一、選擇題：(50%)　※注意：請於試卷內之「選擇題作答區」依序作答。

1. The most abundant cation in extracellular fluid is: (a) Na; (b) K; (c) Mg; (d) Ca

2. The most abundant cation in intracellular fluid is: (a) Na; (b) K; (c) Mg; (d) Ca

3. The mineral associated with the glucose tolerance factor is
(a) Cr; (b) Mn; (c) Mo; (d) Se

4. The mineral serving as a cofactor in sulfite oxidase is
(a) Cr; (b) Mn; (c) Mo; (d) Se

5. The most abundant anion in intracellular fluid is
(a) Chloride; (b) Bicarbonate;
(c) Hydrogen phosphate; (d) Sulfate

6. The mineral binding the phosphate groups in ATP in ATP-dependent enzyme reactions is
(a) Na; (b) K; (c) Mg; (d) Ca

7. The non-metal nutrient associated with Keshan disease,which is characterized by cardiomyopathy, is
(a) Cr; (b) Se; (c) Cl; (d) P

8. The two minerals associated with the enzyme superoxide dismutase (SOD) in the cytoplams are
(a) Fe & Zn; (b) Cu & Zn; (c) Mn & Fe;
(d) Zn & Fe

9. The ion that is actively secreted by the parietal cells in the gastric gland is (a) Na^+; (b) K^+; (c)Cl^-; (d) HCO_3^-

10. The two trace minerals that induce the synthesis of metallothionein in the cell are
(a) Fe & Zn; (b) Cu & Zn;
(c) Mn & Fe; (d) Zn & Fe

11. The two minerals, when either one of them is deficient, will result in thyroid hormone deficiency in the body, are
(a) Ca & P (b) I & Zn;
(c) Se & Zn; (d) I & Se;

12. The hormone primarily responsible for contraction of the gallbladder and release of bile into the duodenum is
(a) Gastrin; (b) Secretin;
(c) Cholecystokinin; (d) Ghrelin

13. Bile salts are synthesized from cholesterol in the
(a) Hepatocytes; (b) Enterocytes ;
(c) β-cells ; (d) Colon

14. The binding protein that regulates many of the calcium-dependent enzymes is:
(a) Calcitonin; (b) Calbidin;
(c) Calcitriol; (d) Calmodulin

15. Vitamin C acts as an enzyme cofactor by the following mechanisms **EXCEPT** _____
(a) maintaining iron in ferrous state
(b) maintaining copper in cuprous state
(c) maintaining vitamin E in reduced form.
(d) maintaining folate in reduced form

16. The mineral that cotransports for absorption of dietary glucose is
(a) Na; (b) K; (c) Mg; (d) Ca

見背面

17. Menkes disease and Wilson's disease are genetic disorders related to abnormal metabolism of which mineral?
(a) Iron; (b) Copper; (c) Zinc; (d) Selenium

18. Conjugation of bile acids with glycine and taurine improves their ability to
(a) ionize and form micelles;
(b) undergo enterohepatic recirculation;
(c) be excreted in the feces, thus keeping serum cholesterol normal;
(d) promote the formation of bile salts.

19. The mineral component in hephaestin is
(a) Iron; (b) Copper; (c) Zinc; (d) Selenium

20. The mineral that its low plasma concentration will stimulate PTH secretion is
(a) Na; (b) K; (c) Mg; (d) Ca

21. The protein that carries iron in the plasma is
(a) Ceruloplasmin; (b) Transferrin;
(c) Transferrin receptor; (d) Hemoglobin

22. The absorption rates of Ca and P are____ & ___, respectively:
(a) 30% & 30%; (b) 60% & 60%;
(c) 30% & 60%; (d) 60% & 30%

23. 血紅素含鐵量為 3.35 mg/g Hb, 血液體積佔體重 13 分之一; 有位年輕女性體重 52 公斤，血紅素值是 9g/100mL;請問若要達到正常量的血紅素值 12 g/100mL, 她的血液中大約需要再補充多少鐵量?
(a) 400 mg
(b) 100 mg
(c) 10 mg
(d) 15 mg

24. 上題所到的女性，她的鐵吸收率大約在哪個範圍?
(a) 5-10%
(b)15-30%
(c)70%
(d)90%

25. 如果這位女性造血與吸收機制均正常，每天攝取 DRI 建議之鐵量，要達到預期的血紅素濃度大約需要多久?
(a) 一年
(b) 6-9 個月
(c) 3-6 個月
(d) 1-3 週

接次頁

※ 注意：請於試卷上「非選擇題作答區」內依序作答，並應註明作答之大題及其題號。

二、單選題：請在答案卷寫每行五題的答案由第 1~5, 5~10, 10~15 題，分列三行：1 ( ). 2 ( ). .... 5 ( )，依此類推。(15%)

1. What is the normal range for fasting serum glucose levels?
   a. 10-30 mg/dL　b. 30-50 mg/dL　c. 60-90 mg/dL　d. 100-140 mg/dL

2. Dietary fiber is currently defined as
   a. carbohydrates and lignin that are nondigestible by human enzymes and are intact and intrinsic in plants.
   b. carbohydrates that are nondigestible by human enzymes, have been isolated, extracted or manufactured and have been shown to have beneficial physiological effects in humans.
   c. crude fiber.
   d. the same as functional fiber.

3. Functional fiber is currently defined as
   a. carbohydrates and lignin that are nondigestible by human enzymes and are intact and intrinsic in plants.
   b. carbohydrates that are nondigestible by human enzymes, have been isolated, extracted or manufactured and have been shown to have beneficial physiological effects in humans.
   c. all dietary fiber.
   d. the same as crude fiber.

4. Hydrocolloids that are secreted at a site of injury on a plant or surround the endosperm of some seeds and that are used as thickening agents.
   a. lignin　b. cellulose　c. pectins　d. gums

5. *Trans* unsaturated fatty acids are now considered more atherogenic than saturated fatty acids because they
   a. are unnatural and only formed during fat processing.　b. cause excess blood clotting.
   c. elevate serum LDL while decreasing HDL.　d. were found to cause sudden cardiac arrest in women.

6. Which group of 20-carbon fatty acid derivatives exhibit a range of physiological actions including lowering of blood pressure, diuresis, blood platelet aggregation and effects on the immune system?
   a. prostaglandins　b. linoleic acid　c. palmitate　d. cholesterol

7. What are two major components implicated in the mechanism of atherogenesis?
   a. growth factors and HDL　b. enterocytes and endothelial cells
   c. cells of the immune system and serum lipids　d. primarily VLDL and IDL

8. A genetic defect diminishing branched-chain alpha-keto acid dehydrogenase complex activity results in
   a. phenylketonuria.　b. homocysteinuria.　c. cystathioninuria.　d. maple syrup urine disease.

9. Which cells lack a metabolic mechanism to convert glucose into energy stores?
   a. skeletal muscle　b. liver　c. adipose tissue　d. RBC's

10. A protein-sparing shift in metabolism from gluconeogenesis to lipolysis occurs during the
    a. early fasting state　b. fasting state　c. starvation state　d. fed state

11. In which organ does urea synthesis occur?
    a. kidney　b. spleen　c. liver　d. pancreas

12. What amino acid plays an important role in controlling toxicity from ammonia released during amino acid catabolism by the glutamate dehydrogenase reaction?
    a. glutamine　b. glycine　c. serine　d. valine

13. Which vitamin directs cellular differentiation of epithelial cells?
    a. riboflavin　b. vitamin K　c. vitamin E　d. vitamin A

14. Vitamin K deficiency is most likely due to:
    a. oxalic acid in food　b. achlorhydria　c. antibiotic therapy　d. a high fiber diet

15. Which organs are responsible for regulation of extracellular water osmolarity and volume?
    a. hypothalamus and kidney　b. liver and pancreas　c. pancreas and kidney　d. spleen and bone marrow

三、解釋名詞：(10%)

1. "methyl-folate trap"
2. intrinsic factor
3. visual cycle
4. The vitamin K cycle
5. "the sunshine vitamin"

見背面

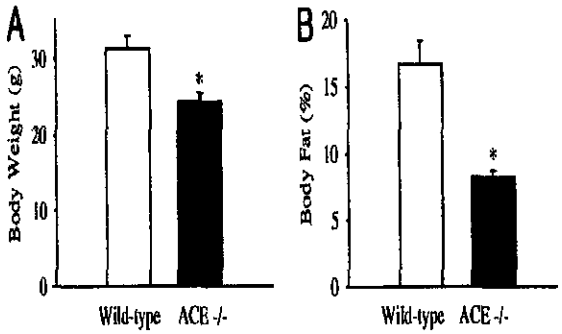
四、實驗簡答題：

1.有研究探討 renin-angiotensin system 對能量調節的影響，將 antiotensin-converting enzyme (ACE)基因剔除小鼠($ACE^{-/-}$)的結果與 wild-type 小鼠比較如下：(8%)

Table 1. Food intake (FI), water intake (WI), fecal fat, and body composition of $ACE^{+/+}$ and $ACE^{-/-}$ mice

Appetite and body composition	$ACE^{+/+}$	$ACE^{-/-}$
FI, g (n = 14)	3.5 ± 0.2	3.0 ± 0.2
FI, g/body weight, g (n = 14)	0.11 ± 0.01	0.13 ± 0.01
WI, ml (n = 14)	4.2 ± 0.2	9.8 ± 0.5*
Fat in dry feces, % (n = 7)	4.7 ± 0.2	4.9 ± 0.1
Digestability, % (n = 7)	94.1 ± 0.3	94.5 ± 0.2
Body fat, g (n = 7)	5.5 ± 0.7	2.3 ± 0.2*
Fat-free mass, g (n = 7)	26.4 ± 0.6	24.9 ± 1.0
Bone density, g/cm² (n = 7)	0.078 ± 0.001	0.076 ± 0.001

Values are mean ± SEM. *, $P < 0.05$ ($ACE^{-/-}$ vs. $ACE^{+/+}$).



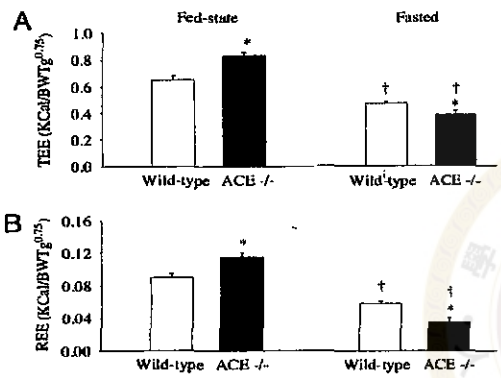


Table 3. Fold-increase (FI) in expression of genes involved in *lipid metabolism in the livers of $ACE^{-/-}$ mice compared with $ACE^{+/+}$ mice*

Gene	FI	Role in fat metabolism
Lipoprotein lipase	4.4*	Lipolysis
PPARγ coactivator-1	2.8*	Induction of fat metabolism
Carnitine palmitoyl transferase	2.3*	Fatty acid oxidation
Long chain acyl-CoA dehydrogenase	2.1*	Fatty acid oxidation
Hormone sensitive lipase	1.4	Lipolysis
Fatty acid synthase	*1.0*	*Fat storage*

*, $P < 0.05$ ($ACE^{-/-}$ vs. $ACE^{+/+}$).

請問： 1) ACE 此酵素在水分調節的作用為何？ (2%)
2) 缺 ACE 小鼠的體重和脂肪有何變化？ (2%)
3) renin-angiotensin system 對能量代謝有影響嗎？從那個圖表可判斷？(2%)
4) 缺 ACE 對小鼠體重和脂肪的變化，是減少食慾還是增加能量消耗？你從哪個結果推論？(2%)

2. 由流行病學調查顯示多攝取蔬果顯著降低某些癌症的罹患率，因此有研究認為蔬果富含類胡蘿蔔素等具抗氧化能力的營養素，而針對抽煙者和暴露於石綿環境的工作者每天補充30 mg β-carotene和25,000 IU維生素A，約4年的實驗與追蹤，卻提早21個月將此 The Beta-Carotene and Retinol Efficacy Trial 計畫停止，部份統計結果如下圖： (8%)

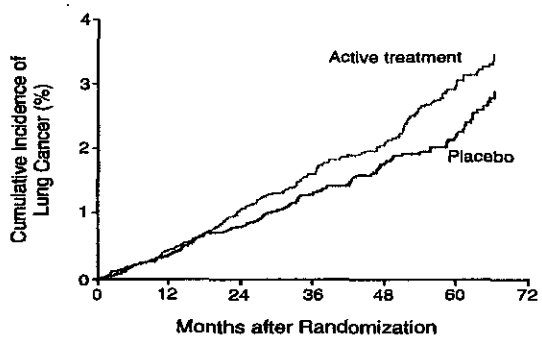


Figure 1. Kaplan–Meier Curves of the Cumulative Incidence of Lung Cancer among Participants Receiving Active Treatment and Those Receiving Placebo.
Data are shown only through 5½ years of follow-up because of the small numbers of participants beyond that time.

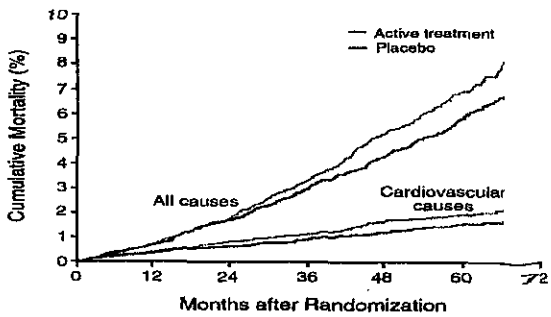


Figure 2. Kaplan–Meier Curves of the Cumulative Incidence of Death from All Causes and Confirmed Cardiovascular Causes among Participants Receiving Active Treatment and Those Receiving Placebo.
Data are shown only through 5½ years of follow-up because of the small numbers of participants beyond that time.

請問 1) 何謂「placebo」？(2%)
2) Figure 1和Figure 2 分別呈現什麼指標的數據結果？(2%)
3) 根據此結果圖來判斷，學者為何要提早停止此計畫？ (2%)
4) 你認為研究者所得之初步結果與原先的假說符合嗎？(1%) 可能的原因是什麼？ (1%)

接次頁

3. 有研究探討正常人與lipoprotein lipase缺乏患者，補充兩種型式的維生素E各1000 mg後的血中濃度變化，如下圖：(9%)

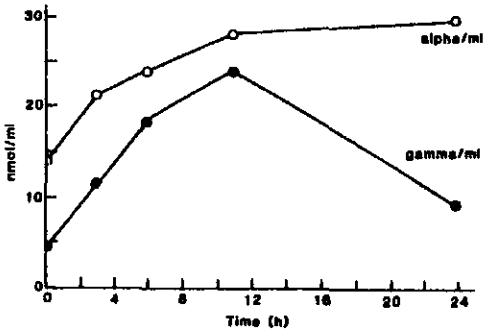


FIG 1. Plasma α-tocopherol (alpha/mL) and γ-tocopherol (gamma/mL) concentrations after ingestion of a single dose (1000 mg each) of

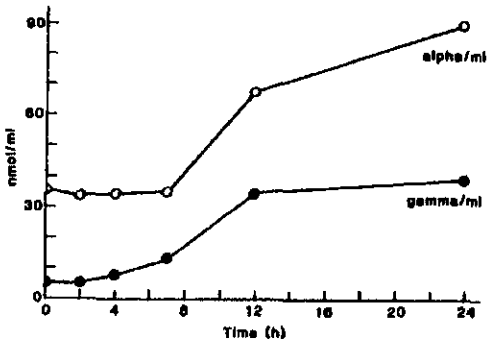


FIG 2. Plasma α-tocopherol (alpha/mL) and γ-tocopherol (gamma/mL) concentrations after ingestion of a single dose (1000 mg each) of

請問 1) 維生素 E 是哪八種不同的型式化合物的通稱？(4%) 哪種型式最具活性 (1%)？
2) lipoprotein lipase 和維生素 E 的利用有何關係？ (2%)
3) FIG 1 或 FIG 2，哪一個是 lipoprotein lipase 缺乏患者的結果？(1%) 如何判斷？(1%)

試題隨卷繳回