※ 注意：請於試卷內之「選擇題作答區」依序作答。

一、選擇題

單選題: 每題 1 分，共 14 分

1-3. Which one of the followings is the example of (A) TD antigen (B) TI antigen (C) None?

1. Polysaccharide of encapsulated bacteria
2. Pathogen's toxin
3. Lipopolysaccharide (LPS)

4-6. Which one of the followings is mainly distributed by human immunoglobulin (A) IgM (B) IgD (C) IgG (D) IgA (E) IgE?

4. Mast cells beneath epithelial surfaces
5. Dimeric form predominates in secretions across epithelia
6. The fetus receives it from the mother by transplacental transport

7-9. Which one of the following properties is the outcome of (A) Pre-T cell receptor signaling (B) Pre-B cell receptor signaling (C) Both pre-B cell and pre-T cell receptor signaling (D) Neither?

7. Stimulation of α chain recombination
8. Survival and proliferation
9. Stimulation of κ chain recombination

10-11. Which one of the following factors is involved in (A) Positive selection (B) Negative selection (C) Both positive and negative selection (D) Neither?

10. Peptides on MHC I/II
11. Medullary epithelial cell

12-14. Which one of the following defects impairs (A) T cell development (B) B cell development (C) Both B and T cell development (D) Neither B nor T cell development?

12. Btk deficiency
13. RAG deficiency
14. TAP1/2 deficiency

單選題: 每題 2 分，共 28 分

15. Which one of following molecules is expressed in the medulla of the thymus and promotes the expression of proteins normally expressed in peripheral tissues?

(A) AID
(B) AIRE
(C) ID-2
(D) IL-2
(E) TECK

16. Which one of following transcription factors determines the CD4 or CD8 commitment in the thymus?

(A) Bcl11b
(B) KLF2
(C) GATA3

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(D) Runx1
(E) ThPOK

17. Which one of following receptors regulates the release of immature B cells from bone marrow into the circulation?
(A) CCR5
(B) CXCR2
(C) IL-7R
(D) S1PR1
(E) TLR

18. Which one of following strategy is **NOT** used by extracellular bacteria to subvert the host immune system?
(A) Antigenic variation
(B) Inhibition of opsonization
(C) Inhibition of BCR/TCR expression
(D) Inhibition of microbial-associated molecular patterns (MAMPs)
(E) Resistance to antimicrobial peptides (AMPs)

19. Autoinflammatory diseases indicate the failure of normal mechanisms that limit inflammation and it can lead inflammation without the infection. Which one of followings **is** an autoinflammatory disease?
(A) Wiskott-Aidrich syndrome
(B) Severe combined immunodeficiency
(C) MHC class I deficiency
(D) Familial Mediterranean fever (FMF)
(E) DiGeorge's syndrome

20. The name given to a fully activated and differentiated B cell that secretes antibody is
(A) T cell
(B) antigen-presenting cell
(C) plasma cell
(D) hematopoietic cell
(E) secretory cell

21. Which of the following statements regarding immunoglobulin light chains is correct?
(A) κ (kappa) associates with only particular heavy-chain isotypes
(B) A given antibody may contain just κ (kappa), or just λ (lambda), or both
(C) Most antibodies in humans contain λ (lambda) light chains
(D) There is no functional difference between κ (kappa) and λ (lambda)
(E) Light chains possess only framework regions, not hypervariable regions

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22. The process of _____ results in the amplification of particular B cells with specificity for antigen:
(A) germline recombination
(B) somatic recombination
(C) clonal selection
(D) antigen processing
(E) antigen presentation

23. T cells recognize antigen when the antigen
(A) is internalized by T cells via phagocytosis and subsequently binds to T-cell receptors in the endoplasmic reticulum.
(B) forms a complex with membrane-bound MHC molecules on another host-derived cell
(C) is presented on the surface of a B cell on membrane-bound immunoglobulins
(D) forms a complex with membrane-bound MHC molecules on the T cell
(E) bears epitopes derived from proteins, carbohydrates, and lipids

24. If a non-professional antigen-presenting cell that lacks co-stimulatory molecules presents peptide:MHC complexes to a T cell specific for that peptide, then _____.
(A) the T cell delivers a signal to the non-professional antigen-presenting cell to activate the expression of co-stimulatory molecules
(B) the T cell begins to express the α (alpha) chain of the IL-2 receptor
(C) the T cell differentiates into a TH1 cell
(D) T-cell tolerance occurs as a result of anergy
(E) the T cell is more heavily reliant on signals transmitted through CD4 or CD8 in order to become activated

25. All of the following are correctly matched except _____.
(A) T_H1: T-bet
(B) Treg: FoxP3
(C) IL-12: dendritic cells
(D) T_H17: RORγ (gamma)T
(E) T_H2: Bcl6

26. Primary lymphoid tissues are the sites where lymphocytes _____, whereas secondary lymphoid tissues are the sites where lymphocytes _____.
(A) are stimulated; develop and mature
(B) encounter pathogens; undergo apoptosis
(C) develop and mature; become activated
(D) undergo clonal selection; differentiate from hematopoietic stem cells
(E) die; are phagocytosed after death

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27. Herd immunity is best described as:
(A) Vaccination of livestock herds
(B) Protecting individuals who have not been vaccinated
(C) Vaccinating the contacts of an infected person
(D) Using multiple vaccines at one time
(E) Protection of vaccinated individuals

28. Autoimmunity is thought to result from a combination of the following **EXCEPT** _____
(A) breakdown of self-tolerance mechanisms
(B) mast cell degranulation and activation
(C) environmental triggers
(D) genetic susceptibility
(E) none of the above

複選題: 每題 2 分, 共 12 分　※ 注意：請於試卷內之「選擇題作答區」依序作答。

29. Cross-priming of the immune response occurs when _____. (Select all that apply.)
(A) viral antigens are presented by MHC class I molecules on the surface of a cell that is not actually infected by that particular virus
(B) cytosol-derived peptides enter the endoplasmic reticulum and bind to MHC class II molecules
(C) phagolysosome-derived peptides bind to MHC class II molecules
(D) peptides of nuclear or cytosolic proteins are presented by MHC class II molecules
(E) endoplasmic reticulum-derived peptides bind to MHC class I molecules

30. The diversity of MHC class I and II genes is due to _____. (Select all that apply.)
(A) gene rearrangements similar to those observed in T-cell receptor genes
(B) the existence of many similar genes encoding MHC molecules in the genome
(C) somatic hypermutation
(D) extensive polymorphism at many of the alleles
(E) isotype switching

31. Which of the following cytokines is not secreted by T_H2 cells? (Select all that apply.)
(A) IFN-γ (gamma)
(B) IL-4
(C) lymphotoxin (LT)
(D) IL-10
(E) TGF-β (beta)

32. Which of the following is a feature of regulatory T cells (Treg)? (Select all that apply.)
(A) Treg express CD8 and control effector cells by inducing apoptosis
(B) Treg express high levels of CD25 (IL-2 receptor α (alpha) chain) and secrete pro-inflammatory cytokines such as IFN-γ (gamma)
(C) Physical association between Treg and their target cells is mandatory for Treg function

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(D) By interacting with dendritic cells in secondary lymphoid tissue, Treg prevent the interaction and activation of naive T cells
(E) Treg secrete TGF-β (beta) and suppress effector T-cell function

33. The process by which cytotoxic T cells kill their targets involves _____. (Select all that apply.)
(A) inducing the target cell to undergo necrosis
(B) inducing apoptosis (programmed cell death) in the cytotoxic T cell
(C) DNA fragmentation in lengths of multiples of 200 base pairs in the target cell
(D) shedding of membrane-bound vesicles and shrinking of the target cell
(E) release of granzyme, perforin, and granulysin by the cytotoxic T cell

34. SARS-CoV2 is the causative agent of COVID-19 disease. Which of the following statement is correct for SARS-CoV2? (Select all that apply.)
(A) It is an RNA virus
(B) The genome of SARS-CoV2 is very stable and nearly mutated during transmission
(C) Human is the only host
(D) It uses spike protein to bind ACE2 receptor to infect host cells
(E) There is no vaccine available to prevent SARS-CoV2 infection of humans

複選題: 每題 4 分, 共 16 分　※ 注意：請於試卷內之「選擇題作答區」依序作答。

35. Which of the following statements are NOT correct? (Select all that apply.)
(A) Host-pathogen interactions determine the infection outcome
(B) The effector mechanisms that are recruited to clear an infection are always the same, regardless of the type of pathogens
(C) Inherited genetic defect in T cell development can result in defects in other components of the immune system and cause severe combined immunodeficiency (SCID)
(D) Allergy and autoimmunity are caused by normal immune responses that are direct against inappropriate antigens
(E) Type I hypersensitivity reaction is caused by an IgG-mediated immune response whose main physiological role is to defend against parasite infection

36. Which of the following statements are NOT correct? (Select all that apply.)
(A) Seasonal influenza vaccines are designed to elicit antibodies matched to each year's circulating virus strains and must be reformulated annually
(B) The gradual mutational change in the surface proteins of influenza virus are referred to as antigenic shift
(C) Some viruses can infect cells then enter a state called latency and establish lifelong infections
(D) Vaccine design takes into account whether the pathogen is intracellular or extracellular
(E) The T cell receptor recognizes antigen in the context of MHC whereas the B cell receptor recognizes antigen directly

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37. Which of the following statements are correct? (Select all that apply.)
(A) Naïve T cells differentiate into effector T cells after T cell priming has occurred
(B) Naïve T cells being activated by specific antigen receive co-stimulatory signals through CD28
(C) Dendritic cells can process and present antigen in the context of either MHC class I or MHC class II
(D) Regulatory CD4 T cells are generated during antigen/MHC recognition in the absence of co-stimulation
(E) The frequency of antigen-specific naïve and memory CD8 T cells specific for an antigen are the same after infection with a pathogen containing that antigen

38. Germinal center reactions are critical for mounting the humoral immune responses. Which of the following statements are NOT correct? (Select all that apply.)
(A) Somatic hypermutation introduces mutations to the constant region of the immunoglobulin
(B) AID (Activation-Induced Cytidine Deaminase) is essential for class switching and somatic hypermutation
(C) Follicular dendritic cells (FDC) present short peptides to helper T cells that then activate B cells
(D) Class switching requires interactions between germinal center B cells and follicular helper T (T_{FH}) cells
(E) Thymus-Independent (TI) stimulation events generate germinal center responses

二、配合題: 每格 1 分, 共 5 分 ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Match the cell type in column A with its description in column B.

Column A	*Column B*
__a. mature dendritic cells	1. produce type-1 interferons during viral infections
__b. T_H17 cells	2. facilitate antibody production and isotype switching
__c. plasmacytoid dendritic cells	3. express the T-bet transcription factor
__d. T_H1 cells	4. possess elaborate finger-like processes that interact with T cells
__e. T_{FH} cells	5. involved in neutrophil recruitment to infected tissues

三、問答題　※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Please describe the (1) fate-specifying cytokines (signal 3 delivered by APCs), (2) master transcription factors, (3) cytokine profiles, and (4) function of iTreg cells. (4 分)

2. Please describe or propose how to treat allergic disease. (3 分)

3. Please describe or propose how to enhance the immunogenicity of an antigen. (3 分)

4. Pathogens that infect the human body replicate either inside cells (such as viruses) or extracellularly, in the blood or in the extracellular spaces in tissues. Please answer the following questions: (4 分)
(1) What is the class of T cells that are stimulated by intracellular pathogens?

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(2) What is the co-receptor for these T cells?

(3) What is the MHC molecule used for recognition of intracellular antigen?

(4) What is the T-cell effector function?

5 Describe 3 main differences between innate immunity and adaptive immunity. (6 分)

6 Explain the statement "Immune memory is the basis for vaccination" (5 分)

試題隨卷繳回