

國立成功大學

114學年度碩士班招生考試試題

編 號：190

系 所：微生物及免疫學研究所

科 目：免疫學

日 期：0211

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:

A typical vaccination involves injecting a peptide fragment through the skin, where dendritic cells (DCs) take up the antigen and transport it to the lymph nodes (LN). In the LN's germinal center (GC), DCs present the antigen to follicular helper T (TFH) cells and B cells, triggering B cells to produce antibodies targeting the antigen. But the extent to which skin-specific sites exist as niches for antibody production by B cells of the immune system is unclear. Writing in *Nature*, Gribonika et al. and Bousbaine et al. reveal that topical administration of the commensal bacterium *Staphylococcus epidermidis* on the skin can induce dermal GC-like structures and support specific antibody responses in the skin without an infection. Gribonika et al. propose that skin GC-like reactions may derive, at least in part from the ability of regulatory T (Treg) cells to convert into TFH cells. Bousbaine et al. report evidence consistent with this idea of local antibody production in the skin. Applying engineered *S. epidermidis* expressing Tetanus toxoid to the skin of mice induced a robust neutralizing IgA response in the nasal and pulmonary mucosa that protects mice against a lethal challenge. Thus, immunity to a common skin colonist involves a coordinated T and B cell response, the latter of which can be redirected against pathogens as a novel form of topical vaccination. This approach achieved antibody defenses similar to those arising after a typical vaccination approach by injection but without the need for potentially painful needle insertion. (*Nature*. 2024 Dec 19. doi: 10.1038/d41586-024-04205-4.)

- (1) In GC, how do DCs present antigens? (10%)
 - (2) What are Tregs; how do they preserve immune homeostasis? What pathological outcomes and diseases can arise if their functions are impaired? (10%)
 - (3) What are toxoids, and how does a tetanus toxoid vaccine protect against tetanus? (5%)
 - (4) Based on your opinion, describe the critical contributions of these researches. (10%)
2. What is the main function of the complement system? (5%) How are the three complement pathways—classical, alternative, and lectin—activated? Provide a brief explanation of each pathway's initiation steps. (15%)
3. Please briefly explain the following terms: (4% each)
- (1) hapten
 - (2) class switching
 - (3) Fab
 - (4) antigen-dependent cellular cytotoxicity
 - (5) epitope
4. How can someone with type O blood donate to a person with type A blood, but someone with type A blood can't donate to a person with type O? Please explain the basic immune reasons for this difference. Also, what type of hypersensitivity occurs if the wrong blood is transfused? (10%)
5. What are the three lines of defense in the immune system, and how does each one protect the body? (15%)