# 國立成功大學 109 學年度碩士班招生考試試題

系　　所：醫學檢驗生物技術學系

考試科目：檢驗醫學　　考試日期：0211，節次：1



※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Discuss resistance mechanisms due to vancomycin-resistant genes in the vancomycin-resistant Enterococcus (VRE) (6 points). Compare the differences of these vancomycin-resistant genes (6 points). Discuss the detection and reporting of these VRE in the routine laboratory (6 points).
2. Discuss the rationale and applications of MALDI-TOF MS in clinical microbiology. (12 points)
3. A man presented to the emergency department with abdominal pain, nausea, and vomiting. He had a medical history of diabetes mellitus, hypertension, end-stage renal disease, hypothyroidism, and congestive heart failure. Laboratory results showed that serum lipase was 680 U/L (13–60 U/L) and triglycerides were 4425 mg/dL (< 150 mg/dL), along with clinical and radiologic findings, it suggested a diagnosis of hypertriglyceridemia-mediated pancreatitis. Then, the patient was treated with insulin and heparin, but triglycerides remained > 4425 mg/dL. Consequently, plasmapheresis was used to reduce the serum triglyceride concentrations, but triglycerides were not reduced at all. The transfusion medicine team noticed the appearance of clear plasma during the next plasmapheresis course and called the laboratory to investigate. After carefully evaluation, this patient was suggested having glycerol intake. Triglyceride concentrations decreased during his hospital stay without further treatment.

In the laboratory, serum triglycerides were measured by the following steps:

$$\text{Triglyceride} + 3\ H_2O \xrightarrow{\text{Lipase}} \text{Glycerol} + 3\ \text{fatty acids}$$

$$\text{Glycerol} + 3\ \text{ATP} \xrightarrow{\text{Glycerol kinase}} \text{Glycerophosphate} + \text{ADP}$$

$$\text{Glycerophosphate} + \text{Nicotinamide-adenine dinucleotide} \xrightarrow[\text{dehydrogenase}]{\text{Glycerophosphate}} \text{Dihydroxyacetone phosphate} + \text{NADH (measured at 340 nm)} + H^+$$

3-1. The transfusion medicine team called the laboratory, so what discrepancy do you thin was happened in this situation? (4 points)

3-2. According to the test principle of triglycerides, what could be the possible reason for this discrepancy? (3 points) Is the reason accordant with the final diagnosis? (3 points)

3-3. If you are the laboratory technician, how do you correct the concentration of triglycerides? (5 points)

4. A 72-year-old male was diagnosed with multiple myeloma. The original serum protein and immunofixation electrophoresis results were shown as below. Total serum IgA and serum lamda-free light chain (λFLC) measurement by nephelometry was 510 mg/dL (82–453 mg/dL) and 980 mg/L (5.71-26.3 mg/L), respectively. However, the λFLC concentration was significantly lower than the expected amount as measured by electrophoresis densitometry (8000 mg/L). Repeat analysis of serum FLC by nephelometry at a higher dilution did not detect the

presence of antigen excess.

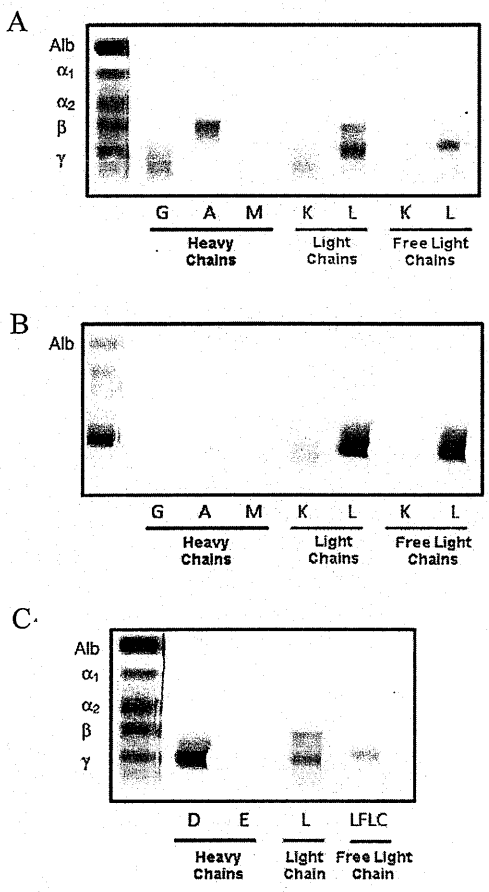


**Figure 1.**
**Immunofixation electrophoresis results in (A) serum, (B) urine, and (C) repeated in serum using IgD and IgE antisera.**

4-1. According to these results, what kind of monoclonal proteins were detected respectively in these tests? (5 points)

4-2. Please describe antigen excess effect (hook effect) in nephelometry analysis? (5 points)

4-3. Please describe the principle of immunofixation electrophoresis. (5 points)

4-4. In this case, the serum FLC immunoassay result was discordant with the monoclonal protein concentration determined by electrophoresis and densitometry. Could you explain the possible reason by these results? (5 points)

5. An 18-year-old male with a history of end stage renal disease secondary to focal segmental glomerulosclerosis, leading to living related donor right kidney transplant, was seen in the ID clinic seven months after the transplant. Pre transplant, both donor and recipient were positive for Cytomegalovirus (CMV). Post-transplant, the patient received mycophenolate, tacrolimus, and prednisone for immunosuppression, as well as valganciclovir (prodrug of ganciclovir) for CMV prophylaxis. Two months after transplant, he started having epigastric pain, nausea, vomiting, mild diarrhea, decreased appetite and weight loss. Lab work was significant for leukopenia, worsening creatinine and CMV viremia with a viral load of 3.1 million IU/ml. Kidney biopsy revealed CMV induced glomerular vasculopathy. Patient was switched to treatment doses of valganciclovir adjusted for his renal function. He also received three doses of CMV-IVIG. The patient's immunosuppressive drugs were modified; mycophenolate was

discontinued, while he continued to receive tacrolimus and prednisone.

The patient's symptoms resolved and CMV viral load showed gradual decline reaching a value of 7,270 IU/ml after five weeks of treatment. However, two weeks later, labs showed an increase in viral load again (42,900 IU/ml). He was switched to an even higher dose of valganciclovir adjusted for his renal function and referred to Infectious Disease. A drug resistance testing for ganciclovir (the pharmacologically active form of valganciclovir) was ordered. Which of the following drug resistance mutations are involved in resistance to ganciclovir? (7 points)

A) NS5A mutation

B) UL 97 and UL 54 mutations

C) TK mutations

D) M184V mutation

6. A 58-year old man presents to the ER with reports of fatigue, upset stomach, myalgia and dark yellow urine. The patient is a native of Sudan who moved to Cairo to attend college and spent his working life as a lawyer in Egypt. 24 years ago he received a transfusion to replace excessive blood loss during an emergency appendectomy. 12 years later he was diagnosed with acute Hepatitis C, and was treated for 48 weeks with pegylated interferon alpha (PEG-IFNα) plus ribavirin. Last year, he retired and emigrated to the United States to live with his children. Upon presentation to the ER, his current physical examination reveals signs of jaundice, and a liver function assay reveals elevated ALT and AST. Serum bilirubin is elevated. Based upon the patient's past history, Hepatitis C Virus RNA quantitative testing is ordered, with a measured viral load of 916,000 IU/ml. He denies IV drug use and reports no other high-risk activity. Blood, urine and stool cultures are all negative. HIV testing is negative. A CT scan reveals extensive liver fibrosis with splenomegaly and varices.

Given the patient's ethnicity and residence history, and assuming compliance with the original therapy, what is NOT a reasonable explanation for the treatment failure and progression to chronic hepatitis with fibrosis? (7 points)

a. Host genetic factors predisposing the patient to an ineffective antiviral response

b. Infection with a genotype refractile to PEG-IFNα + Ribavirin therapy

c. In situ mutations in the infecting strain of Hepatitis C that brought about resistance to PEG-IFNα + Ribavirin

d. Reinfection with a second genotype of Hepatitis C virus

7. A 48 year-old man presented to the emergency room complaining of blurry vision and pain in his left eye. The patient reported no other symptoms other than a slight headache, and there was no redness or exudate from the left eye. He had recently been diagnosed with multiple myeloma and received an autologous bone marrow transplant three months prior to presentation. Following his transplant, he received prophylactic doses of ciprofloxacin, fluconazole, acyclovir, and trimethoprim/sulfamethoxazole. His blood cell counts had been very slow to recover, leading his oncologist to suspect delayed engraftment. Vitreous fluid was removed from the involved eye and submitted for bacterial, fungal, and viral testing.

Which cytopathic effect (CPE) is characteristic of the virus most likely responsible for the patient's symptoms? (7 points)

A. Swollen, grape-like cells in A549 cells

B. Large, rounded cells; cytopathic effect slowly spreads to other cells in MRC-5 cells

C. Shrinking and rounding of primary RhMK cells

D. Syncytia formation in A549 cells

E. This virus is not culturable in vitro

8. A previously healthy 20 year-old college student presents to the ID clinic with several days of a pustular rash. Her medical history is significant for eczema and pseudotumor cerebri following minocycline use which required ventriculostomy. She has been living in Lima, Peru for the past 5 weeks, volunteering at an orphanage and school with 2-3 year-old children and staying with a host family with >20 other young adult volunteers from North America and Europe. She reports that prior to the onset of her rash, the children had large red patches on their skin (about 2-3 weeks ago) which prevented them from attending school. She does not know what the underlying illness was believed to be. She developed lesions first on her forehead along the hairline. She had a couple spots on her forehead that started as blisters. She thought they were slightly weird pimples. They were non-tender and without much of a surrounding rash. She developed chills that night along with tender R cervical adenopathy. The following morning, she had additional lesions on her face, back, and chest. She went to the local emergency room that day. She did not receive a diagnosis for the rash, but was told it might be Chicken Pox. She was given loratidine and took one pill. She then developed a low grade fever to 38°.

She reports and her father confirms that she had "mild" Chicken Pox in 2nd grade. She also received the Varicella vaccine with booster as well as all other routine vaccines offered on schedule, including MMR. Review of systems is essentially negative: no conjunctival symptoms, no mucosal changes, perhaps 1 oral lesion; no respiratory symptoms - no cough, dyspnea or wheezing; stool has been loose since travel, no other GI complaints; no arthralgias, arthritis or myalgias. She generally feels quite well aside from the bothersome lesions. STD history: no HIV testing and unknown Hepatitis testing.

She ended up being diagnosed with chicken pox, even though she previously had it and was also vaccinated.

What is the efficacy rate of the varicella vaccine in protecting a vaccinated individual against Chicken Pox (assuming an original and booster dose were given)? (7 points)

A) ~100%

B) ~85%

C) ~50%

D) ~25%

9. In January, a 58 year old male with a history of refractory multiple myeloma presented to the emergency department after 4 days of fever, rigors, severe fatigue, chills, dry non-productive cough, and expiratory wheezing. A CT scan

showed bilateral patchy infiltrates. A nasopharyngeal (NP) swab was collected and a rapid influenza A/B PCR test was performed, which was negative. A molecular multiplex test for respiratory pathogens (RP) was performed on the same NP swab and was also negative. The patient had received the influenza vaccine two weeks prior.

The patient was admitted for further evaluation. The next day, he experienced tachycardia and worsening hypoxia, requiring intubation and admission to ICU for respiratory failure. A bronchoscopy was performed and the bronchoalveolar lavage (BAL) fluid was collected and sent for multiplex RP testing. The BAL was positive for influenza A (2009/H1N1).

What could explain the discordant rapid influenza PCR and multiplex RP results? (7 points)

A. The NP swab was improperly collected.

B. The virus is no longer present in the NP.

C. His recent vaccination led to a false positive result on the BAL.

D. Multiplex RP testing is more sensitive if performed on BAL than NP swab.

E. A and B