國立中山大學97學年度博士班招生考試試題

科目：**生物科學【生科系】**

問答題：每位考生請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. Hyperventilation is the state of breathing faster and/or deeper than necessary to meet the body's needs. Explain why hyperventilation reduces the CO_2 content of blood, but does not significantly increase the amount of O_2 available to tissues.
2. Endocrine disruptors, such as environmental estrogens from nature or man-made resources, are chemical substances that can interfere with synthesis, secretion, transport, binding, action or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development, and/or behavior. Design an experiment using the model system of your choice to investigate whether the new compound X that you synthesized is an endocrine disruptor.
3. Define G-protein coupled receptor (GPCR) and address in detail the importance of GPCR signaling from the physiological point of view.
4. Describe in detail the molecular mechanism for regulating cell cycle of mammalian cells. Include in your answer the cell cycle check point regulators and specify where and how these regulators work?
5. It is estimated that the error rate of DNA synthesis is of the order of 10^{-10} per nucleotide incorporated. Explain the mechanisms used by the cells to achieve the fidelity of DNA replication.
6. Would you agree with the following statements? The discovery of RNA interference - gene silencing by double-stranded RNAs has led to the understanding of the complexity of posttranscriptional gene regulation. These double-stranded RNAs including siRNA and miRNA use the same mechanism to achieve their functional roles in organism. Why or why not?
7. Give two of the experimental approaches you would use to detect or analyze a gene product, in mRNA and protein level respectively, from cells, tissues or organisms.
8. Avian flu virus and Enterovirus 71 have been endemic in some areas around the world recently. There are numerous viruses of different families existed in various organisms. What are the general features of the virus?

【背面還有試題】

9. 身為博士班考生，您應該已經針對有興趣的研究領域比較過各校相關師資的資訊。因此請儘可能詳細地說明中山大學生物科學系丙組(生態分類組)任何三位老師的研究領域與主要研究課題。並說明台灣還有那些學校系所的那些老師與這三位老師的研究領域相同或近似。(名字寫錯不計分)

10. 請將以下英文翻譯為語意通順且在科學上精確的中文

In the late 1990s, scientists in China discovered several intriguing fossils of 125-million-year-old angiosperms. These fossils, now named *Archaefructus liaoningensis* and *Archaefructus sinensis*, display both derived and ancestral traits. *Archaefructus sinensis*, for example, has anthers and also has seeds inside closed carpels but lacks petals and sepals. In 2002, scientists completed a phylogenetic comparison of *A. sinensis* with 173 living plants. The researchers concluded that Archaefructus may belong to the earliest-diverging group of angiosperm known.

11. 請試著將以下中文翻譯為達意通順的英文。中英文不需字字吻合，但需注意拼字、單複數、時態、冠詞、大小寫與標點符號的使用。並請注意每一個句子是否具有主詞、動詞、受詞等完整文法結構

在靈長類漫長的演化歷程中，有一個支系的動物由樹棲性生物漸漸地離開森林，進入草原成為地棲性的生物，然後開始形成較複雜的社會結構。牠們在演化的過程中漸漸獲得了幾項嶄新的關鍵性特徵，例如：直立行走、枕骨大孔下移、骨盆與陰道變寬、大腦容量變大、較敏銳的視覺、體毛減少、較佳的學習與使用工具能力。現代人的祖先通常被認為起源自非洲隨後播遷至世界其它各地的陸塊。然後隨著各地文明獨立興起與航海技術的發展，許多民族開始了跨洋性的遷徙，而這使得推測人種的起源更為複雜。

12. 以下是一則摘自媒體上的新聞。請運用您對於生態學與演化學的知識，對這則新聞的撰寫邏輯與可能衍生的科學議題提出評論。

【記者張勳騰／苗栗報導】苗栗縣銅鑼鄉新隆村一處燕巢，有一對罕見的純白色家燕，觀者都嘖嘖稱奇，認為是好兆頭。「活了七十三歲，從來沒有看過白色家燕」，吳姓屋主說，真是大開眼界；老一輩的村民也都說，從未看過白色燕子，有村民想抓起來飼養，但被年長者反對。吳姓屋主說，四月間有家燕在一樓屋簷築巢，第一次孵出四隻雛燕，接著又誕生四隻小燕子，後來發現其中有一對家燕全身白色，令全家又驚又喜。民間習俗認為家燕在住家築巢是好事，對於吳家出現白色家燕，大家都說會帶來好運氣，讓屋主笑開懷。屋主說，這對白家燕白天已經可以外出覓食，飛出巢穴後，會與一大群家燕先在附近盤旋，再到河邊覓食，傍晚才會回巢。新隆村出現白色家燕，村民爭相走告，傍晚白家燕回巢時，總吸引村民圍觀，無不嘖嘖稱奇。新隆村各住戶幾乎都有家燕築巢，村民說，會出現白家燕，應該是基因突變；而家燕爭相來村內築巢，要歸功於村內生態未被破壞，家燕覓食容易，才會每年都來築巢。