1. Several GTPases play critical roles in protein synthesis. The GTP analog GDPNP, which closely resembles GTP, except for replacement of the $\beta\gamma$ oxygen with nitrogen, binds to GTPases, but is not cleaved to GDP by the GTPases. Predict which steps of protein synthesis would be inhibited in the presence of GDPNP.

2. Identify the translation start codon in the following mRNA sequence:

   (5') AGUUAUGCCCACAUAGCGGCUUCAAGGAGGUAAUCUCAUGCUCACUC
   AAUACCUAUGCGCAUGCUCAUCUAAUGCGAGC (3')

   What is the amino acid sequence of the polypeptide encoded by the above sequence?

3. Amber mutations cause premature termination of protein synthesis by changing a sense codon to a UAG nonsense (stop) codon. An amber suppressor mutation was discovered, in which genes containing amber mutations could be successfully expressed. The suppressor mutation mapped to a gene encoding a minor species of Tyr tRNA. RNA sequencing of the tRNA showed that position 34 of the tRNA was altered by a G to C transversion. Explain the molecular mechanism of nonsense suppression by the amber suppressor tRNA.

4. The anticodon loop of tRNA contains an example of a $\pi$-turn, also known as a "U-turn". In the case of the anticodon loop, the eponymous U is located at position 33, which is a universally conserved uracil in all tRNA structures. Why is a U required at this position to enable formation of the $\pi$-turn? Why wouldn't a C work?
5. Bacterial ribosomes are important targets for anti-microbial antibiotic therapies. Using standard box diagrams to depict the ribosomal tRNA binding sites, tRNAs and factors, show the state of ribosomes in a bacterial cell following treatment with the following antibiotics:

(a) chloramphenicol
(b) gentamycin
(c) spectinomycin
(d) puromycin
(e) fusidic acid
(f) kirromycin