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March 21, 2007

Geometric Computations in Molecular Biology SS07

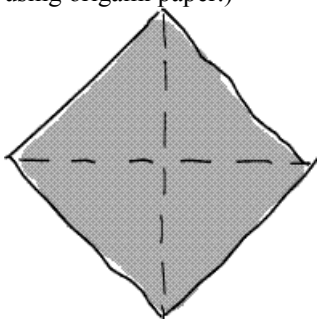
Folding Carbon Atoms after Yoshihide Momotani

Notation:

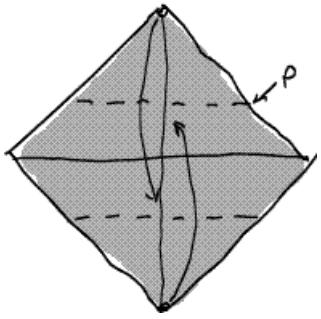
Valley Fold — Fold and unfold

Mountain Fold — Fold to here

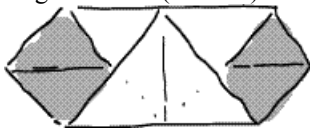
(1) Start with a square piece of paper (colored side up, if using origami paper.)

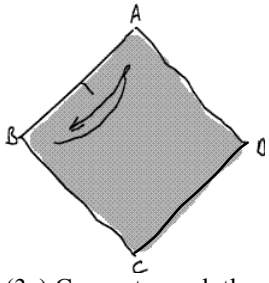


(2)Valley fold the diagonals and unfold.

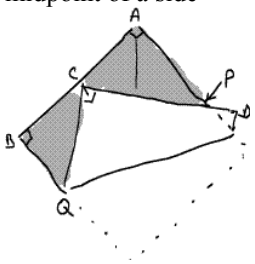


(3) Fold in thirds, either by trial and error, or by using the Haga theorem (see box)



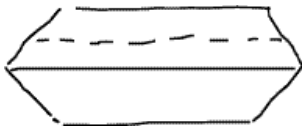


(3a) Crease to mark the midpoint of a side

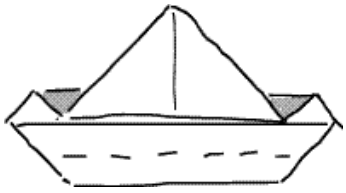


(3b) bring bottom corner up to crease and fold flat. Point P is the place to fold top 1/3. (But not C, which is ½!)

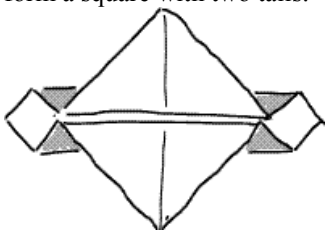
(4) Flip paper over.



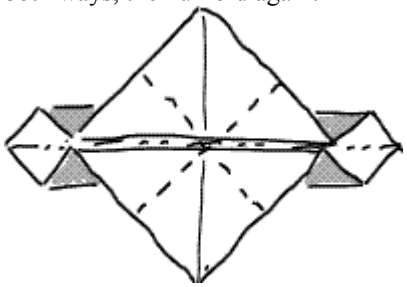
(5) Fold top edge to middle line, folding one layer only & letting flap behind come up



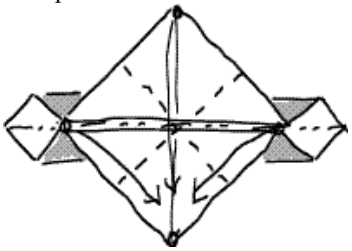
(6) Do same with bottom edge to form a square with two tails.



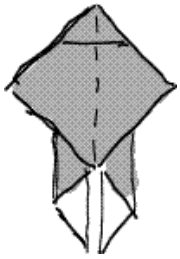
(7) Fold this square like a book, both ways, then unfold again.



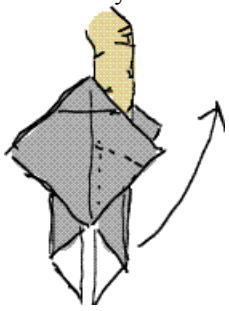
(8) Use these folds and the horizontal mountain fold to collapse the corners…



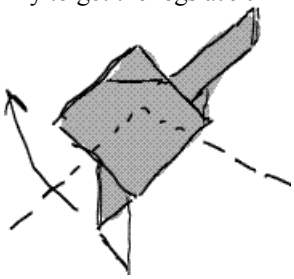
(9) To get a square with two legs.



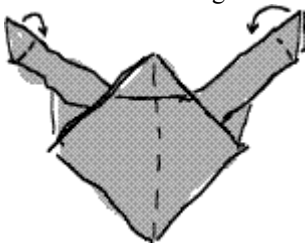
(10) Slide a finger between two flaps at the top and pull one leg up, reversing its fold from valley to mountain.



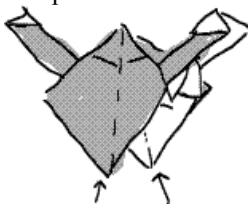
(11) Repeat for the other leg. Try to get the legs at 90°



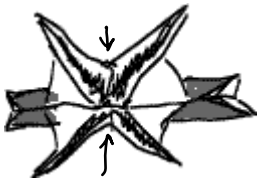
(12) Fold back the triangles at the ends of the legs.



(13) This is half of a carbon atom. It has two tabs that go into pockets in the other half.

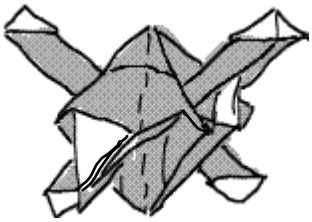


(14) Make body shape like a '+' sign. Here is the view from the bottom arrows.



(15) Slide two modules together, putting tabs in pockets in the + sign. You can tug on a leg to open a pocket slightly if a tab is missing its pocket.

(16) This is a carbon atom, with four bonds in the usual tetrahedral conformation.
(Sp3 hybridization of orbitals)



(17) Atoms can be bonded together by folding a collar from a small piece of paper and hooking it under the triangular tabs.