PDB-101

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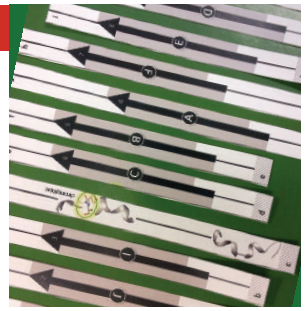
Build a Paper Model of Green Fluorescent Protein (GFP)

GFP is a protein that can exhibit light. It is widely used in biotechnology.

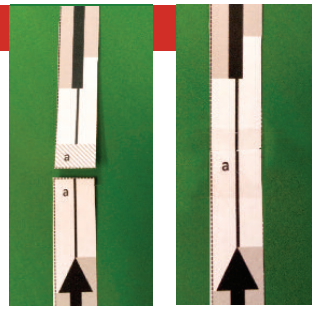
Step1

Cut out the 12 strips of paper (outlined in dotted line) representing the 11 beta strands and 1 helical region of the GFP.



Step2

Tape together the strips so that the **lowercase letter on the white background** (e.g., **a**) **is taped on top** of the same letter on the shaded background. Repeat this for letters **b** through **k** to create a long strip.

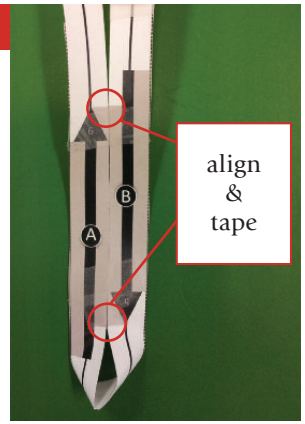


The Primary Structure

The long strip of paper from amino (NH3+) to carboxy (COO-) represents the primary structure of GFP. Regions of secondary structure (beta strands and alpha helices) are marked.

Step 3

Lay the strand labeled **A** on the table **so that the arrow is pointing upwards**, place strand **B** to the right of **A** and orient it **so that the arrow points to the bottom**. Align the grey areas between the strands (representing the hydrogen bonds between them), and tape top to bottom on the aligned grey area.

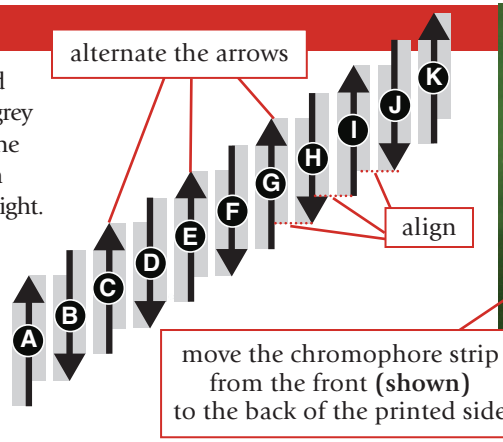


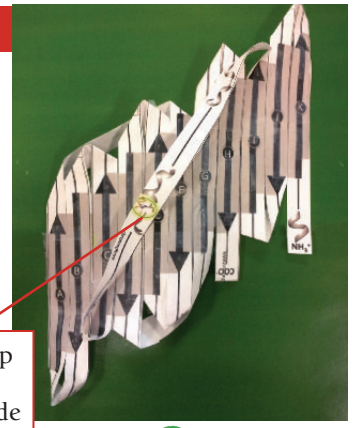
Step 4

Next tape strand **C** next to B, **D** next to C and so on till strand K, in each case aligning the grey areas between the strands and making sure the **arrows in these strands point up and down alternately** as shown in the diagram on the right.

At the end of this step the beta sheet should have strands labeled **A-K reading from left to right**.

At this point make sure the chromophore strip is **behind the printed side of the beta sheet.**





Step 5

Close the GFP beta barrel by aligning the grey area between strands **A and K** and **taping them together**. The chromophore should be inside the barrel.

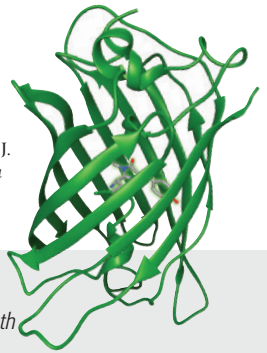
Exploring the Model

1. Can you trace the polymer chain from the amino to carboxy terminus? Hint: the order of the strands from amino to carboxy terminal are marked with the numbers 1-11 (in the arrowheads of each strand).
2. What is the relationship between the strand labels A-K and 1-11? Comment also on the loops between the strands and location of the chromophore.
3. Identify one example each of parallel and antiparallel strands in the GFP barrel.

The GFP model was created using data from the PDB archive

PDB ID: 1EMA

M. Ormo, A. B. Cubitt, K. Kallio, L. A. Gross, R. Y. Tsien, S. J. Remington (1996) Crystal structure of the *Aequorea victoria* green fluorescent protein. *Science* **273**: 1392-1395



Go to **pdb101.rcsb.org** to:

- **READ** the *Molecule of the Month* on Green Fluorescent Protein
- **DOWNLOAD** additional copies of this model, **WATCH** a video demonstration of how to build it, and to access the **DIGITAL ACTIVITY PAGE** allowing for futher exploaration of the 3D model (*Learn* > *Paper Models*)

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