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S. No. of Question Paper : 8683

Unique Paper Code : 249505

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Name of the Paper : BCHT—510 : Immunology

Name of the Course : B.Sc. (Hons.) Bio-chemistry Part III

Semester : V

Duration : 3 Hours

Maximum Marks :

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *Five* questions in all.

Question No. 1 is compulsory.

Use of scientific calculator/log tables may be allowed.

1. (A) Choose the one BEST answer :

(i) If you could analyze, at the molecular level, a plasma cell making IgA antibody you would find all of the following *except* :

(A) a DNA sequence for V, D and J genes translocated near the C_{α} DNA exc

(B) mRNA specific for either k or λ light chains

(C) mRNA specific for J chains.

(D) mRNA specific for μ chains.

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(ii) If all of an animal's immune system is destroyed, which of the following reconstitute the entire immune system ?

- (A) Thymocytes
- (B) Bone Marrow Stem cells
- (C) Lymph Node cells
- (D) All of the above.

(iii) Cell surface molecule that initiates the respiratory burst is :

- (A) Myeloperoxidase
- (B) Superoxide dismutase
- (C) NADPH-oxidase
- (D) Hypohalide.

(iv) In old age, which component of the immune system appears to be impaired ?

- (A) B cells
- (B) Neutrophils
- (C) NK cells
- (D) T cells.

- (v) A polyclonal antiserum raised against human IgA will react with :
- (A) Human IgM
 - (B) k light chain
 - (C) J chain
 - (D) all of the above.
- (vi) If you had 50 V, 20 D and 6 J segments able to code for heavy chain & 40 V and 5 J gene segments for light chain, the maximum repertoire possible is :
- (A) $76 + 45 = 121$ antibody specificities
 - (B) $76 \times 45 = 3420$ Ab specificities
 - (C) $(40 \times 5) + (50 \times 20 \times 6) = 6200$ Ab specificities
 - (D) $(40 \times 5) \times (50 \times 20 \times 6) = 1.2 \times 10^6$ Ab specificities.
- (vii) Which of the following class switching can occur in an ongoing humoral response in mouse ?
- (A) IgM to IgD
 - (B) IgE to IgG
 - (C) IgA to IgG
 - (D) IgM to IgG.

(viii) B cells do *not* express :

- (A) Class I antigens
- (B) Class II antigens
- (C) C3b receptors
- (D) CD4.

(B) Identify the following :

- (i) Conserved DNA sequences, located adjacent to V, D and J segments that direct gene rearrangement.
- (ii) Antibody isotype that is never secreted.
- (iii) One of the several acute phase proteins.
- (iv) Macrophages found in kidney.
- (v) A cytokine that is an endogenous pyrogen.
- (vi) A co-stimulatory signal molecule on the surface of T cell that interacts with B7 on APC.

(C) State whether the following statements are true *or* false. If false, justify :

- (i) A beige mouse lacks thymus.
- (ii) Immature B cells express membrane IgM and IgD.
- (iii) The high affinity IL-2 receptor consists of two transmembrane proteins.
- (iv) RAG-1/RAG-2 genes encode subunits of a B-lineage specific recombinase.
- (v) Functional properties of Immunoglobulins such as binding to Fc receptors associated with heavy chains only.

2. (A) Describe the classical pathway for activation of complement system.
- (B) Dendritic cells provide an important link between innate and adaptive immunity. Explain.
- (C) Describe the structure of IgM molecule. (6,4)
3. (A) For each of the following situations, indicate which type(s) of lymphocytes would be expected to proliferate rapidly in lymph nodes and where in the nodes they would do so :
- (i) Normal mouse with a viral infection
- (ii) Neonatally thymectomized mouse immunized with a protein antigen.
- (B) Define the following terms (any 6) :
- Anaphylatoxin, Haplotype, Chemotaxis, ADCC, Innocent Bystander lysis, Superantigen, chemokine, Anergy.
- (C) IgM can be detected at low levels along with IgA in mucosal secretions. (3,9)
4. (A) List the factors that contribute to the immunogenicity of a molecule. For each of pair of antigens listed below, indicate which is likely to be more immunogenic. Explain your answer.
- (1) Native bovine serum albumin (BSA) or Heat- denatured BSA
- (2) Hen egg- white lysozyme (HEL) or Hen collagen.

- (B) What are professional APCs ? Why are dendritic cells most potent APC to a naïve T cell ? Describe the endocytic pathway for presentation of exogenous antigen by antigen presenting cells.
- (C) In which sites specifically would a pathogen or its antigen would end up if they :
- (i) entered the body through a small wound in the skin
 - (ii) entered the body from the gut
 - (iii) got into the bloodstream ? (4,7,3)
5. (A) Differentiate between the following (any 4) :
- (i) Primary and Secondary Immune Response
 - (ii) Innate and adaptive Immunity
 - (iii) B1 and B2 cells
 - (iv) Haptens and Adjuvants
 - (v) NK cells and Cytotoxic cells
 - (vi) Red pulp and white pulp.
- (B) Diagrammatically explain the structure of thymus. (12,2)
6. (A) Discuss the main processes that generate the diversity in B lymphocyte receptor repertoire.
- (B) Describe the experiment to demonstrate that genes encoding kappa light chain are rearranged during B-cell development. (9, 5)

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7. (A) What is isotype switching ? Describe the proposed mechanism for class switch rearranged Ig heavy chain genes.
- (B) Draw diagrams illustrating the general structure, including the domains of class I and II MHC molecules. You cross a BALB/c (H-2^d) mouse with a CBA (H-2^k) mouse. What MHC molecules will the F1 progeny express on (a) liver cells and macrophages ?
8. (A) What are the hallmark characteristics of a localized inflammatory response ? How do these changes contribute to an effective innate immune response ?
- (B) Explain the positive and negative selection of thymocytes in the thymus.
- (C) A number of defense mechanisms are operative in the mucus membrane lining the digestive tract. Elaborate them.