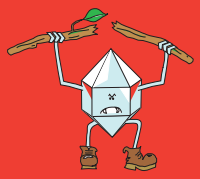
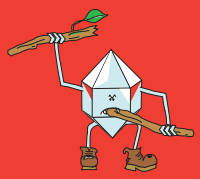
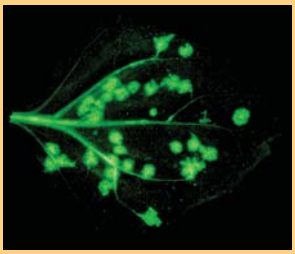


Virus Movement

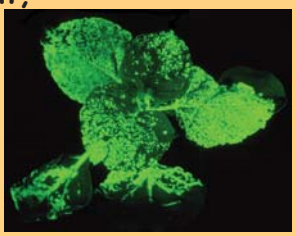


Viruses move around in plants by manipulating the plant's own systems.

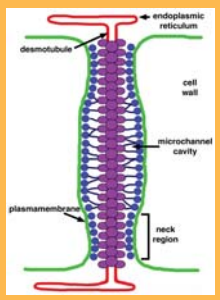
There are two types of virus movement:
1) Slow, local movement, in which the virus moves from one cell into neighbouring cells.



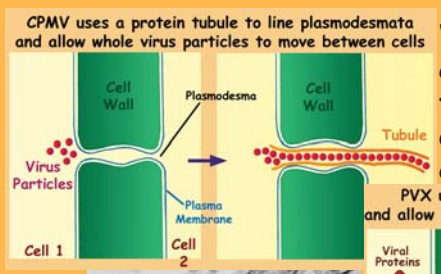
2) Fast, systemic movement, in which the virus moves from an infection site to distant parts of the plant by hitching a ride on the plant's own supply lines (the veins).



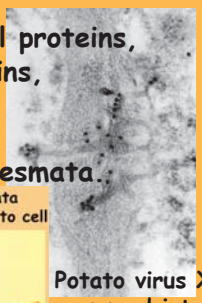
Local Movement



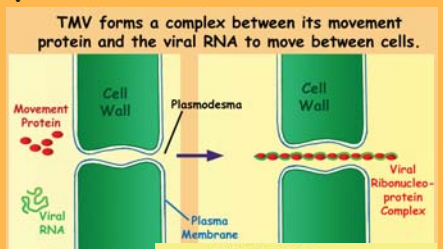
To move from one cell to the next, viruses exploit the channels that plant cells use to communicate with each other. These channels are called plasmodesmata. They are lined with proteins and can be tightly controlled by the plant. Relative to the diameter of plasmodesmata, virus particles are huge. Imagine it's like trying to pull a cat through a keyhole!

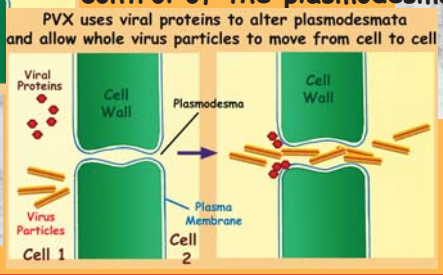


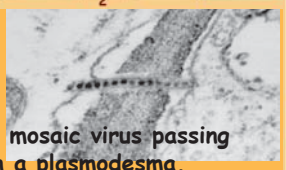
Viruses produce special proteins, called movement proteins, that they use to overcome the plant's control of the plasmodesmata.



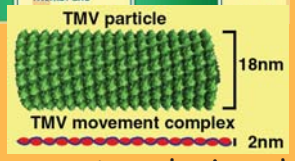
Potato virus X particles crammed into a plasmodesma.







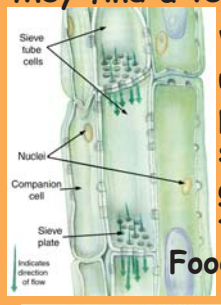
Cowpea mosaic virus passing through a plasmodesma.



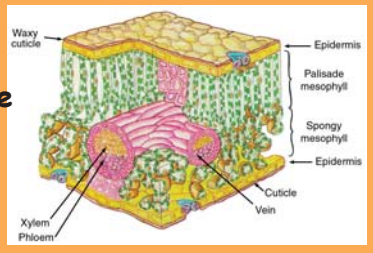
The TMV movement complex is much thinner than a whole particle.

Systemic Movement

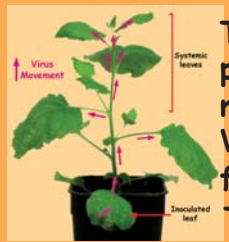
Viruses move from cell to cell through a leaf until they find a vein.



Veins are used by the plant to supply growing tissues.

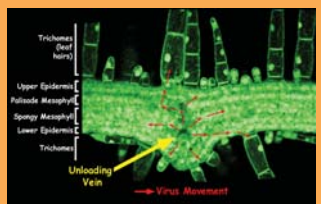


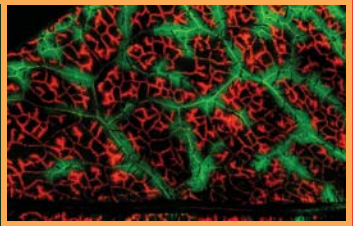
Food flows through the veins in the phloem.



The flow of food through these pipe-like cells is always from mature leaves to younger leaves. Viruses enter veins and move with the flow of food to healthy new leaves. This is much faster than cell-cell movement.

Once in systemic leaves, viruses can unload from the veins and spread into all cell types in the leaf.





Fluorescent dyes can mimic the spread of virus (left) or be used to label the vein network (right). A red dye labels the veins while GFP is used to study virus unloading.