

一、選擇題 ※注意：請於試卷內之「選擇題作答區」依序作答。

單選題：每題 1 分，共 10 分

1-3. Which of the following protein/molecule is involved in (A) Class I pathway (B) Class II pathway or (C) Both or (D) neither of the antigen presentation?

1. Endogenous antigen
2. Invariant chain (Ii)
3. TAP-1

4-6. Which of the following features is belonging to (A) Class I MHC molecules (B) Class II MHC molecules (C) Both (D) Neither?

4. Accommodates peptides of 20 residues
5. HLA-B
6. Polymorphic residues locate at $\alpha 1$ and $\beta 1$ domains.

7-10. Which one of the following properties is related to human immunoglobulin

(A) IgM (B) IgD (C) IgG (D) IgA (E) IgE?

7. Lowest amount in the serum
8. Dimeric form transports across epithelia
9. The best Ig to activate complement system
10. Fc portion of Ig is transported by 2 molecules of FcRn (neonatal Fc receptor) across the placenta.

單選題：每題 2 分，共 24 分

11. Which is NOT the fate of self-responsive B cells in the bone marrow?

- (A) Clonal expansion
- (B) Ignorance
- (C) Generation of non-autoreactive mature B cells
- (D) Apoptosis
- (E) Anergy

12. Which one of the following factors is NOT involved in RAG-dependent V(D)J rearrangement?

- (A) XRCC4
- (B) TdT
- (C) Ku70
- (D) DNA-PK
- (E) AID.

13. A helper T cell response to a protein antigen requires the participation of antigen-presenting cells that express which of the following types of molecules?

- (A) Class II MHC and co-stimulators
- (B) Class I MHC and CD4
- (C) Class II MHC and CD8

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- (D) CD4 and co-stimulators
(E) Class II MHC and CD4.
14. Which of the following is NOT a required step in B and T lymphocyte development?
(A) Proliferative expansion of precursor cells
(B) Cell surface expression of complete antigen receptor complexes
(C) Positive selection
(D) Activation of precursors by foreign antigens
(E) Pre-antigen receptor expression.
15. Which of the following is NOT an example of a checkpoint in lymphocyte development that contributes to the selective maturation of cells with useful antigen receptors?
(A) B cell precursors that cannot express TLR die by apoptosis.
(B) Developing T cells that fail to express TCR α chains die by apoptosis.
(C) Developing T cells that recognize self-major histocompatibility complex (MHC) molecules with high affinity die by apoptosis.
(D) Immature B cells that bind to self-antigen with high affinity die by apoptosis.
(E) T cell precursors that cannot express TCR β chains die by apoptosis.
16. Which one of the following molecules is the specific transcription factor of follicular helper T (T_{FH}) cell?
(A) T-bet
(B) ROR γ t
(C) GATA-3
(D) FoxP3
(E) Bcl-6.
17. Which one of the following experimental approaches is used to reduce the expression of gene?
(A) Affinity chromatography
(B) Chromatin immunoprecipitation
(C) ELISA
(D) Flow cytometry
(E) RNA interference (RNAi).
18. Which of the following is NOT a characteristic of inflammation?
(A) Vasodilation
(B) Increased vascular permeability and edema
(C) Inactivation of macrophages
(D) Influx of leukocytes
(E) Pain
19. The processes of clonal selection and clonal expansion occur during _____.
(A) hematopoiesis

- (B) innate immune responses
 - (C) adaptive immune responses
 - (D) self-renewal
 - (E) memory cell development
20. The specialized cells that provide the interface between the lumen of the gut and the underlying lymphoid tissue _____.
- (A) make up the germinal center
 - (B) are located in the periarteriolar lymphoid sheath
 - (C) are progenitors of monocytes
 - (D) are called M cells
 - (E) are specialized in killing encapsulated bacteria
21. Pattern recognition receptors _____.
- (A) express on the surface of pathogens
 - (B) do not have specificity
 - (C) are used by macrophages and neutrophils to recognize pathogens
 - (D) are antigen-specific
 - (E) only express on the surface of cells
22. Complements and antibodies coat a microorganism and provide binding sites, enabling macrophages and neutrophils to uptake the organism. This phenomenon is termed _____.
- (A) Opsonization
 - (B) Inflammation
 - (C) Phagocytosis
 - (D) Complement activation
 - (E) Pattern recognition

複選題：每題 2 分，共 12 分

23. Which of the following are true for cancer immune checkpoint blockade treatments? (Select all that apply.)
- (A) They are very effective on leukemia.
 - (B) They are used to activate tumor-specific T cell immunity.
 - (C) They are used to activate regulatory T cells to combat tumors.
 - (D) They are antibody-based therapy.
 - (E) They may increase the risk to trigger autoimmunity in patients.
24. Which of the following components are used to make vaccines for COVID-19? (Select all that apply.)
- (A) subunit components
 - (B) mRNA
 - (C) capsule:carrier protein conjugates

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(D) whole infectious viral particles

(E) IFN- γ

25. Reasons affecting the efficacy of COVID-19 vaccines include _____. (Select all that apply.)

(A) no vaccine adjuvant is included in the vaccine

(B) only one serotype of SARS coronavirus (CoV)-2

(C) antibody response is waned (消退) over time

(D) survival of the infectious agent for long periods inside the host

(E) high mutation rates in the pathogen.

26. For a viral subunit vaccine to be effective, _____. (Select all that apply.)

(A) T cells must be first activated

(B) neutralizing antibodies must be induced

(C) germinal centers must be formed

(D) NK cells must be activated

(E) it must be derived from viral surface components.

27. Which of the following is a mechanism by which tumors can evade immune detection? (Select all that apply.)

(A) reduction in levels of HLA class I

(B) recruitment of regulatory T cells

(C) enhancement of inflammatory responses

(D) lowering of levels of FasL on the cell surface

(E) creating physical barriers to the immune system.

28. Which cytokines are associated with tumor-induced suppression of the immune response? (Select all that apply.)

(A) IL-10

(B) TGF- β

(C) IL-2

(D) IL-4

(E) IFN- γ .

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

二、是非題：每題 1 分，共 6 分

Indicate whether the following statement are true (T) or false (F). If it is false, explain why.

1. Innate immunity acts within hours after bacteria invade the body. It is antigen specific and develops immunological memory.
2. Lymphocytes encounter and respond to antigen at the site of infection.

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3. Peyer's patch is the secondary lymphoid organs of the small intestine.
4. Infection stimulates macrophages to release cytokines and chemokines that initiate an inflammatory response.
5. NOD-like receptors express on the membrane of endosomes to detect bacterial degradation products inside the cells.
6. Chemokines are a particular group of cytokines that direct the movement of cells along a concentration gradient.

三、配合題： ※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. Match the physical effects of IgE-mediated mast-cell degranulation in column A with the tissue exposed to the allergen in column B. (5 分)

Column A	Column B
__ a. vomiting	1. respiratory tract
__ b. diarrhea	2. heart and vascular system
__ c. wheezing (喘鳴)	3. gastrointestinal tract
__ d. decrease in blood pressure	
__ e. violent bursts of sneezing	

2. Match the term in column A with its all possible descriptions in column B. (8 分)

Column A	Column B
_ a. Delayed-type hypersensitivity	1. is mediated by Th1 or CD8+ T cells.
__ b. Allergic contact dermatitis	2. type IV hypersensitivity
__ c. Celiac disease	3. is the base of Mantoux test (the standard tuberculin test)
__ d. Immediate hypersensitivity	4. caused by gluten in the diet
	5. Antigen processed by Langerhans cells in the epidermis sensitizes T cell response.
	6. can be caused by poison ivy.
	7. Caused by activation of mast cells
	8. Stimulated by IL-2

3. Match the Toll-like receptor (TLR) to its ligand: (6 分)

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(A) TLR-2/TLR-1 or TLR-2/TLR-6	(1) Flagellin
(B) TLR-3	(2) ssRNA
(C) TLR-4	(3) dsRNA
(D) TLR-5	(4) lipopolysaccharide
(E) TLR-7	(5) unmethylated CpG DNA
(F) TLR-9	(6) lipoteichoic acid and di-/triacyl lipoproteins

四、簡答題 ※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. Please list five general properties of **cytokines**. (5 分)
2. Please list three cytokines/molecules released by **activated CD8⁺ T cells**. (3 分)
3. Please describe the **allelic exclusion** of antigen receptor genes. (2 分)
4. X-linked SCID (XCID) is caused by mutations in the gene IL2RG on the human X chromosome, which encodes the IL-2 receptor (IL-2R) common gamma chain (γ_c). (4 分)
 - (1) Describe members of IL-2 cytokine family that require γ_c for signaling.
 - (2) Explain patients with XCID have severe impairments in the development of T cells and NK cells but the development of B cells is unaffected.
5. Bone marrow transplantation can be used to correct immunodeficiencies caused by defects in lymphocyte maturation. Explain the mechanisms that can result in systemic immune disease or graft rejection in the recipient of bone marrow transplantation. (4 分)
6. Name the primary lymphoid tissues in mammals and three main types of secondary lymphoid tissue (3 分). What are the principal events that take place in primary and secondary lymphoid tissues? (3 分)
7. What are two products of the C3 convertase? (2 分) Name three downstream events that can result from the formation of these products and lead to clearance of the microbe (3 分).