

問答題：每位考生必須回答規定的五題問題，每題 20 分；

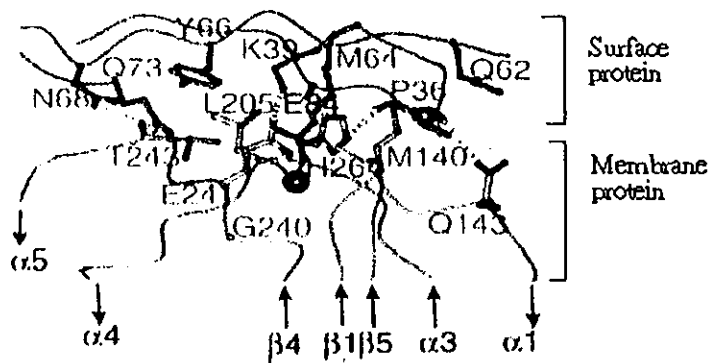
甲組考生--必須回答第 1 至第 4 題，外加其餘題目中之任何一題(其餘題目作答超過一題者，以得分最低的一題計算成績)

乙組考生--必須回答第 5 至第 8 題，外加其餘題目中之任何一題(其餘題目作答超過一題者，以得分最低的一題計算成績)

丙組考生--必須回答第 9 至第 12 題，外加其餘題目中之任何一題(其餘題目作答超過一題者，以得分最低的一題計算成績)

1. Please reason why an animal (or human being), who consumes mainly meat and is reluctant to exercise, is prone to suffer from osteoporosis based on your knowledge of physiological homeostasis in maintaining proper bone structure.
2. An isolated virus is biologically inert, unable to replicate its genes or generate its own supply of ATP. Yet, it has genetic program written in the universal language of life. Based on your knowledge of viral molecular genetics, please state why virus could successfully replicate its genome and produce its progeny within its host cell, and included in your answers the strategies used by virus in taking over cellular biochemical machinery for virus own survival.
3. Smell is perhaps the most exquisitely sensitive and complex of all the senses, and it has also been the most perplexing for scientists to decipher. Odorant detection is mediated by olfactory sensory neurons located in the olfactory epithelium lining the nasal cavity. Researchers have long wondered how can the nose with a relatively small type of olfactory receptors (about 350 types in man and 1000 types in mice ) have the sensitivity to discriminate roughly 10,000~100,000 different odors. In 2004, Richard Axel and Linda B. Buck were awarded the Nobel Prize in physiology or Medicine for their solving the big puzzle concerning "odorant receptors and the organization of the olfactory system". Try to explain the structure of olfactory system and the underlying mechanisms of olfactory perception.
4. Describe the mechanisms concerning regulation of stomach emptying.
5. Proteins are the most important agents for biological function. However, the function of more than 40 % of the proteins encoded by human genome remains unknown. Based on your knowledge, propose how you study a protein X encoded from human genome with unknown function, starting with the genomic information available from the data bank.

6. Life is inconceivable without enzymes. All enzymes exhibit at least three distinctive features in common: high catalytic power, high specificity, and regulation. Discuss all possible factors that contribute to the characteristics of enzymes.
7. The figure below is a stereo view of cellular interface detailing with a surface protein (top) and a domain of a membrane protein (below). The interaction is believed to be critical for signal transduction. If you are studying a project to stop the signal transduction as well as to block the interaction sites, how will you design the experimental procedures and why?



8. Chloroplasts and mitochondria are evolutionarily believed to be living in cells independently. As more evidence accumulated from recent studies, chloroplasts and mitochondria may be present in cells at different times. If this is true, please make your answers as to (1) which is present first in cells and what is the evidence to say so? (2) How to design experimental procedure(s) to prove it?
9. Explain mechanisms and factors influence population growth.
10. How does day length influence the seasonal activity of plants and animals?
11. It is occasionally suggested that mutation is adaptively directed rather than random. Think through what a genetic mechanism of adaptively directed mutation would have to be. For each component of the mechanism, how plausible is it that it could really exist?

國立中山大學九十四學年度博士班招生考試試題

科目：生物科學

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12. Answer the following questions:

(1) Match the kinds of taxonomic groups to the schools that allow them:

*Groups:* polyphyletic, monophyletic, paraphyletic

*Schools:* evolutionary, cladistic, phonetic

(2) Give (a) a phonetic, (b) an evolutionary, and (c) a cladistic classification of the cow, the lungfish, and the salmon

(3) Why are biological species classified hierarchically whereas chemical elements are classified non-hierarchically in the periodic table?