

Virus=protein shell + nucleic acid

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**Some 'viral' diseases that gave heart burn to virologists**

Potato spindle tuber virus - 1922  
 Avocado Sunblotch virus - 1928  
 Tomato apical stunt - 1931  
 Coconut cadang-cadang - 1937  
 Chrysanthemum stunt - 1947  
 Citrus exocortis - 1948

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**Viroids**

1967 Dr. Ted Diener discovered viroids

- Potato spindle-tuber virus (PSTV) is now,
- Potato spindle-tuber viroid (PSTVd)

Unique to plants  
 Free or naked nucleic acid (RNA)  
 →No capsid

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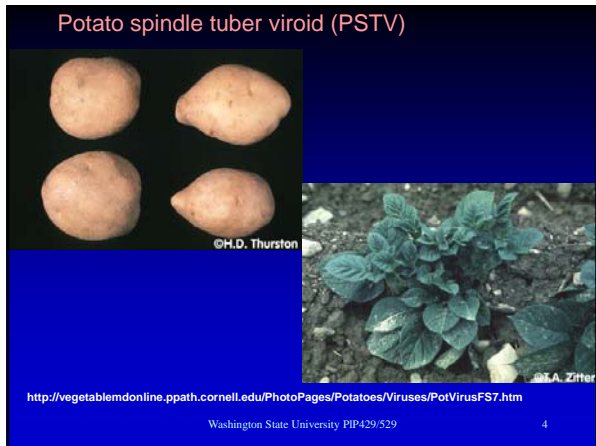
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**Viroid-caused Diseases**

- Potato spindle tuber (PSTVd)- 1922
- Avocado Sunblotch (ASBVd)- 1928
- Tomato apical stunt (TASVd)- 1931
- Coconut cadang-cadang (CCCVd)- 1937
- Chrysanthemum stunt (CSVd)- 1947
- Citrus exocortis (CEVd)- 1948
- Chrysanthemum chlorotic mottle (CChMVd)- 1969
- Hop stunt (HSVd)- 1970

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## Viroids

### Defining characteristics:

1. Low molecular weight
2. Nonencapsidated
3. Replicate autonomously
4. Obligate parasite
5. Infectious

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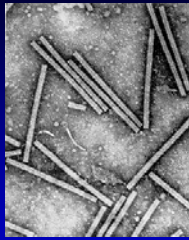
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### Sizes of the genomes (in bases)



Humans: 3 billion  
Plants: hundreds of millions  
Fungi, bacteria: millions  
Tobacco mosaic virus: 6000  
Viroids: 300!

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## Characteristics of Viroids

### Composition:

ssRNA only - circular  
no proteins  
monopartite genome only

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## Characteristics of Viroids

### Size:

75,000 - 125,000 d

= 246-399 nucleotides

→ too small for complete enzyme

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## Viroids

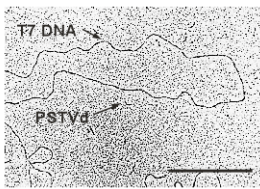


Figure 1 Electron micrograph of *Potato spindle tuber viroid* (PSTVd) and viral DNA (*Coliphage T7* DNA) illustrating the comparative sizes and the rod-like structure of the viroid. The bar represents 0.5  $\mu\text{m}$  (Reproduced from Diener, 1979).

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## Characteristics of Viroids

### Strandedness:

Characteristics of both ss & ds RNA

→ due to internal base-pairing

→ twisted "hairpin" structure

→ structure similar to tRNA

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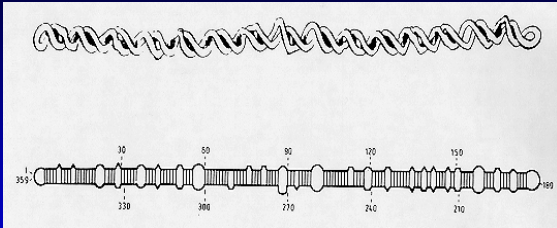
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## Viroid Structure



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## Characteristics of Viroids

### Replication:

not well-understood

during transcription of host DNA

occurs in the nucleus

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## Characteristics of Viroids

### Pathogenesis:

interference with gene regulation

→ “escaped” regulatory RNAs

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## Characteristics of Viroids

### Transmission:

vegetative propagation  
mechanical  
vectors mostly unimportant  
limited seed and pollen

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## Characteristics of Viroids

### Survival:

in association with living host

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## Characteristics of Viroids

### Origin of viroids?

Primitive viruses  
"escaped" regulatory molecules

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