

COPY

THE UNIVERSITY OF MELBOURNE

SEMESTER 1 ASSESSMENT, 2004

DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY

521-303 – MOLECULAR ASPECTS OF CELL BIOLOGY

EXAM DURATION: Three (3) Hours

READING TIME: Fifteen (15) Minutes

COMMON CONTENT: No

This paper contributes 80% of the total assessment for 521-303

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 six (6) 6-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 QUESTION

Question 1 (suggested time 30 minutes)

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

- * Tom20
- * Hsp60/Cpn60
- * cpSecA
- * Nef
- * Ire1
- * ERGIC53

(12 marks)

- (b) What are two structural features found in most SNAREs using sequence analysis? Describe at least one experimental approach to identify SNAREs from genome sequence data.

(8 marks)

(20 marks total)

Question 2 (suggested time 30 minutes)

Use a new booklet

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

- * an internalization signal for receptor-mediated endocytosis
- * a chloroplast transit sequence
- * an endoplasmic reticulum retention/retrieval sequence
- * a mitochondrial targeting sequence
- * an endoplasmic reticulum signal sequence

(5 marks)

- (b) Explain how bi-partite signals direct proteins into the lumen of thylakoids.

(5 marks)

- (c) Describe the experimental strategy used by Rothman and co-workers to purify the clathrin-uncoating ATPase.

(10 marks)

(20 marks total)

USE A SEPARATE ANSWER BOOKLET FOR EACH QUESTION

Question 3 (suggested time 30 minutes)

Use a new booklet

Briefly discuss FOUR (4) of the following seven topics:

- A. COPI coats
- B. Vesicular tubular clusters (VTC)/intermediate compartment
- C. The use of chemical cross-linking to identify protein components of the ER translocon
- D. Types of experiments used to analyse the in vivo functions of matrix metalloproteinases
- E. Early endosomes
- F. The role of N-glycosylation in quality control in the endoplasmic reticulum
- G. The steps involved in purification of cellular organelles (no experimental detail necessary)

(4 x 5 marks = 20 marks total)

Question 4 (suggested time 30 minutes)

Use a new booklet

Discuss TWO (2) of the following three topics (you may use diagrams if you wish):

- 1. Compare and contrast kinesin and myosin motors.
- 2. List two GTP-binding proteins or complexes involved in protein translocation into the ER and describe their roles in this process.
- 3. The role of membrane microdomains in intracellular transport and signaling.

(2 x 10 marks = 20 marks total)

USE A SEPARATE ANSWER BOOKLET FOR EACH QUESTION

Question 5 (suggested time 30 minutes)

Use a new booklet

During this course you have learned about several members of the Ras superfamily of small GTP-binding proteins that are involved in intracellular protein trafficking and in signal transduction in eukaryotic cells.

- (a) Name THREE (3) small GTP-binding proteins involved in intracellular protein trafficking, and describe the function of each one in one or two sentences. **(6 marks)**

- (b) Name THREE (3) other small GTP-binding proteins that are involved in the organization of actin filaments. Using diagrams if you wish, describe how the activation of these proteins by various extracellular stimuli leads to alterations in cell morphology and motility.

(14 marks)

(20 marks total)

Question 6 (suggested time 30 minutes)

Use a new booklet

Discuss ONE (1) of the following two topics:

- A. The trafficking pathways from the *trans*-Golgi network. Include in your answer examples of experimental approaches to define these individual pathways. **(20 marks)**

OR

- B. The molecular components of the extracellular matrix (ECM) and their role in regulating the biological function of cells. Include in your answer two examples of how proteinases can modify the ECM to affect cell survival, proliferation, differentiation or migration.

(20 marks)

END OF EXAMINATION