

KATHMANDU UNIVERSITY  
End Semester Examination  
May/June, 2022

Marks scored:

Level : B.Tech.

Year : II

Exam Roll No :

Time: 30 mins.

Course : BIOT 207

Semester : II

F.M. : 20

Registration No:

Date :

SECTION "A"

[20Q. × 1 = 20 marks]

Mark [X] in the most appropriate option.

- Which of the following statements regarding the B and T cells is FALSE?  
 Both cells are lymphocytes  
 Both originate from the common lymphoid progenitor cells  
 Both contain receptors on their surface  
 Both have direct cytotoxic effects on target cells
- The term "clonal deletion" refers to:  
 Recognition of pathogens by body's immune system  
 Killing of foreign antigens by body's immune system  
 Killing of self-reactive lymphocyte by the body's immune system  
 Production of identical daughter lymphocytes from original cell.
- When a resting naive T-cell engages its specific MHC/peptide complex displayed on the surface of a fibroblast it  
 produces IL1  produces IL2  
 becomes anergic  moves from Go to G1 of the cell cycle.
- Which of the following is the first stage of T-cell receptor gene rearrangement in  $\alpha:\beta$  T cells?  
  $V\alpha \rightarrow D\alpha$    $D\alpha \rightarrow J\alpha$    $V\beta \rightarrow D\beta$    $D\beta \rightarrow J\beta$
- Membrane Attack Complex (MAC) is NOT  
 A C4b567 complex surrounded by poly-C8 complex  
 A mediator in cell lysis  
 Tubular in shape  
 Effective against Gram negative bacteria
- Which of the following statements regarding pathogens is TRUE?  
 They can develop capsules to evade the immune system  
 They are always killed by innate immune response of the host  
 They always have surface molecules that allow recognition  
 They are difficult to be recognized by the immune system
- Which of the following is TRUE?  
 MHC I is exclusively expressed by APC and recognized by CD8 cells  
 MHC I is exclusively expressed by APC and recognized by CD4 cells  
 MHC II is exclusively expressed by APC and recognized by CD8 cells  
 MHC II is exclusively expressed by APC and recognized by CD4 cells

8. Which of the following characteristics is common to both T-cell receptors and immunoglobulins?
- Somatic recombination of V, D and J segments is responsible for the diversity.
  - Somatic hypermutation changes the affinity of antigen-binding.
  - Class switching enables a change in effector function.
  - Carbohydrate, lipid and protein antigens are recognized and stimulate a response.
9. In addition to the primary signal generated for antigen binding to B cell receptor, the thymus-dependent B cell activation requires a secondary signal. The second signal is provided by
- Ig $\alpha$ /Ig $\beta$ .
  - B cell CD40 interaction with T cell CD40L.
  - CD8 interaction with MHC molecule.
  - None of the above.
10. Which of the following statements regarding thymus-dependent (TD) antigens is FALSE?
- Induce isotype switching
  - Induce affinity maturation
  - Possess immunological memory
  - Always induce polyclonal activation of B cells.

Fill in the blanks.

11. \_\_\_\_\_ identified antibodies in serum.
12. \_\_\_\_\_ lymphocyte activates macrophages to kill *M. tuberculosis*.
13. \_\_\_\_\_ is known as secretory antibody.
14. \_\_\_\_\_ has the highest avidity among all immunoglobulins.
15. \_\_\_\_\_ is a lymphocyte of innate immune system.

Define the followings.

16. Antigen Presenting Cells (APCs):
17. Co-stimulatory molecules:
18. Antigen presentation:
19. Opsonization:
20. Thymus Independent antigens:

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Year : II  
Time : 2 hrs. 30 mins.

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Semester : II  
F.M. : 55

SECTION "B"

[7Q. × 5 = 35 marks]

Attempt *ALL* questions.

1. Discuss the antigen processing and presentation pathway for viral pathogens.
2. Discuss the significance of positive and negative selections in the development of lymphocytes with suitable example(s).
3. Elaborate on the effector functions of B and T lymphocytes.
4. Innate and adaptive immunity act in cooperative and interdependent ways to protect the host. Discuss the collaboration of these two forms of immunity.
5. Complement activation can occur via the classical, alternative, or lectin pathway. [2+2+1]
  - i. How do the three pathways differ in the substances that can initiate activation
  - ii. Which portion of the overall activation sequence differs in the three pathways? Which portion is similar?
  - iii. How do the biological consequences of complement activation via these pathways differ?
6.
  - a. You are an energetic immunology student who has isolated protein X, which you believe is a new isotype of human immunoglobulin. What structural features would protein X have to have in order to be classified as an immunoglobulin? [2.5]
  - b. Explain the role of Fc receptors in immune response [2.5]
7.
  - a. Strain R mice (MHC<sup>b</sup>) receives bone marrow from strain Q mice (MHC<sup>a</sup>). Strain R is further transplanted with APCs of type MHC<sup>b</sup> such that the recipient now contains the APCs of type MHC<sup>a</sup> and MHC<sup>b</sup> both. In which of the following cases does the activation of T cells of R strain occur. Explain with reasons. [2.5]
    - i. antigens presented by MHC<sup>a</sup>
    - ii. antigens presented by MHC<sup>b</sup>
  - b. Two vaccines are described below. Would you expect either or both of them to activate T<sub>C</sub> cells? Explain your answer. [2.5]
    - i. A UV-inactivated ("killed") viral preparation that has retained its antigenic properties but cannot replicate.
    - ii. An attenuated viral preparation that has low virulence but can still replicate within host cells.

SECTION "C"

Give *TWO* differences between (*ANY FIVE*):

[5Q × 2 = 10 marks]

8. Conventional B cells and B1 cells
9. Central and Peripheral lymphoid organs

10. Antibody cleavage by papain and Antibody cleavage by pepsin
11. Naïve T cells and Armed Effector T cells
12. Selectins and Integrins
13. Class switching and Affinity maturation

Explain WHY/HOW for (ANY FIVE):

[5Q. × 2 = 10 marks]

14. Mouse with Nude mutation lacks T cell mediated immunity.
15. Secondary immune response is faster than the primary immune response.
16. Innate immunity alone is not sufficient to protect body against all infections.
17. Cells deficient in invariant chain retain MHC II in ER as complexes with misfolded proteins.
18. Not all B cells die of negative selection.
19. CTLA-4 restricts the proliferative response of activated T cells.