

參考用

## General Biology Exam for Biophysics Master Program 2013

1. (a) Describe the primary, secondary, tertiary and quaternary structures of proteins. Use one sentence for each structure. (5%)  
(b) Discuss how is the structure of a protein determined by x-ray scattering experiment. Use 2 sentences. (5%).  
(c) Discuss how is the structure of a protein determined by NMR experiment. Use 2 sentences. (5%)  
(d) Compare the quality of the structure of a protein determined by x-ray scattering and NMR experiment. Use one sentence. (5%)
2. (a) Describe the function of a molecular motor protein that works on cytoskeleton of a cell. (10%)  
(b) Discuss the energy source of the motor protein that you mentioned in (a). (10%)
3. (a) Describe the physical force that is responsible for the formation of a lipid bilayer. (8%)  
(b) From your answer in (a), discuss whether lipids can form other aggregates than bilayer in a solvent. (5%)  
(c) Describe the necessary properties for a membrane protein to stay in a lipid bilayer. (7%)
4. Describe the roles of  
(a) RNA polymerase, (7%)  
(b) golgi (7%)  
(c) ER (6%)  
in the life cycle of a protein.
5. The displacement  $x(t)$  of a large molecule in water due to Brownian motion can be described by  $x(t) = (6 D t)^{1/2}$ , and the displacement  $x(t)$  of a large molecule in a flow of velocity  $v$  is  $x(t) = vt$ .  $D$  is called the diffusion constant  
(a) Plot  $x(t)$  for both Brownian motion and motion in a flow from  $t=0s$  to  $t=5s$ , let  $6D=1m^2/s$  and  $v=1 m/s$ . (8%)  
(b) The diffusion constant  $D$  of a protein in a cell is know to be  $30 \mu m^2/s$ . How long does it take for this protein to move  $1nm$  in a cell? How about  $1\mu m$ ? (7%)  
(c) Suppose the protein discussed in (b) can also be carried by a motor protein which walks along microtubule at a speed  $1\mu m/s$ . Find the distance beyond which the protein moves faster by a motor protein than by Brownian motion. (5%)

