國立成功大學

115學年度碩士班招生考試試題

編　號：180

系　所：微生物及免疫學研究所

科　目：免疫學

日　期：0204

節　次：第 3 節

注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. Please read the abstract and answer the following questions:

Recent advances in xenotransplantation represent a major milestone in transplant immunology and offer a potential solution to the shortage of human donor organs. In 2025, the FDA approved the first clinical trial of genetically modified pig kidney transplantation in humans. Key genetic modifications, such as deletion of the alpha-gal antigen, aim to reduce hyperacute rejection mediated by pre-existing human antibodies. Despite these advances, pig-to-human xenografts still trigger complex immune responses. Long-term studies in brain-dead recipients enabled detailed monitoring of immune events over 61 days, revealing a dynamic sequence of rejection mechanisms. Early immune responses were dominated by innate leukocytes, followed by macrophage-mediated injury and later strong T cell–driven adaptive responses. Antibody-mediated damage and newly generated human antibodies against porcine antigens further highlighted the complexity of xeno-immune recognition. Together, these findings identify key cellular and molecular pathways involved in xenograft rejection and suggest potential biomarkers and immunomodulatory targets. Continued control of both innate and adaptive immunity will be essential for achieving durable xenograft survival and clinical translation [*Nature Medicine, News, 18 March, 2025;doi: https://doi.org/10.1038/d41591-025-00020-0*]

(1) Briefly compare xenotransplantation and allotransplantation and discuss their respective clinical challenges. (6%)

(2) Before organ transplantation, what immunological compatibility tests are performed, and why are they important? (10%)

(3) Compare graft rejection and graft-versus-host disease (GVHD), focusing on the source of immune cells and the direction of the immune response. (6%)

2. Explain how the immune system responds to pathogen infection by describing the process from innate immunity to adaptive immunity. (10%)

3. Define antibody isotypes. (5%) Choose two antibody isotypes and for each, describe one major immune function. (10%)

4. Briefly explain the immunological mechanisms of the following diseases, focusing on the key immune effector mechanisms involved. (6% each)
   (1) Acquired immune deficiency syndrome
   (2) Bronchial asthma
   (3) Mismatched transfused blood cells

5. Compare NK cells and $CD8^+$T cells by describing how each cell recognizes target cells. (10%)

6. Please briefly explain the following terms: (5% each)
   (1) Langerhans cell
   (2) class switch
   (3) membrane attack complex (MAC)
   (4) chemokine
   (5) phagocytosis