant in oncologic and immunodeficiency disorders

Evasion of immune response by viruses?

When a virus infects a host, a complex immune response develops to eliminate the invading pathogen. Viruses, in turn, have evolved a profusion of strategies to escape from the immune system. Viruses can avoid detection by both innate and adaptive immune responses. Viruses can express proteins that directly interfere with host processes or mimic host proteins and compete to bind specific receptors. Pathogens are able to directly deplete immune cells and prevent their recruitment to the site of infection. In a state of latency, viruses remain dormant and undetectable in host cells.

Mechanisms of viral evasion:

- Cellular level
- Systemic level

Targets of viral evasion proteins:

- Pattern recognition receptors in infected cells
- Interferons
- Dendritic cells
- T cell receptors
- Antibodies

How to prevent from the viral infections?

Prevention of Viral Infection

Viruses cause a variety of diseases in animals, including humans ranging from the common cold to potentially fatal illnesses like meningitis. Vaccines may be prepared using live viruses, killed viruses or molecular subunits of the virus. The killed viral vaccines and subunit viruses are both incapable of causing disease. Live viral vaccines are designed in the laboratory to cause few

symptoms in recipients while giving them protective immunity against future infections e.g.: Polio vaccines.

Antiviral drugs

Antiviral drugs have limited success in curing viral disease, but in many cases, they have been used to control and reduce symptoms for a wide variety of viral diseases. For most viruses, these drugs can inhibit the virus by blocking the actions of one or more of its proteins.

For example:

- Acyclovir-for genital herpes
- Tamiflu (oseltamivir) for influenza

Role of Edward Jenner in vaccine?

Edward Jenner (1796) introduced the concept of vaccination. Edward Jenner was an English physician and scientist who developed the first vaccine against smallpox. He pioneered the concept of vaccination by using cowpox virus, which was a milder form of smallpox, to confer immunity to smallpox. In 1796, he tested his theory by injecting a young boy with cowpox, and this experiment was the first successful vaccine trial in history. Jenner published his findings and started advocating for the use of cowpox vaccination to prevent smallpox, which was quickly adopted throughout Europe and the world. His contribution to public health is estimated to have saved millions of lives from the ravages of smallpox and his work paved the way for the development of other vaccines. Jenner's achievement was recognized by a number of honours, including a Royal Society medal, a gold medal from Napoleon, and a knighthood from King George IV.

- Cow pox against small pox
- Adopted worldwide in 19th century
- Smallpox vaccine using milder cowpox virus
- No knowledge of viral particles

What is Toga virus?

- Linear, non-segmented, single-stranded, positive sense RNA.
- 10,000–12,000 Nucleotides
- The virus is enveloped and forms spherical particles (65–70 nm diameter)
- The capsid is icosahedral, constructed of 240 monomers, having a triangulation number of 4.

What is Paramyxo?

- Para means beyond and Myxo means mucus.
- Paramyxo and orthomyxo were formerly known as myxoviruses.

What is a reason behind the spontaneous mutations?

Spontaneous Mutation that arise naturally during replication.

REASON

- Mechanism of genome replication

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- RNA dependent RNA polymerase shows higher error rate than DNA dependent DNA polymerase.

What is the mode of transmission of arena viruses?

Arena viruses are a family of viruses that are usually transmitted from rodents to humans. Arena viruses are shed into the environment in the urine, saliva, or droppings of infected rodent hosts. People become infected by breathing in the virus after rodent urine, droppings or nesting materials are stirred up, such as during cleaning.

Define following?

Vaccine

A vaccine is a biological preparation that provides active acquired immunity to a particular disease.

Vaccination

A vaccination is the injection of a killed or weakened organism that produces immunity in the body against organism.

Immunization

Immunization is the process by which a person or animal becomes protected from a disease.

Why Vaccines?

- Vaccines are safe.
- Vaccines are effective.
- Vaccines work with immune system.
- Vaccines protect individuals and the community.

When scientists create vaccines, they consider?

- ♦ How your immune system responds to the germ.
- ♦ Who needs to be vaccinated against the germ.
- ♦ The best technology or approach to create the vaccine.

Write down the types of vaccines?

There are 4 main types of vaccines:

Live-attenuated vaccines

Live vaccines use a weakened (or attenuated) form of the germ that causes a disease because these vaccines are so like the natural infection that they help prevent, they create a strong and long-lasting immune response. Live vaccines are used to protect against:

- Measles
- Mumps
- Rubella (MMR combined vaccine)
- Rotavirus
- Smallpox
- Chickenpox

- Yellow fever

Inactivated vaccines

Inactivated vaccines use the killed version of the germ that causes a disease. Inactivated vaccines usually don't provide immunity (protection) that's as strong as live vaccines. Inactivated vaccines are used to protect against:

- Hepatitis A
- Flu (shot only)
- Polio (shot only)
- Rabies

Subunit, recombinant, polysaccharide, and conjugate vaccines

Use specific pieces of the virus like its protein, sugar, or capsid. They give a very strong immune response that's targeted at key parts of the virus. One limitation needs booster shots.

- Hepatitis B
- HPV (Human Papillomavirus)
- Whooping cough (part of the DTaP combined vaccine)
- Pneumococcal disease
- Meningococcal disease

Toxoid vaccines

Use a toxin (harmful product) made by the virus that causes a disease. They create immunity to the parts of the virus that cause a disease instead of the virus itself. That means the immune response is targeted to the toxin instead of the whole virus. You may need booster shots. Toxoid vaccines are used to protect against:

- Diphtheria
- Tetanus

What are the virus vectors?

SV 40 Based Vectors

- First animal virus-based vector.
- Small virus with capsid and circular dsDNA
- Bidirectional replication

Lytic Infection of Sv40 three steps

1. Early mRNA synthesis
2. Viral DNA replication
3. Late mRNA synthesis

Vaccinia Virus Vector

- Large ds DNA
- Contains enzymes for replication
- Generated in vivo

Epstein Barr Virus

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- Herpes virus with large genome
- Infect primates and canines
- Used for construction of episomal cDNA

What is gene therapy?

The first attempt at modifying human DNA was performed in 1980 by Martin Cline. Experimental technique that uses genes to treat or prevent disease. Therapeutic delivery of nucleic acid into a patient's cells as a drug to treat disease.

Vectors

- Viral
- Non viral
- Electroporation,

Other gene gun

- Sonoporation
- Magnetofection
- Oligonucleotides
- Lipoplexes
- Dendrimers
- Inorganic nanoparticles

Hurdles:

- Short-lived nature immune response
- Problems with viral vectors
- Multigene disorders
- Insertional mutagenesis
- Cost effective

Chemotherapy Against Viral Diseases?

Ideal drug

- Water soluble
- Chemically and metabolically stable
- Easily absorbed (a polar)

The drug is not:

- Toxic
- Carcinogenic
- Allergenic
- Mutagenic
- Teratogenic

A successful drug must interfere with:

- A specific viral function e.g. enzyme necessary for viral life cycle Anti-Viral Chemotherapy
- A cellular function that the virus needs in order to replicate

If interfere with cellular function either:

- It must be crucial to the virus but not the cell
- Only the virus-infected cell must be killed.

Approved Antiviral Drugs

- Amantadine and rimantadine (influenza A virus)
- Ribavirin (respiratory syncytial virus)
- Idoxuridine and trifluridine (topical treatment of herpetic keratitis)
- Vidarabine and acyclovir (systemic treatment of herpes simplex virus and varicella-zoster virus infections)
- Famciclovir and valaciclovir (oral treatment of varicellazoster virus infections)
- Ganciclovir and foscarnet (cytomegalovirus)
- Zidovudine, didanosine, zalcitabine, and stavudine (human immunodeficiency virus)

Limitations of Antiviral Drugs

- Narrow antiviral spectrum
- Ineffectiveness against the latent virus
- Development of drug resistant mutants
- Toxic side effects

Write down about Virus Titration and also its standard or titter?

Virus Titration

- To understand the concentration of virus
- Infectivity titter
- Reed and Muench method or Karber formula

Standard

- LD50/mL
- Based on the mortality of lab mice
- Infectivity titter
- Computation

Titter

- Frequency of production of specific response of host
- Necessary for viral reproduction
- The smallest amount of virus is capable of producing manifestation in host

Note on Bacteriophage Titration?

Bacteriophage Titration

- Determination of the number of phage particles in a stock.
- Simplest type of titration.
- Several dilution preparation.
- Plating one or more measured samples of each dilution.

Procedure

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- Phage and bacteria introduced on agar surface.
- Incubation
- Interruption of continuous bacterial layer by lysis of phage.

Charging

Sometimes, they adhere to plastic or glass. If particles adhere to pipettor tips during transfers, it may lower the amount of phage particles present. One way to minimize this problem is to “charge” the Pipettor by pipetting a sample of the solution up and down in the tip and discharging the sample back into the original tube.

Plaque Count in Bacteriophage Titration

Plaque values

- Plaque counts analogous to colony counts for bacteria
- Values are directly proportional to the amount of phage plated.
- Plate cultures prepared by combining phage with host cells in top agar.
- Top agar preparations contain lower conc. Of agar (7 g/L) than normal solutions used to prepare agar plates (15 g/L).
- Low agar conc. Allows progeny phage from lysed cells to diffuse through the media and infect neighbouring cells.
- After lysis, plaque (zone of lysed cells) is produced on the plate.
- The size of the plaques depend on how soon the bacteria in the agar reach
- Stationary phase and stop reproducing.
- Plaques will stop spreading at this point.

What is gene?

A segment of DNA molecule that encodes for synthesis of a single polypeptide the entire DNA sequence of an individual/species.

Define intron and exon?

Introns:- The non coding region on the viral genome.

Exons:- The coding regions on the viral genome.

Define lysogens?

A lysogen or lysogenic bacterium is a bacterial cell in which a phage exists as DNA in its dormant state (pro-phage).

Viroid transmission?

- By aphids
- By cross contamination
- Due to mechanical damage to plants as a result of horticultural or agricultural practices
- From plant to plant by leaf contact

Structure of prions?

The protein that prions are made of (PrP) is found throughout the body, even in healthy people and animals. PrPC is a normal protein found on the membranes of cells. It has 209 amino acids (in

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humans) One disulphide bond, A molecular mass of 35–36 kDa A mainly alpha-helical structure. The normal protein is not sedimentable; meaning that it cannot be separated by centrifuging techniques.

Fluorescence?

The ability of substances to absorb short wavelengths of light (ultraviolet) and give off light at a longer wavelength(visible). It is used in fluorescence microscopy.

T-phage?

- Head and tail called binomial symmetry
- Icosahedral head and helical tail symmetry

Structure of Berk filter?

- Manufactured of diatomaceous Earth
- Graded into three porosities
- The V (veil) grade is coarse and Used for preliminary filtration to remove bacteria or large particles from a solution
- The N (normal) grade is most useful since it retains most bacteria, while all viruses will pass through
- The W (Weing) grade has very small pores that will retain all bacteria and large viruses

Picornavirus?

- A picornavirus is a virus belonging to the family Picornaviridae, and order Picornavirales
- Vertebrates, including humans, serve as natural hosts. Birds also serve as host
- Picornaviruses are non-enveloped viruses that represent a large family of small, cytoplasmic, plus-strand RNA (~7.5kb) viruses . 30-nm icosahedral capsid.

Name of plant which have positive sense RNA virus?

- Bromovirus
- Ilavirus
- Alfamovirus
- Ourmiavirus
- Tobamovirus
- Hordievirus
- Pecluvirus
- Furovirus
- Pomovirus

What is meant by Paramyxo?

Para means beyond and myxo means mucus.

Phase growth curves steps?

It consist of four steps

1. Inoculation
2. Eclipse
3. Burst

4. Burst size

Magnification?

It is the ratio of size of the an object seen under the microscope to the actual size observed with unaided eye.

Inclusions?

Examination of virus infected cells by light or electron microscope shows viral multiplication and maturation referred as 'inclusions' or 'factories'.

Write the two names of plant viruses?

Tobacco mosaic virus and Potato virus.

What is the polyribosomes?

Most cellular protein is assembled and synthesized on aggregates of ribosomes called polyribosomes.

Problem facing during the viral concentration?

- One infectious unit equals to 10^3 to 10^5 non-infectious particles
- Low ratio associated with slow uncoating of viral particles
- Exception of vaccinia virus

Which media is used while transfer the viral infection?

Transport media is used while transfer the viral infection.

Positive sense RNA virus of plant?

- Sobemovirus
- Sadwavirus
- Chevavirus
- Flexiviridae
- Potyviridae
- Closteroviridae

Mechanism of vaccine?

Vaccines are made from same organism or parts of them that causes disease after that introduced in body then the immune system reacts to the vaccine-make antibodies and antibodies destroy vaccine germs or stay in the body, giving specific immunity.

Uncoating of viruses?

- Uncoating means removal of capsid
- Exposing the viral genome in the host cell
- The Protein coat around genome gets disintegrated Cytoplasm Cellular enzymes
- Makes genome ready to takeover the host machinery
- Activates cascade of the steps required for viral replication

Types of mutant virus?

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- Biochemical markers: drug-resistance mutations
- Deletions: similar to non-sense mutations
- Host range: refers to whole host animal
- Non-sense mutation: alteration of coding sequence
- Plaque morphology
- Temperature sensitive
- Cold sensitive
- Reverents

In vitro genetic technique used in virology?

- Physical analysis
- Isolation of nucleic acids from virus preparations
- Direct analysis of DNA using restriction endonucleases enzyme
- Use of vectors in DNA sequencing
- Electron microscopy
- RNA sequence analysis using Reverse transcriptase

Technique for the detective viral growth?

- Death of embryo
- Damage to embryo
- Pocks or lesions on egg membrane

LD50?

- It stand for the lethal dose 50.
- LD50/mL based on mortality of lab mice
- Infectivity titre
- Computation

Replication of toga virus?

- Viral RNA acts as both genome as well as mRNA
- After fusion of viral capsid with cell receptor
- RNA released in cytoplasm

Target of the evasion protein?

- Pattern recognition receptors in infected cells
- Interferons
- Dendritic cells
- T cell receptors
- Antibodies

Requirement to initiate the viral diseases?

An overview of the steps in picornavirus replication

- Attachment
- Entry
- Translation
- Transcription/genome replication

- Assemble

Three evolution theories?

FIRST THEORY

They may have originated and evolved with the other life forms.

SECOND THEORY

They may have arisen from segments of the cellular nucleic acids which acquired the ability to replicate at the expense of host cell.

THIRD THEORY (Regressive theory)

Viruses arose from free living organisms which gradually lost genetic information. Until they became totally dependent on the biosynthetic pathways of their host cells.

Red queen hypothesis?

The Red Queen hypothesis describes this relationship, as the organisms must constantly adapt and evolve in order to survive. This relationship is important to understand as phage are now being used for more practical and medicinal purposes.

Membrane technology application?

- Cold sterilization of beverages and pharmaceuticals
- Clearing of fruit juice, wines and beer
- Separation of bacteria from water
- Separation of oil/ water emulsions
- Reverse Osmosis
- Solid-liquid separation for pharmacies or food industries

Factors that affect the titration in viruses?

Incubation time:

- Precise period
- Most viruses take precise time to reproduce
- Time between inoculum and appearance of symptom.

Types of virus:

- Plant virus / animal virus
- Conditions provided
- Optimum media

Procedure contamination:

- Bacterial contamination
- Fungal contamination
- Careless lab work
- Improper clean less and sanitization
- Disruption of viral genome.

Structure of plant viruses?

These are extremely small and can only be observed under an electron microscope. Over 50% of known plant viruses are rod-shaped (flexuous or rigid). The length of the particle is normally dependent on the genome but it is usually between 300–500 nm with a diameter of 15–20 nm. The second most common structure amongst plant viruses are isometric particles. They are 25–50 nm in diameter. In cases when there is only a single coat protein, the basic structure consists of 60 T subunits, where T is an integer. Some viruses may have 2 coat proteins that associate to form an icosahedral shaped particle.

Corona viruses replication?

- Attachment of the viral S protein receptors.
- Endocytosis of the virus into the host cell fusion of virus membrane with endosomal membrane.
- Genome is released into the cytoplasm.
- Synthesis and proteolytic cleavage of the replicate polyprotein.
- A dsRNA genome is synthesized from the genomic ssRNA(+).
- The dsRNA genome is transcribed by providing viral mRNAs/new ssRNA(+) genomes.
- Synthesis of structural proteins encoded by sub genomic mRNAs.
- Assembly and budding at membranes of the endoplasmic reticulum (ER), the intermediate compartments, and/or the Golgi complex.
- Release of new virions by exocytosis.

Step of lytic cycle?

It has six steps

1. Attachment
2. Penetration
3. Transcription
4. Replication of phage DNA
5. Assembly
6. Release

How normal cell transform into cancerous cell?

Oncogene – a gene that when mutated or expressed at abnormally high levels contributes to converting a normal cell into a cancer cell

Write genome and structure of retrovirus?

Genome of retrovirus:

- Single stranded RNA viruses
- Positive sense
- Enveloped
- Changes to DNA by RT enzyme

There are three important gene

- GAG
- ENV
- POL

Structure of retroviruses:

It is the single stranded positive sense RNA viruses. It is Icosahedral in shape. All the retrovirus are surrounded by viral envelope. It contain two identical RNA and reverse transcriptase enzyme.

Replication of retroviruses?

Early steps

From the cell surface to the nucleus, retroviral particles must bind specifically to their target cells to cross the plasma membrane. Reverse-transcribe their RNA genome or uncoated the cores and find their way to the nuclear membrane to penetrate into the nucleus and Hijack the cellular machinery.

LATER STAGE

- Transcription
- Transduction
- Assembly
- Maturation
- Budding
- Release

Subfamilies of herpiviridae?

Alphaherpesvirinae

- Herpes Simplex Virus group called Alpha Herpesvirinae
- Latent infections in sensory ganglion, genome size 120-180kbp
- Simplexvirus, Varicellovirus, Human herpes virus-I and II,III.

Betaherpesvirinae

- Cytomegalovirus group called Beta Herpesvirinae
- Restricted host range, genome size 140-253 kbp
- Cytomegalovirus, Muromegalovirus, Roseolovirus, Human herpes Virus-V, VI and VII, Mouse Cytomegalovirus-I.

Gammaherpesvirinae

- Lymphoproliferative Virus group called Gamma Herpesvirinae.
- Infection of lymphoblastic cells, genome size 105-175 kbp
- Lymphocryptovirus, Rhadinovirus, Human herpesvirus-IV,VIII.

Genetic makeup of retrovirus?

- Diploid nature of virus.

3 very important genes:

GAG

- Gag gene makes protein p24 which serves as capsule around RNA and in cone shaped.

ENV

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- Envelope glycoproteins (gp41 and gp120)
- Gp41: transmembrane protein
- Gp120: outer glycoprotein
- Host receptor

POL

- Reverse transcriptase polymerase
- Integrase activity
- DNA from RNA

What is lysogenic part of lifecycle?

The pathogenic viruses having the ability to lie dormant (or latent) within host cell called lysogenic part of lifecycle.

Define latency?

- The phase in which viral proliferation ceases after initial infection.
- Viral genome not fully eradicated.

Host range of virus?

- The spectrum of host cells that the virus can infect.
- Host range refers to the spectrum of host cells in which a virus can multiply.
- Most viruses infect only specific types of cells in one host species.
- Host range is determined by the specific attachment site on the host cell's surface and the availability of host cellular factors.
- Most viruses are host specific bind to specific receptors on cells
- Animal viruses: receptors on plasma membrane form hydrogen bond with viral surface

Viral host range

- Plants
- Vertebrates
- Invertebrates
- Protists
- Bacteria
- Fungi