BT601: Virology **Spring 2023**

Assignment No. 2

Opening Date: 22-05- 2023 **Due Date: 27-05-2023**

Total Marks: 10

Assignment Question

Viruses are one of the simplest living entities on earth. Viruses even do not have their own metabolism or the cellular components to generate ATP. But still virus particles consist mainly of nucleic acid and protein, arranged to form a regular geometric structure.

a) What are the benefits/functions of outer protein capsid in viruses? 4 marks

Answer:

The capsid is made from the proteins that are encoded by viral genes within their genome. The shape of the capsid serves as one basis for classification of viruses. The capsid of the virus shown in Figurebelowis icosahedral. Virally coded proteins will self-assemble to form a capsid. Some viruses have an envelope of phospholipids and proteins. As the outer exposed surface, the protein capsid may play a major role in virus removal and inactivation, yet analysis of the role of proteins in water treatment processes has lagged behind studies of nucleic acids. This study examined the influence of the amino acid composition of protein capsids on virus inactivation and removal. The virus capsid functions to protect the nucleic acid from the environment, and some viruses surround their capsid with a membrane envelope. Most viruses have icosahedral or helical capsid structure, although a few have complex virion architecture.

The capsid has three purposes:

- It protects the infectious nucleic acid from enzyme digestion.
- It has special sites on its surface that allow the virion to attach to a host cell.
- It contains proteins that allow the virion to penetrate the host cell membrane and, in some cases, inject the infectious nucleic acid into the cytoplasm.

a) Compare the features of viral helical and viral icosahedral symmetries? 6 marks

Answer:

Helical symmetry: The nucleic acid and the capsomeres are wound together to form a spherical or spiral tube. The viruses with helical structure usually appear as rods and their capsomeres self-assemble on the RNA genome into rods extending to the length of the genome. These capsomeres cover and protect the RNA. The tubular nucleocapsid structure may be rigid as in tobacco mosaic virus, but may be pliable and may be coiled on itself in case of some other animal viruses. Helical nucleo-capsids are usually demonstrated within the envelope of most negative-stranded RNA viruses. The helical viruses appear rod-like and may berigid or flexible. The viral genome is found within hollow cylindrical capsid that has a helical structure. The examples of helical viruses include rabies virus, Ebola hemorrhagic virus, etc.

Icosahedral symmetry: Two types of capsomeres constitutethe icosahedral capsule. They are the pentagonal capsomeres or the vertices (*pentons*) and hexagonal capsomeres making up the facets. There are always 12 pentons, but the number of hexons varies with the virus group. Each penton has fivefold symmetry (pentamer or pentagon) in the shape of an equilateral triangle. This pentamer symmetry is found in simple viruses, such as the picornaviruses and par-voviruses. In picornaviruses, each pentamer is made up of five protomers, each of which is composed of three subunits of four different proteins. The hexamer symmetry is usually found in large capsid virions, such as herpesviruses and adenoviruses. Hexons are made up of certain structurally distinct capsomeres between the pentons at the vertices. The presence of hexon extends the icosahedral and is called an icosadeltahedral. The adenovirus nucleocapsid has 12 pentons and 240 hexons, whereas the herpesvirus nucleocapsid has 12 pentons and 150 hexons sur-rounded by an envelope.