

• **both statements are true**

Prions are infectious protein particles (atypical virus-like agents) that are composed **solely of protein**. They cause certain “slow” diseases such as Creutzfeldt-Jakob disease, a severe degenerative brain disease caused by the ingestion of beef from a cow infected with mad cow disease. **Note:** Their ability to propagate within a host relies on inducing the conversion of endogenous prion protein PrP into a protease-resistant isoform **PrP^{Sc}**.

Important: Prions **do not** elicit inflammatory or antibody responses. **Prions are generally quite resistant to proteases, heat, radiation, and formalin treatments, although their infectivity can be reduced by such treatments.**

The viral particles, or virions, contain either single- or double-stranded **DNA or RNA** (never both) that is encased in a protein coat called a **capsid**. The combination of the nucleic acid and the protein capsid is called the **nucleocapsid**. They are either **naked or enveloped**, depending on whether the capsid is surrounded by a lipoprotein envelope.

The capsid is composed of polypeptide units called capsomeres. Some viruses (e.g., orthomyxoviruses and paramyxoviruses) have envelopes that are covered with spikes, which contain either hemagglutinin, neuraminidase, or a fusion protein that causes cell fusion and, in some cases, hemolysis.

In contrast to bacteria, fungi, and parasites, viruses **are not cells**; i.e., they are not capable of reproducing independently, **do not have** a nucleus, and **do not have** organelles such as ribosomes, mitochondria, and lysosomes. Viruses are smaller than cells and **cannot be seen** in the light microscope.

Note: Almost all viruses are haploid (contain a single copy of their genome; the **exception** is the retrovirus family, whose members are diploid).

Viroids consist solely of a single molecule of circular RNA **without** a protein coat or envelope. They cause several plant diseases but are not implicated in any human disease.