JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

MSc-II Semester (BT)

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

Course Name: Immunology

Course Instructors: Dr. Abhishek Max. Time: 2.0 Hour

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

1. Hypersensitivity as an immunological dysfunction in which exaggerated or inappropriate response of the immune system developed, which is mostly targeted at innocuous antigens with consequent tissue damage. Hypersensitive reactions may develop in the course of either humoral or cell-mediated responses and classified into four category; namely, type I, type II, type III, and type IV hypersensitivity. Based on this information, answer the following question [2+2+2+3]

    a. What are the important mechanistic differences between Type II and Type III Hypersensitive reactions?
    b. Detail out the concept of drug induced hypersensitive reactions?
    c. Explain erythroblastosis fetalis with neat and clean schematic diagram and also explain its relation with hypersensitive reactions
    d. Allergic contact dermatitis is an inflammatory disease of the skin that is caused by a type 4 hypersensitivity reaction, How? Explain in detail with suitable schematic diagram.

2. Vaccination is a simple, safe, and effective way of protecting you against harmful diseases, before you come into contact with them. It uses your body's natural defenses to build resistance to specific infections and makes your immune system stronger. Answer the following question using the concept of vaccine. [2+2+3+1]

    a. What are the advantages of the Sabin polio vaccine compared with the Salk vaccine? Why the Sabin vaccine is no longer recommended for use in the United States?
    b. Explain the phenomenon of herd immunity. How does this phenomenon relate to the appearance of certain epidemics?
    c. A number of organisms have been used for vector vaccines, including vaccinia virus, vaccinia virus, the attenuated vaccine used to eradicate smallpox, has been widely employed as a vector vaccine. How would you develop vaccinia vector vaccine? Explain with suitable schematic diagram.
    d. Why is using an adjuvant in a vaccine preparation advantageous?

3. Complement is a system of plasma proteins that can be activated directly by pathogens or indirectly by pathogen-bound antibody, leading to a cascade of reactions that occurs on the surface of pathogens and generates active components with various effector functions i.e complement is a system of plasma proteins that interacts with pathogens to mark them for destruction by phagocytes. Complement activation can occur via the three important pathways. [2+2+2]
    a. How do the three pathways differ in the substances that can initiate activation?
    b. Which portion of the overall activation sequence differs in the three pathways?
    c. Which portion of the overall activation sequence similar in the three pathways?

4. The mature lymphocyte population of a healthy individual has the remarkable ability to recognise an immense variety of antigens. Instead of encoding a unique gene for each potential antigen receptor, evolution has used gene rearrangements, also known as V, D and J gene segment (VJC/VDJC) recombination. Detail out the recombination mechanism in **light** and **heavy chain** of immunoglobulin using suitable diagram. Mentioned the significance of RAG-1 and RAG-2 gene in gene recombination using deletional joining as an example? Do you think RSS sequences are really important for proper gene arrangement, How would you differentiate one turn and two turn sequences? [4+2+2]

5. 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? Also write down allelic exclusion and significance in diversity [4]