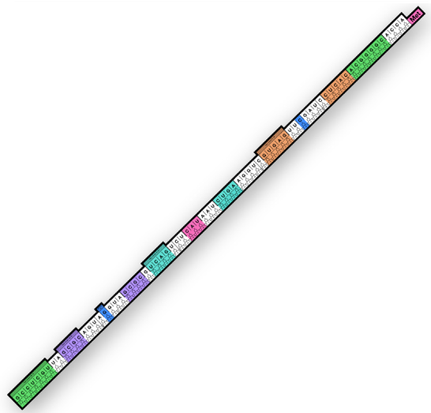
Transfer RNA (tRNA) Paper Model Instructions

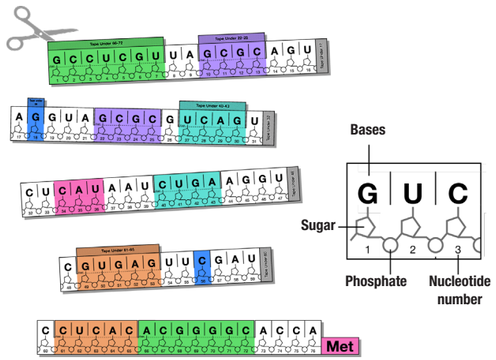
National Human Genome Research Institute

Primary Structure



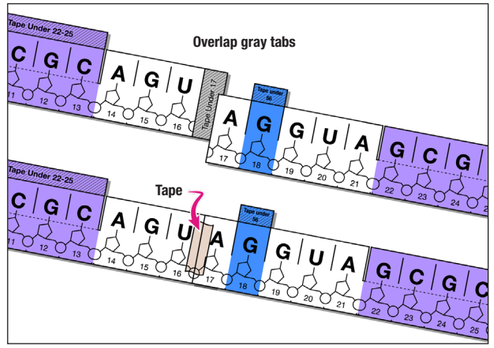
Step 1 - Cut out RNA sequences

Using transparent tape, attach the pieces together following the Instructions on the tab to create one long piece of RNA.



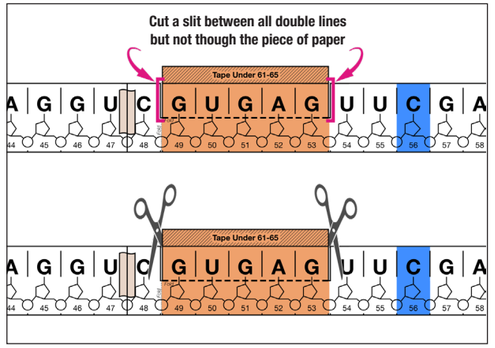
Step 2 - Tape all the pieces together

Using transparent tape, attach the pieces together following the Instructions on the tab to create one long piece of RNA.



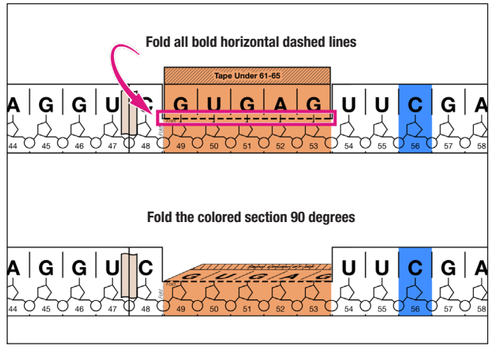
Step 3 - Cut all double lines

Cut between all double lines. Cut down to the end of the double lines to the base of the color, not all the way through the paper.
There are 16 of these double lines.

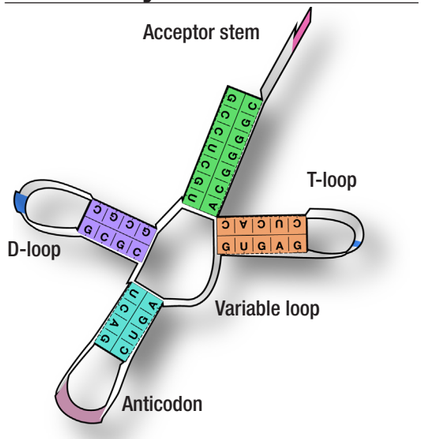


Step 4 - Fold all bold horizontal dashed lines

For most of the colored sequences there is a bold dashed line under the bases. Fold all these bold horizontal dashed lines 90 degrees.
There are 8 of these dashed lines.

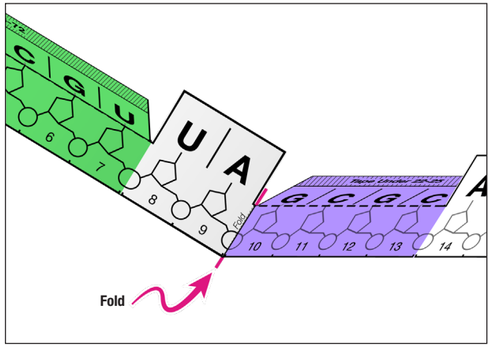


Secondary Structure



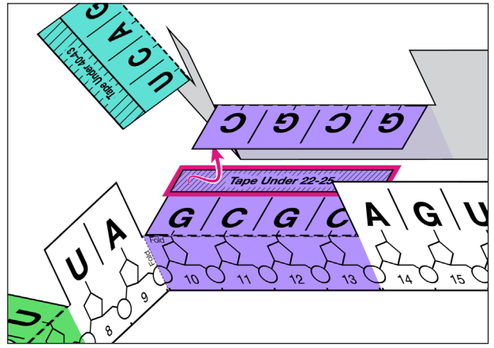
Step 5 - Fold small vertical dashed lines

Make an inside fold to all the small vertical dashed lines, there are 5.
This is necessary for this location to be flexible.

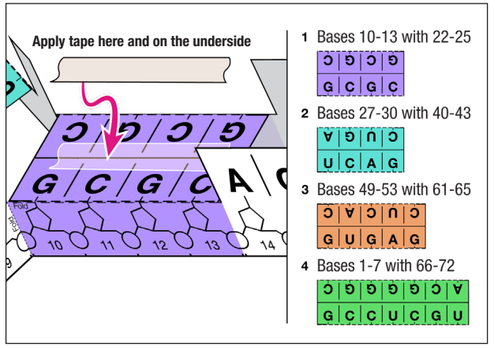


Step 6 - Tape matching colored bases together

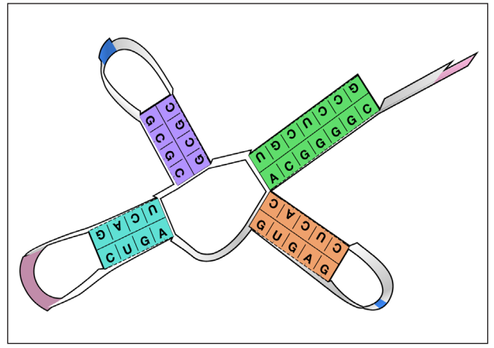
Using transparent tape, attach the pieces together following the Instructions on the tab to create one long piece of RNA.



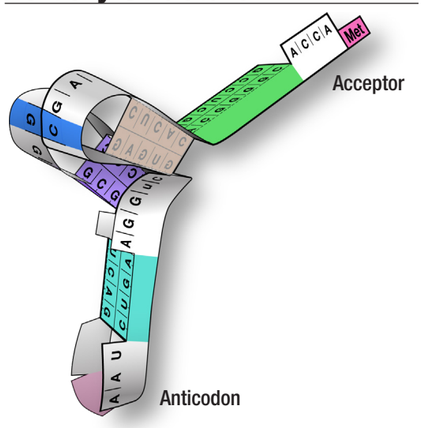
Tape colored bases in the following order.



Notice the almost-perfect base pairing (G:C and A:U bases pair up).
At this point the model is a cloverleaf shape–the secondary structure of tRNA.
Each colored region represents the double helical regions of the structure.

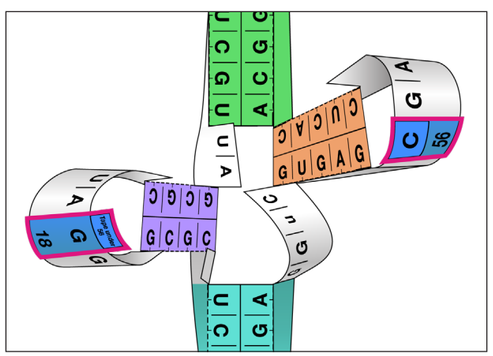


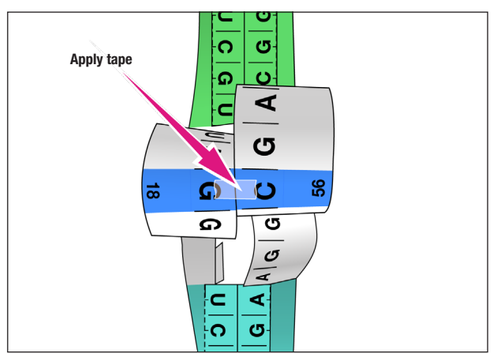
Tertiary Structure



Step 7 - Tape the final G and C

Tape G-18 and C-56 together, outlined here in red.
This forms the beginnings of the tRNA tertiary structure, the inverted L-shape.





Transfer RNA (tRNA)

Transfer RNAs, called tRNAs for short, play a key role in the creation of new proteins, known as translation. The tRNAs serve as links between the messenger RNA (mRNA) and the growing protein molecule. The mRNA is read out in sets of three letters called codons, and each codon corresponds to a specific amino acid, the building block of proteins. By pairing with certain codons on the mRNA molecule, the tRNA ensures that the appropriate amino acid is added onto the new protein. tRNAs fold into a distinct L-shape that helps them carry out this function. One end of the tRNA has a specific sequence to match the codon on the mRNA, and the other end of the tRNA has a site to carry the amino acid that needs to be added to the new protein.

There are 20 different amino acids used in the human body, and this specific tRNA is for the amino acid methionine. Methionine plays a special role in translation because only a few codons can start this process. These are known as start codons, and methionine's codon, AUG, is the most common start codon.

Adapted from PDB-101: Learn: Paper Models: tRNA (rcsb.org)

For more information on tRNA see
NHGRI's Talking Glossary of Genetic Terms,
genome.gov/genetics-glossary/Transfer-RNA

Transfer RNA (tRNA) Paper Model Instructions

To start folding your tRNA, print these pages on 11x17 or tabloid paper

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