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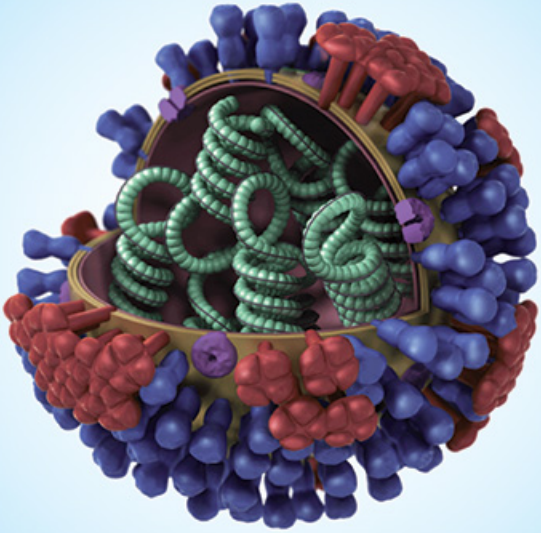
# Viva and Recent Advances in Medical Microbiology



6th Edition

Satish Gupte

JAYPEE

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# Chapter 4

# Virology

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**Q. 1. Define viruses and enumerate their characteristic properties.**
**Ans.** Viruses are unicellular ultramicroscopic particles containing either RNA or DNA, which reproduce inside living cell, pass through filters and are covered by protein coat.

The characteristic properties of viruses are:
1. They do not possess cellular organization.
2. Contain either RNA or DNA.
3. Depends upon synthetic machinery of host cell for the synthesis of nucleic acid, as they lack enzymes for this purpose.
4. Multiply by complex process and not by-binary fission.
5. Not susceptible to antibiotics.
6. Sensitive to interferon.

**Q. 2. Explain how cryptogram works.**
**Ans.** Cryptogram provides a simple way to identify and code viruses by means of shape, size, DNA or RNA content, weight of nucleic acid and vectors of transmission.

**Q. 3. Mention important steps involved in multiplication of viruses.**
**Ans.**
1. Adsorption to cell.
2. Penetration into' the cell.
3. Uncoating of virus.
4. Biosynthesis comprising transcription of m-RNA from viral nucleic acid, translation replication of nucleic acid and synthesis of late protein.

5. Maturation, i.e. assembly of daughter virion.
6. Release of daughter virion by lysis of host cell.

**Q. 4. What is restriction analysis?**
**Ans.** It is identifying the viruses by eliciting electrophoresis. The viral RNA or DNA is cleaved at specific points of various enzymes, endonucleases and resulting fragments are dispersed on a gel revealing a characteristic pattern.

**Q. 5. Define Magnus phenomena.**
**Ans.** When virus yield will have high hemagglutinin titer but low infectivity.

**Q. 6. Describe defective viruses.**
**Ans.** Defective viruses are genetically defective and cannot produce fully formed virions. They produce fully mature virions only in the presence of helper viruses which supplement the genetic deficiency in the defective viruses, e.g. Hepatitis D virus and adeno-associated satellite virus. They replicate only with helper viruses like Hepatitis B and adenoviruses respectively.

**Q. 7. Define viroid.**
**Ans.** These unique structures are nucleic acid species of low molecular weight. These may be responsible for certain diseases of men, animals and plants. Unlike viral nucleic acid, viroid are single stranded RNA molecules with extensive regions of intramolecular complementarity.

**Q. 8. Can you enumerate prions agents?**
**Ans.**
1. Agents causing scrapie
2. Agents causing Kuru
3. Agents causing Creutzfeldt-Jakob disease.

**Q. 9. What are prions?**
**Ans.** They are proteinaceous infectious particles composed of by and large protein without any nucleic acid.

**Q. 10. Area of lysis on a bacterial lawn culture produced by phage is called?**
**Ans.** Plaque.

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**Q. 11. How would you culture viruses?**
**Ans.**
1. Animal inoculation, e.g. suckling mice in case of coxsackie virus.
2. Chick embryo is clean and bacteriological sterile. It does not possess immune mechanism, does not require feeding and caging and hence quite ideal for culture of viruses, e.g. variola, herpes virus, influenza, paramyxovirus, yellow fever virus, etc.

**Q. 12. Which virus cannot withstand freeze drying?**
**Ans.** Poliovirus does not withstand freeze drying.

**Q. 13. How would you detect virus growth on cell culture?**
**Ans.**
1. Cytopathogenic effects, e.g. measle virus produces syncytium formation.
2. Failure of virus infected cells to produce acid.
3. Hemadsorption
4. Interference which means growth of first virus always check infection by second virus.
5. Cell transformation, e.g. tumor producing cells.
6. Detection of viral multiplication by fluorescent antibody technique.
7. Hemagglutination test, e.g. orthomyxoviruses and paramyxoviruses.

**Q. 14. Name the virus that resist autoclavation at 121°C for 1 hour.**
**Ans.** Slow viruses like scrapie virus.

**Q. 15. What is the role of chick embryo in the cultivation of viruses?**
**Ans.** Chick embryo is considered better than animal inoculation in virus culture because of following reasons:
1. They are clean and bacteriological sterile.
2. They do not have immune mechanism like animals to counteract virus infection.
3. They do not need feeding and caging.
4. Chick embryo offer several sites for cultivation, i.e. chorioallantoic membrane, amniotic sac, yolk sac, allantoic sac.

**Q. 16. Name the viruses not killed by chlorination.**
**Ans.** Hepatitis A and poliovirus are not killed by chlorination.

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**Q. 17. Name few antiviral chemotherapeutic agents.**
**Ans.**
1. Amantadine in influenza virus.
2. Iododeoxyuridine for herpetovirus infection.
3. Rifampin for retrovirus and poxvirus.
4. Thiosemicarbazones for poxvirus infection.
5. Interferon may be used for all viruses.

**Q. 18. Describe briefly interferon.**
**Ans.** It is ideal antiviral agent which can be used in man. It is natural by product. In man, it is non-toxic, non-allergic and active against almost all viruses. It blocks transcription and translation of all viral mRNA.

**Q. 19. How interferons inhibit virus replication?**
**Ans.** Interferons inhibit virus replication by inducing at least three enzymes:
1. Protein kinase that leads to phosphorylation of elongation factor EF -2 resulting inhibition of peptide chain growth.
2. Oligoisonadenylate which results in activation of an RN as; that degrades viral mRNA.
3. Phosphodiesterase that leads to inhibition of peptide elongation.

**Q. 20. Classify virus on the basis of their affinity to different system or organ of body.**
**Ans.**
1. Skin lesion (smallpox, chickenpox, measle).
2. Nervous system (poliovirus, rabies virus, coxsackie, ECHO).
3. Visceral lesion (hepatitis, yellow fever).
4. Respiratory tract (influenza, RS virus, parainfluenza, adeno).

**Q. 21. Enumerate DNA and RNA viruses.**
**Ans.**
*DNA viruses*
1. Pox virus, e.g. smallpox
2. Herpes virus, e.g. herpes simplex
3. Adenovirus
4. Papova virus, e.g. $SV_{40}$
5. Parvovirus, e.g. adenosatellite virus

*RNA viruses*
1. Orthomyxovirus, e.g. influenza
2. Paramyxovirus, e.g. measle, mump

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3. Rhabdovirus, e.g. rabies virus
4. Togavirus, e.g. dengue virus
5. Reovirus
6. *Arenavirus*, e.g. lymphocytic choriomeningitis virus
7. Picorna virus, e.g. ECHO
8. Leukovirus, e.g. Rous sarcoma virus
9. Corona virus.

**Q. 22. What is oncogene-virogene hypothesis?**
**Ans.** Every cell of one or all vertebrates contain DNA copy of genome of oncovirus. Virus specific information is vertically transmitted depending on complex interplay between host genotype and environmental conditions.

**Q. 23. Name few oncogenic viruses.**
**Ans.**
1. Polyomavirus
2. Simian virus ($SV_{40}$)
3. Adenovirus
4. Herpes simplex type
5. Epstein-Barr virus
6. Rous sarcoma virus
7. Mammary tumor virus
8. Murine sarcoma virus
9. Feline leukemia virus.

**Q. 24. Describe briefly inclusion bodies.**
**Ans.** During virus multiplication in host cell, virus specific structures are produced. These are inclusion bodies.

Inclusion bodies are thought to be the site of development of virion. The demonstration of inclusion body is of considerable diagnostic aid. They may be demonstrated in cytoplasm and nucleus e.g. measles. Generally, they are in the cytoplasm (Guarnieri bodies of smallpox, Negri bodies of rabies, Henderson-Patterson bodies of Molluscum contagiosum) or in the nucleus (Herpes zoster, chickenpox, yellow fever, etc.).

**Q. 25. Which virus is known also as adeno-associated virus?**
**Ans.** Dependovirus.

**Q. 26. Which virus was used in the preparation of smallpox vaccine?**
**Ans.** Vaccinia.

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**Q. 27. When did the WHO certify that small pox had been eradicated all over the world?**

**Ans.** 1980.

**Q. 28. What is the cause of condyloma acuminata?**

**Ans.** These are venereal wart caused by human papilloma virus.

**Q. 29. Adeno-associated virus is associated with which human disease?**

**Ans.** Adeno-associated virus is not involved in the production of any known adenovirus induced human disease.

**Q. 30. Name vaccine-associated diseases.**

**Ans.**

1. Measles
2. Poliomyelitis
3. Mumps
4. Rubella
5. Smallpox.

**Q. 31. Name the viruses causing parotitis.**

**Ans.**

1. Mumps
2. Parainfluenza
3. Lymphocytic choriomeningitis.
4. Enterovirus.

**Q. 32. Name viruses causing lymphadenitis.**

**Ans.**

1. Epstein-Barr viruses
2. Cytomegalovirus.

**Q. 33. Discuss briefly the pathogenesis of poliovirus.**

**Ans.** Poliovirus enters the body by ingestion or inhalation. They multiply in lymphatic tissue of alimentary canal (from tonsils to Peyer's patches), then viruses are carried to bloodstream and finally to spinal cord and brain. They destroy neuron with degeneration of Nissl body. Lesions are mostly in anterior horn of spinal cord. Sometimes extensive lesion-like encephalitis may be encountered.

**Q. 34. Discuss briefly Salk polio vaccine and Sabin polio vaccine.**

**Ans.** Salk killed polio vaccine is formalin inactivated consisting of three types of poliovirus (type 1, 2, 3). It is administered by injections and gives 80 to 90% protection.

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Sabin live poliovaccine is prepared by growing attenuated strain in monkey kidney cells. It is easy to administer (given orally), economical, gives local immunity in intestine and single dose gives lifelong immunity.

**Q. 35. Define the terms antigenic drift and antigenic shift.**
**Ans.** Antigenic drift is the feature of influenza virus. It undergoes antigenic variation which is gradual change in antigenic structure resulting in periodical epidemic of influenza.

Antigenic shift is abrupt, drastic discontinuous variation in antigenic structure of influenza virus causing major epidemic.

**Q. 36. Enumerate the manifestations of rubella virus infection and also various vaccines used for its prevention.**
**Ans.** In children, there occurs rash and lymphadenopathy (posterior and suboccipital). Infection in early pregnancy may lead to the developmental defect of fetus (embryopathy). In adults, there is involvement of joint (arthritis), fever and purpura.

The vaccines available are Cendehill, HPV 77, TO 336, HPV 77 DES and Ra 27/3. The safe period of giving vaccine is in young girls (11 to 13 years) and in women immediately after childbirth.

**Q. 37. Enumerate various vaccines available against rabies.**
**Ans.**
1. Simple vaccine
2. Inactivated vaccine prepared from suckling mouse or rabbit.
3. Chick embryo vaccine available in two forms; low egg passage and high egg passage.
4. Duck egg vaccine
5. Tissue culture vaccine.

**Q. 38. Describe briefly Japanese B encephalitis virus.**
**Ans.** It occurs in Korea, Malaysia and India. This was isolated in India in 1955 when virus was isolated from Culex vishuni mosquito. Epidemics have been reported from West Bengal, Bihar and Assam since 1973. It is called Japanese 'B' encephalitis to distinguish it from encephalitis A group. A formalin inactivated vaccine is used. Vaccination of pig is suggested for checking epidemic.

**Q. 39. Antigenic variation has not been reported in which strain of influenza virus?**
**Ans.** Influenza virus C.

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**Q. 40. What is the method of choice for the diagnosis of HAV infection?**

**Ans.** Detection of anti-HAV IgM by ELISA.

**Q. 41. Name amplifying host of Japanese encephalitis virus.**

**Ans.**

1. Water birds
2. Pigs.

**Q. 42. What are reasons of non-existing of yellow fever in India?**

**Ans.**

1. It is because of strict vigilance on vaccination and Quarantine for travel from endemic area.
2. Second possible reason may be that stray virus may not be able to get established in vector due to prevalence in local *Aedes aegypti* of dengue fever virus.

**Q. 43. Describe the structure of rotavirus.**

**Ans.** They are closely related to reoviruses. On electron microscope, the outer capsid margin look like the rim of a wheel surrounding radiating spokes and hence the name of the virus is rota (wheel). Virus particle contains 11 segments of DS RNA. The double-shelled viral particle is about 60 to 75 nm in diameter and is the infectious form of the virus. It contains an RNA dependent RNA polymerase that can be activated by poly A polymerase. Infectivity of virus is enhanced by enzymes like trypsin.

**Q. 44. Enumerate few points of difference between hepatitis A and hepatitis B virus.**

**Ans.**

| ***Hepatitis A virus*** | ***Hepatitis B virus*** |
|---|---|
| RNA virus | DNA virus |
| 27 nm diameter | 42 nm |
| Feco-oral route of infection | Parenteral, transplacenta, saliva, feces, etc. |
| Low mortality | High mortality |
| Incubation period 2 to 6 weeks | 2 to 6 months |
| Australia antigen absence from serum | Present |

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**Q. 45. Is there any hepatitis B vaccine available?**
**Ans.**
1. Older type, i.e. purified and inactivated hepatitis B vaccine
2. Recombinant DNA encoded portion of hepatitis envelop protein vaccine.

**Q. 46. Enumerate various antigens of hepatitis B antigen.**
**Ans.**
1. Hepatitis B surface antigen (HBsAg)
2. Hepatitis B core antigen (HBcAg)
3. Delta antigen
4. Hepatitis 'e' antigen.

**Q. 47. Enumerate various preparation of hepatitis B vaccine.**
**Ans.**
1. HBsAg from human carrier
2. HBsAg produced in cell line from human hepatocellular carcinoma
3. HBsAg inserted genome in plasmid
4. Vaccine from polypeptide of HBsAg.

**Q. 48. Enumerate few slow viruses diseases.**
**Ans.**
1. Leukoviruses causing Visna, Maedi
2. Scrapie
3. Kuru
4. Mink encephalopathy
5. Creutzfeldt-Jakob disease
6. Subacute sclerosing panencephalitis
7. Progressive multifocal leukoencephalopathy.

**Q. 49. Name the drugs used against Herpes simplex.**
**Ans.**
1. Iododeoxyuridine (IDU)
2. Acyclovir
3. Cytosine arabinoside
4. Adenine arabinoside (ara-A)
5. Phosphonoformate
6. 2-deoxy-glucose.

} under trial

**Q. 50. AIDS is caused by which microorganism?**
**Ans.** Human immunodeficiency virus designated as HIV.

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**Q. 51. Define AIDS.**
**Ans.** AIDS is a profound immunoregulatory disorder that is usually fatal because it makes the person susceptible to all sorts of infections including the infection by opportunists. Moreover, malignancy may occur because of depletion of helper T cells.

**Q. 52. Enumerate general properties of AIDS virus.**
**Ans.** Currently, AIDS virus is given a new name, i.e. HIV. It is a retrovirus having cylindric nucleoid. The diagnostic bar-shaped nuclei are seen under electron microscope. It is lymphotropic especially helper T cell. HIV is completely an exogenous virus.

**Q. 53. Name the genes required for replication of HIV.**
**Ans.** HIV contains the 3 genes for this purpose. They are *gag*, *pol* and *env*. This virus goes frequent progressive antigenic variations. This variation is also one of the hurdles in the preparation of effective vaccine for AIDS.

**Q. 54. Briefly explain the pathogenesis of AIDS.**
**Ans.** HIV virus mainly attacks helper T cell thus causing absolute reduction in the level of helper T ($T_4$) lymphocyte subset. As a result, there is an inversion in normal helper $T_4$ cell and suppressor ($T_4$) cells ratio.

**Q. 55. Name few anti-HIV drugs.**
**Ans.**
1. Azidothymidine (AZT)
2. AL—721
3. Amphotericine
4. Deoxycimetidine
5. Foscarnet
6. D-Penicillamine.

**Q. 56. Human rotavirus falls in which serogroup.**
**Ans.** Serogroup A.

**Q. 57. HIV belongs to retroviridae and which subfamily?**
**Ans.** Lentivirinae.

**Q. 58. Which is spike antigen of HIV-l?**
**Ans.** gp 120.

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**Q. 59. Name antiviral agents which inhibit viral DNA polymerase.**
**Ans.**
1. Acyclovir
2. Gancyclovir
3. Ribavirin
4. Trisodium phosphonoformate.

**Q. 60. Name antiviral agents which inhibits reverse transcriptase.**
**Ans.**
1. Azidothymidine (AZT)
2. Dideoxycytidine (ddC)
3. Dideoxyinosine (ddt)
4. Trisodium phosphonoformate.

**Q. 61. According to CDC classification of HIV infection and AIDS, persistent generalized lymphadenopathy is included in which group.**
**Ans.** Group III.

**Q. 62. Is Pakistan free from HIV pandemic?**
**Ans.** Till March 1994, National AIDS control programme has reported 733 HIV seropositive cases and 40 cases of full blown AIDS.

**Q. 63. What is latest position of AIDS cases in India?**
**Ans.** There are 82781 seropositive out of 3.41 million screened cases (24.26 seropositivity) till January, 1999 up to January, 2000 around 11225 full blown AIDS patients are reported in India. Recently decline in seropositive HIV cases is reported.

**Q. 64. Name three confirmatory laboratory tests for the diagnosis of HIV.**
**Ans.**
1. Virus isolation is possible by cultivation of patient's peripheral blood lymphocytes along with the following:
   a. Healthy donor's lymphocytes
   b. Mitogens
   c. T cell growth factor

   It is a slow process and may take 3 to 6 weeks. It should be done under conditions of strict biocontainer.
2. Detection of p24 antigen in serum by ELISA
3. Detection of viral nucleic acid using polymerase chain reaction.

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**Q. 65. Why and how viral proteins are being utilized in the preparation of HIV vaccine?**

**Ans.** The use of inactivated or attenuated virus carries the risk that one or two infectious particles may remain in the preparation and thus may precipitate this disease. Now the workers are searching for purified viral proteins, i.e. gp120, gp160, p17, that can be genetically engineered. This vaccine preparation is capable of inducing humoral and cell mediated response. There is also effort for synthetic peptide vaccine.

**Q. 66. Define bacteriophage.**

**Ans.** They are viruses that infect bacteria. Bacteriophages are tadpole or spennatozoa-like made-up of head and tail. Head contains DNA. Tail consists of tube through which DNA passes into the host cell during infection. Tube is surrounded by row of protein manomer connecting head and tail. This sheath is capable of contraction. The tail end has hexagonal base plate having six very long thin tail fibers.

Bacteriophages are host specific, i.e. they parasitise in one species of *Bacterium*. Bacteriophage typing is useful in tracing the source of infection and also in identification of bacteria.

**Q. 67. Name few viruses which can withstand 60°C for 30 minutes.**

**Ans.**

1. Hepatitis virus
2. Adeno-associated virus
3. Scrapie virus.

**Q. 68. Enumerate salient features of Hantavirus.**

**Ans.**

*Family:* Bunyaviridae

*Genus:* Hantavirus

*Serotypes:*

1. Hanta virus
2. Seoul virus
3. Puumala virus
4. Prospect hill virus (pathogenicity doubtful).

*Incubation period:* 4 to 42 days

*Manifestation:* Hemorrhage fever with renal syndrome.

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*Diagnosis:*
1. IFA
2. ELISA (IgM)
3. Neutralization.

**Q. 69. Guillain-Barré syndrome is associated with which viruses?**
**Ans.** Guillain-Barré syndrome is associated with hepatitis virus, Epstein-Barr virus or cytomegalovirus. However, it is more commonly seen with type B hepatitis. The latent period between the viral infection and occurrence of neurological symptoms is from 3 days to 3 weeks. During this latent period, probably sensitization takes place which further results in immunological injury to the myelin sheath.

**Q. 70. To isolate filoviruses what should be the biosafety level?**
**Ans.** Level-4.

**Q. 71. Name the filovirus responsible for maximum mortality rate.**
**Ans.** Ebola-Z.

**Q. 72. What do you know about erythrovirus (Parvovirus B19)?**
**Ans.** It is highly contagious. Routes of its transmission include respiratory secretions, close contact, transplancental and blood transfusion.

It can cause erythema infectiosum, chronic anemia arthropathy, erythroblastosis fetalis, etc.

**Q. 73. Which virus is associated with slapped cheek syndrome?**
**Ans.** Erythrovirus.

**Q. 74. What is the name given to H1N1.**
**Ans.** Swine Flu.

**Q. 75. What two factors determine geographical distribution of parasite?**
**Ans.**
1. Increased density of population.
2. Poor sanitation and public health practice.

**Q. 76. Discuss briefly bird flu?**
**Ans.** Bird flu is caused by an avian subtype influenza virus H5N1. It is associated with domesticated birds. Human infection can occur with this virus. Ribavirin may be effective. Zanamivir and oseltamivir are used to treat patients.

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**Q. 77. What do you understand about Swine flu?**
**Ans.** Swine flu is caused by H1N1 influenza virus. It is highly contagious causing respiratory disease in pigs. H1N1 virus belongs to influenza A virus. Human cases are being reported all over world. Persons with this infection were first reported in Mexico on March 14, 2009.

**Q. 78. Discuss universal vaccines?**
**Ans.** Universal vaccine is also called ideal vaccine. It has following features:
1. Safe and efficient
2. Elicits humoral as well as cellular response similar to those triggered by natural infection.
3. Capable of inducing long lasting and cross strain protection.
4. May be manufactured rapidly and in large amounts under vigorous vigilance.

**Q. 79. What are major targets of universal vaccine?**
**Ans.** Major targets for a universal vaccine are:
1. Highly preserved external domain of influenza matrix-2 (M-2)
2. Protein and conservative epitopes from influenza NP, matrix 1 (M-1) and HA proteins.

**Q. 80. Describe etiology of Swine flu (H1N1)—responsible for 2009 swine influenza pandemic.**
**Ans.**
1. Belongs to orthomyxoviridae family.
2. The etiological agent of 2009 swine influenza pandemic is a novel reassortment influenza A virus that includes segments of triple reassortment H1N1 Swine influenza virus and segments from a Eurasian H1N1 influenza virus.

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***Salient Features***

- Covers comprehensively medical microbiology from all aspects in simple, lucid and user-friendly language
- Includes Question-Answer format approach adopted to prepare readers to face comfortably viva voce and other discussion
- Highlights essential and worth-remembering points
- Contains the updated information of subspecialty of medical microbiology
- Provides review articles in recent advances section touching current clinical microbial challenges.



**Satish Gupte** did his MBBS (1973) from Government Medical College, Srinagar, Jammu and Kashmir; and MD (Microbiology) (1980) from Medical College, Maharshi Dayanand University, Rohtak, Haryana, India. Presently, he is working as Professor and Head, Department of Microbiology, Gian Sagar Medical College and Hospital, Ramnagar, Rajpura, Patiala, Punjab. He has a total of 40 years of teaching experience in microbiology. He is an Examiner for MD, MBBS, BDS and MSc (Microbiology) of Jammu University, Jammu; Sher-i-Kashmir Institute of Medical Sciences Medical College, Srinagar; University of Kashmir, Kashmir; Delhi University; Baba Farid University of Health Sciences, Punjab; Himachal Pradesh University; Rajasthan University, etc. He has authored 15 books on *Medical Microbiology, Blood Transfusion* and *Laboratory Medicine Disciplines*. He has been conferred with the Man of the Year Award (2002) by American Biographical Centre, New York. His biographical sketch appeared in *Who's Who World* (USA).

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