MCB*2050 Sample midterm exam-Fall 2013

Section A: Multiple choice

1. After cutting DNA, which of the following enzymes is used to join the ends of two DNA fragments?

a) restriction endonucleases
b) RNA polymerase
c) DNA gyrase
d) DNA ligase
e) Helicase

2. A mutation in which a CAG (codes for glutamine) changes to UAG is an example of a

a) a missense mutation
b) a nonsense mutation
c) a synonymous mutation
d) an in frame deletion
e) an out of frame insertion

3. miRNA, as used in MCB*2050, stands for

a) mitochondria RNA
b) microsatellite RNA
c) mammalian interleukin RNA
d) microRNA
e) multiple interference RNA

Section B: What am I? Enter the answer in the cell to the right for each row. Write out the answer in full, no abbreviations.

| | |
|---|---|
| The name of a cloning vector the size of a yeast chromosome | |
| A structural motif whose shape is dependent on coordination of zinc with cysteine or histidine in an amino acid sequence | |
| The study of all metabolic pathways and their interactions in a cell | |
| The total actual length of the human haploid DNA from 1 cell if all DNAs were linked end for end | |

Section C: Short answers

1. In eukaryotic transcriptional regulation, what is the function of a promoter and what is the function of an enhancer?

2. The following is an mRNA sequence encoding a very short avian polypeptide involved in a hormone response.

5’-GUAGAUGUUAGAUCCACAGAUACGAGAAGUAACAAGUGUCUAGUGAUAAUAAAAAA-3’

Based on this sequence

| | | |
|---|---|---|
| i) | Circle the initiation codon and the termination codon(s) on the sequence above | |
| ii) | How many amino acids does this mRNA encode? | |
| iii) | Write out a 8 ntd primer you would use for first strand cDNA (written 5’ to 3’) excluding the polyA tail | |
| iv) | Write out (written 5’ to 3’) a 8 ntd forward primer (at the 5’ end) you would use to PCR only the start of the ORF | |
| v) | One of the codons is CAG. Write out the full name and single letter code of the amino acid encoded by CAG (remember huntingtin?) | |
| vi) | Describe how would you monitor the expression of this mRNA in a cell line in response to hormone addition (answer in the space below) | |

3. One aspect of functional genomics is to determine the function of a specific gene by knocking it down using siRNA. Provide an experimental approach and supporting rationale to knocking down the cftr gene (whose complete sequence is known).

4. A human STR locus contains a tandem repeat (TAGAT)*n*, where *n* may be any number between 5 and 16. How many alleles of this locus would you expect to find in the human population?

Section D: Longer answer Questions

1. In point form describe the signalling that would occur starting with the insulin peptide and activation of insulin sensitive glucose secretion proteins and how this differs from signalling with a steroid hormone (e.g estrogen or insect ecdysone)