

COPY

**THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY
SEMESTER 2 ASSESSMENT, 2004**

521-302 FUNCTIONAL GENOMICS

EXAM DURATION: Three (3) Hours

READING TIME: Fifteen (15) Minutes

THIS PAPER HAS 3 PAGES

Instructions to Students:

Use a **SEPARATE** script book for EACH QUESTION.

Attempt **FIVE** (5) of the seven (7) questions.

Total marks for the paper: 100

Authorized Materials:

No specific materials are authorized.

Instructions to Invigilators:

Students need **FIVE** (5) 6-page script books.

This paper is worth 80% of the total mark for the subject

This paper may be reproduced and lodged with the Baillieu Library

Please use a new script book for each Question
Attempt five (5) of the following seven (7) questions
Suggested time for each question – 36 minutes

Question 1 (Please use a new script book)

One of the great challenges in the post-genomic era (i.e. the current era) is to discover the functions of the many genes that have been identified by genome sequencing projects. Describe approaches that can be applied to discover the functions of genes of unknown function.

(20 marks)

Question 2 (Please use a new script book)

- a. Gene regulatory proteins are often made up of distinct modular domains. Describe an experiment that illustrates this property.

(10 marks)

- b. Many gene regulatory proteins form homodimers and/or heterodimers. Explain the advantages of the dimerisation of gene regulatory proteins in regulating gene transcription.

(10 marks)

(Total = 20 marks)

Question 3 (Please use a new script book)

- a. Describe the function of the telomerase enzyme.

(10 marks)

- b. Discuss the possible consequences to cells and organisms of (i) the inappropriate expression of telomerase and (ii) the inactivation of telomerase?

(10 marks)

(Total = 20 marks)

Question 4 (Please use a new script book)

Answer ONE (1) of the following two (2) parts

- a. Initiation of transcription by RNA polymerase II, splicing of pre-mRNA, and post-transcriptional modification of RNA all occur at specific sites within nucleic acid sequences. For any TWO of the processes listed above, discuss the features within the nucleic acid as well as the protein factors that contribute to this specificity.

- b. Describe the molecular pathway and the specific chaperone proteins involved in the export and import of proteins between the nucleus and cytoplasm.

(20 marks)

Please use a new script book for each Question

Attempt five (5) of the following seven (7) questions

Suggested time for each question – 36 minutes

Question 5 (Please use a new script book)

Knowledge of protein biosynthesis has been extended recently with the determination of the complete three dimensional structure of ribosomes, as well as the elucidation of many of the biosynthetic and regulatory steps involved in ribosome biogenesis. Briefly discuss the key functional features of ribosomes and their biosynthetic and assembly pathways under the five [(i) - (v)] headings listed below, wherever possible, distinguishing between the knowledge gained from investigations of prokaryotic (eg. bacterial) and eukaryotic (eg. mammalian) ribosomes:

- (i) functional sites on ribosomes for decoding messenger RNAs.
- (ii) antibiotic inhibitors of ribosomes.
- (iii) role of ribosomal proteins.
- (iv) role of small nucleolar RNAs (snoRNAs).
- (v) regulatory processes operating in ribosome biogenesis.

Where appropriate, use diagrams to illustrate your answers. Allocate approximately equal time to discussion of each of the individual sections (approximately six minutes per section).

(20 marks)

Question 6 (Please use a new script book)

Briefly describe how the following proteins/genes can play a role towards the development of cancer. Answer FIVE (5) of the SIX (6) parts.

- a. Rb
- b. v-src oncogene
- c. ras oncogene
- d. p53
- e. BRCA1
- f. erbB oncogene

(20 marks)

Question 7 (Please use a new script book)

Discuss how experimental animal models have contributed towards the understanding of cancer development. Include in your answer how the animal models have provided evidence that cancer development requires multiple independent genetic changes and how the animal models have allowed the identification and *in vivo* analysis of cancer causing genes.

(20 marks)

END OF EXAM