FOLDING OF PROTEIN DOMAINS

TIM BARREL/ALPHA-BETA BARREL

RCSB PDB-101

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The fold is named after the enzyme triose-phosphate isomerase (TIM). The fold is also referred to as the alpha-beta barrel. It is assumed by about 10% of enzymes.

In this type of fold, the beta strands form a beta sheet cluster which closes to form a cylinder called beta barrel in the center, surrounded by alpha helices on the outside. The catalytic site of the enzyme is in the middle of the barrel.

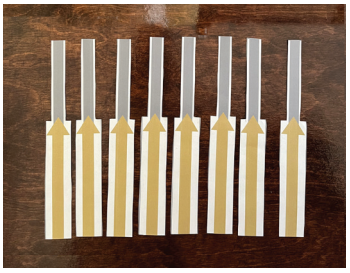
Explore the PDB structure **8TIM** in 3D to see an example of this fold.

DOMAIN FOLDING INSTRUCTIONS

STEP 1

Preparing the components

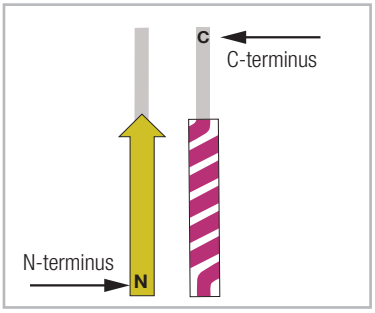
To construct this fold, you will need 8 alpha helices (print 2 sheets) and 8 beta strands (print 1 sheet). 1 beta strand will be left over.



STEP 2

Marking the N- and C-termini

Take one beta strand and mark N on the bottom of the arrow facing up. This will be the first element used. Take one helix and mark C on the extending loop facing up. Put it aside as it will be the last element connected.

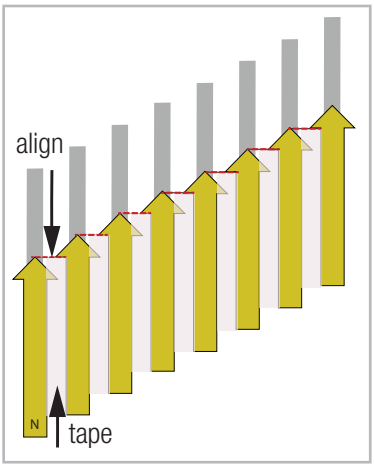


STEP 3

Creating the parallel beta sheet cluster

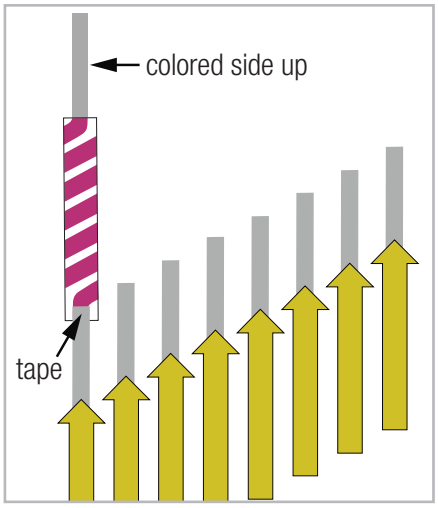
In the TIM fold, the polymer forms a pattern of alternating beta strands and alpha helices. The paper strand generated in this manner is very long and difficult to control when creating the tertiary structure. To simplify, start with creating the beta strand cluster that later forms the barrel, and then attach the surrounding helices.

Starting with the beta sheet marked with the N-terminus, align the arrows side by side so that the arrow tip on the left aligns with the arrow base on the right and tape together. Continue aligning and taping until all 8 arrows are connected side by side.

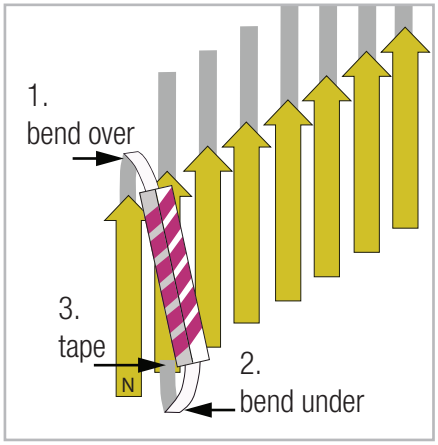


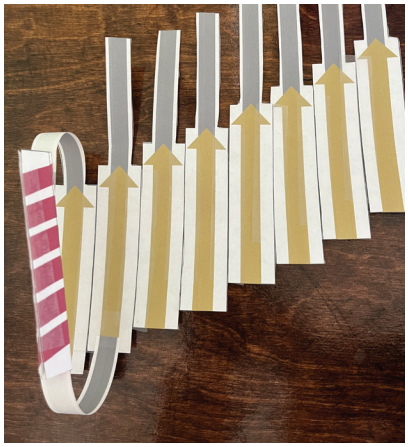
STEP 4
Adding the first alpha helix

Take an alpha helix and orient the prism so the colored side of the adjoined loop faces up. Put it at about 0.25” under the first beta strand loop on the left and tape. The gray extending loop and the pink line representing the helix will now be connected to represent the polymer.



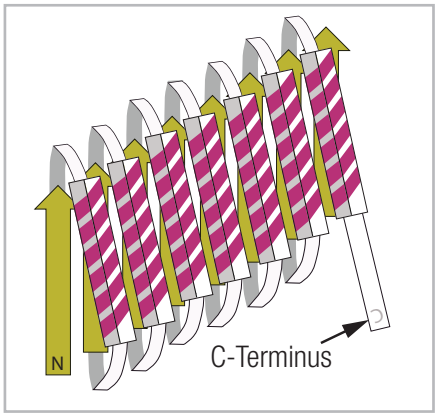
Bend the loop that attaches to the beta strand towards you so the alpha helix is above the beta strand cluster. Now take the loop that attaches to the alpha helix, bend it under, and tape it to the bottom of the next beta strand. When you follow the main line representing the polymer, you will see that it continues over the first beta strand, through the alpha helix onto the next beta strand.





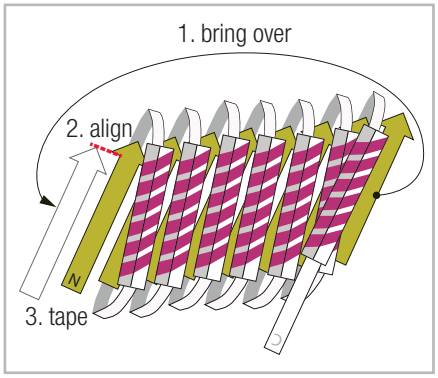
STEP 5
Adding the rest of the helices

Continue to add helices in the same fashion as described in the previous step. The helix that has the C-terminus marked on it should be used last. Bend it over the beta sheet. Now the line representing the polymer is continuous from the N- to the C-terminus.



STEP 6
Connecting the beta barrel

Tape together the two exposed edges of the beta strand cluster aligning them so that the tip of the arrow of the last beta strand aligns with the arrow base of the N-terminal beta strand.



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