

一、選擇題(單選，每題 2 分) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. Regarding innate lymphoid cells (ILC) which statement is NOT correct?
 - A. NK cells belong to ILC1 which can secrete IFN- γ
 - B. ILC2 secretes IL-5, IL-9 and IL-13
 - C. ILC3 secrete mainly IL-7 and its transcription factor is ROR α
 - D. All ILCs belong to innate immune system and can secrete interleukins that are originally believed to be produced by T cells only.

2. Regarding chemokine and chemokine receptors which statement is NOT correct?
 - A. Based on their conserved aspartic acid residues, chemokine can be classified into CC, CXC, CX3C and C chemokines
 - B. Chemokine receptors use large G proteins to transduce signals
 - C. Silent chemokine receptors are a group of receptors that bind chemokines but do not transduce signals
 - D. Chemokine receptors are also important for leukocyte development

3. Regarding macrophages, which statement is NOT correct?
 - A. Macrophages are present in different tissues and organs
 - B. Specialized macrophages in the brain is call kupffer cell
 - C. Macrophages express various phagocytic receptors, including scavenger receptors and Fc receptors
 - D. Phagocytosis and antigen presentation are both important functions of macrophages

4. Regarding the complement system, which statement is NOT correct?
 - A. Free IgM (does not bind antigen yet) is not able to activate complement
 - B. The classical pathway is initiated by the binding of C1q to Fc of an antibody
 - C. C4b2a is the C3 convertase for both classical and lectin pathways
 - D. Activation of C5-C9 do not involve protease activity

5. Regarding B cell activation, which statement is NOT correct?
 - A. Activation of follicular B cells involves signal one from IgM (BCR) and signal two from costimulatory signals such as CD40
 - B. Full activation of B cells requires BCR to recognize the same epitope as that recognized by TCR from a cognate Th cell, which is called linked recognition
 - C. Following activation, B cells are able to differentiate into plasma or memory B cells
 - D. Activated B cells are also able to do class switching

※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

二、解釋名詞(各 3 分)

1. CTLA-4
2. Positive selection
3. Anergy
4. T cell exhaustion

見背面

- 5. MHC restriction
- 6. PD-1
- 7. Elastase
- 8. T cell receptor
- 9. Epigenetic modification
- 10. Toll-like receptors
- 11. Antigenic drift
- 12. IL-17
- 13. Spleen

三、配合題

1. Match the term in Column A with its description or function in Column B. (單選，每格 1 分，共 4 分)

<i>Column A</i>	<i>Column B</i>
___ a. β (beta)2-microglobulin	1. Trims peptides to fit MHC class I molecules
___ b. CLIP	2. Hyperpolymorphic protein
___ c. Invariant chain	3. MHC Class I-associated molecule
___ d. Endoplasmic reticulum aminopeptidase (ERAP)	4. MHC Class II molecules in MIIC
	5. Cross-presentation pathway
	6. Transports MHC molecules to endocytic vesicles

2. Match the cell type in column A with its description in column B. (單選，每格 1 分，共 4 分)

<i>Column A</i>	<i>Column B</i>
___ a. CD4 T _H 1 cells	1. Produce type-1 interferons during viral infections
___ b. CD4 T _H 2 cells	2. Facilitate antibody production and isotype switching
___ c. regulatory CD4 T cells (T _{reg})	3. Express the T-bet transcription factor
___ d. CD8 T cells	4. Express the ROR γ T transcription factor
X	5. Kill target cells by inducing apoptosis
	6. Involved in neutrophil recruitment to infected tissues
	7. Suppress T cell proliferation

3. 配合題: pick up the right answer from the below list (單選, 每格 2 分, 共 10 分)

- _____ (1) serum sickness
_____ (2) cancer antigen
_____ (3) contact hypersensitivity
_____ (4) RAG gene
_____ (5) anaphylaxis

- (A). MHC class I antigen presentation
(B). MHC class II antigen presentation
(C). non classical MHC antigen
(D). antigen binding sites in T cell receptor (TCR)
(E). NK cell receptor
(F). Initiate the cutting of recombination sequence-specific DNA cleavage during Ig gene rearrangement
(G). affinity maturation
(H). Class switching
(I). Type I hypersensitivity
(J). Type II hypersensitivity
(K). Type III hypersensitivity
(L). Type IV hypersensitivity

四、簡答題

1. Please correct the following false statements (請更正以下每一題錯誤的敘述, 每題 3 分, 共 12 分)

- (1) The developmental pathway for T cells is thymus → bone marrow → spleen
(2) T-cell receptor rearrangements have many features in common with immunoglobulin rearrangement, including the use of TdT (Terminal deoxynucleotidyl transferase) gene.
(3) Both T cells and B cells recognize soluble, native protein antigens.
(4) Regarding peptide-MHC interactions, the peptide is covalently bond in the groove of the MHC molecules.

2. Give **three** reasons why secondary T cell immune responses are faster and more effective than primary immune responses. (共 2 分)

3. Give **three** most likely outcomes for a mature naïve T cell that encounters a self antigen outside the thymus in healthy individuals and in the absence of infection. (共 3 分)

五、問答題

1. Primary immunodeficiency (PID) is due to deficiency in a gene that causes developmental defects in immune cells. It is known that cytokine or cytokine receptors are critical for controlling the development of immune cells. What is the general signaling pathway downstream of cytokine receptors? (4 分) Please give one example and explain the mechanism why single gene mutation in the signal pathway may result in PID. (4 分) Recent advances in CRISPR-Cas9 system may help repair the mutation and cure the PID. What is the basic principle of this technique? (4 分) What are the concerns when using this system to do gene therapy for PID? (4 分)