

Paper model of TIM-barrel

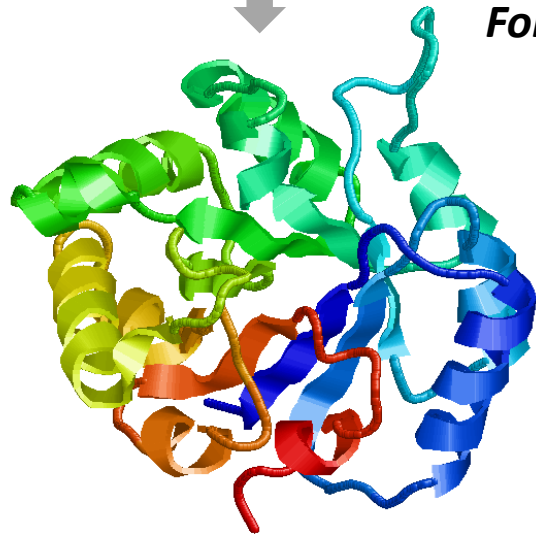
A protein is a long chain of amino acids.

A protein in nature folds into a unique three-dimensional structure.

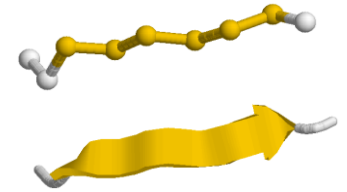
A folded protein is made up of structural motifs, such as α -helix and β -strand.



Folding



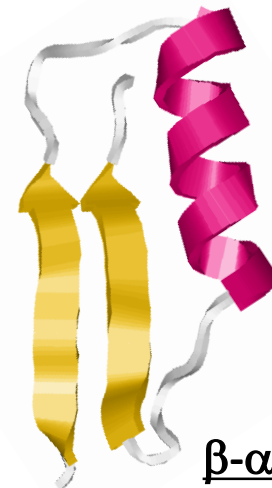
α -helix



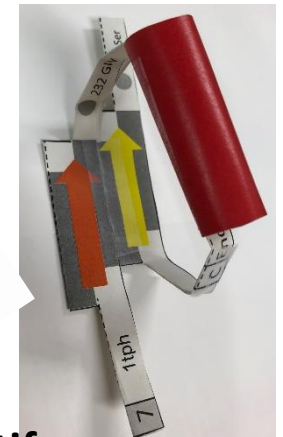
β -strand

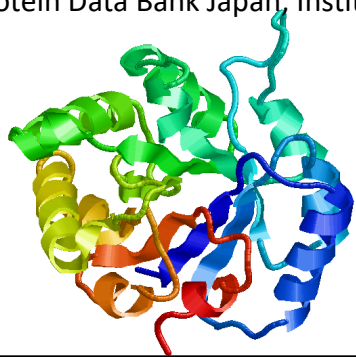
TIM barrel fold: Many enzymes employ this fold. It is made up of eight β - α - β motifs.

β - α - β motif: two parallel β -strand is connected by a α -helix. It is frequently observed in proteins.



β - α - β motif



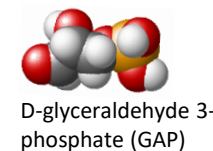
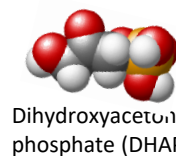


Build a paper model of TIM-barrel

Triosephosphate Isomerase of Chicken
(PDB ID:1tph Chain 1, TPIS_CHICK, 245 amino acids)

Find PDB ID "1tph" from PDB WEB page ([Molmil \(pdbj.org\)](http://Molmil.pdbj.org)), and compare your model and the protein structure

This is an important enzyme in glycolysis. It has been found in almost all the organisms, including animals, plants and bacteria.



(1) Cut out 8 pieces of paper (outlined in solid line)

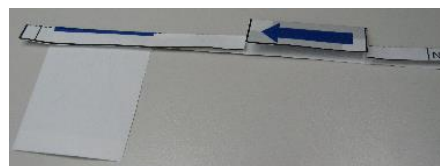
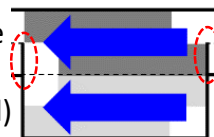
(2) Fold the paper pieces on the mountain-fold line (dotted line)

(3) Roll a colored rectangle into a cylinder so that white region is hidden, and tape it.

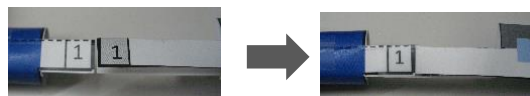


Cylinder is α -helix.

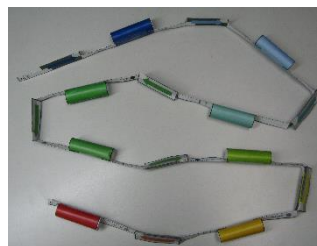
Don't forget to make cuts at the side of the arrows (β -strand)



(4) Tape together two ends with the same number, such as 1, 2, ..., 7, so that a white end is over a gray end.



8 pieces becomes one rope!



(5) Align the 1st blue and 2nd sky blue arrows side by side, and tape them. Note that the 2nd arrow is placed at the right of the 1st, and the cylinder is above the two arrows.



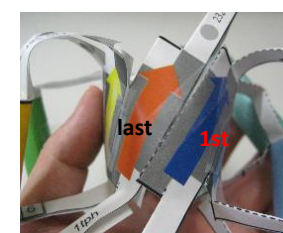
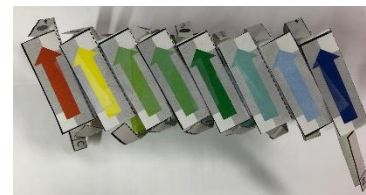
Arrow is β -strand.

β - α - β motif

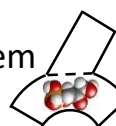
Align gray areas between arrows

(6) Similarly, align and tape 2nd and 3rd arrows, 3rd and 4-th, ..., 7-th and 8-th arrows.

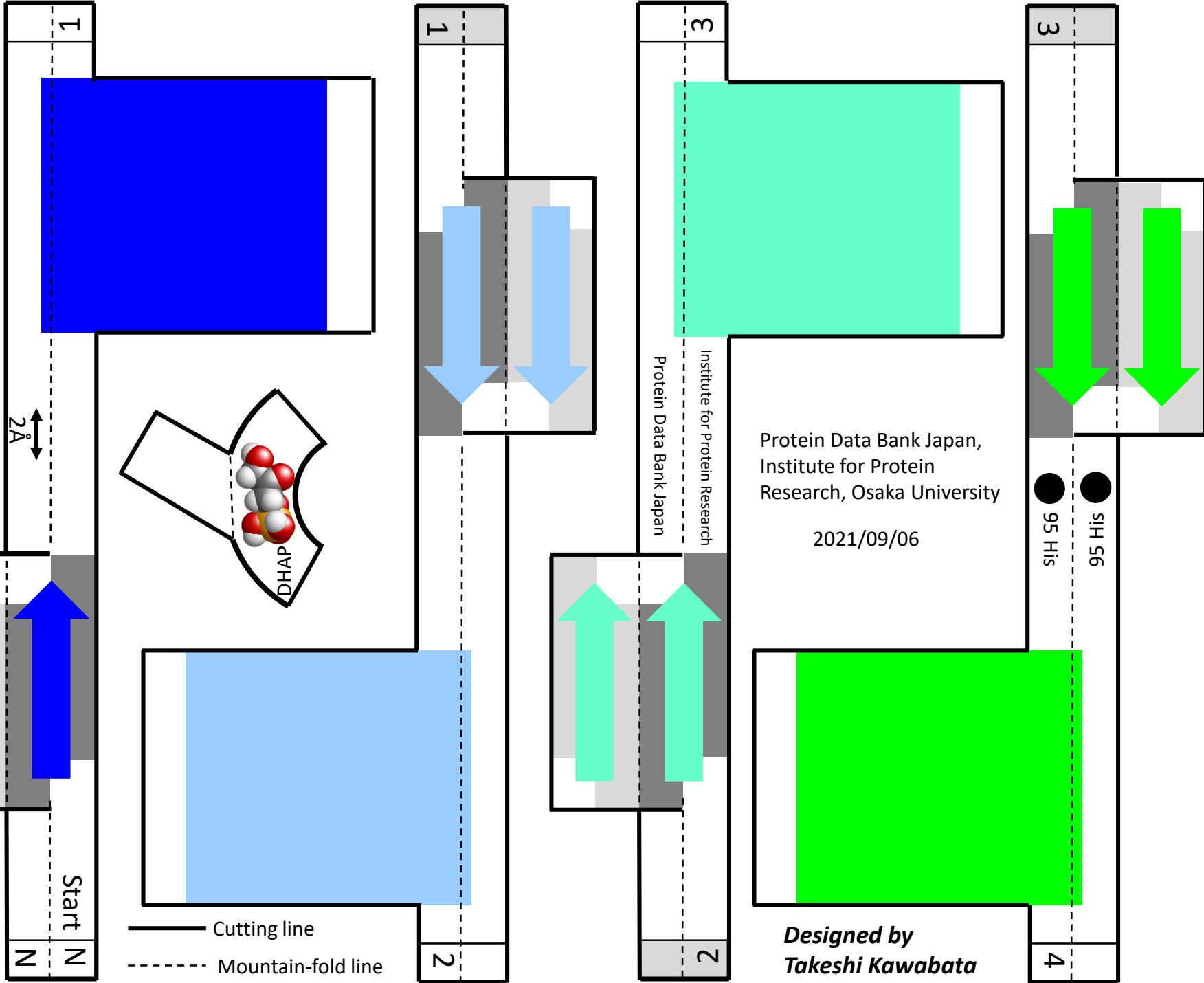
(7) Close the barrel by aligning the last orange arrow and the first blue arrow side by side and tape them.

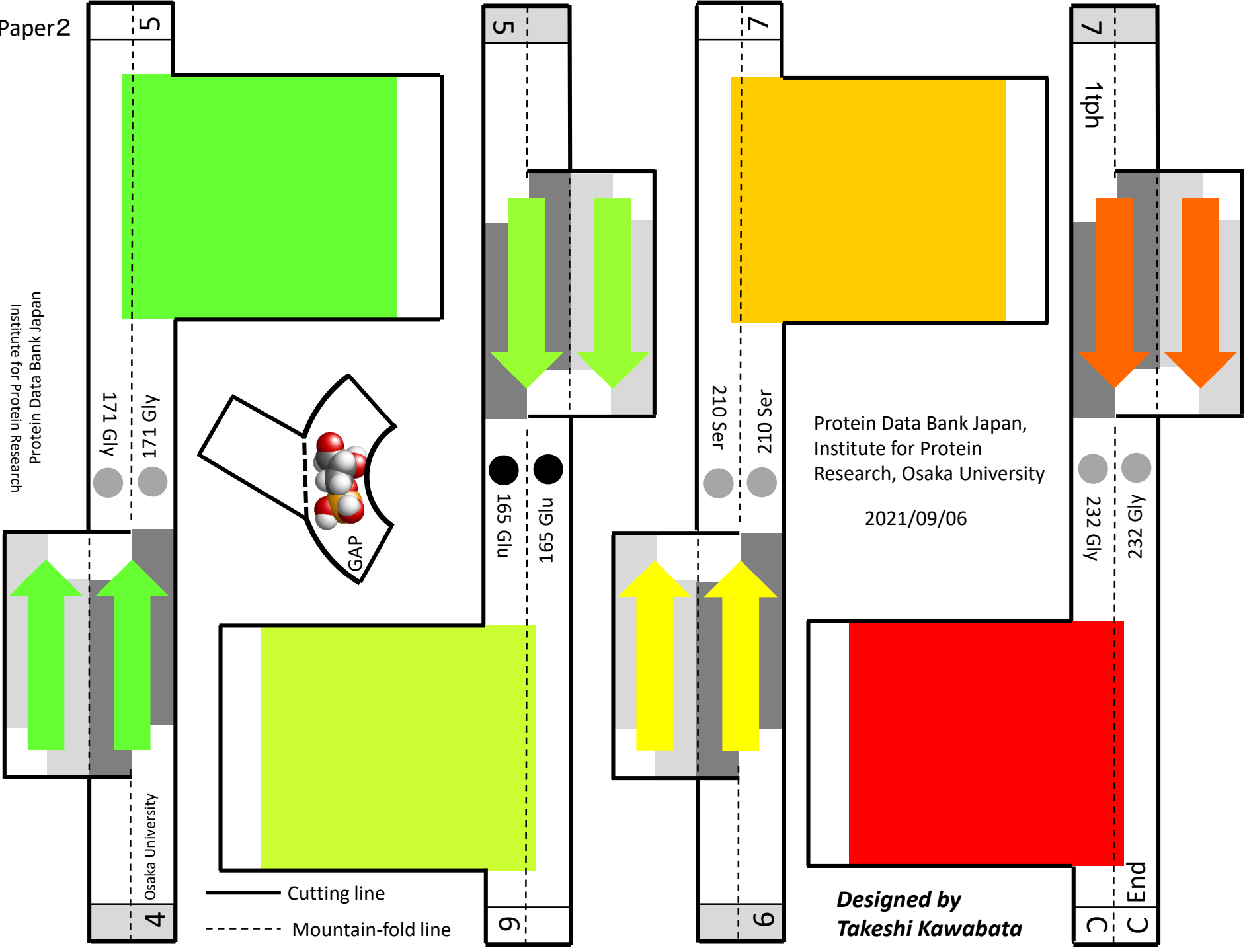


[8] Check the filled black circles ●. They are enzymatic reaction sites. Cut out DHAP and GAP molecules and put them into the barrel.



Paper 1





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Osaka University

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9

7

1tph

End

C