

# 國立中山大學 99 學年度博士班招生考試試題

科目：生物科學（生科系）

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問答題：每位考生必須回答規定的五題問題；

甲組考生--必須回答 01 至 04 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 05 至 08 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 09 至 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)

- 01.** In a hot humid Sunday morning of July, you decided to participate in your friend's 100-km bicycle ride on a hilly course:
- (1) Please describe how your cardiovascular system would adapt in order to meet the need of exercise one minute after you started peddling. Please also describe the adaptation of the same system 30 minutes after you started riding.
  - (2) After one hour of riding under the sun, you were very sweaty and very thirsty. To the best of your knowledge, please describe, in detail, which endocrine system(s) was (were) activated to cope with your physiological needs, and how it (they) was (were) activated. Please also describe the physiological and/or biochemical effect(s) following its (their) activation.
  - (3) After another 20 minutes, your sensation of thirst and exhaustion was heightened even more. You thought about the 3-liter ice cold beer you drank before sleep the night before. Ten seconds before passing out, you realized that it was a big mistake to drink that beer. Please describe your cardiovascular change(s) immediately before you passed out, and indicate why such change(s) failed to prevent you from fainting. Please also explain why it was a mistake to drink that beer the night before. (20 points).
- 02.** Please describe all the general electrophysiological, neurochemical, and biochemical events that are involved in the activation and contraction of a motor unit, beginning from the dendrites of a motor neuron in the spinal cord. (20 points).
- 03.** Without going into extreme details, please describe, in general, how does a marine bony fish manage its water and salt balance? And how does a marine shark cope with this issue? How does a freshwater bony fish handle its water and salt balance? (Please indicate the organs/tissues/structures involved, and the task(s) they performed.) (20 points).

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04. What is the important immune component in the body's defense against the following microorganisms and why is this component vital to defense? (20 points, 4 points of each).
- (1) pneumococci
  - (2) virulent *Corynebacterium diphtheriae*
  - (3) intestinal infection with poliomyelitis
  - (4) group A hemolytic streptococci
  - (5) *Candida albicans*
05. Legumes and rhizobia have mutualistically symbiotic relationships. Legume plants provide nutrients for rhizobial growth, and rhizobia supplies fixed ammonia to the host legume plants. Please explain how legume plant-rhizobium interacts to establish the mutualistically symbiotic relationship. (20 points).
06. In plant, the vascular systems are mainly involved in long-distance transport of sucrose in phloem tissues, and water and minerals in xylem tissues. Please explain how sucrose, water and minerals are transported from sink to source or from root to aerial part of plants, respectively (20 points).
07. Please explain the following terms: gene-for-gene hypothesis, hypersensitive response, and local and systemic acquired resistance in plant-microbe interactions (20 points).
08. Outline the secretory and endocytic pathways of protein sorting in animal cells. What are the techniques commonly used for studying protein sorting? (20 points).
09. 假設你的老闆要你使用至少兩個基因序列重建一個親緣關係假說，並依其推測一群生物在體型上的雌雄二型性的演化趨勢，請問你認為把這樣的一個研究做好應該具備什麼樣的步驟流程？ (20 分)
10. 請介紹五個演化、生態或系統分類學門的期刊 (僅寫期刊名不算分) (25 分)
11. 請說明至少一種方法偵測一群生物的分化乃肇因於 allopatric speciation? sympatric speciation? 或是 peripatric speciation? (20 分)
12. 利用圖示來對比下列成對相關關鍵詞 (每小題 5 分)
- (1) Directional selection vs disruptive selection
  - (2) Founder effect vs bottleneck effect
  - (3) Monophyletic vs paraphyletic groups