JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

MSc-II Semester (BT)

Course Code (Credits):20MS1BT212 (3) Max. Marks: 35

Course Name: Immunology

Course Instructors: Dr. Abhishek Chaudhary Max. Time: 2 Hours

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Note: *(a)All questions are compulsory.*

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

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1. For several decades, immunologists sought to imagine a genetic mechanism that could explain the tremendous diversity of antibody structure. Two different sets of theories emerged viz. Germ-line theories and somatic-variation theories. Detail out both the theories and write down the limitations associated with these theories. Also explain Tonegawa and Hozumi gene rearrangement Model with suitable example and its significance to overcome the limitations associated with Germ-line and somatic-variation theories. [1.5+1.5+1+2]

2a. To date, seven means of antibody diversification have been identified in mice and humans briefly describe all the seven diversification processes involved in the generation of immunoglobulin diversity. Also explain Allelic exclusion and its significance in diversification process. [5]

2b. Considering only combinatorial joining of gene segments and association of light and heavy chains, how many different antibody molecules potentially could be generated from germ-line DNA containing 500 VL and 4 JL gene segments and 300 VH, 15 DH, and 4 JH gene segments? [3]

3. Although once considered very promising, the use of synthetic peptides as vaccines has not progressed as originally projected. Peptides are not as immunogenic as proteins, and it is difficult to elicit both humoral and cellular immunity to them. The use of conjugates and adjuvants can assist in raising protective immunity to peptides, but barriers to the widespread use of peptide vaccines remain and pose an interesting problem for immunologists. Most importantly, advances in techniques to produce recombinant proteins or fragments of proteins in transfected cell culture have removed the impetus to develop vaccines based on synthetic Peptides. Discuss how you will construct peptide for use as vaccine using vaccinia virus as vector. [5]

4. One of the limitations of both synthetic peptide vaccines and recombinant protein vaccines is that they tend to be poorly immunogenic; in addition, they tend to induce a humoral antibody response but are less likely to induce a cell-mediated response. What is needed is a method for constructing synthetic peptide vaccines that contain both immunodominant B-cell and T-cell epitopes. Furthermore, if a CTL response is desired, the vaccine must be delivered intra-cellularly so that the peptides can be processed and presented together with class I MHC molecules. A number of innovative techniques are being applied to develop multivalent vaccines that can be used to overcome the above limitations. Explain all innovative techniques used to develop multivalent vaccine. [4]

5. When some subpopulations of activated TH cells encounter certain types of antigens, they secrete cytokines that induce a localized inflammatory reaction called delayed-type hypersensitive reactions (DTH). The reaction is characterized by large influxes of nonspecific inflammatory cells, in particular, macrophages. In some cases a DTH response does cause extensive tissue damage and is in itself pathologic, in many cases tissue damage is limited, and the response plays an important role in defence against intracellular pathogens and contact antigens. Describe various phases involved in DTH and illustrate the mechanism of DTH using Contact Dermatitis as an example. [6]

6. Autoimmune diseases involving direct cellular damage occur when lymphocytes or antibodies bind to cell-membrane antigens, causing cellular lysis and/or an inflammatory response in the affected organ. Gradually, the damaged cellular structure is replaced by connective tissue (scar tissue), and the function of the organ declines while some Autoimmune Diseases are mediated by stimulating or blocking auto-antibodies which lead to autoimmune diseases in which antibodies act as agonists, binding to cell receptors in lieu of the normal ligand and stimulating inappropriate activity. Using the concept of stimulating or blocking auto-antibodies, explain the mechanism of Grave's disease and myasthenia gravis. Also explain the significance of molecular mimicry to understand the mechanism of Autoimmunity disease using suitable example [6]