

THE UNIVERSITY OF MELBOURNE

SEMESTER 1 ASSESSMENT, 2003

DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY

521-303 – MOLECULAR ASPECTS OF CELL BIOLOGY

EXAM DURATION: Two and a half (2 ½) Hours

READING TIME: Fifteen (15) Minutes

COMMON CONTENT: No

THIS PAPER HAS 4 PAGES

Authorized Materials:

No specific materials are authorized.

Calculators are permitted but not required. No other special accessories necessary.

Instructions to Invigilators:

Please supply three (3) 14-page Examination Booklets.

Instructions to Students:

Attempt **ALL** six (6) questions

Use a SEPARATE script book for **EACH** section

Total Marks for the paper: 120

This paper may be lodged with the Baillieu Library

USE A SEPARATE ANSWER BOOKLET FOR EACH SECTION

SECTION A

Answer **EACH** of the following questions.

Question 1

(a) Define the function and describe the location of the following components in the eukaryotic cell:

- * Tom20
- * α -importin
- * v-SNARE
- * AP-2 complex
- * Nef
- * cpSecA
- * Tom40

(14 marks)

(b) What is the function of Sar1 in vesicle-mediated cargo transport. What experimental evidence supports this model?

(6 marks)

(20 marks total)

Question 2

(a) In one or two sentences, describe the following targeting sequence motifs:

- * an internalization signal for receptor-mediated endocytosis.
- * a chloroplast transit sequence.
- * a thylakoid targeting sequence.
- * a nuclear localisation sequence.
- * a mitochondrial targeting sequence.

(5 marks)

(b) Describe the experimental strategy used by Schnell and Blobel to identify the protein import (TOC) machinery in the chloroplast outer envelope.

(10 marks)

(c) We now know something of the three-dimensional structure of the TOC complex and the TOM complex. How were the TOM and TOC complexes isolated from the organelle membranes and which experimental technique(s) were used to determine these structures?.

(5 marks)

(20 marks total)

SECTION B (start a new booklet)

Answer **EACH** of the following questions.

Question 3

Briefly discuss **FOUR** (4) of the following six topics:

- A. The trafficking of the KDEL receptor.
- B. Advantages of the green fluorescent protein (GFP) in the study of membrane transport.
- C. The role of the Golgi apparatus in N-glycosylation.
- D. Lipid rafts.
- E. Experimental evidence for the involvement of cadherins in cell-cell adhesion.
- F. Cell polarity in epithelial cells.

(4 x 5 marks = 20 marks total)

Question 4

Answer **ONE** (1) of the following two topics:

- A. Discuss the transport of cargo from the cell surface through the endosomal pathway to the lysosomes. Include in your answer the nature of the transport vesicles and intracellular compartments on route to the lysosomes.

(20 marks)

OR

- B. Discuss the role of integrin receptors in cell-matrix adhesion and cell-cell adhesion.

(20 marks)

(20 marks total)

SECTION C (start a new booklet)

Answer EACH of the following questions

Question 5

- (a) Briefly discuss TWO (2) of the following three topics:
- A. A genetic approach to identifying proteins involved in translocation into the endoplasmic reticulum.
 - B. The role of N-linked oligosaccharides in quality control in the endoplasmic reticulum.
 - C. The structure and function of kinesin and kinesin-related proteins.

(2 X 5 marks = 10 marks total)

- (b) Draw a diagram describing the mechanism of co-translational protein import into the endoplasmic reticulum and briefly describe the role of each of the proteins involved in the process.

(10 marks)

(20 marks total)

Question 6

Answer ONE (1) of the following two topics

- A. Discuss the roles played by matrix metalloproteinases (MMPs) in health and disease.

(15 marks)

Briefly outline the types of experimental approaches used to probe the involvement of MMPs in various cellular processes.

(5 marks)

OR

- B. Giving examples, discuss the importance of intracellular localization in cell proliferation signalling pathways.

(20 Marks)

(20 marks total)

END OF EXAMINATION