

※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

Part A (50%)

I. (10%) Quorum sensing signals are important for bacterial physiology. Different bacteria may use different structures of quorum sensing factors.

(1) N-acyl homoserine lactones (AHLs) are usually used by (A) Gram-positive (B) Gram-negative. (2%)

(2) What are the major structural differences in different AHLs? (3%)

(3) How do other competing bacteria disrupt AHLs? (3%)

(4) Please give an example that quorum sensing signals change bacterial physiology. (2%)

II. (6%) (1) Please describe how “quaternary ammonium compounds” kill bacteria. (3%) (2) Please list another chemical agent used for bacterial control and describe its mechanism of action. (3%)

III. (6%) (1) Tamiflu, a drug for the influenza virus, inhibits neuraminidase activity. Please explain inactivation of this enzyme blocks viral growth (3%). (2) Why do RNA viruses usually have a higher mutation rate? (3%)

IV. (8%) (1) Please describe the basic structure of bacterial lipopolysaccharides (LPSs). (3%) (2) Please describe the functions of LPSs. (5%)

V. (6%) Please explain the terms below: (1) chemotaxis. (2) coenzyme (3) ribozyme.

VI. (6%) The enzyme activity could be controlled by posttranslational regulations. Please explain the regulations below in detail (1) allosteric regulation (2) covalent modifications of enzymes (3) feedback inhibition

VII. (8%) DNA mutations are a driving force of evolution and diseases. (1) Please explain “transition mutations” and “transversion mutations”. (3%) (2) Indicate which type is more common and explain why. (2%) (3) Please list one mutagen, an agent that damages DNA, and explain how it mutates DNA. (3%)

Part B (50%)

I. (6%) After obtaining a natural microbial strain that can produce the desired metabolites for medical application, researchers will try to create “production strains”, optimized for industrial purposes, using different approaches. In addition to chemical/physical mutagenesis, please give one other strategy that can be used to generate the production strains, and explain how this strategy works (i.e. the principle of this strategy).

見背面

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- II. (12%) If you were a scientist studying microbial ecology, how can you use the following techniques in your research (3%), and what result(s) can you obtain using each technique (3%)? Please also briefly describe the principle of each technique (6%).
- (1) 16S metagenomic sequencing; (2) fluorescent in situ hybridization (FISH); (3) enrichment culture techniques
- III. (6%) Ascomycota and Basidiomycota are higher fungi. What sexual reproductive structures are characteristics of these two fungi and are used for classification? (4%) They are also referred to as "dikaryotic fungi". Why? (2%)
- IV. (5%) We know that recognition of the spike protein receptor binding domain (RBD) of SARS-CoV2 by the host receptor, angiotensin-converting enzyme 2 (ACE-2) initiates the entry process of the viral particle. Vaccination would help block such a process. Why? (3%) In addition to blocking the entry process, what other immune responses might be triggered during vaccination for SARS-CoV2? Please give at least one example. (2%)
- V. (15%) Each pair of terms is correlated. Please compare their similarity and differences.
- (1) Cellular and acellular slime molds (2) Endotoxin and exotoxin (3) coliform and fecal coliform bacteria (4) frank and opportunistic pathogens (5) antigen and hapten
- VI. (6%) Please give each archaeal or bacterial group one feature, which can be used to differentiate it from most other archaeal or bacterial groups. (1) Class *Mollicutes* (2) Phylum *Chlorobi* (3) *Magnetococcus spp.* (4) haloarchaea (5) *Deinococcus-Thermus* (6) Phylum *Spirochaetes*

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