



Lecture title: introduction to veterinary virology

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Definitions:

- **Virology:** the science which deals with study of viruses as causative agents of very important diseases that occurs in human, animals, plants and other living organisms (insects, bacteria,...).
- **Viruses:** They are the smallest and simplest form of life on earth, which can replicate only in living susceptible cells. Viruses consist of :
 - 1.A nucleic acid genome either DNA or RNA.
 - 2.A protein coat (capsid) that enclosed the genome.
 - 3.In some cases a lipid membrane (envelope).
- **Virion:** A complete infectious virus particle.

General characters of viruses:

1. Virus particles are very small in size; they are between 20-500 nm (nanometer) in diameter.
1 nm = 1/1000 μ m, 1 μ m=1/1000 mm.
2. Viruses are obligatory intra cellular microorganisms.
3. Multiply inside the cells by replicating their genomes which either DNA or RNA, but not both.
4. The virus dose not contain any organelles (ribosomes, t RNA, metabolic enzymes, etc), but they depend on infected cells to provide all their needed organelles.
5. Virus does not affect with antibiotics.
6. Most viruses sensitive to interferon.
7. Viruses can not grow on artificial media, but only in living cells (specific host, Lab. Animals, chicken embryonated eggs & tissue culture).
8. Some viruses cause latent infection.
9. Viruses can not be seen by ordinary microscope, but only by Electron microscope (EM).

N.B;

According to size, viruses can classify beginning from the largest and more complex microorganisms as following **protozoa, yeast, bacteria, mycoplasma, rickettsiae, chlamydia & virus.**



The chemical composition of viruses

Schlesinger in 1933 who firstly showed that bacterial viruses (bacteriophage) consisted essentially of protein and DNA, Stanley in 1935 report that Tobacco mosaic virus (TMV) consisted of protein and RNA, then other biochemists have studied the chemistry of other viruses which infect plants, animals, insects, bacteria. All they found that all viruses contain only one type of nucleic acid (NA) either DNA or RNA but not both, plus a protective coat of protein in addition to that some viruses may contain lipids& carbohydrates .

TMV contains about 95% protein plus 5% NA. So the importance of NA is limited until it was discovered in 1952 that it was DNA which infect bacterial cell during phage replication and initiated the synthesis of progeny virus, where as most of the protein component of the virus particle remained out side the host cell and played no further part in the infection, then NA was responsible for carrying the genetic information of the virus.

The importance of viral NA was increased when they found that TMV RNA was infectious and capable of carrying all the genetic information required for manufacture new virus in the absence of its protein covering.

Also animal viruses like picorna (FMD V) considered as infectious NA that it acts directly as mRNA, it does not need RNA polymerase, in adeno and parvo viruses (DNA) they have also infectious NA.

Structure of viral nucleic acids:

Genetic information are stored as the following:

1. Double stranded DNA cells (animal, plants, bacteria and some viruses).
2. Single-stranded DNA in other viruses (phage Θ x 174).
3. Single stranded RNA (myxovirus).
4. Double-stranded RNA (reoviruses).

How we can differentiate between DNA and RNA?

- By DNAase or RNAase
- Between double and single stranded NA; by acridine orange stain, which is yellowish green in double stranded and red orange in single stranded.



Chemical composition of nucleic acid

NA chain is composed of basic units called nucleotides each of which consist of :

1. Nitrogenous base: ring compound containing nitrogen and carbon.
2. Molecule of a 5-carbon pentose sugar which is either ribose RNA ribose (RNA) or deoxyribose (DNA).
3. Molecule of phosphoric acid which links the base to the pentose sugar.

There are four kinds of nucleotides (bases) in DNA:

Guanine	}	Purines
Adenine,		
Cytocine	}	Pyrimidines
Thymine		

In the RNA molecules the bases are guanine, adenine, cytocine and uracil.

Viral proteins:

Protein coat which encloses the viral genome called **capsid** which consists of **protomers** that accumulated to give pentan or hexan forms producing the **capsomers** which protect the viral NA and have surface characters acts to attach the virus on host cells then penetration, also it contains antigenic determinants.

Viral envelope:

Most viruses contain envelope or membrane surrounding the virus so they called **enveloped** viruses, others have no envelope and they called **naked** viruses. Enveloped viruses contain lipids like orthomyxo and paramyxo viruses, these viruses will become sensitive to organic solvents (ether, alcohol, chloroform), these characters used in newly isolated virus classification.

Also viral membrane contains glycolipids or glycoprotein which appears as projections from the envelope called spikes or peplomers.