

第一部份：總分 50 分

1. Describe neural and chemical influences on the respiratory centers in the medulla. (10%)
2. Compare the physiological effects of estrogens and testosterone. (10%)
3. What are the physiological functions of diencephalon and reticular formation? (10%)
4. Demonstrate the factors that regulate gastrointestinal motility. (10%)
5. Explain the following items. (10%)
 - a) Gastric acid back-diffusion
 - b) Zollinger-Ellison Syndrome
 - c) Rapid eye movement(REM) sleep
 - d) Skill memory
 - e) Limbic system

第二部份：總分 50 分

A. 必答題: 20 分

The thyroid hormone thyroxine is composed of two linked, iodinated tyrosine residues. It is stored in the thyroid gland in a structure called "follicle", as part of a much larger protein called thyroglobulin. The follicle consists of a cellular epithelium surrounding an extracellular space, or lumen. When the thyroid is stimulated by TSH(thyroid stimulating hormone), thyroxine is digested out of thyroglobulin by proteases and released into blood stream.

The actual pathway for thyroxine release was difficult to identify. When the thyroid is stimulated by TSH, "colloid droplets" appear in the cytoplasm of the follicle cells. The similarity of the material in these droplets to the material in lumen of the follicle sparked an intense debate: Do the droplets represent material on the way out of the cell to the lumen (to replenish supply), or do they represent luminal material engulfed by the cell (to generate thyroxine)? This question has been resolved by a series of experimental observations.

1. If the colloid in the lumen is prelabeled with ^{131}I -iodine and the follicles are then stimulated with TSH under conditions that block further incorporation of iodine, the intracellular droplets are labeled.
2. Intracellular droplets form about 4 minutes after exposure to TSH and are seen first in the apical cell processes, which abut the lumen of the follicle, then in the apical region of the cell, and finally in the basal region.
3. Thyroglobulin in the lumen of the follicle carries M6P that normally targets proteins for delivery to lysosomes.

Given these observations, propose a pathway for thyroxine production and release from the follicle cells.

B. 下列 4 題中，請選 2 題作答，每題 15 分，請詳細作答。

1. Compare the differences and similarities among skeletal muscle, cardiac muscle and smooth in (a) their morphology and structure and (b) their molecular mechanisms of contraction and (C) their physiological characteristics.
2. Draw a diagram of a nephron. Discuss the functions and molecular mechanisms of reabsorption and excretion in different regions.
3. The action potentials generated by the SA node, Atrium, AV node, Purkinje and ventricle of the heart are all different. Please draw diagrams of their action potentials and explain the molecular mechanisms for their differences.
4. Discuss the process of bone formation. What are the influences of hormones on this process?