UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, DECEMBER 1999

Fourth Year - Programs, 5bm(c), 5bm(e)

BME495F - MOLECULAR AND CELLULAR BIOLOGY

Exam Type: A

Examiner - P. Y. Wang

(ANSWER ANY 8 QUESTIONS; Each Question=12.5%)

(1) Use 1 example each, with formulas and equations, to illustrate the following basic reactions -
   (a) action of alkali on RNA
   (b) hydrazinolysis of DNA
   (c) protective group in nucleotide chain extension synthesis
   (d) end-group labeling in peptide and DNA sequencing
   (e) affinity labeling.

(2) Explain clearly with sketches and examples where applicable -
   (a) the differences and causes therefor between chromatin and chromosome
   (b) the procedure whereby the nuclear DNA's in an eucaryote cell can be visualized, counted, and grouped.

(3) With sketches, describe in detail the replication in E. coli with respect to -
   (a) oriO
   (b) unwinding the dsDNA
   (c) DNA polymerases and ligase action
   (d) differences in termination as compared to eucaryote cells
   (e) release of the super coil.

(4) In transcribing a structural gene in bacteria, describe, with sketches where applicable -
   (a) the initiation steps
   (b) RNA chain elongation
   (c) termination
   (d) how the lactose operon is regulated.

(5) In assembling the 30S and 50S rRNA for translation, describe with sketches -
   (a) the functions of IF-1, IF-2, IF-3 and EF-Tu
   (b) translocation with EF-G
   (c) termination by RF.

(6) In decoding of mRNA codons, describe -
   (a) the isolation and charging of the t-RNA
   (b) the procedure to decipher the genetic code in a bacterial cell-free system.

(7) In mapping genes on a bacterial chromosome, give a detailed explanation, with sketches, on -
  (a) requirements for conjugation
  (b) insertion sequence
  (c) principle of mapping genes at tail end of the cDNA.

(8) In the recombinant DNA biosynthesis of luciferase, show, with sketches where applicable, how -
  (a) the mRNA is isolated and identified
  (b) the mRNA is transcribed into DNA and inserted into a plasmid vector
  (c) the luc gene is turned on.

(9) With examples, describe and explain -
  (a) molecular bases of immunogenicity
  (b) isotypy, allotypy and idiotypy
  (c) humoral- and cell-mediated immune responses
  (d) breaking immune tolerance
  (e) complement activation.

(10) Use a haptenated antigen -
  (a) show that the Ab produced by a Balb/c mouse is polyclonal
  (b) explain clearly the reason for the Ab diversity
  (c) show that the Ab's are secreted by spleen cells
  (d) explain the principle and describe the procedure in preparing mAb specific for the hapten only.

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