

Lecture 2

Atypical virus –like agent:

(prion, defective viruses, pseudovirion and Virioids)

Introduction:

- 1- **Viroids** very small ss RNA genomes (~300 nucleotides). No coat and RNA does not encode protein. Known viroids cause diseases in plants because host cells replicate the RNA.
- 2- **Prions (protein infectious agent)** do not have a nucleic acid genome. Prion diseases are often called spongiform encephalopathies because of the post mortem appearance of the brain with large vacuoles in the cortex and cerebellum.
Prion diseases in humans are probably primarily a genetic neurotoxic disorder. Transmission of the disease to humans via infectious prions is likely to be rare.
 - The prion is a modified form of a normal cellular protein known as PrP^c (for cellular), found predominantly on the surface of neurons and thought to be involved in synaptic function.
The modified form of PrP^c (= prion) is known as PrP^{sc} (for scrapie) which is relatively resistant to proteases and accumulates in cytoplasmic vesicles of diseased individuals.
Prion protein may cause normal protein to fold abnormally.
- 3- **Defective virus** composed of nucleic acid & proteins but cannot replicate without a helper virus for example Hepatitis D virus, adenovirus.
- 4- **Pseudovirion** contains host cell DNA instead of viral DNA within the capsid

(1) Defective Viruses:

Are composed of viral nucleic acid and proteins but cannot replicate without a "helper" virus, which provides the missing function.

Defective viruses usually have a mutation or a deletion of part of their genetic material. During the growth of most human viruses, many more defective than infectious virus particles are produced. The ratio of defective to infectious particles can be as high as 100:1 . For example certain Adenoviruses and Hepatitis -D virus are defective viruses.

(2) Pseudovirions:

Contain **host cell DNA** instead of viral DNA within the capsid. They are formed during infection with certain viruses when the host cell DNA is fragmented and pieces of it are incorporated within the capsid protein. Pseudovirions can infect cells, but they do not replicate.

(3) Viroid's:-

Consist of a **single molecule of circular RNA without a protein coat or envelope**. There is extensive homology between bases in the viroid RNA leading to large double-stranded regions. Viroid's replicate but the mechanism is unclear. They cause several plant diseases. but are not implicated in any human disease.

(4) Prions

Are infectious particles that are **composed of only protein**, no detectable nucleic acid. Proteins i.e., they Prion is a type of protein that can trigger normal proteins in the brain to fold abnormally. Prions are composed of a **single glycoprotein** with a molecular weight of 27,000-30,000. Prion diseases are called **spongiform encephalopathies** (slowly progressive diseases) because of the post mortem appearance of the brain with large vacuoles in the cortex and cerebellum and Prion diseases in humans are probably primarily a **genetic neurotoxic disorder** which include **Creutzfeldt-Jakob disease or Kuru in humans** and **scrapie in sheep** and **bovine**

spongiform encephalopathy (BSE) in cattle and also called Mad cow in cattle.

Because neither DNA nor RNA has been detected in prions, they are clearly different from viruses.

Furthermore, electron microscopy reveals filament rather than virus particles.

Prions are much more resistant to inactivation by ultraviolet light and heat than are viruses.

They are remarkably resistant to formaldehyde and nucleases. However, **they are inactivated by hypochlorite, NaOH, and autoclaving.**

Causes of prion diseases

Prion diseases occur when normal prion protein, found predominantly on the surface of neurons, becomes abnormal and clump in the brain, causing brain damage.

This abnormal accumulation of protein in the brain can cause memory impairment, personality changes, and difficulties with movement.

Experts still don't know a lot about prion diseases, but unfortunately, these disorders are generally fatal.