Answer key

BB2950 Molecular Biology, Quiz 5: 12-8-17, 25 points total
PLEASE WRITE YOUR NAME ON THE BACK OF EACH PAGE

1. *(2 points)* 5' caps are:

A. Modified guanine nucleotides added to the pre-mRNA by RNA Pol II with a 5' to 3' linkage.

B. Modified guanine nucleotides added to the pre-mRNA by RNA Pol II with a 5' to 5' linkage.

C. Modified guanine nucleotides added to the pre-mRNA by capping enzyme with a 5' to 3' linkage.

(D) Modified guanine nucleotides added to the pre-mRNA by capping enzyme with a 5' to 5' linkage.

2. *(5 points)* Describe the bonds that are made and broken in the process of splicing, including the order and molecular mechanism of these reactions. Be sure to mention the 5' splice site, 3' splice site, and branchpoint adenine.

The 2'O (OH) of the branchpoint adenosine carries out a nucleophilic attack on the phosphorus (phosphate) at the 5' splice site, forming a bond between the branchpoint 2'O and the 5' end of the intron and breaking the bond between the upstream exon and the intron. The 3'O (OH) of the upstream exon then carries out a nucleophilic attack on a phosphorus (phosphate) at the 3' splice site, forming a bond between the 3' end of the upstream exon and the 5' end of the downstream exon and breaking the bond between the intron and downstream exon.

3. *(3 points)* Match each translation elongation factor to its function:

EF-Tu	Promotes translocation of the mRNA and tRNAs relative to the ribosome
EF-Ts	Promotes exchange of GDP for GTP by another EF
EF-G	Escorts aminoacyl-tRNAs into the A site

4. *(3 points)* Circle the component(s) and property(ies) below that belong to the ribosomal small subunit:

(16S (18S) rRNA)
23S (28S) rRNA
(Ribosomal proteins)
Peptidyltransferase activity
("Decoding center")

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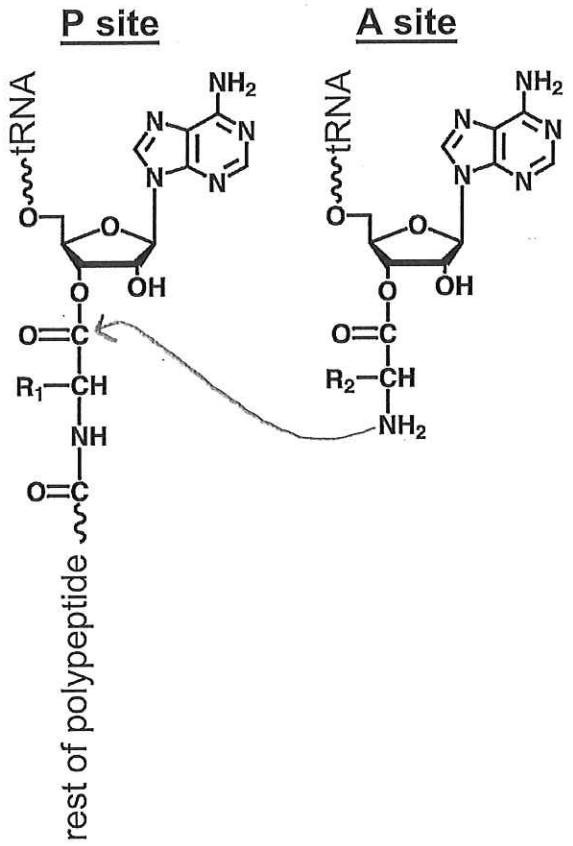
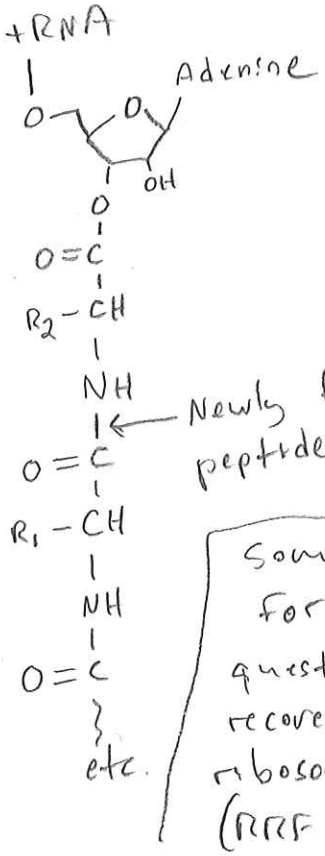
5. *(7 points)* The structures below show the 3' most nts of the tRNAs in the P site and A site of a ribosome, linked to a growing polypeptide chain and a single amino acid, respectively.

2 pts A. A nucleophilic atom in the A site structure will attack an atom in the P site structure to form a new peptide bond. Draw an arrow from the nucleophile to the atom being attacked.

3 pts B. In the space to the right of the figure, draw the structure that will now be linked to the A site tRNA. Include the ribose as shown below, but you do not need to copy the structure of the adenine base (just write "Adenine"). The portions of the tRNA and polypeptide chain shown as squiggly lines as in the figure below can be squiggly lines in your drawing too.

2 pts C. Indicate the newly formed peptide bond in the structure you just drew.





Some points lost for missing steps in question 6 can be recovered by describing ribosome recycling (RRF + EF-G)

6. *(5 points)* What happens when a stop codon enters the A site of a translating ribosome? Briefly describe as many of the subsequent steps as you can.

1. Release factors enter the A site (RF-1 and RF-3 or RF-2 and RF-3)
2. The polypeptide is transfered from the P site tRNA to a molecule of water (the bond between the polypeptide and tRNA is hydrolyzed; water/OH^- attacks the carbonyl C on the polypeptide releasing it from the tRNA).
3. Release Factors dissociate from the ribosome (exchange of GDP for GTP by RF-3 causes RF-1/2 to dissociate, GTP hydrolysis causes RF-3 to dissociate).