

2018

MICROBIOLOGY — HONOURS

Sixth Paper

(Group – B)

Full Marks – 50

The figures in the margin indicate full marks

Candidates are required to give their answers in their own words as far as practicable

Unit – I

Answer *any two* questions

1. (a) Choose the correct answer(s) :

(i) Which of the following WBC cannot phagocytose —

- A. Neutrophil B. Basophil
C. Eosinophil D. B-cell.

(ii) Plasma cell formation is initiated in —

- A. Primary follicle B. Secondary follicle
C. Germinal centre D. Marginal zone.

(iii) Adjuvant increase all of the following except —

- A. Number of antigen molecule
B. Time of exposure
C. Processing of antigen
D. Inflammatory response.

(iv) B-cell recognizes —

- A. Internal epitopes B. Surface epitopes
C. Hydrophobic epitopes D. Agretopes.

(v) MHC plays important role in all except —

- A. Tissue transplantation B. Blood transfusion
C. Antigen presentation D. T-cell response.

(vi) Proteasome is required for processing of antigens, which will be presented by :

- A. MHC – II B. MHC – I
C. TCR D. BCR.

[Turn Over]

(b) Fill in the blanks :

(i) _____ are the only class of dendritic cells that do not express Class II MHC on its surface.

(ii) Epithelial cells found in Peyer's patches that are involved in inducing immune response are _____.

(iii) The adherence of immune cells to capillary walls during the process of inflammation is called _____.

(c) Are NK cells part of innate or adaptive immunity? Explain.

(d) Justify — Infection has no influence on the rate of hematopoiesis.

$$[(1 \times 6) + (1 \times 3) + 1\frac{1}{2} + 2]$$

2. (a) What are sequential and non-sequential epitopes?

(b) What is a major source of non-protein antigens?

(c) Compare and contrast the BCR and TCR in terms of the following characteristics :

(i) Specificity for antigen

(ii) Cellular expression

(iii) Types of Ag recognized.

(d) What is the role of Mucosal-Associated Lymphoid Tissue (MALT) in host defence?

(e) Which region of the whole MHC molecule shows the highest amino acid variation? What roles do anchor residues play in peptide binding by MHC molecules?

(f) Most viruses and bacteria enter cells via specific receptors. Why would a cell have receptors that allow pathogens to enter? $[2 + 1 + 4 + 1\frac{1}{2} + (1 + 1\frac{1}{2}) + 1\frac{1}{2}]$

3. (a) Explain briefly whether the following statements are *true* or *false* :

(i) Dendritic cells arise only from the lymphoid organ.

(ii) All T_H cells express CD4 and recognize only antigen associated with class II MHC molecule.

(iii) A hapten can stimulate antibody formation but cannot combine with many different antibody molecules.

(iv) In order for B cells to mature into plasma cells, they need help from T cells.

(v) All antigens are immunogens but all immunogens are not antigens.

(b) What are chemokines? Give one example.

$$(2 \times 5) + (1\frac{1}{2} + 1)$$

4. (a) Draw a diagram illustrating the general structure and including domains of class II MHC molecules.

(b) An individual is infected with —

- (i) Intracellular bacteria and
- (ii) Extracellular bacteria.

Which kind(s) of immune response will be expected in each case?

(c) What are the two primary characteristics that distinguish hematopoietic stem cells and progenitor cells?

(d) For each pair of antigens listed below, indicate which is likely to be more immunogenic. Explain your answer —

- (i) Insulin and Insulin-BSA conjugate.
- (ii) A monomeric polypeptide (X) and a dimeric protein molecule

(X-X).

(e) Infants immediately after birth are often at risk for infection with group B *streptococcus*. A vaccine is proposed for administration to women of childbearing years. How can immunizing the mothers, help the babies?

(f) For each of the following set of cells, state the latest common progenitor cell that gives rise to both cell types —

- (i) Monocytes and neutrophils
- (ii) Natural killer cells and B cells. $3+(1+1)+2+(1+1)+1\frac{1}{2}+(1+1)$

Unit - II

Answer *any two* questions

5. (a) What is agglutination inhibition? Briefly state one application of this method.

(b) Why does the human system has three separate complement pathways when all of them converge to a single result, i.e. cell lysis?

(c) RBCs, unlike nucleated cells, are more sensitive to complement mediated cell lysis. Explain why?

(d) What is measured by Sandwich ELISA?

(e) What immunologic mechanisms most likely account for a person's developing each of the following reactions, after an insect bite?

(i) Within 1-2 minutes after being bitten, swelling and redness appear at the site and then disappear by 1 hr.

(ii) 6-8 hrs later, swelling and redness again appear and persist for 24 hrs.

(iii) 72 hrs later, the tissue becomes inflamed and tissue necrosis follows. $(1+2)+2+2+1+(1\frac{1}{2}\times 3)$

[Turn Over]

6. (a) Distinguish between Atopic dermatitis and Contact dermatitis.
- (b) Compare the following :
- Sabin and Salk polio vaccine
 - Active and Passive immunization.
- (c) What would be the consequences if a significant proportion of the population was not vaccinated against childhood diseases like measles or pertussis?
- (d) Explain the relationship between the incubation period of a pathogen and the approach needed to achieve active immunization.
- (e) What are the characteristic features of the hinge region of an antibody molecule? What are its functions? $2+(2 \times 2)+2+2+(1\frac{1}{2}+1)$
7. (a) Draw a diagram of pentameric IgM and label the parts and domains.
- (b) Explain briefly the function of complement in clearance of circulating immune complexes.
- (c) Indicate which type of hypersensitive reaction (I-IV) apply to the following characteristics (may apply to more than one) —
- Occurs as a result of mismatched blood transfusion.
 - May involve cell destruction by antibody dependent cell mediated cytotoxicity.
 - Localized form characterized by wheel-and-flare reaction.
 - Is an important defense against intracellular pathogens.
 - Drug-induced haemolytic anemia.
- (d) Fill in the blanks with proper terms :
- A mother who is Rh⁻, is given _____ when she is carrying an Rh⁺ baby. If she develops a titer to Rh⁻ antigen, the baby could be born with _____.
- $3+2\frac{1}{2}+(1 \times 5)+(1+1)$
8. (a) Which bacterial strain is used to develop BCG vaccine?
- (b) Explain whether the following statements are *true* or *false* :
- IgG functions more effectively than IgM in bacterial agglutination.
 - The heavy chain variable region (V_H) is twice as long as light-chain variable region (V_L).
 - Transplacental transfer of maternal IgG antibodies against measles confer long-term immunity on the fetus.
- (c) Define anaphylatoxins. Give one example.
- (d) A young girl who had never been immunized to tetanus stepped on a rusty nail and got wounded. Doctor gave the child an injection of tetanus antitoxin.
- Why was antitoxin given instead of a booster shot of tetanus toxoid? Explain.
 - If the girl receives no further treatment and steps on a rusty nail again 3 yrs. later, will she be immune to tetanus? $[1+(2 \times 3)+(1+1)+(2+1\frac{1}{2})]$