

- B. (5')CGCUAUAGCGUUU(3')
- C. (5')UUUGCGAUUCGC(3')
- D. (5')GCGAUUCGCAA(3')
7. Please select the following RNA which is synthesized by DNA-dependent RNA polymerase I in eukaryotes.
- A. 18S rRNA
- B. microRNA
- C. mRNA
- D. tRNA
- E. small nuclear RNA U1
8. Please select the following enzyme that does not possess reverse transcriptase activity.
- A. Human immunodeficiency virus (HIV) polymerase
- B. Human telomerase
- C. Influenza virus polymerase
- D. Hepatitis B virus polymerase
9. Please select the following codon for aspartic acid (Asp) that corresponds to the tRNA anticodon (5')GUC(3').
- A. (5')GUC(3')
- B. (5')CAG(3')
- C. (5')GAU(3')
- D. (5')CUG(3')
10. Please select the following statement that is not correct for enhancers in eukaryotic transcription.
- A. Work when located long distances from the promoter
- B. Work when upstream or downstream
- C. Work when orientation in one direction
- D. Work through heterologous promoters
- E. Work by binding one or more proteins
11. Phosphodiesterase could catalyze which of the following compound?
- A. Glycogen
- B. Phosphorylase
- C. Hyaluronic acid
- D. Phosphatidylinositol
- E. Deoxyribonucleotide
12. NF- κ B is a protein complex that controls DNA transcription. In unstimulated cells, the NF- κ B dimers are sequestered in the cytoplasm by I- κ Bs. After TNF- α binding to its receptor, which of the following event after I- κ B phosphorylation is important for NF- κ B activation?
- A. Deacetylation
- B. Glycosylation
- C. Hydroxylation
- D. Ubiquitination
- E. ADP-ribosylation

13. Integrin is a (an) :
- A. enzyme
 - B. receptor
 - C. chaperone
 - D. enzyme inhibitor
 - E. transcription factor

Please read the following paragraphs and answer question 14 and 15.

More than 100 years ago, Richard Pfeiffer, a student of Robert Koch, coined the term "endotoxin" to describe a substance produced by Gram-negative bacteria that could provoke fever and shock in experimental animals. In the decades that followed, endotoxin was chemically characterized and identified as a lipopolysaccharide (LPS) produced by most Gram-negative bacteria. It followed logically that there must be receptors for such molecules, capable of alerting the host to the presence of infection, but these remained elusive for many years.

In 1996, the mechanism was found by Jules A. Hoffmann and his colleagues to understand its essential role in fly's innate immunity. Around the same time, Bruce A. Beutler was studying the mechanism behind septic shock, a potentially deadly condition involving overstimulation of the immune system. His work led to the discovery of cognate receptor as an LPS sensor by using positional cloning. It proved that mice could not respond to LPS, when the receptor gene was mutated or deleted. This identified the specific receptor as one of the key components for such immune sensor. On October 3, 2011, Dr. Beutler and Dr. Hoffmann were awarded the Nobel Prize in Medicine or Physiology for their work.

14. What is the receptor for LPS?
- A. Leptin receptor
 - B. Toll-like receptor
 - C. Epinephrine receptor
 - D. Glucocorticoid receptor
 - E. Epidermal growth factor receptor
15. Which of the following description about LPS is wrong?
- A. It contains lipid A moiety.
 - B. It is a negatively charged compound.
 - C. It could be dissolved in PBS, as an aqueous suspension.
 - D. It contains formylated peptides for white blood cell activation.
 - E. It contains repetitive glycan polymer, referred as the O antigen.
16. Which of the following reactions is catalyzed by a transferase?
- A. $A \leftrightarrow P + Q$
 - B. $A + B \leftrightarrow P + Q$
 - C. $A + ATP \leftrightarrow P + ADP$
 - D. $A + NAD^+ \leftrightarrow P + NADH$
 - E. $A + H_2O \leftrightarrow P + Q$
17. The reaction rate of an enzymatic reaction $A + B \rightarrow P + Q$ can be increase by 5-fold in the presence of compound X. X is best referred to as a(an) _____.

- A. prosthetic group
 - B. cofactor
 - C. allosteric effector
 - D. uncompetitive inhibitor
 - E. coenzyme
18. When saturated, a solution containing 10^{-3} M of enzyme A can catalyze the breakdown of 1.2×10^{-2} M of substrate per minute. The k_{cat} of enzyme A in sec^{-1} is:
- A. 0.01
 - B. 0.02
 - C. 0.05
 - D. 0.1
 - E. 0.2
19. Which of the following statements regarding competitive inhibitor is wrong?
- A. It binds to the active site of the enzyme.
 - B. Its presence reduces the K_M of the enzymatic reaction.
 - C. The V_{max} of the enzymatic reaction is not affected.
 - D. Some drugs are competitive inhibitors of enzymes.
 - E. The k_{cat} of the enzymatic reaction is not affected.
20. To speed up chemical reaction, an enzyme usually reduces the activation energy by
- A. binding tightly to substrate
 - B. binding weakly to substrate
 - C. binding tightly to transition state
 - D. binding tightly to prosthetic group
 - E. binding weakly to product
21. Which one of the following enzymes converts adenosine to AMP?
- A. adenosine phosphoribosyl transferase
 - B. adenosine kinase
 - C. adenosine deaminase
 - D. all are wrong.
22. The synthesis of long-chain fatty acids is carried out by
- A. acetyl-CoA carboxylase
 - B. fatty acids synthase
 - C. both are right
 - D. both are wrong.
23. Amino acids can be catabolized to intermediates for carbohydrate biosynthesis. Which one of the following reactions is **WRONG**?
- A. Asparagine and aspartate form oxaloacetate
 - B. Glutamine and glutamate form α -ketoglutarate
 - C. Tyrosine and phenylalanine form fumarate
 - D. Proline, arginine and histidine form succinyl-CoA.
24. A defect in glucose-6-phosphatase may cause
- A. von Gierke disease

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- B. Lesch–Nyhan Syndrome
C. Hypouricemia
D. Severe combined immunodeficiency disease.
25. Which one of the following methods can **NOT** be used to analyze gene expression?
A. Northern blot
B. Southern blot
C. Western blot
D. Quantitative real-time polymerase chain reaction.
26. The following description about selectin is not correct
A. a Ca^{+2} dependent binding ability for its ligands
B. a sugar binding protein
C. L-selectin is an endothelial cell specific selectin
D. Involved in leukocyte rolling on the endothelial cell layer
E. Ionic interaction is involved in the ligands and receptors recognition
27. Which enzyme is involved in the Trans Golgi oligosaccharides processing
A. Golgi apparatus alpha mannosidase I
B. N-acetyl glucosaminyl transferase
C. galatosyl transferase
D. Fucosyl transferase
E. Mannosyl transferase
28. which proteins is not the component for basal membrane
A. lamin
B. perlecan
C. type IV collagen
D. entactin
E. fibronectin
29. The cytoplasmic tail of which integrin interacts with intermediate filaments
A. $\alpha 5\beta 1$
B. $\alpha 6\beta 4$
C. $\alpha 3\beta 1$
D. $\alpha 2\beta 1$
E. $\alpha 6\beta 1$
30. Which one is correct for the following descriptions about RNA polymerase (Pol).
A. RNA Pol I and III found and function in nucleoplasm
B. rRNA mainly synthesis by RNA Pol I in the nucleoplasm
C. tRNA and 5.8S RNA synthesized by RNA Pol III
D. snRNAs are synthesized by RNA Pol II
E. 5S RNA and U6 snRNA are synthesized by RNA Pol III
31. In human body, docosahexaenoic acid (DHA) can be synthesized from
A. oleic acid B. linoleic acid C. γ -linolenic acid
D. α -linolenic acid E. arachidonic acid

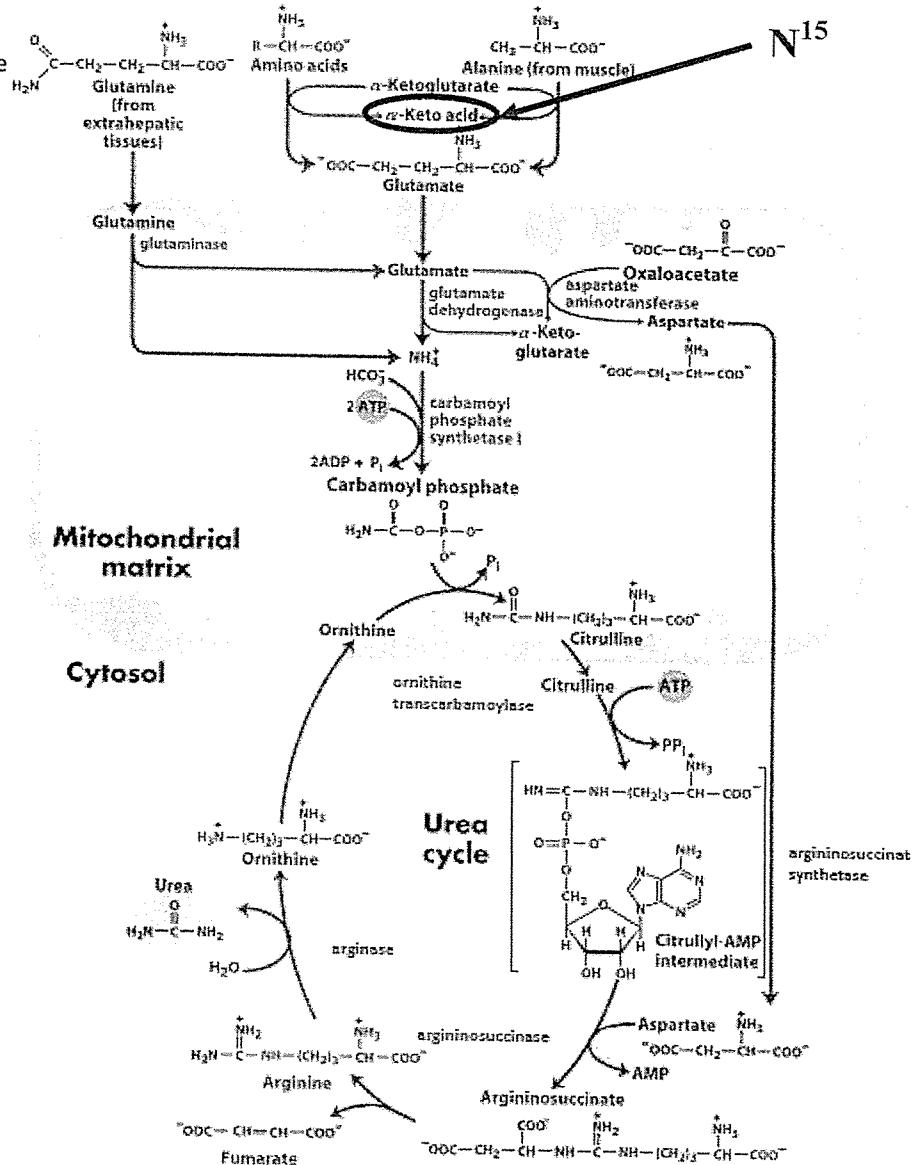
32. Which of the following are located on the cell membrane?
A. cholesteryl ester and phospholipid
B. cholesteryl ester and triacylglycerol
C. cholesterol and phospholipid
D. cholesterol and triacylglycerol
E. phospholipid and triacylglycerol
33. Which of the following carry more cholesterol in the blood of human?
A. VLDL B. IDL C. LDL D. HDL E. chylomicron
34. Which of the following is responsible for the release of free fatty acid from adipocyte?
A. HMG-CoA reductase B. hormone sensitive lipase C. lipoprotein lipase
D. pancreatic lipase E. lysosomal lipase
35. Which following enzyme can be regulated by calcium ion?
A. phosphorylase B. phosphorylase kinase C. glycogen synthase
D. phosphofructokinase-1 E. phosphofructokinase-2.
36. Which enzyme can directly release a glucose from glycogen?
A phosphorylase B. glucan transferase C. glycosidase D. N-glycosyltransferase
E. debranching enzyme.
37. How many following situation can cause hypoglycemia? i. Glucose 6-phosphate dehydrogenase, ii. Damage of beta cells in pancreas, iii Fructose-1, 6-Bisphosphatase deficiency, iv. Impairment of fatty acid oxidation, v. Insulin increases glucose tolerance. A. 1 B. 2 C. 3 D. 4 E. 5
38. Which compound is directly produced by fecal flora?
A. uroporphyrin B. urobilin C. uroporphyrinogen
D urobilinogen E. coproporphyrinogen.
39. Ornithine transcarbamoylase deficiency will cause
A. Hyperammonemia
B. Hypoammonemia
C. Citrullinemia
D. Hypoornithinemia
E. Hyperargininemia
40. Mutation in the ornithine permease that transports ornithine from cytosol to mitochondria for catabolism will cause
A. Hyperammonemia
B. Hyperornithinemia
C. Homocitrullinuria
D. Citrullinemia
E. Argininosuccinicaciduria
41. Which of the following statements are correct?
A. Alanine carries nitrogen wastes in the muscles to the liver for catabolism.

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- B. Alanine carries nitrogen wastes in the muscles to the intestine for catabolism.
- C. Glutamine is the major nitrogen waste carrier of most tissues.
- D. Compared to glutamine, glutamate carries one more nitrogen atom for catabolism.
- E. It takes energy to produce urea.

42. As indicated in the figure below, the nitrogen atom (N^{14}) of the amino acid glutamate was replaced with its isotope N^{15} . In which of the following molecules can we find N^{15} ?

- A. NH_4^+
- B. Carbamoyl phosphate
- C. Ornithine
- D. Citrulline
- E. Aspartate



43. Which of the following enzyme does not take part in the TCA cycle?

- A. Citrate synthase
- B. Malate dehydrogenase
- C. Aldolase
- D. Aconitase
- E. Fumarase

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44. Which of the following substrates is NOT coupled to the production of NADH?
- A. Malate
 - B. Pyruvate
 - C. alpha-Ketoglutarate
 - D. Succinate
 - E. glyceraldehyde 3-phosphate
45. During strenuous exercise, the most important reaction involved in the reoxidation of NADH is:
- A. dihydroxyacetone phosphate \rightarrow glycerol 3-phosphate
 - B. glucose 6-phosphate \rightarrow fructose 6-phosphate
 - C. isocitrate \rightarrow α -ketoglutarate
 - D. pyruvate \rightarrow lactate
 - E. 2-phosphoglycerate \rightarrow phosphoenolpyruvate
46. The conversion of 1 mol of fructose 1,6-biphosphate to 2 mol of pyruvate by the glycolytic pathway results in a net formation of:
- A. 2 mol of NAD⁺ and 2 mol of ATP
 - B. 2 mol of NADH and 2 mol of ATP
 - C. 1 mol of NAD⁺ and 2 mol of ATP
 - D. 1 mol of NADH and 2 mol of ATP
 - E. 2 mol of NADH and 4 mol of ATP
47. α -Helix and β -strand are components of ____ structure
- A. primary
 - B. secondary
 - C. tertiary
 - D. quaternary
 - E. all are true
48. Which of the following levels of protein structure is correctly defined?
- A. primary: interaction between subunits of a protein
 - B. secondary: hydrogen bond arrangement of polar R-groups
 - C. tertiary: three dimensional arrangement of all atoms in a single peptide
 - D. quaternary: order of amino acid residues in the peptide chain
 - E. none of the above are correct
49. Collagen is an example of a(n):
- A. enzyme.
 - B. regulatory protein.
 - C. transport protein.
 - D. storage protein.
 - E. structural protein.
50. ____ are proteins that help other proteins to fold.
- A. Immunoglobulins
 - B. Phospholipases
 - C. Synthetases
 - D. Molecular chaperones
 - E. Proteases

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