

※ 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. "From so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved." – Charles Darwin wrote in his book, *The Origin of Species*.

Please answer the following questions.

(A) The evolution of drug-resistant pathogens such as bacteria and viruses is a major health problem. Does genetic variation make evolution possible? Explain. (10%)

(B) Is natural selection the only mechanism of adaptive evolution? Explain. (10%)

(C) What is the biological definition of species? Can speciation take place without geographic isolation? Explain. (10%)

(D) Can studying different organisms/forms of life, such as yeast, worms, fruit flies, zebra fish, and mice help us understand human diseases? Explain. (20%)

2. "Personalized medicine is an emerging practice of medicine that uses an individual's genetic profile to guide decisions made in regard to the prevention, diagnosis, and treatment of disease. Knowledge of a patient's genetic profile can help doctors select the proper medication or therapy and administer it using the proper dose or regimen. Personalized medicine is being advanced through data from the Human Genome Project." – National Human Genome Research Institute.

Please answer the following questions.

(A) What is Human Genome Project? Is it finished? Explain. (10%)

(B) US actress Angelina Jolie discovered that she carries mutations in a tumor suppressor gene, BRCA1, which puts her at very high risk of developing breast cancer and ovarian cancer. Although she did not have breast cancer, she decided to have both breasts removed by surgery. Is the surgery her only option? Explain. (10%)

(C) How does "the knowledge of a patient's genetic profile help doctors select the proper medication or therapy and administer it using the proper dose or regimen?" Explain. (10%)

(D) Human Epigenome Project aims to "identify, catalog, and interpret genome-wide DNA methylation patterns of all human genes in all major tissues". Can it help us develop better practice of personalized medicine? Explain. (20%)