2020

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 one*** question.

1. (a) What are the components of anatomical barrier and what is their role in innate immunity?

(b) How do factors of innate immunity serve as second signals for the activation of adaptive immunity?

(c) How innate immunity differs from adaptive immunity?

(d) Compare and contrast the following antigen-binding molecules used by the immune system — antibodies, T-cell receptors, in terms of the following characteristics :

(i) Specificity for antigen

(ii) Cellular expression

(iii) Types of antigen recognized. 5+4+4+(4×3)

2. (a) Mention the type of cells present in the cortex region of Thymus.

(b) Justify —

(i) A hapten can stimulate antibody formation but can not combine with it.

(ii) Infection has no influence on the rate of hematopoiesis

(c) Briefly discuss the advantages of having two antigen processing pathways.

(d) What are adjuvants? Give the composition of Freund's complete and incomplete adjuvants.

4+(4×2)+5+{2+(3×2)}

3. (a) State, giving proper justification, which of the following statement/s is/are **T(true)** ***or*** **F(false)** :

(i) MHC genes play a major role in determining the degree of immune responsiveness to an antigen.

(ii) The pluripotent stem cell is one of the most abundant cell types in the bone marrow.

(iii) B-cell epitopes can be deduced with great accuracy from the primary structure of a protein.

(b) Distinguish between primary and secondary lymphoid organs.

(c) Match each term related to innate immunity (i-v) with the **most appropriate** description listed below (1-5). Each description may be used once, more than once, or not at all.

Terms

(i) Extravasation

(ii) Margination

(iii) Exudate

(iv) Edema

(v) CRP

Description

(1) Adherence of phagocytic cells to the endothelial wall

(2) Accumulation of fluid in intercellular space, resulting in swelling

(3) One of several APR proteins

(4) Migration of a phagocyte through the endothelial wall into the tissues

(5) Protein-rich fluid that leaks from the capillaries into the tissues. (4×3)+3+(2×5)

4. (a) For each of type of cell indicated (i-iii), select the most appropriate description (1-5) listed below. Each description may be used once, more than once, or not at all.

Cell types

(i) _____ Myeloid stem cells

(ii) _____ Kupffer cells

(iii) _____ NK cells

Descriptions

(1) A type of null cell involved in ADCC

(2) Macrophages found in the liver

(3) Give rise to RBCs

(4) WBCs that migrate into the tissues and play an important role in the development of allergies

(5) Give rise to thymocytes

(b) Differentiate between :

(i) monocytes / macrophages

(ii) Class I MHC molecules / Class II MHC molecules.

(c) Discuss on the processing and presentation of endogenous antigens with a neat, labelled diagram. State how it differs principally from the processing and presentation of exogenous antigens.

(2×3)+(4+5)+(5+5)

Unit - II

Answer ***any one*** question.

5. (a) State, giving proper justification, which of the following statement/s is/are **T(true)** ***or*** **F(false)** :

(i) Babies can acquire IgE-mediated allergies by passive transfer of maternal antibody.

(ii) A DNA vaccine only induces a response to a single epitope.

(b) "As a member of an anthropologic research team, you have occasion to visit a primitive tribe in the remote reaches of the Andaman Islands. During your visit, on one day, the natives participated in one ceremony of theirs that consisted of covering the body of the male members of the community with elaborate patterns of stripes and circles with a variety of colors extracted from local plants. On your return 3 weeks later, you are asked to look at a male who has developed alarmingly itchy red areas of skin that run in sharply demarcated stripes across his back and on one arm."

(i) What type of hypersensitivity reaction could have developed in him?

(ii) Name any two major cytokines participating in that reaction.

(c) Draw a schematic diagram of a typical IgG molecule and label its different parts. State how could the diagram of IgG be modified to depict an IgA molecule isolated from saliva.

(4×2)+(3+4)+(5+5)

6. (a) Choose the **most suitable** option :

(i) In what manner does a Type III hypersensitivity reaction differ from a Type II hypersensitivity reaction?

(A) The antigens involved in a Type III reaction are not bound to a cell's surface, while those involved in a Type II reaction are bound to the surface.

(B) Type III is an immediate hypersensitivity, while Type II is a delayed hypersensitivity reaction.

(C) Type III hypersensitivities involve IgE, while Type II hypersensitivities involve IgG and IgM.

(D) Type III hypersensitivities are T-cell mediated, while Type II hypersensitivities are B-cell mediated.

(ii) Nicole Maurice Arthus described a hypersensitivity reaction that was :

(A) IgE-mediated (B) Mediated by Tc cells

(C) Dependant on immune complex formation (D) Antibody-independent.

(iii) Which of the following does not involve cell-mediated immunity?

(A) Contact sensitivity to lipstick

(B) Rejection of a liver graft

(C) Serum sickness

(D) Immunity to chicken pox.

(iv) Cell-mediated immune responses are :

(A) Enhanced by depletion of complement

(B) Suppressed by cortisone

(C) Enhanced by depletion of T cells

(D) Enhanced by depletion of macrophages.

(v) Delayed skin reactions to an intradermal injection of antigen may be markedly decreased by :

(A) Exposure to a high dose of X-irradiation

(B) Treatment with an anti-neutrophil serum

(C) Removal of the spleen

(D) Decreasing levels of complement.

(b) Where are 'hypervariable' regions located on an antibody?

(c) "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?

(d) Discuss on the immunological basis of 'erythroblastosis faetalis'.

(e) Cite two examples of inactivated viral vaccines. (2×5)+2+4+5+4

7. (a) How can you prove experimentally that immunoglobulins are actually Y-globulins?

(b) What is the principle of HAT selection in Hybridoma technology?

(c) What is a secretory component for an antibody molecule?

(d) What are Bence-Jones proteins?

(e) You are given two solutions, one containing protein X and the other containing antibody to protein X. When you add 1 ml of anti-X to 1 ml of protein X, a precipitate forms. But when you dilute the antibody solution 100-fold and then mix 1 ml of the diluted anti-X with 1 ml of protein X, no precipitate form.

(A) Explain why no precipitate formed with the diluted antibody.

(B) Which species (protein X or anti-X) would likely be present in the supernatant of the antibody-antigen mixture in each case?

(f) What is the principle of immunoelectrophoresis? 4+4+2+2+(4+4)+5

8. (a) Some microorganisms produce enzymes that can degrade the Fc portion of antibody molecules. Why would such enzymes be advantageous for the survival of microorganisms that possess them?

(b) Macrophages have receptors for C3b. What is the biologic significance of this fact?

(c) What is the last complement component to be split into two biologically active fragments? What are their functions?

(d) What is active immunization? When is this required?

(e) What is the role of IgE in hypersensitivity?

(f) Justify — "IL-4 decreases IgE production by B cells". 4+4+(2+3)+(2+4)+3+3