

系所組別：藥理學研究所

考試科目：生物化學

考試日期：0220，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

請勿在本試題紙上作答，否則不予計分

Part I: 50%**I. Please select one of the best answers in the following questions (2.5% each)**

1. Which of the following terms is not used to describe a parameter of DNA topology?
 - a. wobble
 - b. writhe
 - c. twist
 - d. linking number
2. Which structural property of DNA is crucial for the conservation of genetic information?
 - a. antiparallelism
 - b. the ability to form a double helix
 - c. base-pair complementarity
 - d. b and c.
 - e. all of the above
3. In eukaryotic cells, protein synthesis in the cytoplasm utilizes three types of RNA molecules. Which of the following contains a three nucleotide sequence called the anticodon?
 - a. mRNA
 - b. tRNA
 - c. rRNA
 - d. all of the above
4. Which of the following factors recognizes the UAG, UAA, and UGA codons?
 - a. RNA polymerase
 - b. DNA polymerase
 - c. termination factors
 - d. elongation factors
5. Which of the following structures interacts with ribosomes?
 - a. tRNA
 - b. mRNA
 - c. rRNA
 - d. b and c
 - e. all of the above
6. Which nucleic acid structure has its bases methylated after synthesis?
 - a. DNA
 - b. mRNA
 - c. tRNA
 - d. rRNA

(背面仍有題目,請繼續作答)

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7. Which of the following lead(s) to a point mutation?
- deamination of a cytosine base into a uracil base
 - benzo(*a*)pyrene conversion of guanine to a thymine base
 - deamination of 5-methyl cytosine into thymine
 - all of the above
8. Which of the following is defined as the tertiary structure of a protein?
- the primary amino acid sequence
 - structural domains such as a DNA binding domain
 - folded structures such as an α helix
 - structural features such as a turn
9. Which of the following is not part of a zinc-finger motif?
- zinc ion
 - proline residue
 - cysteine residue
 - histidine residue
10. The K_m for an enzyme-catalyzed reaction
- determines the shape of the kinetics curve.
 - determines the V_{max} for the reaction.
 - is a measure of the affinity of the substrate for the enzyme.
 - is a measure of the rate of the reaction.
11. Which of the following is a mechanism for regulating protein activity?
- proteolytic processing
 - phosphorylation/dephosphorylation
 - ligand binding
 - b and c
 - all of the above
12. Which of the following is a typical feature of prokaryotic genes?
- polycistronic messenger RNAs
 - complex transcription units
 - introns
 - a and c
13. In eukaryotes, tandemly repeated genes encode
- rRNAs.
 - cytoskeletal proteins.
 - β -globin.
 - all of the above
14. Which of the following pairs of proteins are considered to be paralogous?
- yeast α -tubulin and yeast β tubulin
 - yeast α -tubulin and worm α tubulin
 - fly β -tubulin and human β tubulin
 - worm β -tubulin and human α tubulin

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15. All the following statements are true about a nucleosome except

- a. It contains an octamer core of histones
- b. It is about 10 nm in diameter
- c. It is the “string” of the “beads-on-a-string” appearance
- d. It contains approximately 150 base pairs of DNA

16. In mammals, X-chromosome inactivation

- a. occurs in half the diploid cells of the adult female.
- b. results from the ionization of the X-chromosome.
- c. is considered an epigenetic event.
- d. b and c

II. Please answer in detail for the following questions (5% each)

1. Describe the evidence that supports the bacterial ancestry of mitochondria.
2. A double-stranded piece of DNA containing the sequence GCATGGCCACTACCG has a higher T_m than one containing the sequence GAATGGTAACAACCTG. Describe the properties of DNA that make this true.

Part II: 50%

一、選擇題 (3% each)

1. Overexpression of ErbB/HER--family receptor tyrosine kinases appears in many types of human cancer. Recently, an antibody Cetuximab (or Erbitux) has been used as an anticancer drug for targeting to ErbB1/HER1 receptor tyrosine kinase. Which of the following description is its action mechanism?
 - (A) It directly blocks the interaction between ErbB1 and the downstream signaling proteins such as Grb2 and Shc;
 - (B) It directly binds to ErbB1 and interfere ligand-induced activation of the receptor;
 - (C) it inhibits the cytoplasmic tyrosine kinase activity of ErbB1 by competitive inhibition of ATP binding;
 - (D) It inhibits receptor dimerization and the following EGF ligand binding;
 - (E) It promotes receptor internalization and down-regulates its activity.

(背面仍有題目,請繼續作答)

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2. Which of the following events rarely occurs in the synthesis of triacylglycerols in adipose tissue?
- (A) a reaction catalyzed by glycerol kinase;
 - (B) addition of a fatty acyl CoA to a diacylglycerol;
 - (C) addition of a fatty acyl CoA to a lysophosphatide;
 - (D) reduction of dihydroxyacetone phosphate;
 - (E) hydrolysis of phosphatidic acid by a phosphatase..
3. Which of the following description about β -oxidation is correct?
- (A) is usually suppressed during starvation;
 - (B) uses NADP⁺;
 - (C) occurs by a repeated sequences of four reactions;
 - (D) uses only even-chain, saturated fatty acid as substrates;
 - (E) generates ATP only if acetyl CoA is subsequently oxidized.
4. Which of the following description about aminotransferases is correct?
- (A) Aminotransferases catalyze reactions that result in a net use or production of amino acids;
 - (B) Aminotransferases catalyze irreversible reactions;
 - (C) Aminotransferases usually require α -ketoglutarate or glutamine as one of the reacting pair;
 - (D) Aminotransferases require pyridoxal phosphate as an essential cofactor for the reaction;
 - (E) Aminotransferases are not able to catalyze transamination reactions with all essential amino acids.
5. Which of the following chemotherapeutic agents works by impairing *de novo* purine synthesis?
- (A) 5-fluorouracil;
 - (B) Acyclovir (acycloguanosine);
 - (C) Hydroxyurea;
 - (D) Methotrexate;
 - (E) Azidothymidine (3'-azido-3'-deoxythymidine).
6. In the interaction of a hormone with its receptors all of the following are true **except**?

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- (A) an array of transmembrane helices may form the binding site for the hormone;
(B) receptors have a greater affinity for hormones than for synthetic agonists or antagonists;
(C) more than one polypeptide chain of the hormone may be necessary;
(D) more than one second messenger may be generated;
(E) lipid soluble hormone could theoretically interact with a nuclear receptor.
7. Which of the following description about nitric oxide synthase (NOS) is correct?
(A) may be involved in controlling neuronal signaling but not muscle contraction;
(B) has both constitutive and inducible form;
(C) forms NO in one tissue, which acts on a distant tissue;
(D) is most active when bound to other proteins
(E) is found in endothelial tissue only in response to inflammation.
8. Which of the following description about Ras protein in signal transduction is correct?
(A) it is inactive in the GTP-Ras conformation;
(B) it transmits a signal by initiating a kinase cascade;
(C) it is formed from an oncogene;
(D) from a mutated gene in many cancers has inactivated GTPase activity so inhibits the downstream signal to divide;
(E) it becomes inactive as a signaling protein by phosphorylating transcription factors.
9. When blood glucagon rises, which of the following hepatic enzyme activities decreases?
(A) protein kinase A;
(B) adenylate cyclase;
(C) fructose-1,6-bisphosphatase;
(D) 6-phosphofructo-2-kinase;
(E) Hexokinae.
10. The inner mitochondrial membrane contains a transporter for:
(A) NADH;
(B) ATP;
(C) GTP;
(D) NADPH;
(E) Acetyl CoA.

(背面仍有題目,請繼續作答)

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1. Cells from a patient with familial hypercholesterolemia (FH) and cells from an individual without that disease were incubated with LDL particles containing radioactively labeled cholesterol. After incubation, the incubation medium was removed and the radioactivity of the cells was measured. Then, the cells were treated to remove any unbound material and were lysed to measure the internal cholesterol content. Results are given below. What mutation of the gene for the LDL receptor protein could account for these results? Please briefly explain it!

Cell type	Radioactivity of cell	Cholesterol content
Normal	5000 cpm/mg cells	Low (150 mg/100 mL)
FH	5000 cpm/mg cells	High (500 mg/100mL)

2. Organophosphate compounds are irreversible inhibitors of acetylcholinesterase. What effect does an organophosphate inhibitor have on the transmission of nerve impulses? Please briefly explain it!
3. Acetaminophen is primarily metabolized by sulfation and glucuronidation and excreted. It can also be metabolized by a cytochrome P450 (CYP2E1) to the highly reactive NAPQI, which can damage liver. Alcohol is an inducer and substrate for CYP2E1. If acetaminophen is taken several hours after drinking alcohol, liver toxicity is greatly enhanced. If acetaminophen and alcohol are consumed together, enhancement of toxicity is not observed why? Please briefly explain it!
4. Using pyruvate, labeled with ^{14}C in its keto group, via the pyruvate dehydrogenase reactions and the TCA cycle, where would the carbon label be at the end of one turn of the TCA cycle? Where would the carbon label be at the end of the second turn of the cycle?