

1. Investigate the structure of the tRNA Synthase in complex with a tRNA molecule. (pdb ID 1ASY).
 - a. Why don't tRNA molecules contain a 5' triphosphate like other RNA molecules do?
 - b. Verify that the tRNA contains a 3' hydroxyl and a 5' Phosphate, as all tRNAs should.
 - c. What regions of the tRNA are recognized by the aaRS?
 - d. Find the anticodon loop.
 - i. Describe how the anticodons are positioned relative to the rest of the RNA molecule (i.e. part of a helix, base paired in non-Watson/Crick conformation, flipped out of loop, etc.)
 - ii. What is the sequence of this anticodon? What codon would it pair with? What amino acid does it code for?
 - e. This aaRS will recognize a tRNA molecule with an A or a G at the 3rd anticodon position. Please investigate the structure and propose a way that an A at the 3rd position will be recognized by the aaRS. Why would this aaRS recognize two different codons?
 - f. In addition to the 3' OH of the tRNA, what needs to be present in the active site for this aaRS to be active? Does this structure show an active conformation of the enzyme?
 - g. Find a Dihydrouridine in this tRNA. How does the modification change the three dimensional shape of this base?
2. Show a mechanism for aaRS "charging". Briefly discuss why this is an energy dependent process.
3. Be familiar with the common base modifications in tRNA structures and how they can influence base pairing. Draw m¹G and Ψ.
4. Describe the steps that produce the 5' cap and 3' polyA tail in eukaryotic mRNA.
5. What is the role of the 5' cap in eukaryotic mRNA?
6. What is the lariat form of introns? Sketch how it is formed – this can be very general, but make sure your sketch shows the important steps and what happens to the RNA chain during this process.
7. What is the role of base modifications in tRNA?
8. How do the mRNA and the tRNAs interact with the ribosome. Which subunits make the primary contacts with each polymer?
9. Draw the peptidyl transfer reaction. In your sketch, label the A site and the P site.
10. Describe the initiation process in prokaryotes – include how the initiation factors participate, the role of $tRNA_f^{Met}$, and which steps are energy dependent.
11. Describe the elongation process prokaryotes – include how the elongation factors participate and which steps are energy dependent.