UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, DECEMBER 2000

Fourth Year - Program AEESCBASCB

BME495H1 F - MOLECULAR AND CELLULAR BIOLOGY

Exam Type: A
Examiner - P.Y. Wang

(ANSWER ANY 10 QUESTIONS; Each Question = 10%)

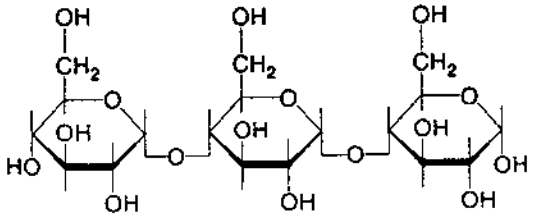
(1) Explain clearly, with chemical equations and formulas, how to introduce radioactive isotope as label to -
(a) a protein, such as chymotrypsin,
(b) D-glyceraldehyde-3-phosphate.
Show how the isotope-labeled molecules can be counted.

(2) With sketches, chemical equations and formulas where applicable, show and EXPLAIN how to -
(a) visualize polynucleic acids on PAGE,
(b) distinguish polyRNA from polyDNA with a chemical reaction,
(c) demonstrate the presence of RNA primer in replication,
(d) separate mitochondria from ribosomes.

(3) Describe briefly the structural features of 3 major types of lipids. With formulas and equations show how the steroid rings are biochemically assembled from a linear polyolefin.

(4) With chemical equations and formulas show how an aldotriose from glycolysis is converted into acetyl co-enzyme A. How many H^- are transferred during the process?

(5) Explain clearly with chemical equations and formulas where applicable, why different approaches are required for sequencing the following 4 linear oligomers:
(a) Gly-Phe-Ala,
(b) 5'pApTpG3',
(c) 5'UpUpA3',
(d)



(6) With formulas and complete chemical scheme, show how a gene machine can polymerize nucleic acid monomers with the same directional specificity like DNA polymerase in replication.
Show the hydrolytic specificities of an endo-, an exo-, and a restriction nuclease.

(7) In counting chromosomes in diploid cells, explain clearly -
(a) the choice of cells and how to isolate them,
(b) the use of Con A and Colcemid. Sketch the appearances of the nucleus when they are added.
(c) the need to count at least 40 cells,
(d) how to distinguish a human chromosome among mouse chromosomes.

(8) With sketches explain clearly the differences, during the replication of haploid and diploid cells, -
(a) at the start,
(b) at termination,
(c) in appearances of the chromosomes just before the new strands are separated.

(9) With sketches describe -
(a) the components of a bacterium cell,
(b) how a structural gene is transcribed.

(10) Describe with sketches how mRNA is aligned in the 30S/50S rRNA for translation. How does the translation process distinguishes fMet-tRNA and Met-tRNA?

(11) Explain clearly with example, why a structural gene cannot be located by chemical DNA sequencing. Describe the principle of gene mapping in E. coli.

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