Bacteriophage T4–linking the ejector sheath to the head

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http://homepage.mac.com/whitby/

http://web.me.com/whitby/Octahedron/Welcome.html

References

1. Octahedron, the Universe defined by Robert William Whitby

A description of the atomic shapes and how they join which follows from the discovery that the periodicity of the atomic elements matches the periodicity of recurring form in which identical regular octahedra combine to form ever larger regular octahedra. Octahedron1stEd.pdf shows that the atomic elements are crystalline assemblies of identical regular octahedra and explores the implications of this discovery., 500 pages
http://homepage.mac.com/whitby/FileSharing103.html

2. Bacteriophage injector by Robert William Whitby

Injector.pdf shows how an octahedral assembly consisting of rings connected by hinged legs acts as a contractile sheath. When fitted with a tube, the assembly mimics the DNA/RNA injector of the bacteriophage.
http://homepage.mac.com/whitby/BiologicalViruses/FileSharing193.html

3. Bacteriophage base plate by Robert William Whitby

PhageBase.pdf shows that the observed widening of the sheath, the change in shape of the baseplate, and the dome-like depression in the bottom of the baseplate are consistent with an octahedral assembly.
http://homepage.mac.com/whitby/BiologicalViruses/FileSharing195.html

4. Pentagonal facial joining of hexagonal face icosidodecahedra by Robert William Whitby

The file HxCosiDecPntJns.pdf shows how identical hexagonal face icosidodecahedra can join pentagonal face to pentagonal face to form a triacontahedral assembly which is elongated parallel to a pentagonal facial diameter. The icosahedral symmetry of the assembly, the icosahedral symmetry of its units, and the structural integrity that permits the elongation are characteristics required of the head of bacteriophage T4.
http://homepage.mac.com/whitby/BiologicalViruses/FileSharing199.html

References–Michael G. Rossman

The Rossman papers listed here can be downloaded in PDF format from the website–
http://bilbo.bio.purdue.edu/~viruswww/Rossmann_home/publ/index.shtml#429

425. Rossmann, M. G., V. V. Mesyanzhinov, F. Arisaka, P. G. Leiman. 2004. **The bacteriophage T4 DNA injection machine.** Curr. Opin. Struct. Biol. 14(2):171-80

<The baseplate switches from the hexagonal to the star conformation> page 178, column 2

424. Fokine, A., P. R. Chipman, P. G. Leiman, V. V. Mesyanzhinov, V. B. Rao, M. G. Rossmann. 2004. **Molecular architecture of the prolate head of bacteriophage T4.** Proc. Natl. Acad. Sci. U.S. 101:6003-6008

397. Kanamaru, S., P. G. Leiman, V. A. Kostyuchenko, P. R. Chipman, V. V. Mesyanzhinov, F. Arisaka, M. G. Rossmann. 2002. **Structure of the cell-puncturing device of bacteriophage T4.** Nature (London). 415:553-557**.**

Introduction

This paper shows two ways in which the sixfold sheath of the bacteriophage T4 could join with its fivefold head. Method I requires two intermediate rings of edgially joined octahedral units. [See Figure 1.] The sixfold ring representing the sheath is joined by linking octahedral assemblies to a twelvefold ring; the twelvefold ring is joined by linking octahedral assemblies to a fifteenfold ring; the fifteenfold ring is joined by linking octahedral assemblies to the fivefold ring representing the head. Method II requires a single fifteenfold ring. [See Figure 2.]

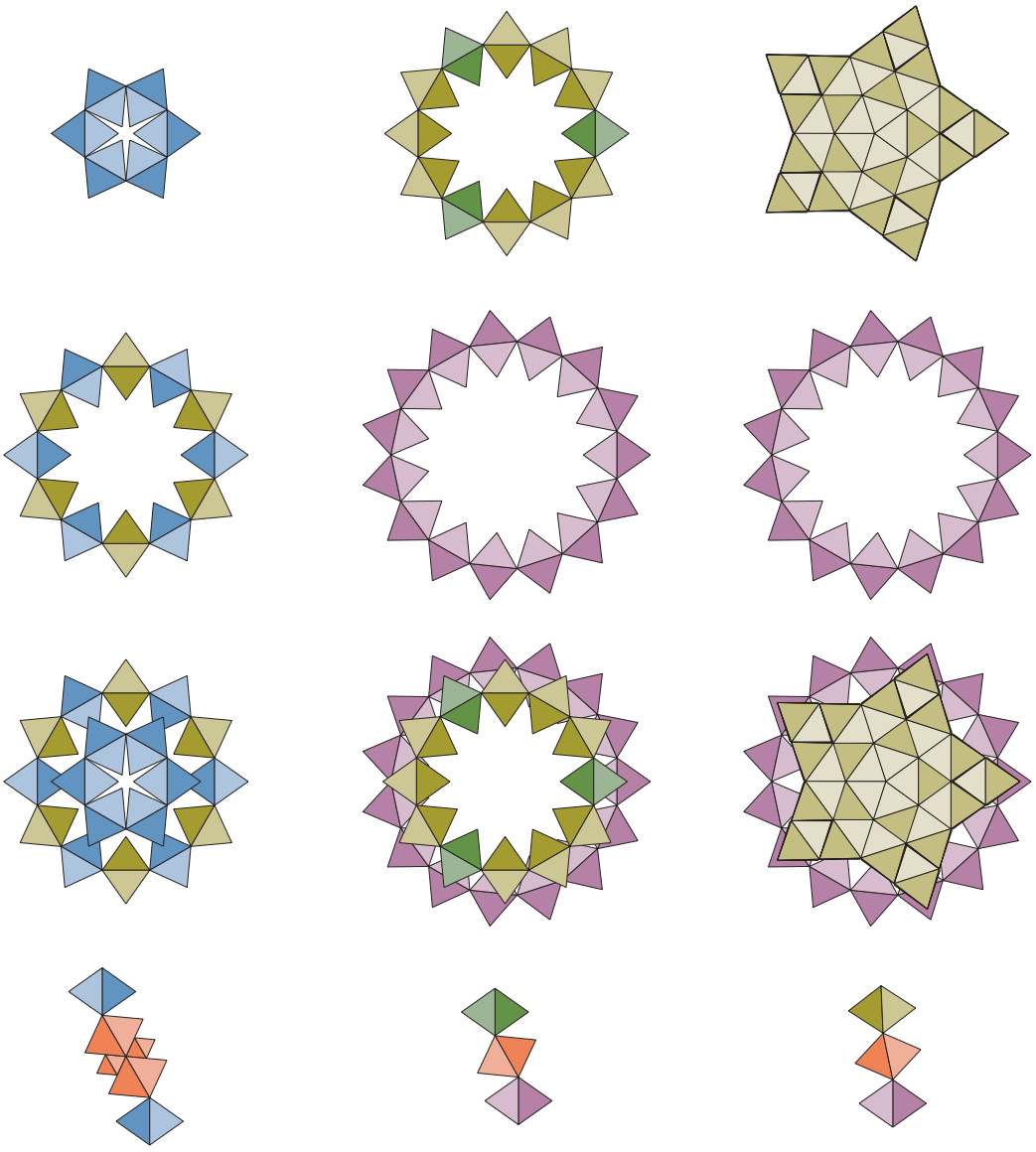

Fig. 1 Accommodating a fivefold head to a sixfold sheath–Method I

The figure shows a way in which the fivefold head of bacteriophage T4 can join with its sixfold sheath. It requires two intermediate rings of hinge joined octahedral units which are linked to each other and to the sheath and head by additional octahedral assemblies.

At left, a ring of six edgially joined octahedra is joined to a ring of twelve edgially joined octahedra. The sheath is represented by the sixfold ring of blue colored octahedra at the top. The twelvefold ring of alternating blue and yellow octahedra is next. The two rings are shown with their axes coincident. At bottom, the linking octahedral assembly is represented by the red octahedra.

At middle, a ring of twelve edgially joined octahedra (nine yellow and three green) is joined to a ring of fifteen edgially joined violet octahedra.The three green octahedra of the twelvefold ring are joined to three of the octahedra of the fifteenfold ring by the red octahedral assemblies.

At right, a fivefold ring of icosahedrally oriented yellow 2-octahedra is joined to a ring of fifteen edgially joined violet octahedra. The outermost octahedron of each of the 2-octahedra is joined to a violet octahedron of the fifteenfold ring by the red octahedron as shown at the bottom.

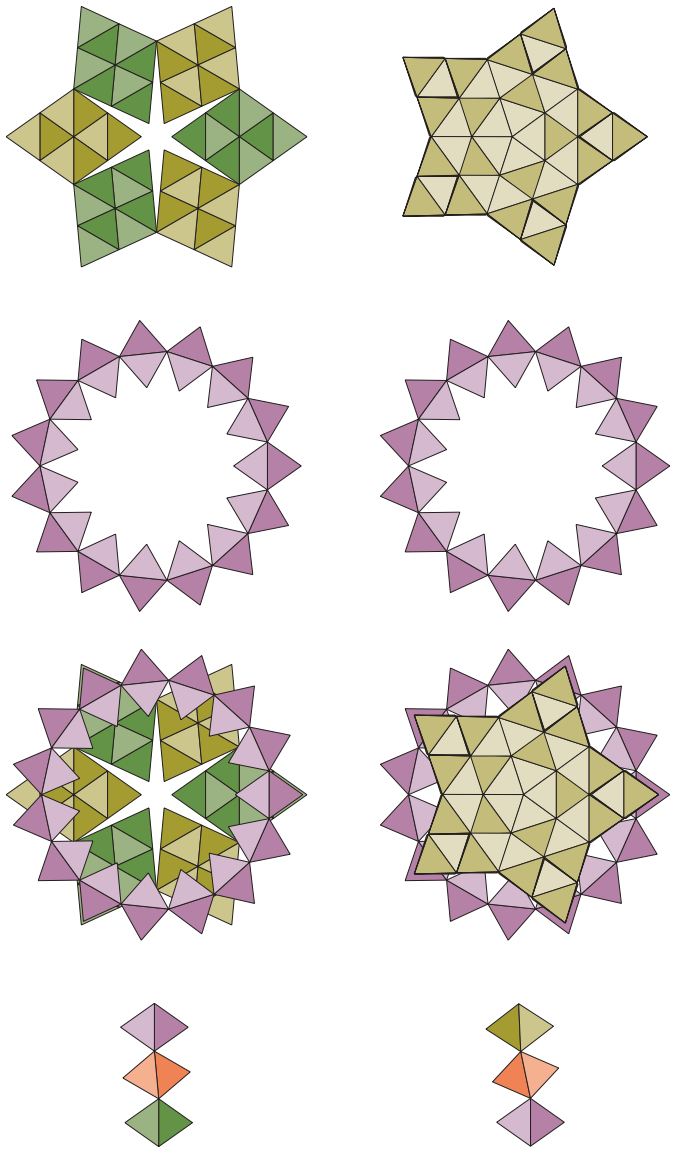

Fig. 2 Accommodating a fivefold head to a sixfold sheath–Method II

The figure shows a method of joining a sixfold ring of hinge joined octahedra to a fivefold ring of octahedra using a single intermediate fifteenfold ring of hinge joined octahedra.

At left, a sixfold ring of alternating green and yellow 2-octahedra is linked to a fifteenfold ring of violet octahedra by three red octahedral assemblies. The outermost octahedron of each of the green 2-octahedra is joined to a red octahedron which is joined to a violet octahedron.

At right, the fifteenfold ring is joined to a fivefold ring of 2-octahedra by five red octahedral assemblies. The outermost octahedron of each of the two yellow 2-octahedra is joined to a red octahedron which is joined to a violet octahedron.