

國立中山大學 98 學年度博士班招生考試試題

科目：生物科學（生科系）

共 2 頁

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 1 至 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 5 至 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 9 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)

1. Compare and contrast the molecular mechanisms for regulating striated and smooth muscle contraction.
2. What are the two characteristics that define a stem cell? Describe the stem cell hypothesis for cancer formation. What are the therapeutic implications of cancer stem cells?
3. Antigen presentation is a critical step for initiating host immune response against pathogens. Describe the cell, molecules involved in presenting endogenous and exogenous antigens. How they present antigen to and activate T-cells?
4. After a strenuous football game, the athletes experience symptoms of extreme fatigue and more susceptible to muscle cramps, decrease of the frequency of urination. Give the possible explanation of these symptoms based upon your knowledge of human physiology in control of water and salt homeostasis.
5. What are regulatory RNAs and what are their features? Give two examples of regulatory RNAs and explain their regulatory mechanisms respectively.
6. Most of the biological processes, for example cell cycle, apoptosis, signal transduction etc., involve several protein molecules. Describe experimental methods to studying the possible role played by a certain protein molecule in a biological process.
7. Three essential functional elements are required for replication and segregation of eukaryotic chromosomes. What are these three functional elements? Describe how they function. What is the role of telomerase in maintenance of chromosome structure?
8. A retrovirus can integrate its genome into the genome of the host cell. What gene is unique to all retroviruses, and why the gene product of this unique gene is absolutely required by retroviruses in their life cycle? List one example of human retroviruses that has the medical implications

resulting from its infection, and describe why this retrovirus only infects certain cells.

9. 語言能力: 以下是一個碩士班學生論文計畫的草案摘要, 請指出這段摘要文字中的拼字, 文法以及語義表達上的錯誤與邏輯問題 (20%)

Palynology is the study of pollen grains and spores and of other biological materials that can be studied by means of palynological techniques. In this study, authors used spores of Blechnaceae species that grow in northwest Argentina for studying. These are: *Blechnum australe* subsp. *auriculatum*, *B. austrobrasilianum*, *B. brasiliense*, *B. cordatum*, *B. laevigatum*, *B. mochaenum* var. *squamipes*, *B. occidentale*, *B. penna-marina*, *B. sprucei* and *B. tabulare*. The spores were studied using light microscope (LM), transmission electron microscope (TEM) and scanning electron microscope (SEM). The palynological features of the exospore structure in Blechnaceae are similar. But The perispore of the spores has the greatest variability at specific and infraspecific levels, there are five structural types in perispore are observed. The results in this study could be contributed to a better knowledge about classification of genus *Blechnum* and helpful to further palynological research.

10. 基礎常識: 若有外國學者訪台打算採集淡水溪流中的生物, 並比較台灣與華南產物種間的親緣地理關係, 而您被指派安排行程與介紹台灣的淡水溪流環境, 請問您將如何就台灣島形成的過程, 植被與氣候的變遷與現況, 人類活動對溪流生態的衝擊以及某類生物在台灣的多樣性熱點進行行程的安排與介紹? (20%)

11. 邏輯推理: 以下文字摘錄自聯合新聞網 - 紐約自然歷史博物館 19 日展出一具 4700 萬年前的雌性動物化石, 這是迄今發現最早最完整的靈長類動物化石。科學家認為, 這個動物很可能是人類與猿、猴的共同祖先, 這具化石填補人類進化史上的一個缺口。這個動物的學名為 *Darwinius masillae*, 暱稱伊達 (Ida), 鼻尖至尾末全長 58 公分, 化石保存得異常完整, 僅缺失一根小腿骨的一部分, 約僅占全身骨骼的 5%。19 日出刊的最新一期 *PloS One* 科學雜誌公布此一發現。展覽主持人表示, 一名私人蒐藏家 1983 年取得這具在德國梅塞爾化石坑地層中發現的化石, 但不了解其重要性。以奧斯陸大學古生物學家胡朗姆 (Jorn Hurum) 教授為首的一批科學家對化石展開 2 年的研究, 得出這項重大發現。梅塞爾化石坑藏有豐富的始新世化石。這個類似猴子的動物雖然有一條長尾巴, 但具有人類的若干特徵, 包括可與其他手指分開的拇指, 有指甲, 四肢較短, 兩眼前視。但牠也缺少現代狐猴的兩個關鍵特徵: 尖銳的爪子與一排較低的梳齒。胡朗姆發表聲明說:「這是第一件把全世界所有人類連為一體的化石。」他強調, 伊達近似人類最早期的祖先之一, 但不太可能是人類的直系祖先。英國著名博物學家艾登波羅 (David Attenborough) 表示:「這個小動物能顯示我們與其他所有哺乳動物之間的聯繫。我們一直沒有找到這個聯繫, 現在終於找到了。」胡朗姆等人推測, 伊達的腕骨嚴重骨折, 這可能是牠死亡的原因。未滿一歲的牠在梅塞爾湖畔喝水時, 因為吸入二氧化碳而昏迷, 跌入湖中並沉入湖底, 變成化石, 保存 4700 萬年。牠胃裡遺存的果實、種籽及葉子的化石顯示, 牠是草食動物。

這篇中譯新聞稿一再地提到一個演化學上的概念 - "演化上缺失的環節"(evolutionary missing link), 也就是許多生物學家畢生尋找生物演化上祖先與子裔間的"中間過渡型"生物(或化石), 請問所謂的"中間過渡型生物"理念是否違背支序學派理論(cladistics)? 為什麼?

12. 學術潛力: 請舉出一名中山大學生物科學系丙組老師的研究領域, 並評述這位老師與台灣其它學校兩位專長相仿老師在研究上的異同, 並且說明這個領域的研究在純科學與應用上的價值 (20%)