Difference Between Prions and Viroids

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Key Difference - Prions vs Viroids

Infectious particles cause diseases in plants, animals, and other organisms. There are different types of infectious agents such as bacteria, fungi, protozoans, viruses, viroids, prions, etc. Viroids and prions are small infectious particles which behave like virus particles. However, both types are structurally different from a typical viral particle. Viruses consist of two major parts: genetic material and protein capsid. Viroids and prions contain either genetic material or protein capsid. Viroids can be defined as small and naked infectious RNA molecules that cause diseases in higher plants. Prions can be defined as small proteinaceous particles that cause diseases in animals including humans. The key difference between prions and viroids is that **prions do not contain nucleic acids while viroids do not contain proteins.**

What are Prions?

A prion is an infectious protein particle made up of amino acid chains. They do not contain nucleic acids such as DNA or RNA. Most prions are smaller than viroids. Prions infect animals, causing neurological degenerative diseases such as mad cow disease (bovine spongiform encephalopathy) in cows, scrapie disease in sheep and goats, kuru and gerstmann-strausler-sheinker diseases in humans, creutzfeldt-jakob disease, etc. Kuru and mad cow diseases are very common and their symptoms include the loss of motor control and unusual behaviors. Prion diseases can arise in three different ways named, acquired, familial and sporadic. However, the primary method of prion infection in animals is through ingestion.

Prions have a very long incubation period in hosts. Since prions are proteins, they can be digested by proteinase K and trypsin. However, prions are resistant to ribonucleases. They are also highly resistant to heat, chemical agents, and irradiation.

Prions are able to self-replicate. However, they are not considered as viruses. They served as a separate infectious group.

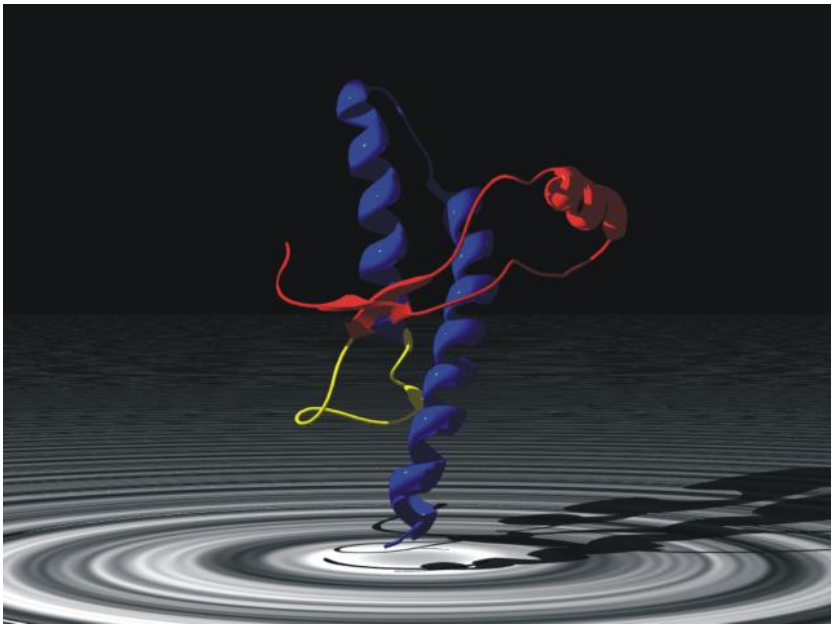

Figure 01: Prion Structure

What are Viroids?

A viroid is an infectious RNA particle formed from a single-stranded circular RNA. Viroids were first discovered and named by the plant pathologist Theodor O. Diener in 1971. The first viroid identified was Potato Spindle Tuber Viroid (PsTVd) and thirty-three species of viroids have been identified up to now. Viroids do not contain a protein capsid or an envelope. They are made up of only RNA molecules. Since viroids are RNA particles, they can be digested by ribonucleases. But unlike prions, viroids cannot be destroyed by proteinase K and trypsin. The size of the viroid is smaller than a typical virus particle. Viorids need a host cell for reproduction. Other than a single stranded RNA molecule, they do not synthesize proteins.

Viroids do not cause human diseases. They infect higher plants and cause diseases like potato spindle tuber disease, and chrysanthemum stunt disease. These infectious RNA particles are responsible for crop failures and subsequently, the loss of millions of money in agriculture annually. Potato, cucumber, tomato, chrysanthemums, avocado and coconut palms are plants which are commonly subjected to viroid infections. Viroid infections are transmitted by cross contamination followed by mechanical damage to the plant. Some viroid infections are transmitted by aphids and leaf to leaf contact.

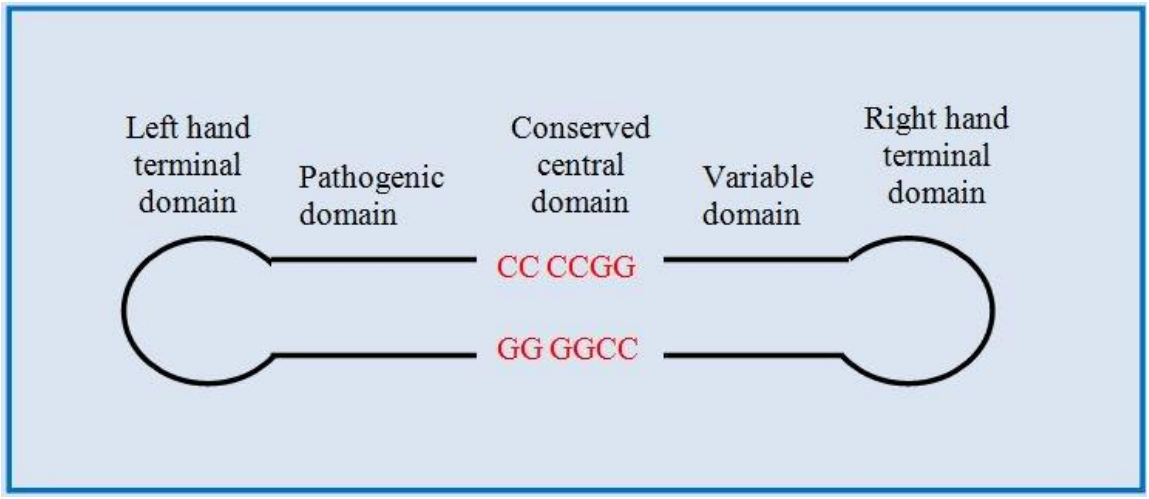

Figure 02: Structure of Pospiviroid

What are the similarities between Prions and Viroids?

- Prions and viroids are pathogenic particles.
- Both types lack either one component of two major components (protein coat and nucleic acids) of viruses.
- Both particles are smaller than viruses.

What is the difference between Prions and Viroids?

Prions vs Viroids	
Prions are infectious protein particles.	Viroids are small and naked infectious RNA molecules.
Discovery	
Prions were discovered by Stanley B. Prusiner.	Viroids were named by T. O. Diener in 1971.
Genetic Material	
Prions do not contain DNA or RNA.	Viroids contain RNA.
Digestion by Proteinase K and Trypsin	
Prions can be digested by proteinase K and trypsin.	Viroids cannot be digested by proteinase K and trypsin.
Digestion by Ribonucleases	
Prions are resistant to	Viroids can be digested by

ribonucleases.	ribonucleases.
Infections	
Prions infect animals.	Viroids infect higher plants.
Common Diseases	
Prions cause diseases such as mad cow disease in cows, scrapie disease in sheep and goats, etc.	Viroids cause diseases such as potato spindle tuber disease, chrysanthemum stunt disease.
Reproduction	
Prions can self propagate.	Viroids can reproduce only within a host cell.
Size	
Prions are smaller than viroids.	Viroids are smaller than viruses.

Summary - Prion vs Viroid

Prions and viroids are infectious particles which cause diseases in animals and plants, respectively. Prions are small infectious protein molecules which cause diseases in animals. Prions do not contain nucleic acids. Viroids are plant pathogens that possess only a single stranded circular RNA molecule. Viroids do not encode or contain proteins. This is the difference between prions and viroids.

References:

1. "Prions and Viroids - Boundless Open Textbook." Boundless. Boundless, 26 May 2016. Web. Available here. 23 June 2017.
2. Diener, T. O., M. P. McKinley, and S. B. Prusiner. "Viroids and prions."Proceedings of the National Academy of Sciences of the United States of America. U.S. National Library of Medicine, Sept. 1982. Web. Available here. 23 June 2017.

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