一、選擇題：**1-4** 題單選，每題 1 分；**5-12** 題複選，每題 2 分。請作答於**選擇題作答區**。

（單選題，每題 1 分）

1. Method is not used to determine the level of gene expression
   (A) Northern blotting
   (B) RT-PCR
   (C) Western blotting
   (D) Gene array (gene-chip) assay
   (E) DNA sequencing.

2. Which is not an antigen-mediated receptor pathway in immune system?
   (A) IFNγ receptor pathway
   (B) Toll-like receptor pathway
   (C) NK receptor pathway
   (D) T cell receptor pathway
   (E) B cell receptor pathway

3. Enzyme(s) that mediate the rearrangement of V, D, J gene segments
   (A) Protein tyrosine kinase
   (B) RAG1 and RAG2
   (C) RecA
   (D) AP-1
   (E) NFAT.

4. Which property is not true for the action of cytokines?
   (A) Pleiotropism
   (B) Redundancy
   (C) Synergy
   (D) Affinity maturation
   (E) Antagonism

（複選題，每題 2 分）

5. Which ones of the following cells/molecules are involved in positive selection in thymus?
   (A) Cortical epithelial cells
   (B) Medullary DCs
   (C) Macrophages
   (D) MHC class I/II
   (E) LPS

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6. Which events are happening during the maturation of B-lymphocytes?
   (A) Expression of CD3
   (B) Expression of Igα and Igβ
   (C) Up-regulation of transcription factor Pax-5
   (D) Up-regulation of signal molecule Lck
   (E) Up-regulation of growth factor receptor IL-2R.

7. Cytokines secreted by Th2 cells
   (A) IFNα
   (B) IL-4
   (C) IL-5
   (D) IFNβ
   (E) IFNγ

8. Co-receptor mediated signal transduction in T cells
   (A) Integrins
   (B) CD4/CD8
   (C) CD3
   (D) CD19
   (E) CD28

9. Who discovered the MHC restriction phenomenon?
   (A) Peter Doherty
   (B) Rolf Zinkernagel
   (C) David Baltimore
   (D) Susumu Tonegawa
   (E) Mark Davis

10. What are the fates of self-responsive B cells?
   (A) Ignorance
   (B) Anergy
   (C) Apoptosis
   (D) Receptor editing
   (E) Hypersensitivity

11. Which one(s) of the following features are true for class I MHC molecules?
   (A) Polypeptide chains are α and β
   (B) The α1 and β1 domains are the locations of polymorphic residues
   (C) Accommodates peptides of 8-11 residues
   (D) Accommodates peptides of 10-30 residues
   (E) HLA-A, HLA-B and HLA-C in Human

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12. Mast-cell activation has different effects on different tissues. Which one(s) of the following is true?
(A) Increase fluid secretion in gastrointestinal tract
(B) Decrease the diameter of airways
(C) Decrease mucus secretion in airways
(D) Increase blood flow of blood vessels
(E) Decrease permeability of blood vessels

二、是非題、解釋名詞、配合題、問答題：請作答於**非選擇題作答區**。

1. 是非題(共 20 分)：對請劃〔O〕、錯請劃〔X〕。

(1) Tumor necrosis factor-alpha 和 transforming growth factor-beta 是相同的 cytokine。(2 分)

(2) NKT 細胞在經由抗原活化後就會變成 NK 細胞。(2 分)

(3) 活化的 NKT 細胞會分泌 IL-2，IL-4 和 IFN-γ。(2 分)

(4) TCGF (T cell growth factor) 和 IL-2 是相同的 cytokine。(2 分)

(5) Dendritic Cell 表面表現高量的 MHC I 以及 MHC II。(2 分)

(6) 人類約有 5,000 到 10,000 個基因。(2 分)

(7) T cell receptor complex 是由α, β, CD3γ, CD3ε, CD3δ, ζ等蛋白所組成。在無法表現ζ的細胞，負責辨識抗原的 αβ heterodimer 表現於此細胞之表面是不受影響的。(2 分)

(8) 可以在接收 TNF-alpha 後，並傳遞訊息至細胞內部之 receptor 不只一種。(2 分)

(9) 主流 $CD4^+$ T 淋巴球的發育(development)不需要 MHC I。(1 分)

(10) TCR-γδ T 淋巴球的發育(development)不需要 MHC II。(1 分)

(11) CD8 不但會表現在毒殺型淋巴細胞之表面，也會表現在某些 dendritic cell 的表面。(1 分)

(12) NKT 細胞之 T cell receptor 是經過基因重組的過程所產生的。(1 分)

2. A new viral disease TARS is threatening human health . You and your professor worked very hard to study immune response in patients infected by this virus and to develop a vaccine against this virus. After much hard work, you were able to culture the virus and identify the major viral protein TRT as a 30 KD protein. You also found that mice immunized with TRT mount both B and T cell responses.

Regarding the epitopes recognized by B and T cells, which of the following is correct? (2 分，單選)

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(A) T cells recognize a short peptide within the TRT protein but not that on the protein surface
(B) T cells recognize the soluble native TRT protein
(C) B cell epitope is usually a linear continuous epitope
(D) CD8 T cells recognize the virus-infected cells via antigens presented by MHC class II
(E) Both B and T cells can recognize TRT protein, so they recognize the same epitopes

3. When a mutation is introduced into MHC class II region leading to disruption of genes, which of the following function could be impaired? （複選，也可能只有一個答案）(2 分)

(A) MHC class I antigen presentation (B) MHC class II antigen presentation (C) expression of MHC class I molecule (D) expression of MHC class II molecule (E) synthesis of invariant chain

4. 配合題: Pick the right answer from the list below. (單選, 共 8 分)

_____(1) TAP
_____(2) discovery of MHC restriction
_____(3) CLIP
_____(4) RAG

(A) MHC class I antigen presentation
(B) MHC class II antigen presentation
(C) Both MHC class I and II antigen presentation
(D) antigen binding sites in T cell receptor (TCR)
(E) S. Tonegawa
(F) G. Snell
(G) P. Doherty
(H) Initiate the cutting of recombination sequence-specific DNA cleavage during Ig gene rearrangement
(I) NK cell receptor
(J) Generation of memory cells

5. 解釋名詞(各 2 分)
A. Clonal selection
B. Superantigen
C. MHC restriction
D. Allelic exclusion
E. Anergy
F. Toll-like receptors
G. B-1 B cells
H. X-linked hyper IgM syndrome
I. Acute phase proteins

6. How is complement activation pathways regulated? Please give at least two examples in your answer. (5 points)

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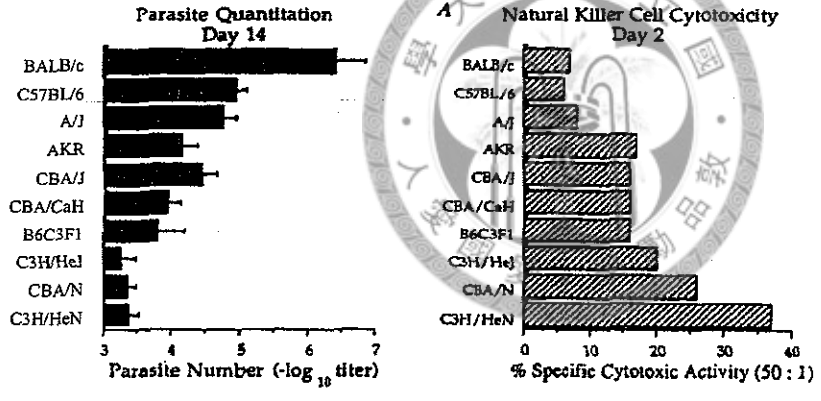
7. Please list the three families of adhesion molecules. Explain the role of adhesion molecules in cell trafficking. (5 points)

8. Natural killer cells are the first line of defense against various pathogens including viruses and bacteria. To study the possible role of NK cells in anti-parasite activity, *Leishmania major*, was injected into different strains of mice. As shown in the following figures, the parasite numbers (left panel) and the corresponding *in vitro* NK cell activity (right panel) were measured. The *in vitro* NK cell activity was accessed by incubating splenic NK cell with YAC-1, an NK target cell, at ratio of 50:1 and lysis of the target cells was calculated as % specific cytotoxic activity.

   A. Please describe the roles of NK cells in the innate immune response (3 points)
   B. From the following experiments, what kind of conclusion can you make? (2 points)
   C. Please design an experiment to show that the reduced parasite number is indeed due to the increased NK cell activity (4 points)



9. Cytokines are critical factors for regulating immune responses. The effects of cytokines are mainly mediated by the Jak-STAT signaling pathways, which are positive regulators of cytokine response. Other than Jak-STAT pathway, several negative regulators are also important for balancing the reactions. Among them, PIAS proteins are known to counteract the action of STATs in the cytokine- mediated response. To explore the *in vivo* role of Jak1, a member of the Janus kinase, and Pias1, a member of PIAS proteins, they were "knocked-out" by homologous recombination. The role of Jak1 was examined in viral infection treated or untreated (Unt) with IFNβ (left panel). Similarly, the role of Pias1 was also examined during MHV, a virus, infection. The viral titer was measured in the Jak1-/- or Pias1-/- cells, as a readout for cellular anti-viral response.

   A. Please describe how Jak-STAT pathway is activated in response to cytokine stimulation? (5 points)
   B. How do you interpret the results and what kind of conclusion can you make from the following figures in terms of the roles of Jak1 (3 points) and Pias1 (3 points)?

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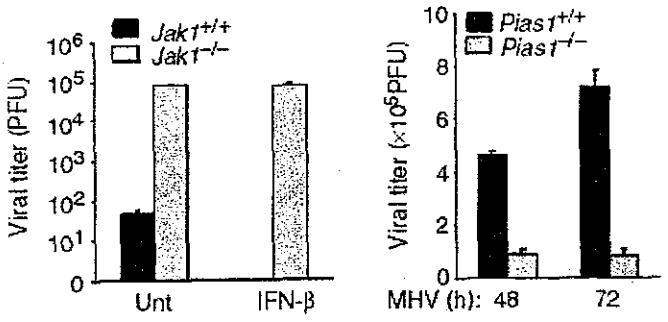

試題隨卷繳回