1. Cytoplasmic polyadenylation can promote the translation of some mRNA molecules that contain a have short poly(A) tails. _______ binds to the CPE region in the 3’ end of the mRNA in order to mediate the repression of ________. Another molecule, _______ binds both to the CPEB and the eIF4E to help further repress translation.

2. Describe how mRNAs containing CPE sequences that cause translational dormancy can become translationally active.

3. When there are high levels of iron present, _______ is made and _______ is degraded. Conversely, when there are low levels of iron present, _______ is made and _______ translation is repressed. This pathway is mediated by iron levels and by _______.

4. True or False (if False explain why):
   a. DICER RNase uses siRNAs to find complementary mRNAs and direct their cleavage.
   b. The microRNA lin-4 regulates the lin-14 mRNA by binding to sites in the lin-14 3’ UTR.
   c. When an adenosine is deaminated to an inosine, it can be recognized as a “G.”
   d. DNA sequencing can be accomplished using labeled dNTPs for chain termination.
   e. Protein families arise from duplication and convergence.
   f. RNA editing of an mRNA transcript always results in a change in the amino acid that will be encoded.
5. What is a restriction enzyme, how does it work, and why is it useful? How do bacteria protect their DNA from their own restriction enzymes?

6. In a plasmid vector, one of the essential elements for replicating the plasmid is an __________. Another element that is necessary in a plasmid vector is a __________, often amp' is used. __________ are sites in the plasmid vector that contain multiple restriction enzyme recognition sequences. In a bacteriophage vector, the __________ in the phage genome is removed and replaced with your gene of interest. A shuttle vector can replicate in both yeast cells and E. coli cells and thus needs both __________ and __________. Shuttle vectors allow you to __________ your gene in one type of cells and __________ to another type of cells.

7. Why are ddNTPs useful in DNA sequencing?

8. What is a DNA microarray? How are microarrays useful?

9. What does BLAST stand for?

10. You are a BISP 199 student working in a lab that studies heart development. As a first step in determining what genes are expressed during heart development, your slavedriver PI (whose knowledge of molecular biology is a bit sketchy) has assigned you the task of preparing a genomic DNA library from embryonic heart tissue. As an exemplary molecular biology student, you respectfully inform her that her reasoning is flawed and that it would be more logical to prepare a cDNA library for this purpose instead.

   a. Why is it more logical to prepare a cDNA library for her stated purpose? (i.e. what is the important difference between the information contained in these two types of libraries?)
b. Describe the method by which you would go about preparing your cDNA library from embryonic heart tissue.

11. You’ve just entered your masters program and are currently studying the regulation of expression of Brain-Dead 1, a protein you identified that is highly expressed in undergraduate brains during finals week and seems to be important for learning and memory. You find that the gene encoding this protein is very conserved, and that expression in mouse brain similarly goes up during stressful maze-running tasks and you decide to further investigate its regulation and function in mouse.

a. To investigate the mechanism by which Brn-Dead1 expression is regulated, you perform first a northern blot and then a run-on transcription assay. Both assays yield the same result: the levels of Brn-Dead1 RNA in brain samples from unstressed versus maze-stressed mice is exactly the same. What information does this give you about the mechanism by which Brn-Dead1 expression is regulated? (i.e. what TWO mechanisms of regulation do these results allow you to rule out?)

b. How does the information obtained from a run-on transcription assay differ from that you obtain from a northern blot?

c. Based on this result, propose a mechanism by which Brn-Dead1 expression is upregulated during times of mental duress.