



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SBC 221: MOLECULAR AND CELL BIOLOGY

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DATE: MONDAY 2ND APRIL 2012

TIME: 11.00 A.M. – 1.00 P.M.

INSTRUCTIONS

SECTION A: ANSWER ALL QUESTIONS

1. The process of ____ involves the introduction of a gene into a cell where it exchanges places with its counterpart in the host cell.
 - a) transgenic technology
 - b) gene targeting
 - c) knockout technology
 - d) recombinant DNA technology

2. Genetic engineering manipulates gene products at the level of the
 - a) protein.
 - b) amino acid.
 - c) DNA.
 - d) RNA.

3. Which of the following tools of recombinant DNA technology is INCORRECTLY paired with one of its uses?
 - a) restriction endonuclease - production of DNA fragments for gene cloning.
 - b) DNA ligase - enzyme that cuts DNA, creating sticky ends.
 - c) DNA polymerase - copies DNA sequences in the polymerase chain reaction.
 - d) reverse transcriptase - production of cDNA from mRNA.
 - e) electrophoresis - RLFP analysis.

4. Which of the following is true of the polymerase chain reaction?
- a) It enables a small amount of DNA to be amplified.
 - b) It involves the addition of a poly-A sequence to mRNA.
 - c) It cuts DNA into numerous small fragments for analysis.
 - d) It separates DNA fragments according to size.
 - e) It requires RNA in order to proceed.
5. Exons of a gene are defined as
- a) the untranslated regions of the corresponding mRNA
 - b) regions in the corresponding mRNA that are involved in initiation of transcription
 - c) regions that are not transcribed by RNA polymerase
 - d) regions that are excised from the corresponding protein after it is synthesized
 - e) regions that remain in the corresponding mRNA after splicing
6. Restriction enzyme recognition sites are often palindromic because
- a) DNA is an antiparallel double helix, so the two strands are the equivalent
 - b) In a recognition site the number of A's is the same as the number of T's, and the number of G's is the same as the number of C's.
 - c) Restriction enzymes typically bind to DNA as dimers
 - d) Processing an mRNA requires the spliceosome, which "restricts" the genomic contribution to a gene by removing introns
7. What primers could you use to amplify the target DNA sequence indicated by the dots? Be sure to specify both primers in the 5'-to-3' direction.
- 5'GGCTAAGATCTGAATTTTCCAAG...TTGGGCAATAATAATGTAGCGCCTT 3'
8. True or false Exons contain the coding sequence, 5' UTR, and 3'UTR
9. True or false. Exons make up the processed mRNA sequence
10. True or false Exons start with GU (GT) and end with an AG sequence
11. Compute the complementary strand for the following sequence
- atggtcacctgactcctgaggagaagtctgcggttactgccctgtggtag

12. Once RNA polymerase has made the first phosphodiester bond, it doesn't ever stop until it reaches the termination signal at the end of the mRNA sequence.

True or false

13. Which of the following is a true statement regarding transcription factors and the enhancer elements that they bind?

14. Each gene within the genome can only be bound and regulated by a single transcription factor.

15. All genes that are repressed during development are bound by the same transcription factors.

16. Enhancers can be simultaneously bound by multiple transcription factors.

17. Each transcription factor binds to and regulates the transcription of only a single gene.

18. Imagine that you are using DNA microarrays to determine the differences between the RNA profiles of wild type skin cells and that of cancerous skin cells. The RNA from wild type is labeled in red while the RNA from the cancerous cells is labeled in green. What does it mean if a gene spot on the microarray slide is red.

- a) The gene is transcribed at higher levels in the wild type skin cell sample.
- b) The gene is transcribed at higher levels in the cancerous skin cell sample.
- c) The gene is transcribed at equal levels in both tissue samples.
- d) The gene in question is not expressed

19. What does it mean if a different gene spot on the micorarray slide is yellow?

- a) The gene is transcribed at higher levels in the wild type skin cell sample.
- b) The gene is transcribed at higher levels in the cancerous skin cell sample.
- c) The gene is transcribed at equal levels in both tissue samples.
- d) The gene in question is not expressed

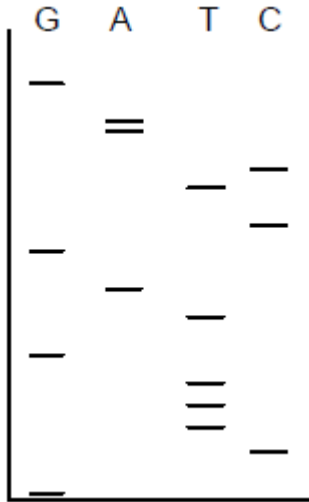
20. And what does it mean if a third gene spot on the microarray slide is black?

- a) The gene is transcribed at higher levels in the wild type skin cell sample.
- b) The gene is transcribed at higher levels in the cancerous skin cell sample.
- c) The gene is transcribed at equal levels in both tissue samples.
- d) The gene in question is not expressed

Section B: ANSWER ALL questions (5marks each)

1. Shown below is an autoradiograph of a DNA sequencing experiment performed by the method of Sanger. What is the sequence of the DNA?

Indicate polarity.



2. Which subunit of DNA polymerase has the;
catalytic activity?

3'-5' exonuclease activity?

5'-3' exonuclease activity

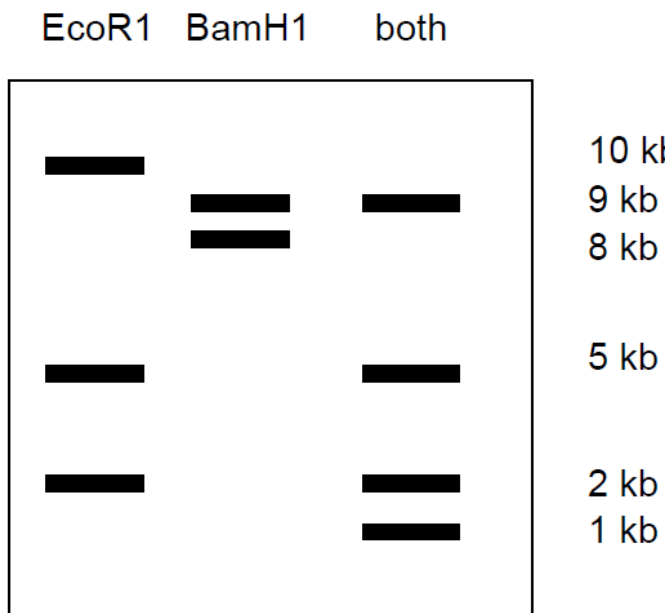
3. A linear DNA molecule is subjected to complete restriction digestion by (1) EcoR1 alone, (2) BamHI alone, and (3) both enzymes together.

The fragments are run on a gel. Results are shown below.

(a) How long is the original DNA molecule?

(b) How many EcoR1 recognition sites does it have?

(c) Does the longest EcoR1 fragment contain a BamH1 restriction site?



4. What are the key features of a plasmid vector when considering their use in recombinant clone production?
5. Describe three different mechanisms of regulation of gene expression transcriptionally process
6. How does the color intensity measured for a given gene in a microarray experiment related to the expression level of the gene?

Section C – answer any two questions 10 marks each

1. Outline the process of pyrosequencing, as used in Next Generation sequencing
2. Outline the Cyclic reversible termination method as it is used in imaging in Illumina/Solexa sequencing
3. By using the techniques of genetic engineering, scientists are able to modify genetic materials so that a particular gene of interest from one cell can be incorporated into a different cell. Describe a procedure by which this can be done.