Strands formed by C-atom quintuplets and H_2PO_4-groups

Robert William Whitby
30 March 2004
http://homepage.mac.com/whitby/

Reference

1. Octahedron1stEd.pdf
2. COassys.pdf
3. SugarBackbones.pdf

Introduction

Four distinct quintuplets are formed by the addition of a C-atom to each end of an L-triplet [Reference 3, Figure 4 "C-atom quintuplets"]. Each of these quintuplets is a candidate for the C-atom backbone of D-ribose. Accordingly, each quintuplet has been tested to see if an O_2-group could attach to each of its ends so as to permit the quintuplet to join with H_2PO_4-groups in the formation of an edgially axised strand of DNA or RNA. As the figures herein show, each of the quintuplets is interchangeable with each of the other quintuplets in the formation of such a strand.

Figure 1 shows the four distinct quintuplets formed by the addition of C-atoms to each end of both a D-triplet and an L-triplet. The triplets are labeled A, B, C, and D.

Figure 2 shows how the Type A quintuplets are formed and how they join with the O_2-groups of an H_2PO_4-group. A quintuplet derived from the D-triplet requires an H_2PO_4-group of opposite hand to the H_2PO_4-group required by a quintuplet derived from the L-triplet. That means that the P-atom of one group mirrors the P-atom of the other group.

Figure 3 shows the atom by atom formation of a Type A quintuplet derived from an L-triplet. This is then joined with a pair of O_2-groups from a clockwise H_2PO_4-group. Two of these assemblies are joined in a strand. An identical strand is shown with complete H_2PO_4-groups.

Figure 4 and Figure 5 show the formation of a strand using Type B quintuplets.

Figure 6 and Figure 7 show the formation of a strand using Type C quintuplets.

Figure 8 and Figure 9 show the formation of a strand using Type D quintuplets.

For comparison, Figure 9 shows each of the four quintuplets derived from the L-triplet with O_2-groups attached to each end, and Figure 10 shows each of the completed strands for the same four quintuplets.

The end of the quintuplet to which the H_2PO_4-group is attached in the strand assemblies was chosen arbitrarily.

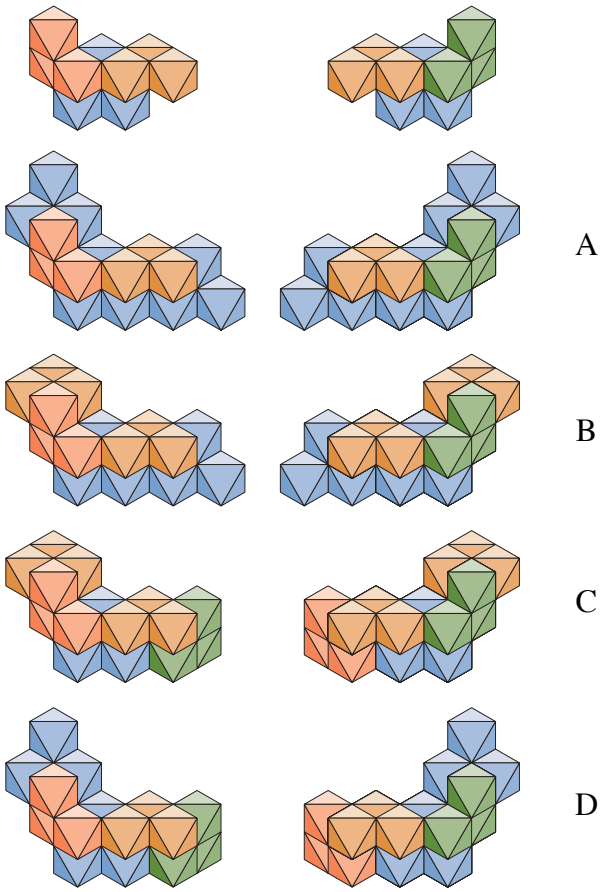


Fig. 1 C-atom quintuplets derived from asymmetrical triplets

The figure shows how the L-triplet and D-triplet can be extended by the addition of a C-atom at each end. The four resulting C-atom quintuplets of a given hand are interchangeable in joining with H_2PO_4-groups of the appropriate hand to form an edgially axised strand.

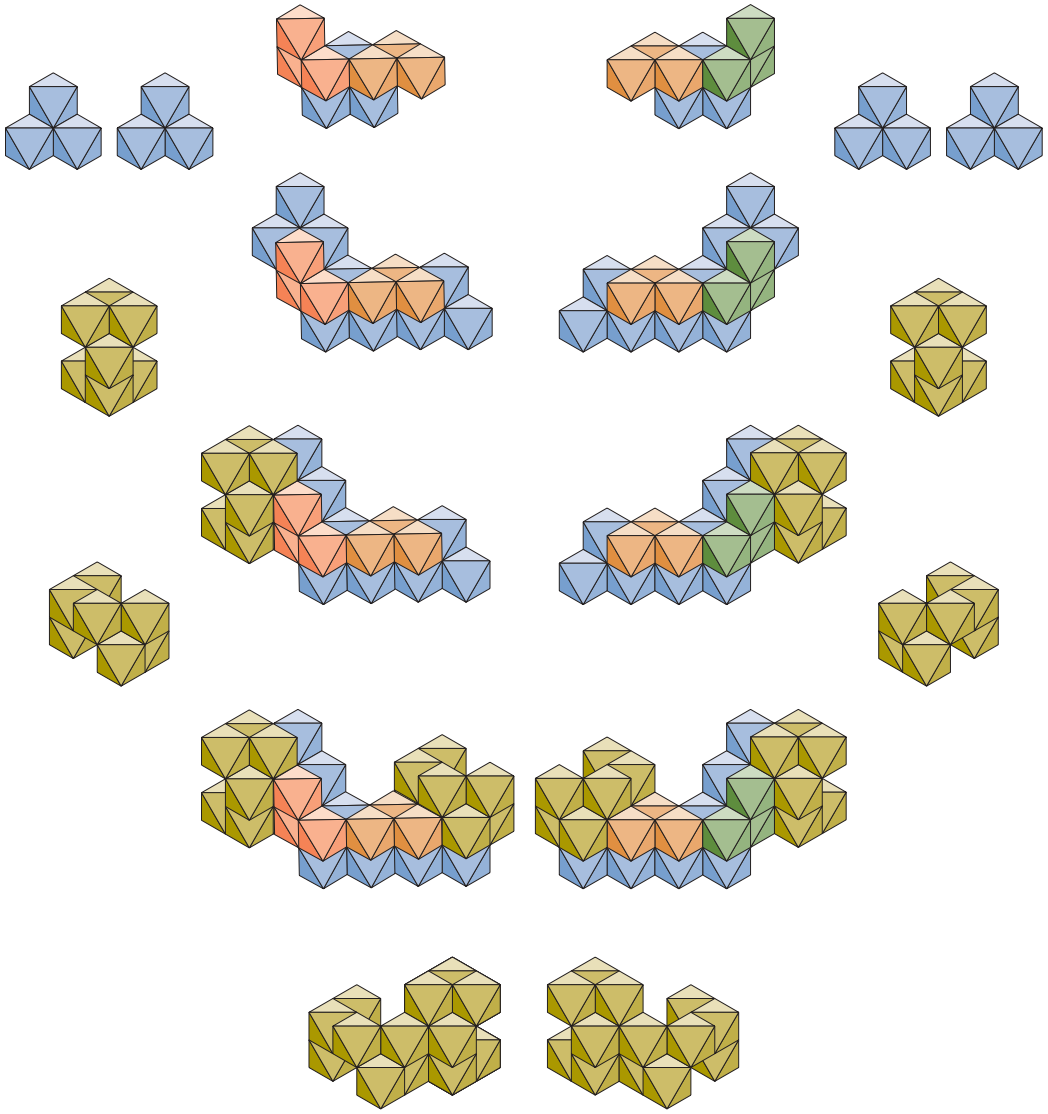


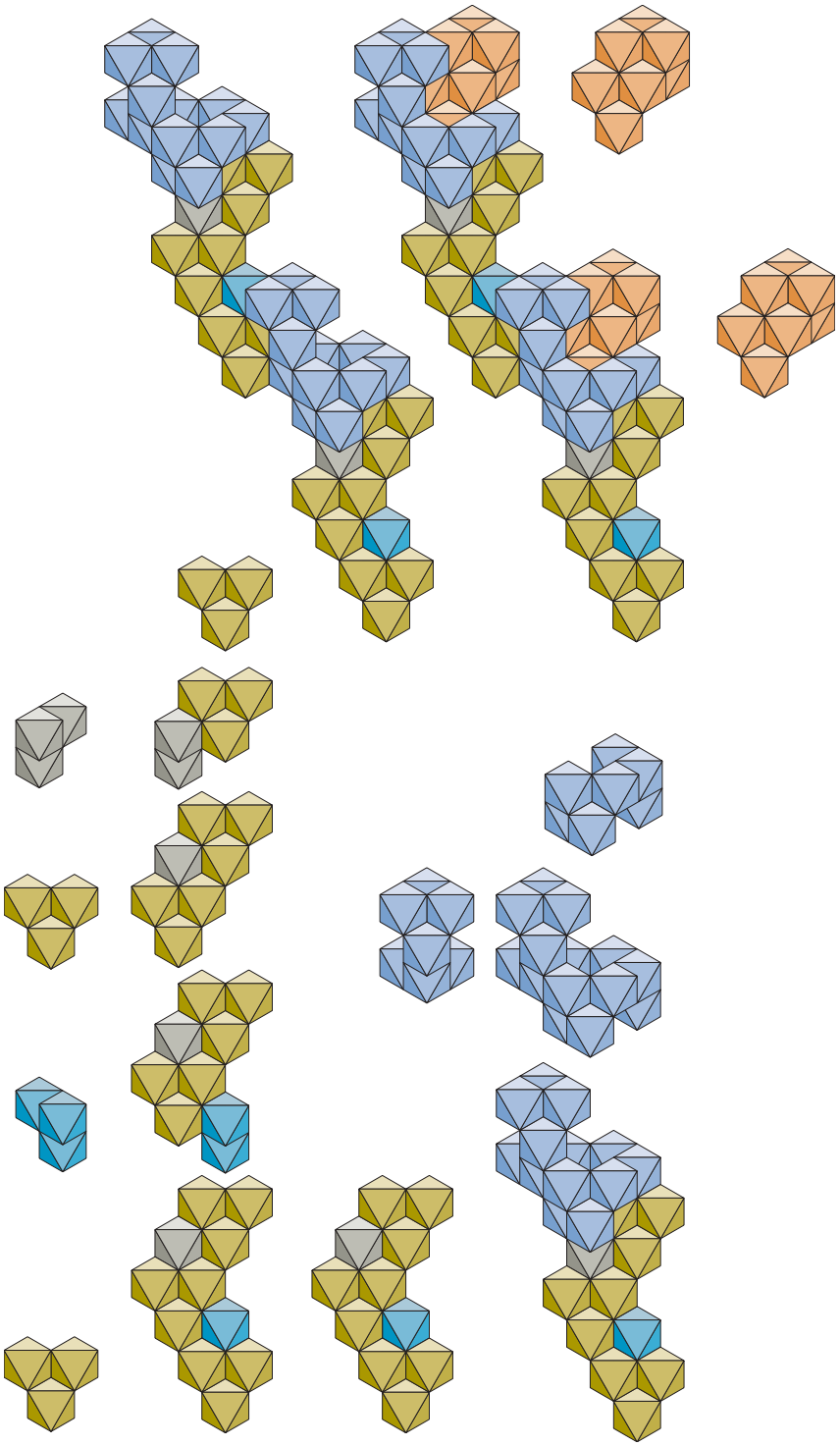
Fig. 2 Type A quintuplets–joining of the O_2-groups of an H_2PO_4-group

The figure shows how the O_2-groups of an H_2PO_4-group are joined to Type A quintuplets within an edgially-axised strand. The O_2-groups are colored yellow. The relationship of one O_2-group to the other within an H_2PO_4-group is shown at the bottom of the figure. The H_2PO_4-groups are mirrors and require P-atoms of different hand. The quintuplets which derive from the D-triplet require counter-clockwise P-atoms; the quintuplets which derive from the L-triplet require clockwise P-atoms.

Two assemblies are shown. That which derives from the D-triplet is shown on the left. The assembly which derives from the L-triplet is shown on the right. The triplets are shown at the top of figure. The blue C-atoms are added to the triplets to produce the quintuplets. The first O2-group is added in the second step. A second O_2-group is added to the other end of each triplet in the third and final step of the assembly. At each step, the assembly on the left mirrors the assembly on the right.

Fig. 3 Strand assembly using L-quintuplets of Type A joined with H_2PO_4-groups

The figure shows the formation of an edgially axised strand of Lquintuplets of Type A joined with H_2PO_4-groups. The atom by atom assembly of the quintuplet is shown at the lower left. The quintuplet is joined to an O_4-group at the lower right. Two of the quintuplet and O_4-group assemblies form a strand at the upper left. Two H_2P-groups are added to produce the strand at the upper right.



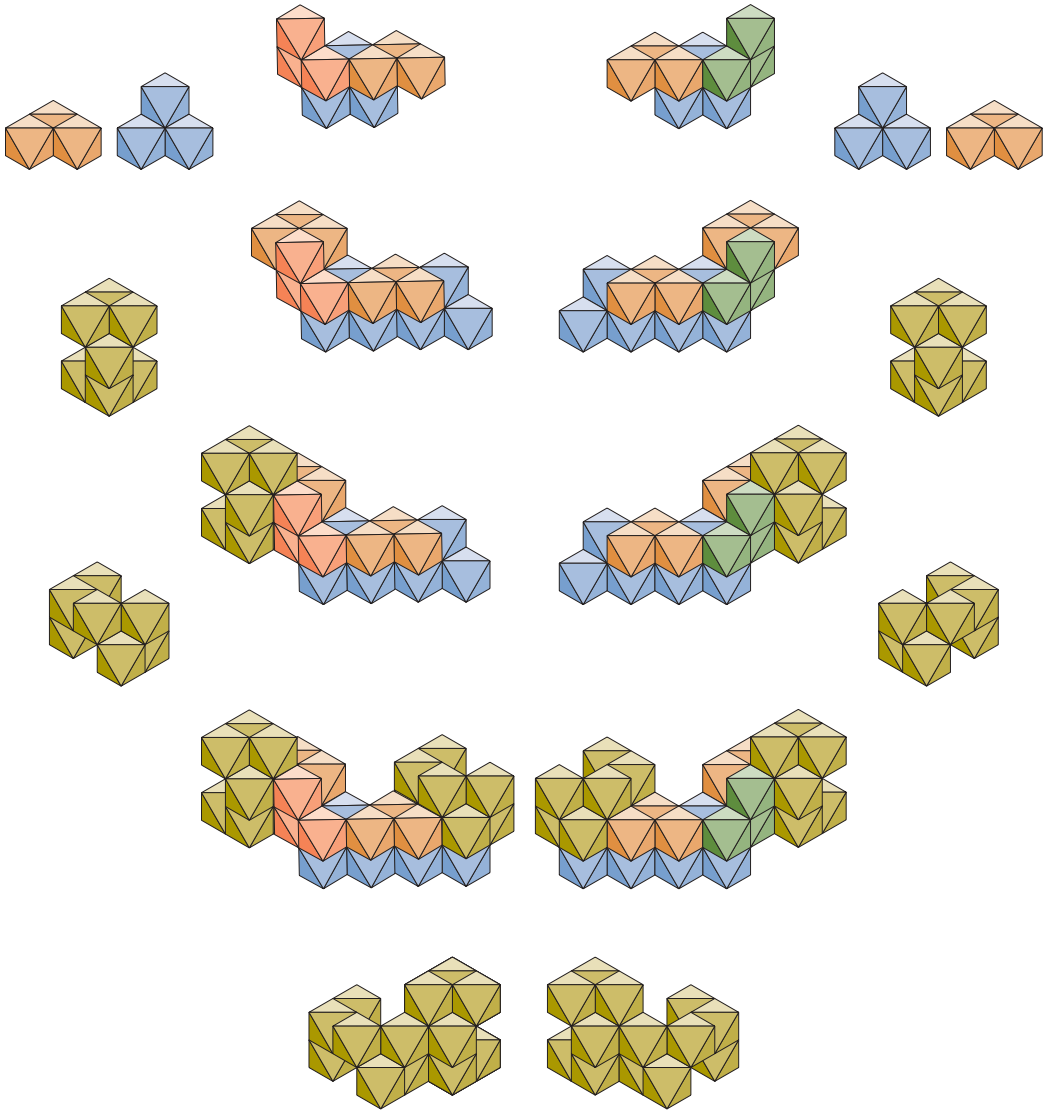


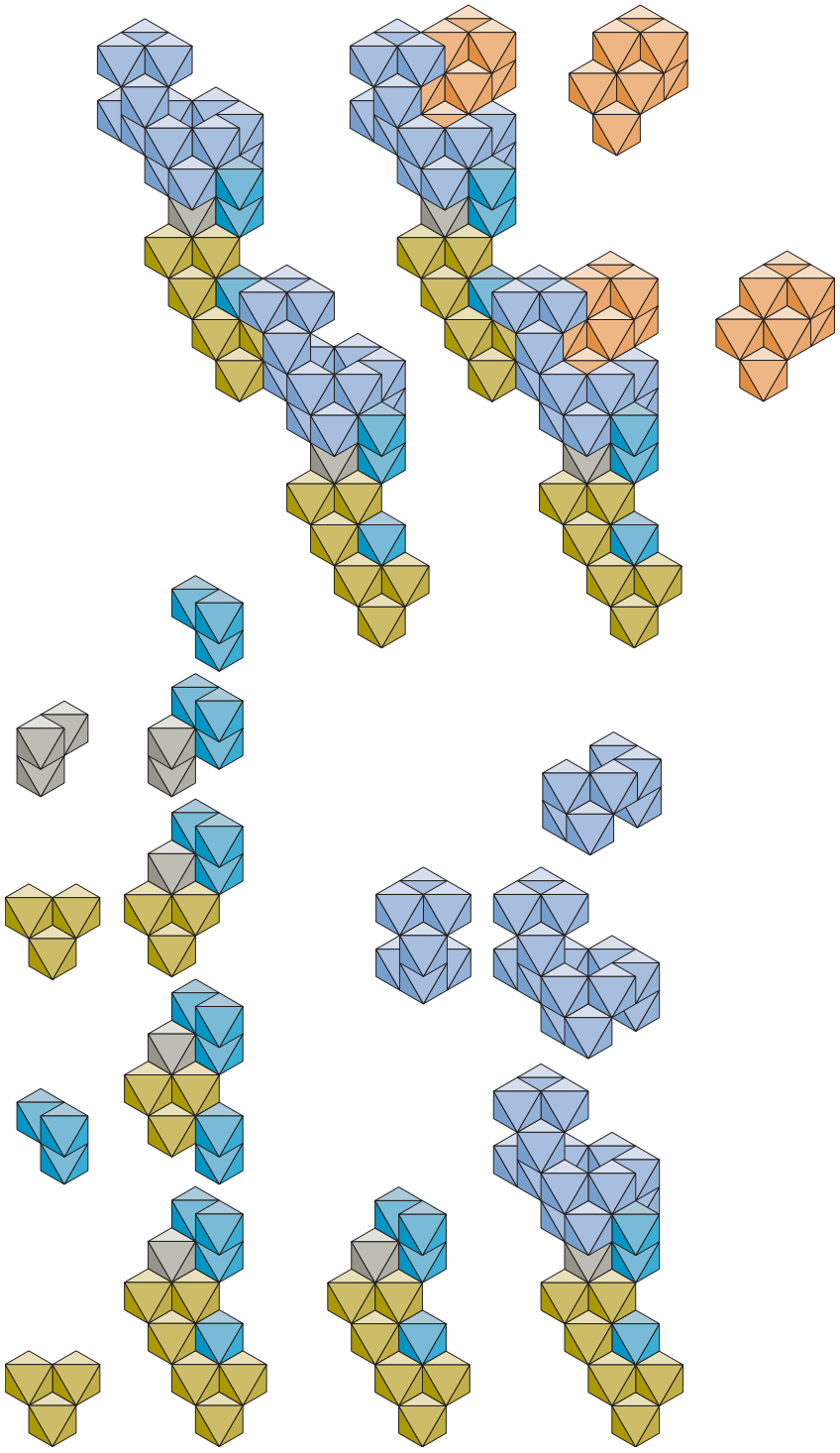
Fig. 4 Type B quintuplets–joining of the O_2-groups of an H_2PO_4-group

The figure shows how the O_2-groups of an H_2PO_4-group are joined to Type B quintuplets within an edgially-axised strand. The O_2-groups are colored yellow. The relationship of one O_2-group to the other within an H_2PO_4-group is shown at the bottom of the figure. The H_2PO_4-groups are mirrors and require P-atoms of different hand. The quintuplets which derive from the D-triplet require counter-clockwise P-atoms; the quintuplets which derive from the L-triplet require clockwise P-atoms.

Two assemblies are shown. That which derives from the D-triplet is shown on the left. The assembly which derives from the L-triplet is shown on the right. The triplets are shown at the top of figure. The blue C-atoms are added to the triplets to produce the quintuplets. The first O_2-group is added in the second step. A second O_2-group is added to the other end of each triplet in the third and final step of the assembly. At each step, the assembly on the left mirrors the assembly on the right.

Fig. 5 Strand assembly using L-quintuplets of Type B joined with H_2PO_4-groups

The formation of an edgially axised strand of L-quintuplets of Type B joined with H_2PO_4-groups. The atom by atom assembly of the L-quintuplet is shown at the lower left. The quintuplet is joined to an O_4-group at the lower right. Two of the quintuplet and O_4-group assemblies form a strand at the upper left. Two H_2P-groups are added to produce the strand at the upper right.



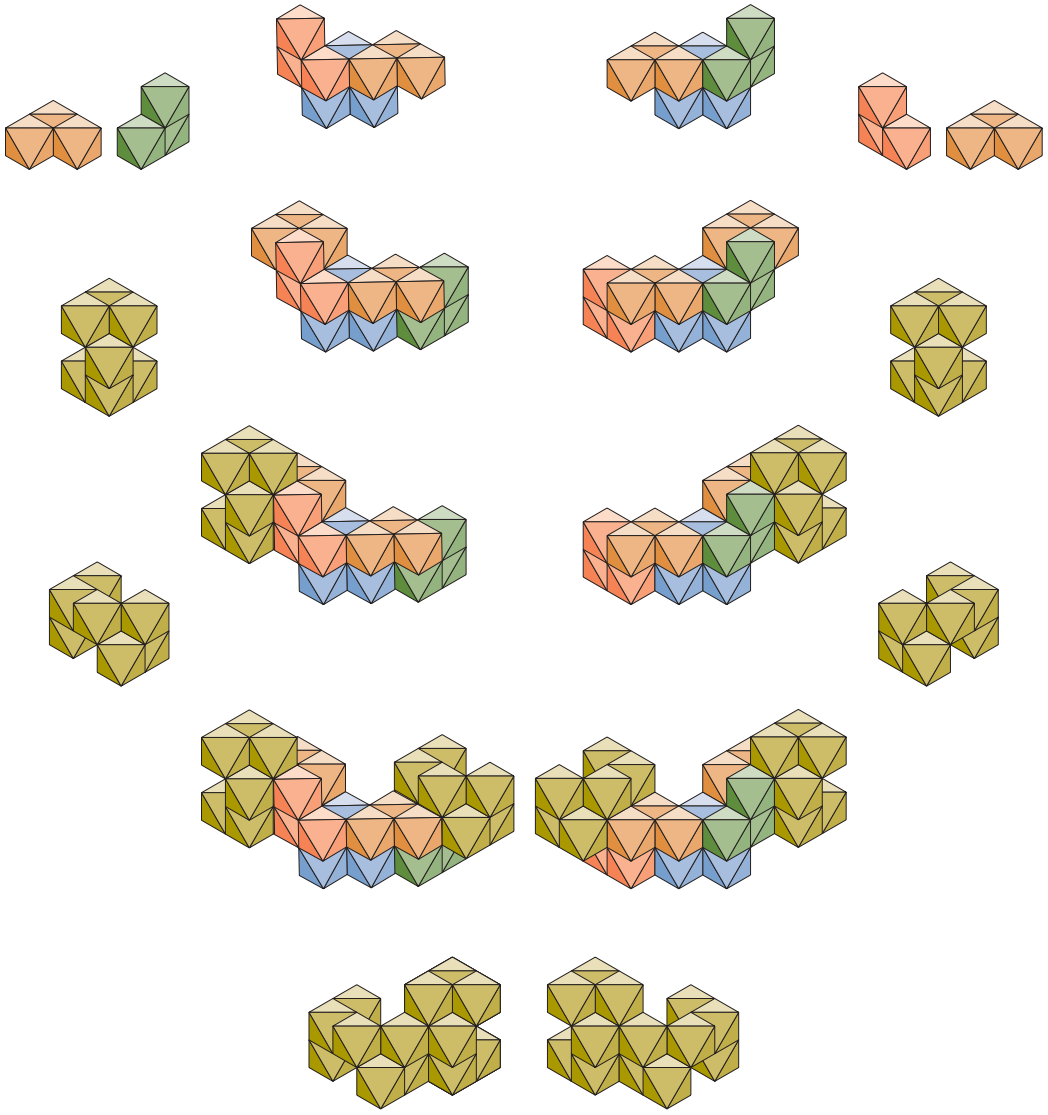


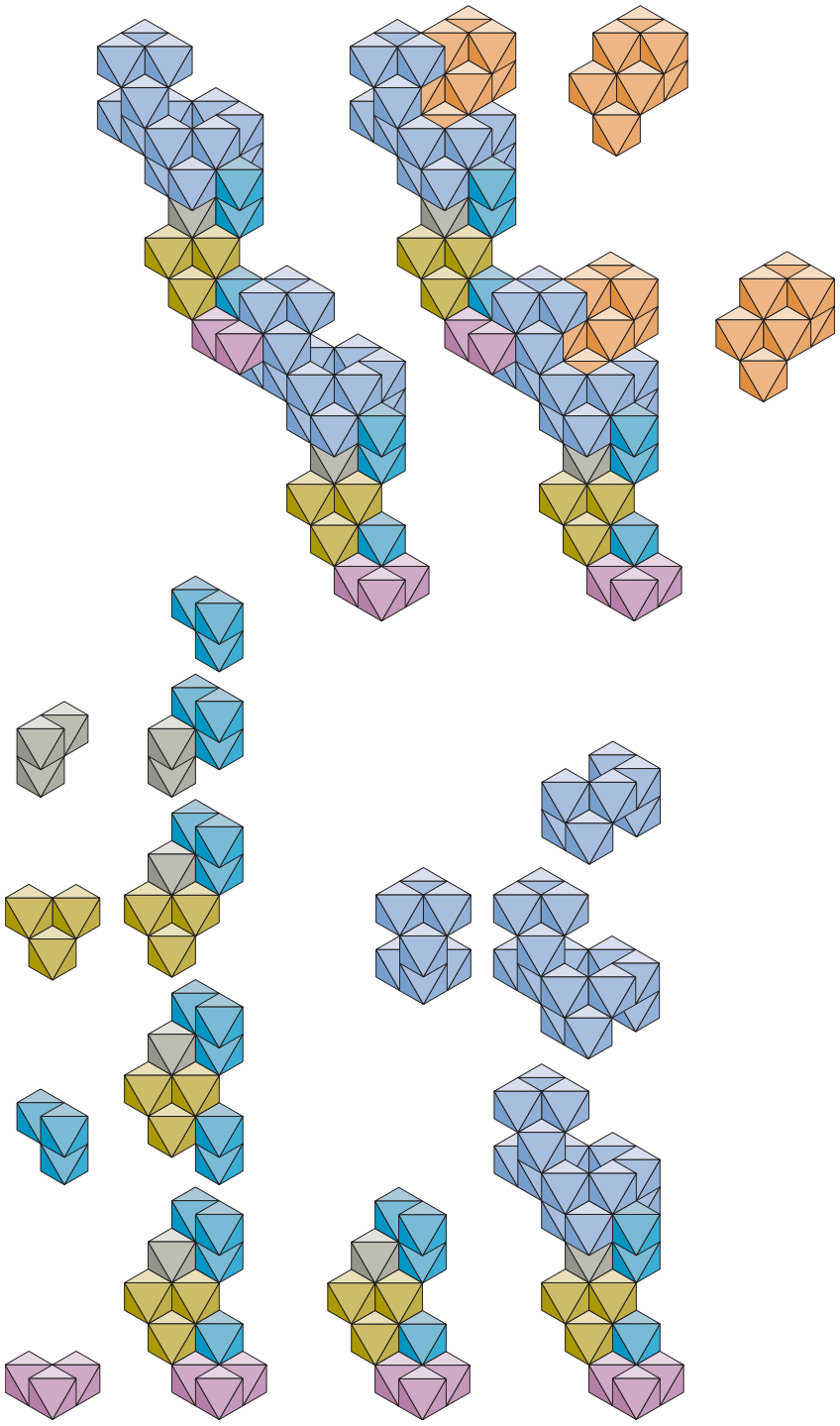
Fig. 6 Type C quintuplets–joining of the O_2-groups of an H_2PO_4-group

The figure shows how the O_2-groups of an H_2PO_4-group are joined to Type C quintuplets within an edgially-axised strand. The O_2-groups are colored yellow. The relationship of one O_2-group to the other within an H_2PO_4-group is shown at the bottom of the figure. The H_2PO_4-groups are mirrors and require P-atoms of different hand. The quintuplets which derive from the D-triplet require counter-clockwise P-atoms; the quintuplets which derive from the L-triplet require clockwise P-atoms.

Two assemblies are shown. That which derives from the D-triplet is shown on the left. The assembly which derives from the L-triplet is shown on the right. The triplets are shown at the top of figure. The blue C-atoms are added to the triplets to produce the quintuplets. The first O_2-group is added in the second step. A second O_2-group is added to the other end of each triplet in the third and final step of the assembly. At each step, the assembly on the left mirrors the assembly on the right.

Fig. 7 Strand assembly using L-quintuplets of Type C joined with H_2PO_4-groups

The formation of an edgially axised strand of L-quintuplets of Type C joined with H_2PO_4-groups. The atom by atom assembly of the L-quintuplet is shown at the lower left. The quintuplet is joined to an O_4-group at the lower right. Two of the quintuplet O_4-group assemblies form a strand at the upper left. Two H_2P-groups are added to produce the strand at the upper right.



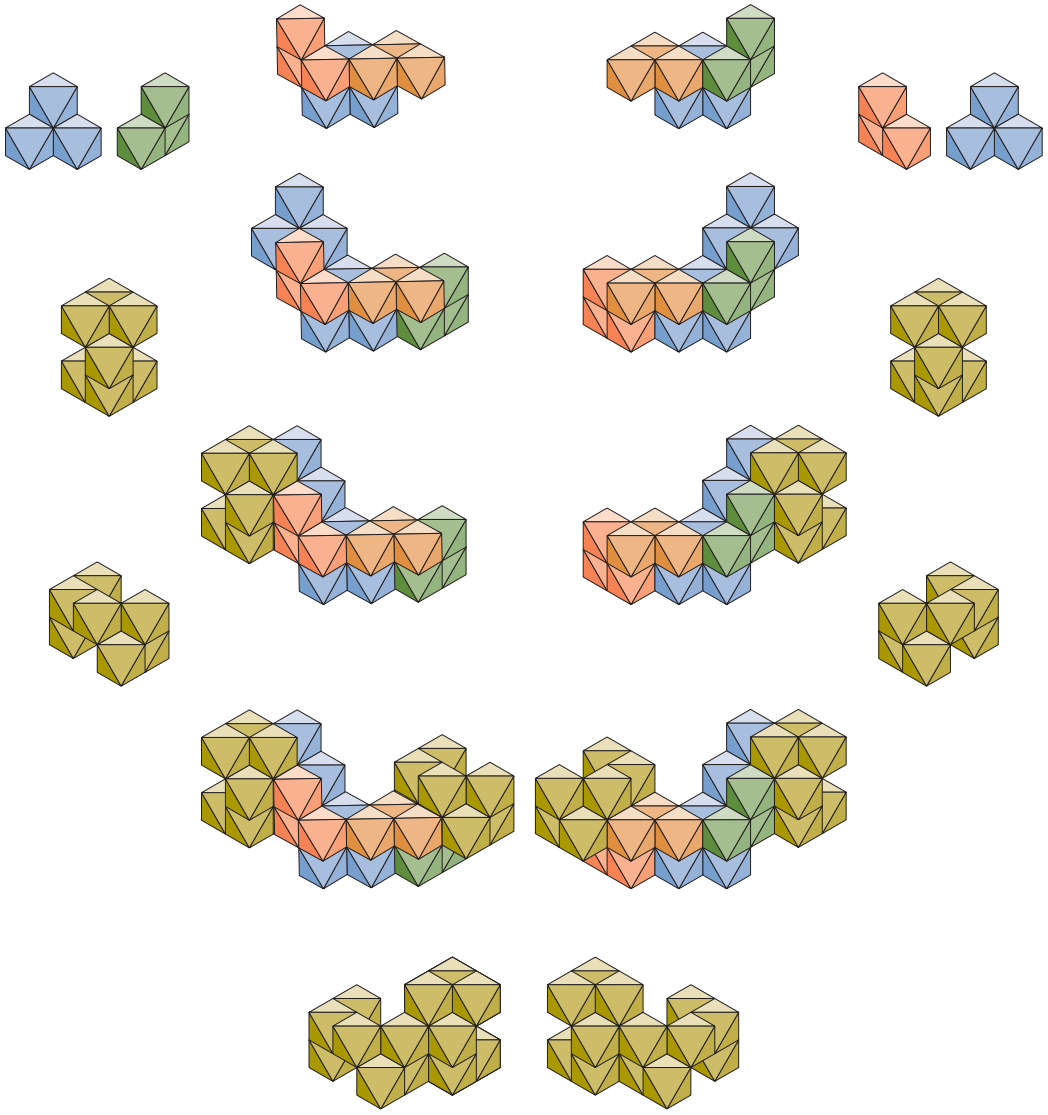


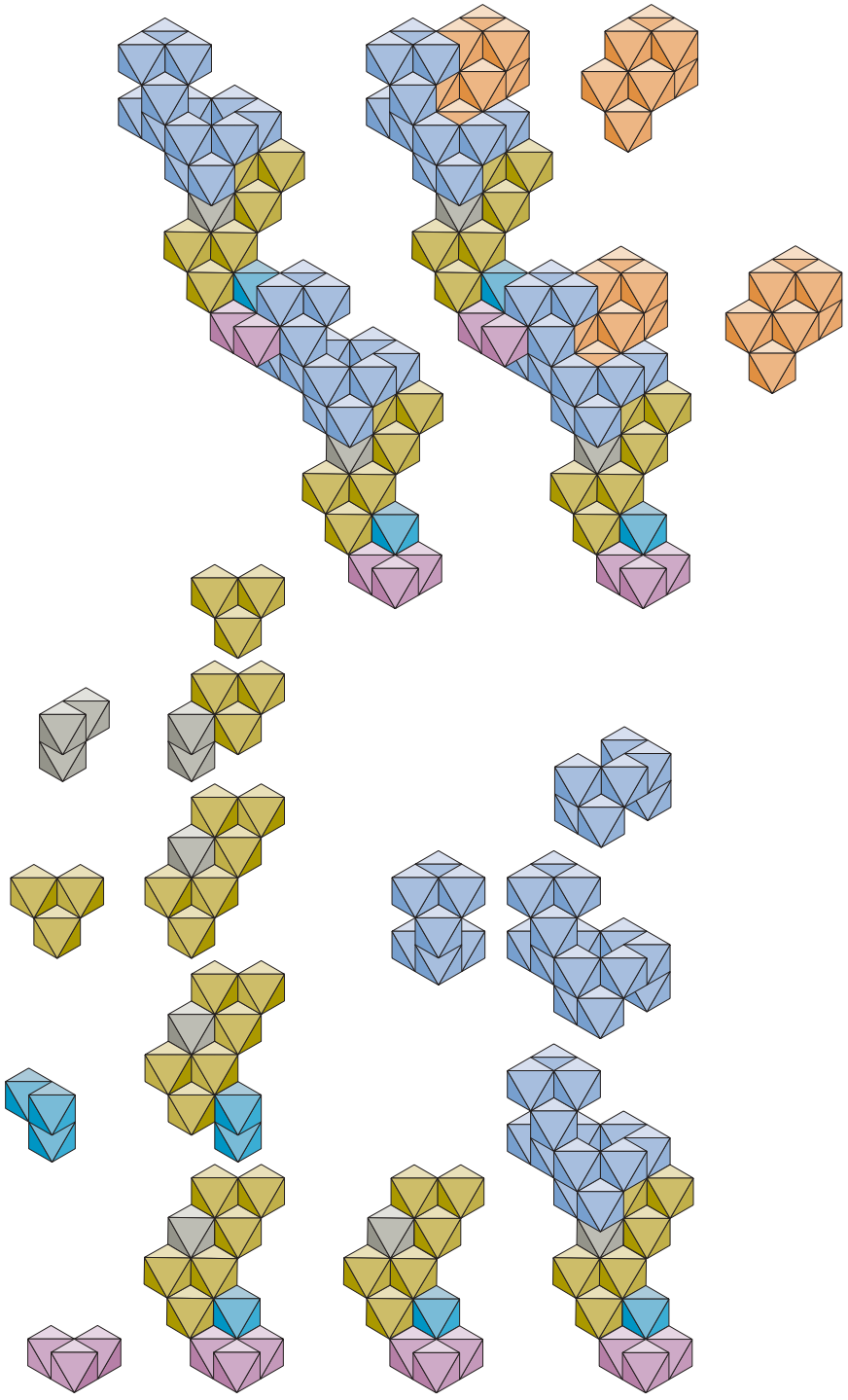
Fig. 8 Type D quintuplets–joining of the O_2-groups of an H_2PO_4-group

The figure shows how the O_2-groups of an H_2PO_4-group are joined to Type D quintuplets within an edgially-axised strand. The O_2-groups are colored yellow. The relationship of one O_2-group to the other within an H_2PO_4-group is shown at the bottom of the figure. The H_2PO_4-groups are mirrors and require P-atoms of different hand. The quintuplets which derive from the D-triplet require counter-clockwise P-atoms; the quintuplets which derive from the L-triplet require clockwise P-atoms.

Two assemblies are shown. That which derives from the D-triplet is shown on the left. The assembly which derives from the L-triplet is shown on the right. The triplets are shown at the top of figure. The blue C-atoms are added to the triplets to produce the quintuplets. The first O_2-group is added in the second step. A second O_2-group is added to the other end of each triplet in the third and final step of the assembly. At each step, the assembly on the left mirrors the assembly on the right.

Fig. 9 Strand assembly using L-quintuplets of Type D joined with H_2PO_4-groups

The formation of an edgially axised strand of L-quintuplets of Type D joined with H_2PO_4-groups. The atom by atom assembly of the L-quintuplet is shown at the lower left. The quintuplet is joined to an O_4-group at the lower right. Two of the quintuplet O_4-group assemblies form a strand at the upper left. Two H_2P-groups are added to produce the strand at the upper right.



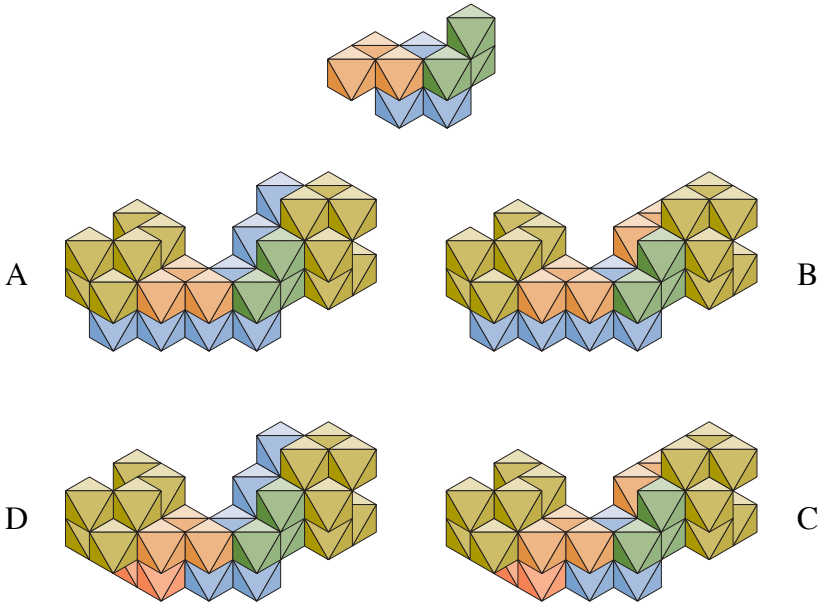


Fig. 10 Four quintuplets derived from an L-triplet

The figure shows the four quintuplets derived from an L-triplet by the addition of a C-atom in two different orientations to each end. They are collected here from the previous figures for comparison. The O_2-group at the left end of one quintuplet has the same orientation as that of the O_2-group at the left end of each of the other quintuplets. The same is true for the O_2-group at its right end and the O_2-groups at the right end of each of the other quintuplets. The distance between the two O_2-groups of a quintuplet is the same as that between the O_2-groups of each of the other quintuplets. That is, the geometrical relationship between the two O_2-groups of one quintuplet is identical to the geometrical relationship between the O_2-groups of each of the other quintuplets.

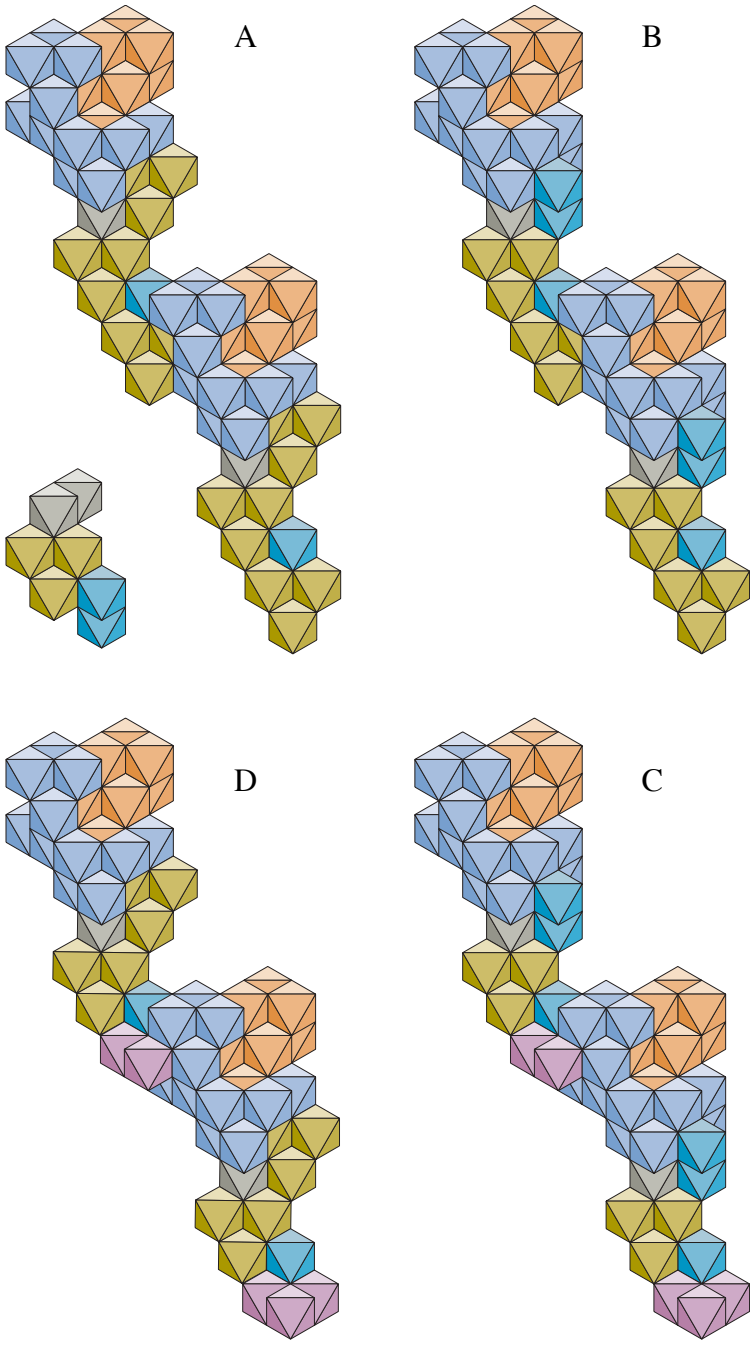


Fig. 11 Clockwise H_2PO_4-group joined with D-quintuplet

The figure shows each of the four possible quintuplets derived from an L-triplet joined to a clockwise H_2PO_4-group and paired with an identical assembly to form a two unit strand.