

國立嘉義大學九十六學年度

微生物與免疫學系碩士班招生考試試題

科目：專業英文

I. Reading Exam

Please read the following short articles abstracted from scientific journals or newspapers. Clearly explain and write down few sentences in Chinese to describe the central theme of the short articles.

- (A) Microbiologists have known for some time that certain pathogenic bacteria and some soil microbes swap genes, which shuttle from microbe to microbe as part of mobile bits of DNA called plasmids. Such gene transfers account, for example, for the rapid spread of resistance to antibiotics. But recent work suggests that the transfers may be even more common than thought, particularly in the deep evolutionary past, allowing microbes to exchange a wide variety of different genes--and complicating biologists' efforts to trace microbial evolution. Indeed, as new work presented at the Microbial Genomes III meeting shows, these widespread gene transfers have not been confined to the evolutionary past but are going on today, even in supposedly ancient organisms, called Archaea, whose genomes have been thought to be long fixed. (*Adapted from Science 1999 284:1306*) (10%)
- (B) The liver is a huge and metabolically active organ, enriched with substantial numbers of non-conventional immune cells that help to protect it from pathogens and potentially harmful immune responses to benign foreign material (such as antigens in food). Particularly striking are the many natural killer T (NKT) cells, which likely serve to regulate hepatic immunity. To examine the behavior of hepatic NKT cells in situ, mice were used in which one of the alleles coding for the NKT chemokine receptor CXCR6 had been replaced with green fluorescent protein. Intravital confocal microscopy revealed that NKT cells remained confined to the blood vessels within the liver, moving randomly and visiting each hepatocyte every quarter of an hour. This behavior differs from that of conventional activated T cells, which generally pass across the vessel endothelium into the surrounding tissue. Nevertheless, as do T cells on patrol in lymph nodes, hepatic NKT cells stop moving upon encountering antigen, consistent with their surveillance duties. In the absence of CXCR6, the number of hepatic NKT cells was significantly reduced, suggesting that this chemokine receptor mediates a survival signal. (*Adapted from Science 2005 308:167*) (10%)
- (C) Microbial pathogens that inhabit our environment must undergo a radical change to survive inside a mammalian host. Among the more than 100,000 different species of environmental fungi are six phylogenetically related ascomycetes called the dimorphic fungi: *Blastomyces dermatitidis*, *Coccidioides immitis*, *Histoplasma capsulatum*, *Paracoccidioides brasiliensis*, *Sporothrix schenckii*, and *Penicillium marneffeii*. These fungi change morphology once spores are inhaled into the lungs of a mammalian host from hyphal molds in the environment to pathogenic yeast forms. Dimorphic fungi inhabit the soil world-wide and collectively cause over a million new infections a year in the United States alone. They tend to remain latent after infection and may reactivate if the subject becomes immune deficient. It has long been believed that phase transition from mold to yeast is obligatory for pathogenicity, but the mechanism that regulates this switch has remained a mystery. Recently, researches provide firm genetic evidence that establishes the central role of dimorphism in pathogenicity, and describe a regulator of this morphologic transition. It is temperature that induces dimorphic fungi to change phases. (*Adapted from Science 2006 312:583*) (10%)
- (D) Antibiotics are under threat. There is an explosion not just of antibiotic resistance but of multidrug resistance. The word 'superbugs' is commonly used to describe organisms — emerging at an alarming rate — that are resistant to most or all clinically used antibiotics. Methicillin-resistant *Staphylococcus aureus* now causes more than 100,000 recalcitrant infections each year and has insidiously started to spread into community-acquired infections. For virtually every organism and every antibiotic we are

observing a steady decrease in susceptibility over time. Meanwhile, there have been no new classes of antibiotics developed to fill the gap. The discovery of new antibiotics has plummeted over the past 12 years, with few new drug approvals. Except for the very recent development of two narrow-spectrum drugs — linezolid and daptomycin — there have been no new structural classes of antibiotic drugs introduced into human medicine since 1963, when the quinolone nalidixic acid was approved. (*Adapted from Nature Review Drug Discovery 2007 6:28*) (10%)

II. Translation Exam

Please translate the following short paragraphs into Chinese. Any particular word that you do not recognize, you can write it down in English in your translated sentences.

- (A) Fluorescence is the emission of photons by molecules that have absorbed light. Electrons move from a ground to an excited state, and on return to the ground state, a photon is emitted, of lower energy than the excitation light, which is represented by an increase in wavelength. The excitation of a fluorescent material, e.g. fluorescein by blue light, leads to an emission of green light, but the reverse is not possible. The shift in wavelength is an important and useful feature, since it is possible to excite several fluorescent dyes simultaneously by a single excitation wavelength. In another word, one can choose dyes with different emission wavelengths in a single excitation wavelength region. Hence, it enables separate information to be retrieved from the emissions from each dye, using selective filters for different wavelengths. (*Adapted from Practical Immunology 4th Ed. Blackwell Science*) (15%)
- (B) Both single- and double-stranded phage vectors have been employed in recombinant DNA technology. For example, lambda phage derivatives are very useful for cloning and can carry fragments up to about 45 kilobases in length. The genes for lysogeny and integration often are nonfunctional and may be deleted to make room for the foreign DNA. The modified phage genome also contains restriction sequences in areas that will not disrupt replication. After insertion of the foreign DNA into the modified lambda vector chromosome, the recombinant phage genome is packaged into circular capsids and can be used to infect host *E. coli* cells. These vectors are often used to generate genomic libraries. *E. coli* also can be directly transformed with recombinant lambda DNA and produce phages. (*Adapted from Microbiology, 5th Ed. McGraw Hill*). (15%)
- (C) Although research on the role of single nutrients in immune function is extensive, this is not the case for multiple nutrients and subsequent nutrient-nutrient interactions. Availability of one nutrient may impair or enhance the action of another in the immune system, as reported for nutrients such as vitamin E and selenium, vitamin E and vitamin A, zinc and copper, and dietary fatty acids and vitamin A. Nutrient-nutrient interactions may negatively affect immune function. For example, excess calcium interferes with leukocyte function by displacing magnesium ions, thereby reducing cell adhesion. Because of consumer interest in supplementation to improve immune function, the potential for harm exists. (*Adapted from J Am Diet Assoc. 1996. 96:1156*) (14%)

III. Please choose the best answer for the following questions based on your knowledge and what you have read from the short articles as follows:

- (A) Researchers from the National Public Health Institute of Finland report on a study of 200 cases of the common cold in university students over a one-year period. Student participants were asked to identify when they had a cold, based on a set of symptoms, and contact a study office, set up at the university, within two days of the appearance of the symptoms. The students were then tested to determine the cause of the symptoms. In 138 of the 200 cases, the researchers were able to identify an infectious agent as the cause. Rhinovirus was found to be the cause of 105, or just over half the cases in the study. Other causes of cold symptoms included coronavirus, influenza A virus, and respiratory syncytial virus (RSV). All of these viruses are known to cause symptoms associated with colds. Nearly all the colds with a known cause were found to be caused by a viral infection. Only 7 patients were found to have bacterial infections, but six were also found to have a viral infection as well. "These findings are consistent with our recommendations that antibiotics not be used to treat common cold symptoms" says Stuart Levy, president-elect of the American Society for Microbiology. "Almost all cases of the common cold are caused by viruses and antibiotics do not work on viral infections. The unnecessary and inappropriate use of antibiotics to treat cold symptoms is contributing to the development of

antibiotic-resistant bacteria. Despite this research and previous studies showing that antibiotics are of little use in treating the common cold, it is estimated that up to 60% of patients with common colds receive some type of antibiotic. This results in an estimated cost of \$37.5 million per year in the United States for unnecessary prescriptions on top of the risk of developing antibiotic resistance. *(Adapted from a news release issued by American Society for Microbiology)*

(B) Fatty fish contain large amounts of omega-3 fatty acids--diet-derived essential fatty acids known to benefit patients with cardiovascular disease and arthritis. This research group recently identified a new class of aspirin-triggered bioactive lipids, called resolvins, the activity of which may in part explain the beneficial effects of omega-3 fatty acids. Resolvins are made from the omega-3 fatty acids by cellular enzymes and can reduce inflammation in mice. The main bioactive component of this class of lipids was identified in mice and named resolvin E1. The researchers have now identified this lipid in plasma taken from volunteers given omega-3 fatty acids and aspirin. Human resolvin E1, the authors show, inhibits both the migration of inflammatory cells to sites of inflammation and the turning on of other inflammatory cells. This study also reveals a potential pitfall of COX-2 inhibitors, drugs designed to block inflammation, which have been shown to have negative cardiovascular side effects. COX-2 is involved in making resolvin E1 and the authors suggest that inhibition of vascular COX-2 by these inhibitors might block the synthesis of resolvin E1, which would eliminate an important anti-inflammatory pathway. The experiment to prove this idea, however, has yet to be done. *(Adapted from a news release issued by Journal of Experimental Medicine)*

(C) Red vine 紅藤菜 (*Brunnichia ovata* 落葵科), a persistent woody vine that regenerates new growth from woody root stocks and climbs by its tendrils, especially soybeans. Tendrils are organs used by some vines to assist their climbing, but little has been known about how they develop or support the vine. At the ARS Southern Weed Science Research Unit in Stoneville, Miss., plant physiologist Kevin C. Vaughn and post-doctoral scientist Christopher G. Meloche discovered two unique aspects of red vine tendrils. Red vine tendrils begin as straight, thin and flexible appendages of the shoot. Vaughn and Meloche discovered that epidermal cells along the length of the vine's tendril expand in response to touch by elongating toward a stimulus. The tendrils themselves, as a whole, respond by coiling around the object for support. Cells enriched with phenols break apart as the tendrils rub against the object. Then the phenols react with an enzyme, polyphenol oxidase (PPO), to produce sticky phenolic polymer cement used by the tendrils to stick to the vine's climbing surface. This is the first time the PPO enzyme has been implicated in generating an adhesive in a climbing plant. In another first, the researchers also discovered that the weed's tendrils produce gelatinous fiber cells, the same structures found in leaning trees trying to right themselves. These fiber cells are also enriched in lignin to radically increase their strength. Then the cells automatically die, which leads to a dry, rigid coil structure securely anchoring the vine to the support. The researchers found a unique cell wall composition with this process and are looking at steps in the metabolic pathways that might be inhibited to control red vine. *(Adapted from a news release issued by USDA/Agricultural Research Service)*

(D) "One of the major components of the immune system is T cells, a form of white blood cell. These cells are programmed to look for certain kinds of disease-causing pathogens, and then destroy them and the cells infected by them," said Nikolich-Zugich who is a professor of molecular microbiology and immunology in the Oregon Health and Sciences University (OHSU), School of Medicine. "Throughout our lives, we have a very diverse population of T cells in our bodies. However, late in life this T cell population becomes less diverse, potentially resulting in a higher level of susceptibility to disease. We think we have found one of the key reasons behind this age-related susceptibility." Specifically, in old age, the number of CD8 T cells diminishes. CD8 T cells have two functions: to recognize and destroy abnormal or infected cells, and to suppress the activity of other white blood cells to protect normal tissue. The scientists believe that late in life a different kind of CD8 T cell is increasingly produced by the body. These cells, called T cell clonal expansions (TCE), are less effective in fighting disease. They also have the ability to accumulate quickly as they have a prolonged lifespan and can avoid normal elimination in the organism. In the end, these TCE cells can grow to become more than 80 percent of the total CD8 population. The accumulation of this one type of cell takes away valuable space from other cells, resulting in an immune system that is less diverse and thus less capable in effectively locating and eliminating pathogens. *(Adapted from News, FuturePundit Dec. 5, 2004 by Randall Parker)*

1. One of the following virus is primary virus cause symptoms associated with cold in the report of the National Public Health Institute of Finland: (2%)
 - A. Influenza A virus
 - B. Coronavirus
 - C. Respiratory syncytial virus
 - D. Rhinoviruses
2. How many cases of cold patients were suffered from both bacterial and viral infections? (2%)
 - A. 138 out of 200 cases
 - B. 60% of patients
 - C. Over half of the cases
 - D. 6 cases
3. Unnecessary and inappropriate use of antibiotics to treat cold symptoms will most possibly result in what kind of problem? (2%)
 - A. Increasing the risk in developing antibiotic resistance
 - B. Increasing the susceptibility to respiratory syncytial virus infection
 - C. Causing complications by bacteria infections
 - D. Reducing symptoms of viral infections
4. Aspirin-triggered bioactive lipid is capable to: (2%)
 - A. Inhibits both the migration of inflammatory cells to site of inflammation and activation of inflammatory cells
 - B. Upregulates COX-2 in production of PGE2
 - C. Reduces the symptoms of arthritis by de novo synthesizing omega-3 fatty acids
 - D. Blocks the synthesis of resolving E1 in mouse
5. What is the tendril of red vine? (2%)
 - A. It is the woody root of the plant
 - B. It is appendage of the shoot
 - C. It is the enzyme produce by the plant
 - D. It is the compound inhibiting the climbing of the plant
6. The epidermal cells along the vine are enriched with phenols for what reason? (2%)
 - A. Serving as the materials for sticky phenolic polymer cement
 - B. Making coiling structure under the effect of PPO enzyme
 - C. Substrate for PPO enzyme to produce fiber
 - D. Assisting the weed in against biting by insects
7. We have diverse T cell populations, what will happen to the T cell population when we are getting old or as in the late of our lives? (2%)
 - A. The TCE population enhance the capability of destroying infected or abnormal cells
 - B. The diversity of T cells is increased while the total number of T cell is reduced
 - C. The population of TCE are diminished and the CD8 T cell population increased
 - D. CD8 T cells are outnumbered by TCE
8. One of the following description about CD8 T cell is NOT true: (2%)
 - A. Specifically recognize antigen-MHC II complexes presented by common cell populations
 - B. Suppress the activity of other white blood cells to protect normal tissue
 - C. Capable of producing granzyme and perforin
 - D. Secretion of type II interferon