POSTGRADUATE INSTITUTE OF MEDICINE
UNIVERSITY OF COLOMBO

POSTGRADUATE DIPLOMA IN MOLECULAR MEDICINE
(SEMESTER II EXAMINATION – OCTOBER , 2013

Date : 15th October 2013 **Time :** 9.00 a.m. -12.00 noon

SEQ PAPER I
(MOLECULAR IMMUNOLOGY & PATHOLOGY – MODULE III)

Answer all **six (06)** questions.
Answer each question in a **separate** answer book.

1.

1.1 Briefly describe the signal 1 activation between T helper cell and antigen presenting cell including the different types of receptors and ligands. (30 marks)

1.2 Mention the fate of the T helper cell after signal 2 activation. (20 marks)

1.3 Briefly explain the role of CTLA-4 of helper T cells. (20 marks)

1.4 Briefly describe the complement pathway which is initiated by protein factors B, D and properdin. (30 marks)

2.

2.1 Illustrate the different types of MHC molecules. (10 marks)

2.2 Briefly describe the steps involved in antigen processing in MHC class I pathway. (30 marks)

2.3 Describe the functions of invariant chain in MHC class II processing. (30 marks)

2.4 Explain the function of chaperone system in MHC class I processing pathway? (30 marks)

3

3.1 Describe the process of purification of antigen specific polyclonal antibody pool using a rabbit model . (30 marks)

3.2 Describe the importance of immunological synapse between TCR and MHC class II molecule including all co-stimulatory and accessory molecules. (30 marks)

3.3 Describe the four phases of the primary antibody response. (30 marks)

3.4 List the sources of adult stem cells used in therapeutic practice. (10 marks)

Contd.....2-/

4.

4.1 (a) Briefly describe the morphological changes that occur during apoptosis. (20 marks)

(b) Discuss the molecular basis of the apoptotic process. (30 marks)

4.2 Discuss the proliferative potential of different types of cells in human body in relation to the cell cycle. (50 marks)

5.

5.1 Discuss the molecular basis of carcinogenesis giving examples. (70 marks)

5.2 Briefly describe the pathogenesis of thrombosis giving examples. (30 marks)

6.

6.1 Briefly discuss the molecular basis of the following in acute inflammation.

(a) leucocyte rolling (30 marks)

(b) lecuocyte adhesion (30 marks)

6.2 Briefly describe three (03) pathological changes that occur in blood vessels in old age. (40 marks)

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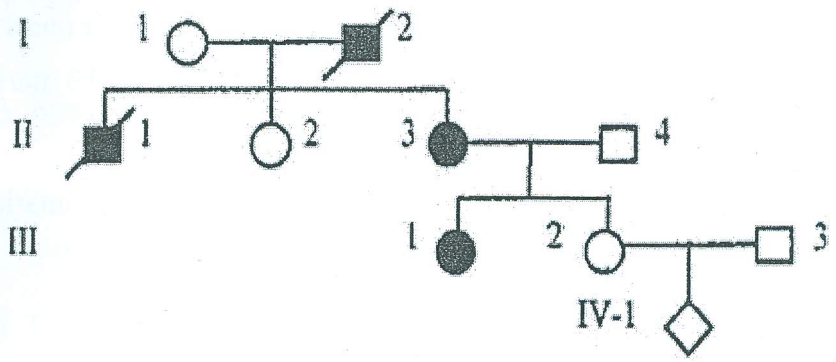
Date : 17th October 2013 **Time :** 9.00 a.m. -12.00 noon

SEQ PAPER
(GENETICS AND HUMAN DISEASES – MODULE IV)

Answer all **six (06)** questions.
Answer each question in a **separate** answer book.

1. Questions 1.1 to 1.3 are based on the following pedigree.
The pedigree refers to a family with a late onset disorder developing at around 40 years of age.



1.1 State the most likely pattern of inheritance of the above disease in this family. (10 marks)

1.2 Give two (02) reasons for your answer in (1.1) above. (20 marks)

1.3 Given that III-2 is 30 years old, what is the probability that the fetus (IV-1) will inherit the disorder ? (20 marks)

Contd-/2

1.4 Briefly explain the following;

(a) How chromosomal non-disjunction in mitosis causes mosaicism in an individual. (35 marks)

(b) Why only females are able to transmit mitochondrial disorders. (15 marks)

2. Answer any **two (02)** of the following

2.1 Explain the following

(a) General procedure of genetically modifying a retrovirus into a gene therapy vector. (25 marks)

(b) How the above recombinant retrovirus can be produced in large quantities. (25 marks)

2.2 Discuss the following

(a) *In vivo* and *ex vivo* gene therapy. (25 marks)

(b) Disadvantages/ limitations in selecting an adenoviral vector (AV) for gene therapy over adeno- associated virus (AAV). (25marks)

2.3

(a) What is a recombinant peptide vaccine? (10 marks)

(b) Using Hepatitis E (HVE) as an example, list the steps involved in producing a recombinant vaccine. (40marks)

3.

3.1 Name the repair systems that function to repair the pyrimidine dimer induced by UV radiation. (10 marks)

3.2 Explain how the above systems in 3.1 repair the pyrimidine dimer in biological cells following exposure to UV radiation. (40 marks)

3.3 Double strand breaks in DNA cannot be repaired by cells using single strand DNA repair mechanism. List the types of mechanisms that cells have developed to repair the double strand damages. (15 marks)

3.4 Explain one (01) mechanism you listed in 3.3 above. (35 marks)

Contd-/3

4.

4.1 Briefly explain the features that would indicate an inherited susceptibility to breast cancer. (30 marks)

4.2 List five (05) frequently occurring genetic alterations in somatic cells in breast cancer. (20 marks)

4.3 List two (02) types of prognostically and/or therapeutically significant molecular markers expressed in breast cancer. (10 marks)

4.4 Explain how the molecular markers mentioned in 4.3 above are detected in a breast cancer tissue. (40 marks)

5.

5.1 An eight year old boy with behavior problems (but no dysmorphic features) has karyotyping performed and the result reveals a balanced Robertsonian translocation between chromosomes 14 and 21 in him.

(a) State his karyotype. (10 marks)

(b) Outline the significance of this finding for him at present and the future. (35 marks)

(c) Discuss the benefits and disadvantages of performing this test on him. (20 marks)

5.2

(a) Outline the investigations needed to support the diagnosis of a mitochondrial genetic disease.

OR

(b) Discuss the likely mechanisms for the variability of mitochondrial disease within a family. (35 marks)

Contd-/4

6.

6.1 Discuss the following

(a) Chorionic villus sampling

(b) Amniocentesis

(c) Ultrasound scanning of pregnancy for detection of fetal anomalies

(75 marks)

6.2 A 2 year old boy has the clinical diagnosis of achondroplasia.
This condition is caused by a heterozygous mutation of the FGFR3 gene.
It is associated with short stature but normal intelligence.

Discuss how you would determine the recurrence risk of this condition for this child's siblings. (25 marks)