Genetics and Medicine Exam 4 Biology 1010 Spring 2015

1. As the investigator at a crime scene, you take samples from several isolated blood spots. Most large (volume) samples belong to the victim based upon the blood type. Several blood samples are present in minute volumes too small for standard typing. Which of the following techniques would be best used in determining whether the blood sample belonged to the victim or the assailant?
    a. DNA fingerprinting of exons
    b. Cloning of hemoglobin genes
    c. PCR of several single copy tandem repeat (str) DNA sites
    d. DNA restriction endonuclease digestion of chromosomal DNA.
2. Chromosome silencing by making the DNA structure more condensed affects gene/protein regulation by…
    a. Allosteric regulation of individual enzymes.
    b. Transcription of genes.
    c. Post-transcriptional using alternative splicing.
    d. Post-translational modifications such as phosphorylation.
3. Transcription is:
    a. Conversion of a nucleotide sequence into a sequence of amino acids.
    b. Making a complementary RNA sequence to one strand of a DNA molecule.
    c. Making a complementary sequence of RNA for both strands of a DNA molecule.
    d. Annotation of the DNA sequence to determine the location of the genes.
4. Which is not a characteristic of the Genetic Code?
    a. Many amino acids are encoded by more than one code word.
    b. It has stop sequences.
    c. It varies significantly between different organisms.
    d. The code is read in a linear sequence of three nucleotides at a time.
5. Reverse transcriptase is an enzyme which functions to:
    a. Transcribe mRNA from a strand of DNA and then recopy the DNA
    b. Help strengthen the bonds between the base pairs of a DNA:RNA hybrid strand
    c. Copy and mRNA into a DNA:RNA hybrid prior to displacing the RNA and making a complementary DNA strand
    d. Separate the two strands of DNA so that they can be copied into both a DNA and an RNA copy
6. Of the features listed below, which one most likely explains why influenza viruses can change antigenic properties so quickly?
    a. DNA viruses are single stranded and can be more easily mutated and copied.
    b. Cells infected with two different strains of virus can shuffle their 9 segments of their genome giving many possible new combinations.
    c. The viral interaction with the lysosome strips the protein protection or coat off of the virus making it more infective.
    d. When mature proteins bud off the cell they can carry a wide assortment of proteins in the membranes surrounding them.
7. Ebola is a _____ disease with _____ infectivity.
    a. Bacterial…high
    b. Viral…high
    c. Bacterial…low
    d. Viral….low
8. In the lactose operon E. coli, the _____ is always available and it works by binding to the ____.

a. Repressor….operator
b. Inducer…repressor
c. Promoter…repressor
d. Operator…inducer

9. Antibiotics, such as streptomycin can obstruct protein synthesis in bacteria but not humans because
   a. Eukaryotic and prokaryotic ribosomes are different.
   b. Eukaryotic, and not prokaryotic ribosomes are located on the endoplasmic reticulum
   c. Eukaryotic, and not prokaryotic ribosomes are made up of both RNA and protein
   d. Eukaryotic, but not prokaryotic codon recognition catalyzes peptide bond formation in proteins
10. Prions are proteins that cause disease because they:
   a. Contain more than one type of polypeptide
   b. Display a high degree of rigidity when attached to nucleic acid
   c. Contain amino acids coded by mutations, and therefore have altered chemical properties
   d. Contain a transmissible conformation
11. The ribosome
   a. Is composed of two subunits that separate after completing translation of the mRNA.
   b. Can only function with transcripts of the identical gene thus many ribosomes are needed to maintain the cell.
   c. Has four sites for binding important components like tRNAs, mRNA, amino acids, and the part of the peptide already made.
   d. Is needed to be certain that the correct amino acid is attached to the correct tRNA.
12. Which of the following mechanisms for transcriptional regulation is shared between bacteria and eukaryotic organism?
   a. miRNA binding to eliminate mRNAs
   b. condensing the DNA such that RNA polymerase will not bind
   c. having regulatory proteins that either inhibit or assist in RNA polymerase binding to the promoter.
   d. Having genes involved in a single function, i.e. amino acid synthesis, be organized into operons
13. In preparing a vaccine each year for flue, government scientists
   a. Identify a dozen flu viruses that are each used for producing the vaccine
   b. Test the viruses to see which one is the most dangerous and make a vaccine against that
   c. Combine three viruses with a benign virus to fabricate a combination vaccine
   d. Identify the most dangerous virus and make a vaccine against that.
14. The studies by Yamanaka and others with stem cells have shown
   a. That only human embryonic stem cells are totipotent
   b. That induced pluripotent stem cells are dangerous
   c. That differentiated cell types can be converted into induced pluripotent stem cells
   d. That human embryonic stem cells can be converted into induced pluripotent stem cells
15. The biologist Harry Meade, a farmer's son now working in Massachusetts, is producing the human protein Antithrombin III in goats. Which of the following steps was the most important in generating a herd of Antithrombin III producing goats?
   a. To build several 1 million dollar barns
   b. To sequence the gene for antithrombin III
   c. To place the cDNA for antithrombin III into the goat genome next to a strong promotor
   d. To develop a means for getting rid of casein from the milk

Essay questions

1. Toward the end of the video on stem cells, Rudolf Jaenisch of MIT described experiments using genetically engineered mice that had sickle cell disease. Discuss these experiments and their significance. (4 points)
2. Describe two different types of RNAs noting differences between them with respect to their structural, functional and locational properties (6 points).