

國立中央大學100學年度碩士班考試入學試題卷

所別：物理學系生物物理碩士班 不分組(一般生) 科目：普通生物 共 頁 第 頁

本科考試禁用計算器

*請在試卷答案卷(卡)內作答

1. Let us consider a neuron cell.
 - (a) Describe the differences of the working principles between a voltage-gated ion channel and an ion pump. (7 points)
 - (b) Explain why is the membrane potential nonzero when a neuron cell is not firing. A figure will help. (6 points)
 - (c) Describe how can a spike of membrane potential (action potential) be generated. A figure will help a lot. (7 points)

2. Let us consider cell cycles (eukaryotic cells, of course).
 - (a) Describe the phases of a cell cycle. Do not just give the names of the phases. A figure will help (10 points)
 - (b) Describe the sequence of the key events in the M phase. (10 points)

3.
 - (a) Describe what happens in a cell nucleus when a gene is expressed. (6 points)
 - (b) Describe how is a protein made in an eukaryotic cell. (7 points)
 - (c) Describe how is a membrane protein being transported from where it is produced to the cell membrane. You have to list the organelles involved in this process. A figure will help a lot. (7 points)

4. Let us consider muscle contraction.
 - (a) Make a plot and explain the structure of a muscle fiber. (10 points)
 - (b) Explain what happens when a muscle is contracted. (10 points)

5. Consider the growth of a cell culture in a test tube or in a petri dish.
 - (a) Let the number of cells in the culture at time t be n , the cell cycle time is τ and the death rate of a cell is d . Plot $n(t)$ for the case $d = 0$. (10 points)
 - (b) Write down the equation for the time evolution of $n(t)$. In other words, what is equal to dn/dt ? (10 points)

參考用