

(1) Adult liver and kidney do not grow or change its size under normal physiological conditions. However, isolated hepatocytes and renal epithelial cells do proliferate in cell culture. What do you think is the reason? (10%)

(2) What are the concentrations of intracellular and extracellular Na^+ and K^+ ? What is the key membrane protein which functions to maintain the Na^+ and K^+ electrochemical gradient between inside and out side of the cell? How does this membrane protein work? (10%)

(3) Please describe the structure and function of cell-cell junctions. (10%)

(4) Apoptosis is also called programmed cell death or physiological cell death. What are cell biological changes that can be observed during apoptosis? What are the biochemical mechanisms leading to the changes that you have just described? (15%)

(5) What are extracellular matrix and its receptor? What is the focal adhesion complex? Please define functions of the focal adhesion. (15%)

(6) What are receptor tyrosine kinase and protein tyrosine kinase? How are these kinases involved in the signal transduction pathways for peptide growth factors? (15%)

(7) Please describe the major findings of Dr. Gunter Blobel, a distinguished cell biologist and Nobel Laureate in Physiology/ Medicine in 1999. (5%)

(8) The following methods are commonly used in cell biology. They all require the usage of antibody. Please describe briefly the difference between these methods and what purposes of study can these methods achieve? (20%)

- (a) Immunohistochemistry
- (b) Immunofluorescence microscopy
- (c) Confocal microscopy
- (d) Western blot