

香港中文大學
The Chinese University of Hong Kong
Course Examinations 2002-03 年度科目考試

Course Code & Title 科目編號及名稱: BCH 2010 Cellular Basis of Biochemistry

Time allowed 時間: 2 hours 小時 minutes 分鐘

Student I.D. No. 學生編號: Seat No. 座號:

Use one answer book for sections A & B and use another answer book for sections C & D. Please return the question paper together with your answer book.

SECTION A (10 marks): COMPULSORY questions. This question carries 10 marks.

1. A pulse-chase experiment was performed to determine the movement of various microtubule-associated proteins (MAPs) in neurons. A group of rats were injected with radio-labelled amino acids and were subsequently killed 4, 6 and 13 days after the injection. Neurons isolated from the sacrificed (killed) rats were aligned and then cut into 15 consecutive 4 mm segments. Each segment was isolated and analyzed separately by gel electrophoresis. Please refer to the supplementary sheet (page 3) for figures.

Figure A shows the transport profile of radio-labelled MAPs at 4 days, 6 days, and 13 days after the injection of radio-labelled amino acids. The lanes (S1-S15) represent the 15 consecutive 4 mm nerve segments distally to the point of injection (the ribosome-containing cell bodies).

Figure B illustrates the position of injection of radio-labelled amino acids and the alignment of the neuron after isolation.

- a) (4 marks) Comment on the relative rate of the movement of MAPs A1, B and C.
- b) (2 marks) Comment on whether these proteins are transported directionally?
- c) (4 marks) Protein A is post-translationally modified and exists in two forms: A1 and A2. The ONLY difference between the two proteins is the presence of an extra phosphate group in A1. Comment on the relative transport rate of proteins A1 and A2.

SECTION B (20 marks): Answer ANY TWO questions. Each question carries 10 marks.

- 1. Briefly discuss, with examples, the SNARE hypothesis.
- 2. Briefly discuss how a single-pass membrane protein is synthesized and integrated to the membrane of endoplasmic reticulum.
- 3. Briefly discuss the various properties of cytoskeletal polymers.

SECTION C (20 marks) : Answer ONE question. Each question carries 20 marks.

1. Discuss, with examples, how monomeric G-proteins are used to control vesicular transport.
2. Discuss the roles of microtubules in intracellular transport.

SECTION D (50 marks): Answer question 1 and ANY ONE from questions 2-3.

1. (30 marks) Write brief notes on **ANY THREE** of the following topics: (*compulsory*)
 - a) The signal transduction cascade in the visual excitation of a rod cell.
 - b) The signal transduction pathway of nitric oxide.
 - c) Cell adhesion mediated by proteins and carbohydrates.
 - d) The structure of eukaryotic nucleus and chromosomes.
2. Signal transduction cascade mediated by the receptor tyrosine kinase plays an important role in cell proliferation and tumorigenesis (cancer formation).
 - a) (12 marks) Describe briefly the ras-dependent and ras-independent pathways mediated by the receptor tyrosine kinase.
 - b) (8 marks) Explain why many proteins participated in these pathways are oncogenes.
3. The cell division cycle is the fundamental means by which all living things are propagated.
 - a) (8 marks) Briefly describe the characteristics of the four successive phases of a standard eukaryotic cell cycle.
 - b) (12 marks) What are the roles of cyclins and cyclin-dependent protein kinases in eukaryotic cell cycle?

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Supplementary materials to Section A

