國立台灣大學九十二學年度碩士班招生考試試題

科目：動物生理學

題號：476

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1. 請畫出人類 oxygen-hemoglobin dissociation curve，並利用此曲線說明血紅素(hemoglobin)的特性及其重要性？ 2,3-DPG 增加對此曲線有何影響？對一個正常人來說，呼吸純氧能增加其血液的含氧量嗎？(15%)
2. 何謂肌肉的 excitation-contraction coupling？請簡單說明骨骼肌和心肌 E-C coupling 的差異？(15%)
3. 心臟的節律點(pacemaker)位於 SA node 中，此節律點細胞的動作電位具有哪些特點使其能成為心臟的節律點？(15%)
4. 請比較神經細胞的 membrane potential、equilibrium potential、action potential 和 postsynaptic potential 的特性與離子機制。(15%)
5. 當一個人在豔陽下除草，大量出汗之後，其體內環境之恆定會產生變化，下列哪些選項不屬於這些變化？請針對每一選項簡單說明選擇或不選擇之理由。(15%)
   (A) 血壓增加
   (B) 血量減少
   (C) 血液中抗利尿激素濃(ADH)度增加
   (D) 體液之滲透壓(osmolarity)增加
   (E) 血液中 Angiotensin II 濃度減少
6.

Pet hamsters love to run on their wheels at night, the time when their wild cousins venture out of their burrows to scurry around in search of food. Wheel-running—or its natural equivalent—is just one of many activities and physiological states that follow a daily rhythm, cycling up and down about every 24 hours, under the control of an internal biological clock known as the circadian clock. The circadian clock driving locomotor activity and other circadian behaviors, such as the sleep-wake cycle, is located within the suprachiasmatic nucleus (SCN) of the hypothalamus. Environmental cues are needed to keep circadian rhythms synchronized with external conditions. Under a 24-hour light-dark cycle, the daily timing of locomotor activity depends on both the light and circadian clock. In animals made arrhythmic by SCN lesion, SCN grafts drive circadian rhythms of locomotor activity, even if the grafts are encapsulated (to prevent extension of axons but allow diffusion of secreted factors). In a systematic screen, researchers identified a molecule called transforming growth factor-α (TGF-α) as a likely output signal from the mammalian clock. TGF-α production in the SCN is high during the day and low at night. When infused into the brain near the SCN continuously for 3 weeks, TGF-α completely stopped the animals from running their wheels (locomotor activity) (figure 1), altered the timing of the sleep-wake cycle and disrupted the circadian rhythm of bodily movement (activities less vigorous than wheel-running).

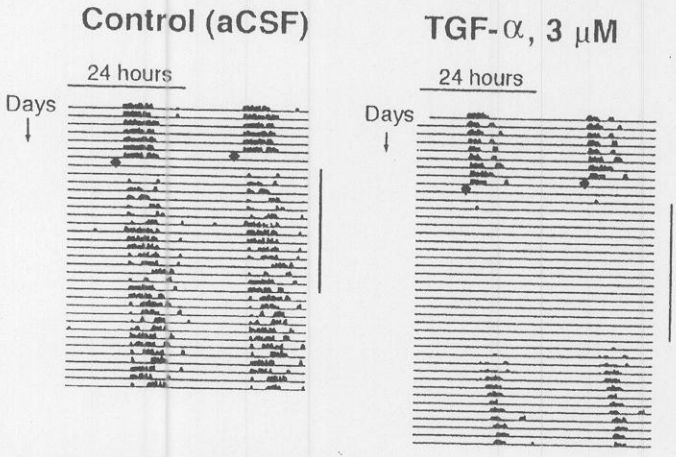

Figure 1 Inhibition of locomotor activity by TGF-α. Running–wheel activity records of hamsters in constant dim light are shown. Artificial cerebrospinal fluid (aCSF) and TGF-α were infused into the third ventricle for 2 to 3 weeks via an implanted cannula with an osmotic minipump, and locomotor activity was monitored. Lines on the vertical axis represent successive days. Tick marks: running wheel revolutions (>0 per 10-min bin). Height of each mark: number of revolutions. Bar at the right of the record: the period of infusion. Solid diamond: time of cannulation.

請依據短文及附圖回答下列問題：

a. 本實驗有何主要發現？其支持證據為何？(10%)
b. "TGF-α"是研究者欲測試的物質，因此將 TGF-α 注入倉鼠腦中，觀察所產生的效果(見圖右半)。但是為何要將人工腦脊髓液(aCSF)注入鼠腦中(見圖左半)？這樣做有何意義？(7%)
c. 當倉鼠處於沒有晝夜之分的環境中，其跑滾輪的活動就不再是 24 小時的週期，由圖一可以發現其週期稍微大於 24 小時，因此下一條記錄曲線會往右移。此圖之記錄顯示長期注入 TGF-α 會抑制該期間內倉鼠跑滾輪之活動，請問該實驗中 TGF-α 是否影響 SCN 中生物時鐘的運行？請說明你選擇是或否的理由。(8%)

試題隨卷繳回