# DNA[1]

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

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

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1. Excerpted from Octahedron1stEd.pdf—bookmark: DNA—pages 297-300

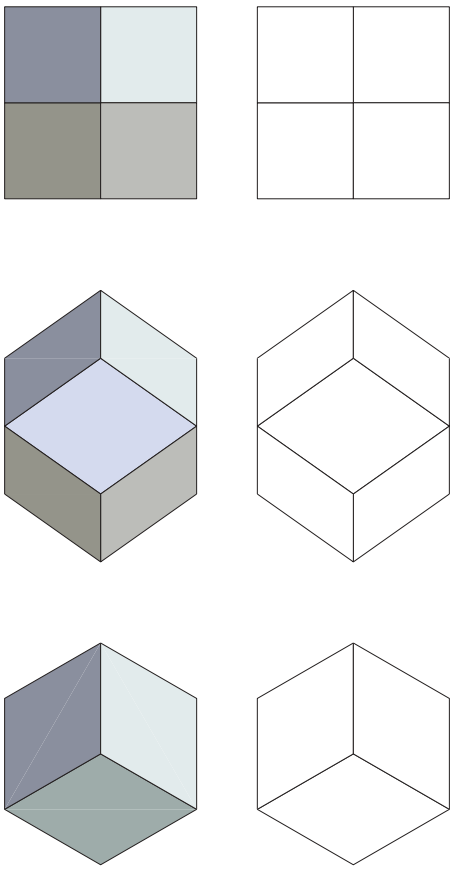
# DNA

## Structure of DNA

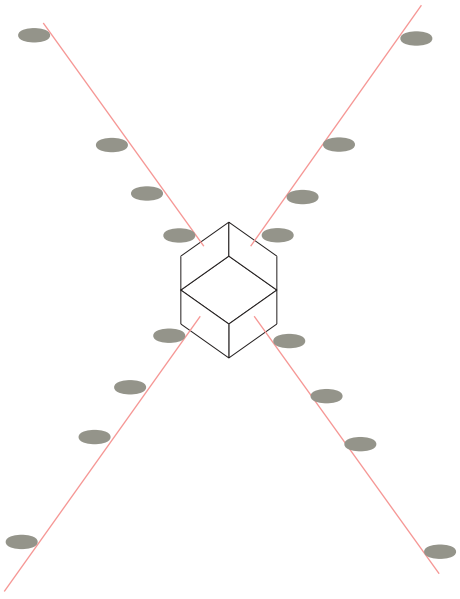
Twentyfold symmetry, tenfold symmetry, and fivefold symmetry are not found in regular crystals. Fivefold and tenfold symmetry is demonstrable in quasicrystals. It is reported to be so for viral coats. It is not found in regular crystals. The Laue photograph showing an X-pattern is compatible with those which would be produced by a set of pyramids with geometrically similar and concentric rhombic bases, with a common altitude. The Laue spots are parallel to the sides of an $\tan^{1}(\mathrm{sqr}(8))$ rhombus. This is the same as the profile of the regular octahedron when viewed in the direction of a mid-edgial diameter.

The x-pattern of the DNA x-ray photograph suggests a rhombic dodecahedral crystal which is oriented so that one of its facial axes is perpendicular to the film plane.

The reflecting faces are parallel to a pair of edges of one of the dodecahedral faces and the line of spots are normal to these edges.



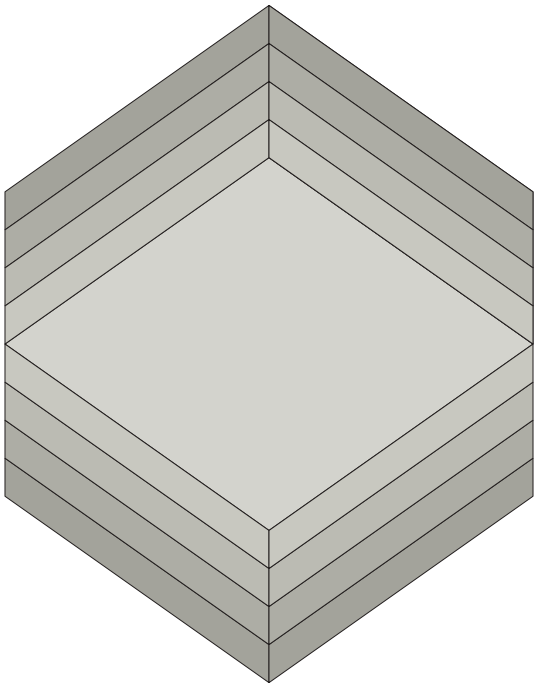
**Rhombic dodecahedron.**
The three views are 4-face vertexial, facial, and 3-face vertexial. Each view is shown with faces both colored and uncolored.



**DNA crystal: rhombic dodecahedral nature of DNA diffraction pattern.**
The spots are reflections from crystal faces which are modifications of the dodecahedral faces.

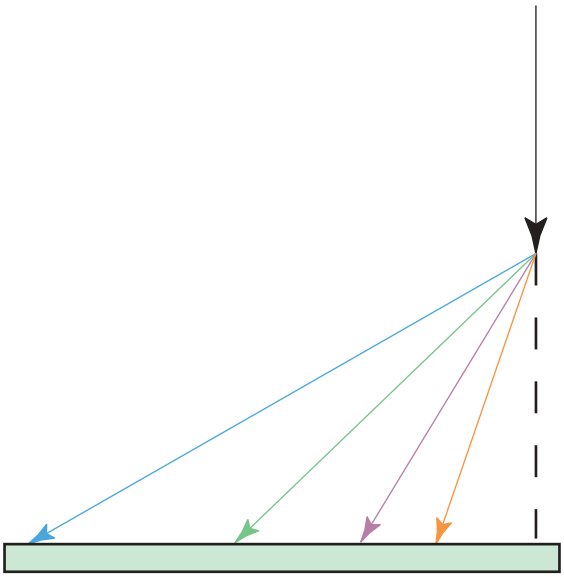
### Relationship of diffracting planes to the rhombic dodecahedron

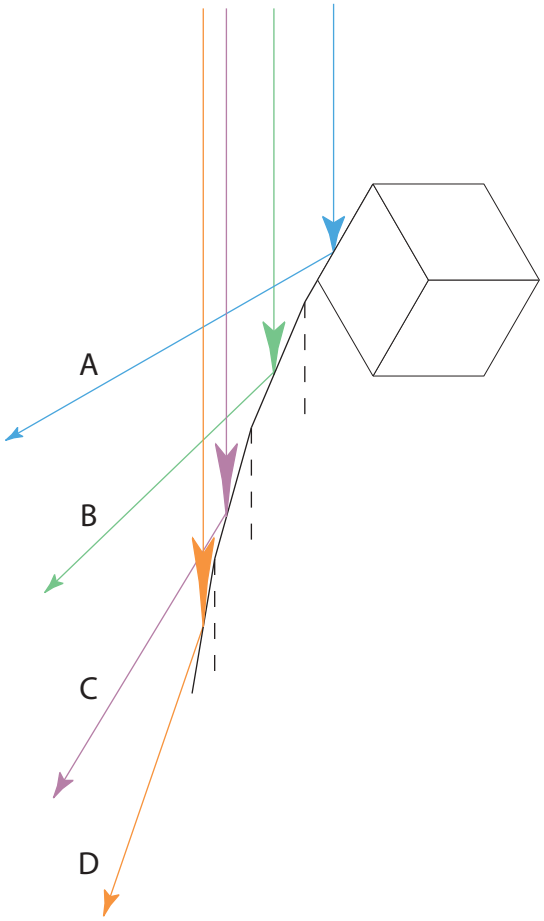
The faces of the rhombic dodecahedron are defined by the edges of the regular octahedra which form the DNA groups. When these octahedra are viewed in a direction parallel to the face and in a direction that is parallel to the photographic plane, the octahedra are seen in a facial view. The modifying faces are defined by a vertex of the octahedron.



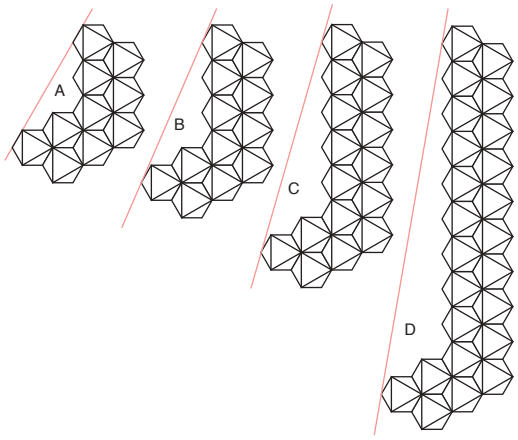
**DNA crystal: rhombic dodecahedron with four of its faces modified.**
The plane of the photon trajectory from each of the additional faces is parallel to that of the original face.

**DNA: photon trajectories from a rhombic dodecahedral crystal**






**DNA crystal: photon trajectories from a rhombic dodecahedral crystal viewed parallel to a reflecting face.**




**DNA crystal: four planes defined by octahedral assemblies.**

The planes are perpendicular to the picture plane. Plane A is the face of a rhombic dodecahedron and is defined by octahedral edges. The others are modifications of the rhombic dodecahedral face and are defined by octahedral vertexes. This set of planes will reflect x-rays in the manner that is shown in the DNA photographed by Rosalind Franklin.

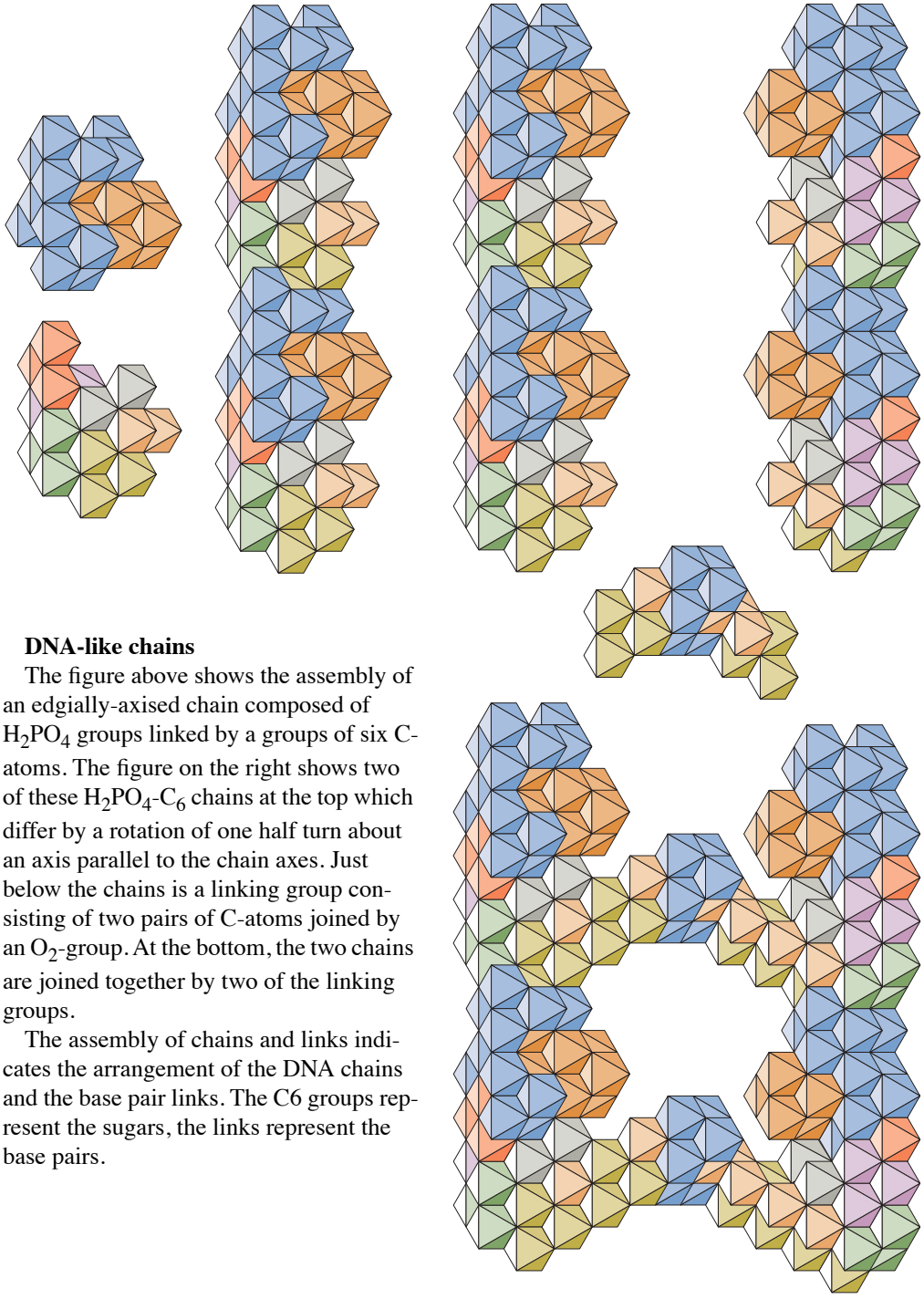
**Octahedral relationships which form the diffracting planes.**

If the x-ray beam is in the direction of the DNA axis, and this is a pair of chains, then the chains are not helical. They are parallel edgial chains. This axial orientation is compatible with the right-angled "L" shape of t-RNA which is built of similar units.

**Evidence for edgially axised chains**

1. Permits contact or pairing of base atoms.
2. Provides two chains that are separable without unwinding.
3. Permits a solid structure using the elements described-- $H_2PO_4$, $C_6$, base.
4. Opposed sugars are inverted.

## DNA-like chains



**DNA-like chains**

The figure above shows the assembly of an edgially-axised chain composed of $H_2PO_4$ groups linked by a groups of six C-atoms. The figure on the right shows two of these $H_2PO_4$-$C_6$ chains at the top which differ by a rotation of one half turn about an axis parallel to the chain axes. Just below the chains is a linking group consisting of two pairs of C-atoms joined by an $O_2$-group. At the bottom, the two chains are joined together by two of the linking groups.

The assembly of chains and links indicates the arrangement of the DNA chains and the base pair links. The C6 groups represent the sugars, the links represent the base pairs.