

考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

一. 選擇題 (單選, 每題二分, 答錯倒扣0.5分)

1. Gross deficiency of xanthine oxidase in human will cause
  - A. immunodeficiency disease
  - B. orotic aciduria
  - C. Lesch-Nyhan syndrome
  - D. xanthinuria
  - E. a severe gouty arthritis
2. Which of the following statements about the de novo biosynthesis of purine nucleotides is INCORRECT
  - A. 5-phosphoribosyl-1-pyrophosphate (PRPP) is a key intermediate and is synthesized in reaction catalyzed by PRPP synthetase utilizing ribose-5-p and ATP.
  - B. The formation of 5-phosphoribosylamine (PRA) is a committed step. This reaction is catalyzed by PRPP aminotransferase utilizing glutamin.
  - C. Aspartate and glycine form part of the ring system of purine
  - D. Synthesis of AMP from inosinic acid require NAD and glutamine
  - E. Biosynthesis occurs primarily in liver
3. Which of the following group of amino acids are all required in the cultures of mammalian cells?
  - A. Arginine, Histidine, Isoleucine, Asparagine.
  - B. Leucine, Lysine, Methionine, Proline.
  - C. Phenylalanine, Threonine, Proline, Tyrosine.
  - D. Phenylalanine, Lysine, Threonine, Valine.
  - E. Alanine, Tyrosine, Histidine, Cystine
4. Which set of compounds are used in the biosynthesis of tetrapyrrols in most animal tissues?
  - A. Serine and Glycine.
  - B. Succinyl-coA and Glycine.
  - C. Succinyl-coA and Serine.
  - D. Serine and Glycine.
  - E. Glutamine and Aspartate.

二. 選擇題 (複選)

Answer questions 5-16 according to the following key.

- A. if 1,2, and 3 are correct
- B. if 1 and 3 are correct
- C. if 2 and 4 are correct
- D. if only 4 is correct
- E. if all are correct

I. 5-9 題, 每題二分, 答錯倒扣0.5分

5. Mammalian pyruvate dehydrogenase complex is regulated by
  1. allosteric modulation
  2. covalent modification
  3. energy charge
  4. enzyme phosphorylation

考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

6. Glycogen degradation is stimulated by the active forms of the enzymes
  1. protein kinase
  2. inhibitor 1
  3. phosphorylase kinase
  4. phosphoprotein phosphatase
7. Insulin stimulates
  1. glycogen synthesis
  2. glycogen degradation
  3. glucose uptake into muscle cells
  4. glucose uptake into liver cells
8. The cholesterol present in LDL (Low-density lipoproteins):
  1. binds to a cell receptor and diffuse across the cell membrane.
  2. When it enters a cell, suppresses the cell's cholesterol synthesis by inhibiting HMG CoA reductase
  3. once in the cell is converted to cholesterol esters by LCAT (lecithin-cholesterol acyl transferase).
  4. once it has accumulated in the cell, inhibites the replenishment of LDL receptors.
9. The prostaglandin synthase complex:
  1. contains both a cyclooxygenase and a peroxidase component.
  2. is induced by antiinflammatory steroids.
  3. produces  $PGH_2$
  4. uses as substrate the pool of free arachidonic acid in the cell.

II. 10-16 題，每題三分，答錯倒扣0.75分

10. Structural features that are common to all prostaglandins include:
  1. 20 carbon atoms.
  2. an internal ring structure.
  3. at least one double bond.
  4. a peroxide group at C-15.
11. During the interaction of a peptide hormone with its receptor:
  1. more than one polypeptide chain may be necessary.
  2. more than one second messenger may be generated.
  3. an array of transmembrane helices may form the binding site for the hormone.
  4. receptors have a greater affinity for hormones than for synthetic agonists or antagonists.
12. Major steps in the inactivation and excretion of all classes of steroid hormones include:
  1. conjugation to glucuronic acid
  2. hydroxylation
  3. oxidation
  4. side chain cleavage

考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

13. Acetyl CoA carboxylase:

1. is controlled primarily by allosteric effectors.
2. undergoes protomer-polymer interconversion during its physiological regulation.
3. is inhibited by cAMP-mediated phosphorylation.
4. content in a cell responds to changes in fat content in the diet.

14. Citrate stimulates fatty acid synthesis by

1. allosterically activating acetyl CoA carboxylase
2. providing a mechanism to transport acetyl CoA from the mitochondria to the cytosol.
3. participating in a pathway that ultimately produces  $\text{CO}_2$  and NADPH in the cytosol.
4. participating in the production of ATP.

15. Which of the following events is/are usually involved in the synthesis of triacylglycerols in adipose tissue?

1. addition of a fatty acyl CoA to a diacylglycerol.
2. addition of a fatty acyl CoA to a lysophosphatide.
3. hydrolysis of phosphatidic acid by a phosphatase.
4. glycerol kinase reaction.

16. The high glucagon/insulin ratio seen in starvation:

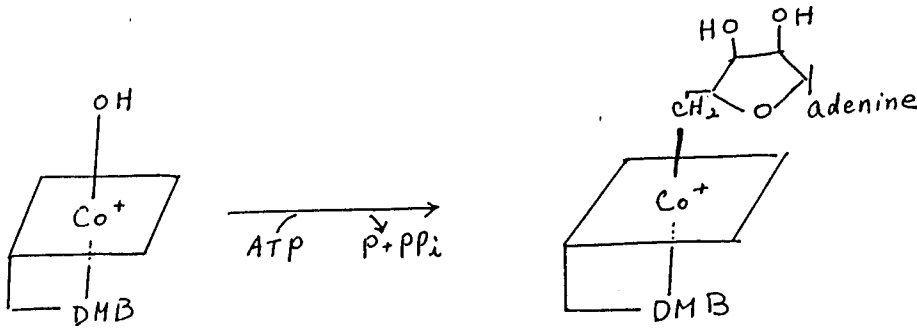
1. promotes mobilization of fatty acids from adipose stores.
2. stimulates  $\beta$ -oxidation by inhibition of the production of malonyl CoA.
3. leads to increased concentration of ketone bodies in the blood.
4. produces a condition that results in an increased utilization of ketone bodies by the brain.

三. 簡答題

17. You want to isolate cell hybrids resulting from the fusion of two different permanent human fibroblast cell lines. Describe selective conditions in which only hybrids could grow. What is the phenotype of each parental cell line and how would you isolate such cell lines? (3%)
18. Cells selected for resistance to the cytotoxic effects of 8-azaguanosine have been isolated. Three types of genetic defects have been noted in drug-resistant cells. Predict what these genetic defects are. (3%)
19. Describe the regulation of glycogen synthase by covalent modification. (4%)
20. Acetyl CoA that is  $^{14}\text{C}$  labeled at its methyl group is incubated with oxaloacetate and all the necessary enzymes and cofactors of the tricarboxylic acid cycle. Will the radioactivity be released as  $^{14}\text{CO}_2$  and will the succinate be labeled after one turn of the cycle? Give your explanation. (4%)
21. A fall in blood glucose causes a rise in glucagon, which results in inhibition of phosphofructokinase activity in the liver. Discuss the molecular mechanism involved. (4%)
22. What are the reactions that require ATP and GTP during gluconeogenesis. (3%)
23. Describe the allosteric modulation involved in the regulation of glycogen degradation and glycogen synthesis. (4%)

考生注意事項：所有考題務必在答案卷上作答。凡在問題卷上作答者無效。

24. 4-Amino-10-methylfolate (methotrexate) was found to be effective in the treatment of leukemias. Give a brief description of the mechanism of the effects of methotrexate in cellular metabolism. (5%)
25. (a) Genetic defect of the enzyme which catalyzed the conversion of hydroxocobalamin to 5'-deoxyadenosyl-cobalamin would result in urinary excretion of what compound?  
 (b) If the condition describe above could be successfully treated by injection of massive doses of Vitamin B<sub>12</sub>, What kind of genetic alteration in the enzyme would be consistent with this result? (6%)



hydroxocobalamin

5'-deoxyadenosylcobalamin

DMB is dimethyl benzimidazole

26. Draw the structure of argininosuccinate and indicate the origin of each part of the molecules in urea cycle. (5%)
27. How does muscle use alanine as the carrier to transport ammonia to liver? Answer the question by using a simple flow chart to show the reactions involved. (5%)
28. Certain chemical treatments can lead to the lytic expression of the prophage lambda in lysogenic cultures of E. coli. This has been proposed as a possible screening assay for carcinogens. Explain. (5%)
29. Based on your knowledge of the differences between a cDNA clone of a complete transcript and a genomic clone of a complete gene, which kind of clone would be best for each of the following purposes? (10%)
- A bacterial expression vector
  - A probe for hybridization to detect mRNA content
  - DNA for packaging into a lambda phage vector
  - A probe for testing paternity by comparing restriction fragment patterns
  - Studying the expression pattern in transgenic mice