

## **Viral Quasisymmetry**

Viruses are faced with a challenge: their genomes need to encode all of their proteins, but at the same time, these genomes need to fit into the tiny space of a viral capsid. In the 1960s, Donald Caspar and Aaron Klug discovered that viruses solve this problem using quasisymmetry.

Viral capsids are built using many identical copies of one or a few capsid proteins, arranged to form a shell with icosahedral symmetry. Some viruses, such as Satellite Tobacco Necrosis Virus, build a tiny capsid with perfect symmetry. Other viruses need more room, so they build larger capsids, but still only using one type of building block.With small changes in shape, the subunits form pentamers and hexamers, and these pack into larger, quasisymmetrical capsids.

These paper models show a few examples of how quasisymmetry is used to build viruses of different sizes. The subunits are represented as circles, with ones that form pentamers in red and ones that form hexamers in shades of yellow and orange. For each virus, a model of the atomic structure is also included.

Cut out the models and tape the edges together to form the icosahedral virus.

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