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면접구술시험 문제

Instructions. Please read the passages and answer the following questions.

[Passage 1] Eukaryotic cells* are surrounded by a cell membrane*, and there are various organelles* surrounded by membranes such as the nucleus, mitochondria, endoplasmic reticulum*, Golgi apparatus*, and lysosomes. The membranes forming the cell membrane and organelles are composed of phospholipids* and proteins. Phospholipids, composed of a polar head and a hydrophobic* tail, form a lipid bilayer*.

[Passage 2] The biosynthesis of proteins according to genetic information is called gene expression. In eukaryotes*, genetic information is stored in DNA, located in the cell nucleus. For the biosynthesis of proteins, genetic information stored in DNA should be transcribed into mRNA. The mRNA produced in the nucleus is translocated to the cytoplasm* through a nuclear pore*, binds to ribosomes in the cytoplasm, and is translated in the synthesis of proteins.

[Passage 3] Small non-polar substances such as oxygen or carbon dioxide easily pass through phospholipid bilayer membranes. However, most substances need the help of membrane proteins to pass through the phospholipid bilayer membranes. Due to their large size and polarity, biomacromolecules* such as proteins and nucleic acids are very difficult to pass through phospholipid bilayer membranes.

[Passage 4] When a foreign substance such as a pathogen* invades our body, it is recognized as an antigen and a specific defense action occurs. When the protein constituting the surface of the virus is injected into the body, it acts as an antigen* and an antibody* is generated. Therefore, part of the surface proteins of the virus can be utilized as a vaccine to build immunity.

* Eukaryotic cell: 진핵세포, membrane: 막, organelle: 세포소기관,
endoplasmic reticulum: 소포체, Golgi apparatus: 골지체, phospholipid: 인지질,
hydrophobic: 소수성, lipid bilayer: 지질 이중층, eukaryotes: 진핵세포, cytoplasm: 세포질,
nuclear pore: 핵공, biomacromolecules: 생체고분자, pathogen: 병원체, antigen: 항원,
antibody: 항체

Question 1. Recently, vaccines using genes have been developed and are being used to prevent COVID-19 infection. Refer to the passages [2] and [4], and describe what kind of principle is being applied to the gene-based vaccines. [25 pts.]

Question 2. Describe what information and functions are required to manufacture a vaccine using genes, referring to the passages [2], [3], and [4]. [25 pts.]

Question 3. DNA-based vaccines would go through a much more complicated biological processes than RNA-based ones. Explain the reason by referring to all the passages. [50 pts.]