系所組別： 微生物及免疫學研究所甲、丁組

考試科目： 微生物學

※ 考生請注意：本試題 □可 ☑不可 使用計算機

1. Both enterovirus 71 (EV71) and human immunodeficiency virus (HIV) are viruses with positive single-stranded RNA genomes. Please describe the differences in their RNA replication processes in details. (10%)

2. Both herpes simplex virus (HSV) and hepatitis B virus (HBV) are viruses with double stranded DNA genomes. Please describe the differences in their (A) genomic structures and (B) DNA replication processes in details. (10%)

3. Pleas name (A) one DNA virus and (B) one RNA virus and describe how they transform cells to cause cancers in details. (10%)

4. Please describe how (A) B cells, (B) $CD4^+$ T cells, (C) $CD8^+$ T cells, and (D) neutrophils clear viruses in details. (20%)

Please read the following article and answer the related questions below.

Enterohemorrhagic *Escherichia coli* (EHEC) O157:H7 produces long bundles of polar type 4 pili (T4P) called HCP (for *h*emorrhagic *c*oli *p*ili) that form physical bridges between bacteria associating with human and animal epithelial cells. Here, we sought to further investigate whether HCP possessed other pathogenicity attributes associated with T4P production. Comparative studies performed with wild-type EHEC EDL933 and an isogenic *hcpA* mutant revealed that HCP play different roles in the biology of this organism. We found that in addition to promoting bacterial attachment to host cells, HCP mediate (i) invasion of epithelial cells, (ii) hemagglutination of rabbit erythrocytes, (iii) interbacterial connections conducive to biofilm formation, (iv) specific binding to host extracellular matrix proteins laminin and fibronectin but not collagen, and (v) twitching motility. Nonadherent laboratory *E. coli* strain HB101 complemented with *hcpABC* genes on plasmid pJX22, which specifies for HCP overproduction in EDL933, became hyperadherent and invasive and produced a thick biofilm, suggesting that the presence of HCP confers HB101(pJX22) new attributes otherwise not exhibited by HB101. Analogous to other bacteria in which T4P are involved in the pathogenesis of several infectious diseases, our data strongly suggest that HCP display multiple functions that may contribute to EHEC colonization of different hosts and to virulence, survival, and transmission of this food-borne pathogen. (Cited from Journal of Bacteriology, 191: 411–421)

5. Explain the following terms: (16%)
   a. Isogenic mutant
   b. Polar pili
   c. Hemagglutination
   d. Twitching motility

6. What approaches did they use to determine the functions of HCP? (10%)

7. Based on the functions of HCP described, how would HCP contribute to EHEC colonization? (14%)

8. What is the main symptom resulting from infection by EHEC? What other diseases can *E. coli* cause in human? (10%)