

國立中山大學 96 學年度碩士班招生考試試題

科目：生物化學【生醫所碩士班】

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單選題 50 題，每題 2 分，總分 100 分。

1. An overdose of a new drug produced effects on the central nervous system including vertigo, ataxia, and hypnosis within 15 minutes after oral administration of the drug. No metabolic products were found in urine, however, a high concentration of drug was found in the bile. Information from the manufacturer indicated that the drug is an organic acid with a pK_a of 6.4 and the nonionized form has high lipid solubility. One-half of the administered drug is eliminated in the urine within three days. The symptoms and physiochemical data indicate that the drug probably (1) Passes readily through cell membranes, including the blood-brain barrier (2) Passes readily through cell membranes, but does not cross the blood-brain barrier (3) Penetrates readily from the circulation into the brain, but not into other organs (4) Can diffuse only into the glomerular filtrate (5) Cannot escape from the circulation.
2. Which of the following molecular motors is **NOT** powered by ATP? (1) DNA helicase (2) Dynein (3) Myosin (4) Kinesin (5) Ribosomal translocase.
3. Which of the following molecules is **incorrectly** paired with its action? (1) Lysozyme-attacks bacterial cell walls (2) Histamine-fights allergic reaction (3) Interferon-helps neighboring cells resist viral infection (4) Interleukin 1-stimulates division of helper T-cells (5) Interferon-suppresses vascular endothelial growth factor production..
4. HIV compromises the immune system mainly by infecting? (1) Red blood cells (2) Helper T-cells (3) Suppressor T-cells (4) Cytotoxic T-cells (5) B cells.
5. Dopamine is an important neurotransmitter. Which disease or disorder results when the neurons in the brain that produce dopamine die? (1) Multiple sclerosis (2) Lou Gehrig's disease (amyotrophic lateral sclerosis) (3) Parkinson's disease (4) Alzheimer's disease (5) Seizure disorder.
6. Histone modifications that are epigenetic marks of chromatin are (1) Stable through cell division (2) Stable through life time in one individual (3) Only associated with repressed chromatin (4) Are not reversible (5) Signal distinct biological outcomes.
7. Cyclic AMP (1) Is found only in eukaryotes (2) Stimulates sodium channels (3) Activates an intracellular protein phosphatase (4) Directly interacts with G proteins (5) Activates an intracellular protein kinase.
8. To have a hormone receptor system that is responsive to changes in hormones concentration, the concentration of the hormone should be (1) Always more than 10 times the K_d (2) Never more than 10 times of K_d (3) Far below the K_d before the stimulation of hormone secretion (4) Far above the K_d before the stimulation of hormone secretion (5) Always constant.
9. A variety of antibiotics and toxins can inhibit protein synthesis, which one in the following is **NOT** correct? (1) Streptomycin and other aminoglycosides inhibit elongation and cause the misreading of mRNA (prokaryotes) (2) Tetracycline binds to the 30S subunit and inhibits the binding of aminoacyl-tRNAs

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- (prokaryotes) (3) Erythromycin cause premature chain termination by acting as an analog of aminoacyl-tRNA (prokaryotes and eukaryotes) (4) Diphtheria toxin inhibits protein synthesis by covalently modifying an elongation factor, thereby preventing elongation (5) Racin, a toxin from castor beans, inhibits elongation by removing a crucial adenine from rRNA.
10. Transcription in eukaryotes is highly regulated eukaryotic promoters are complex, being composed of several different elements. Which one in the following is **NOT** the characteristic of eukaryotic promoters?
(1) Promoters for RNA polymerase II may be located on the 5' side or the 3' side for transcription (2) One common type of eukaryotic promoter consists of a TATA-box centered between -30 and -100 and paired with an initiator element (Inr) (3) Eukaryotic promoter elements are recognized by RNA polymerase II (4) The TATA-box binding protein initiates the assembly of the active transcription complex (5) The activity of many promoters is greatly increased by enhancer sequences that have no act over distances of several kilobases.
11. The events in posttranscriptional processing of mRNA are controlled by (1) The phosphorylation state of the carboxyl-terminal domain (CTD), part of RNA polymerase II (2) The unphosphorylation state of the CTD, part of RNA polymerase II (3) The phosphorylation state of the amino-terminal domain (ATD), part of RNA polymerase II (4) The unphosphorylation state of the ATD, part of RNA polymerase II (5) The phosphorylation state of the CTD, part of transcription factors.
12. Several different repair systems detect and repair DNA damage. Which statement in the following is **NOT** correct? (1) Repair begins with the process of proofreading in DNA replication (2) Mismatched bases that were incorporated in the course of synthesis are excised by exonuclease activity present in replicative polymerase (3) Thymine dimers can be directly reversed through the action of specific enzymes (4) Single damaged bases (base-excision repair) can be excised (5) Double-stranded breaks in DNA can only be repaired by homologous processes.
13. Ethanol alters energy metabolism in the liver. The oxidation of ethanol results in an upregulated overproduction of NADH, which has several consequences, **EXCEPT** (1) A rise in the blood levels of lactic acid and ketone bodies (2) Fall in blood PH and acidosis (3) The liver is damaged because the excess of NADH causes excessive fat formation (4) The generation of acetaldehyde (5) Fatty acids are fully synthesized, esterified, and sent from the liver to adipose tissue.
14. The final electron acceptor for the electron transport system is (1) ADP (2) ATP (3) Oxygen (4) Hemoglobin (5) NADH.
15. In humans, cholesterol is degraded and excreted as (1) Bile salts (2) Ketone bodies (3) CO₂ and H₂O (4) Short-chain fatty acids (5) Billrubin.
16. Lesch-Nyhan syndrome can result from a deficiency in hypoxanthine-guanosine ribosyl transferase (HGPRTase) and a resultant buildup in? (1) Urea (2) Adenosine (3) Guanosine (4) Uric acid (5) Thymidine.
17. An organism is fed ¹³C-labeled oxaloacetate and unlabeled glucoses, and nucleotides are isolated. Given

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- your knowledge of the citric-acid cycle and amino acid biosynthesis, the label is likely found in? (1) Purines (2) Pyrimidines (3) Purines and pyrimidines (4) G, C and U/T but not A (5) A but not G, C or U/T.
18. The addition of an NH_4^+ molecule to glutamate produces glutamine. This process requires? (1) Pyridoxal phosphate acts as an amino group carrier (2) All amino acids are degraded into citric acid cycle intermediates (3) Amino groups are transferred to arginine (4) Pyridoxal phosphate transfers one-carbon unit (5) Catabolism of the carbon skeleton.
19. N_2 makes up about 80% of the atmosphere. This is the source of nitrogen for all living things. The nitrogen cycle describes the movement of N_2 from the atmosphere to living things. Which of the following statements is true? (1) It requires Fe-S protein (2) It requires Mo-Fe protein (3) It requires Mo-S protein (4) Pyruvate is always the source of electrons (5) It requires ATPs.
20. The turnover of cellular proteins is a regulated process requiring complex enzyme systems. Which statement in the following is **NOT** correct? (1) Proteins to be degraded are conjugated with ubiquitin, a small conserved protein, in a reaction driven by ATP hydrolysis (2) The ubiquitin-conjugating system is composed of three distinct enzymes (3) A large, helix-shaped complex called the proteasome digests the ubiquitinated proteins (4) The proteasome requires ATP hydrolysis to function (5) The resulting amino acids provide a source of precursors for protein, nucleotide bases, and other nitrogenous compounds.
21. About the synthesis of urea, which statement is **NOT** correct? (1) The first step in the synthesis of urea is the formation of carbamoyl phosphate, which is synthesized from HCO_3^- , NH_4OH , and two molecules of ATP by carbamoyl phosphate synthetase (2) Ornithine is then carbamoylated to citrulline by ornithine transcarbamoylase (3) Citrulline leaves the mitochondrion and condense with aspartate to form argininosuccinate, which is cleaved into arginine and fumarate (4) Urea is formed by the hydrolysis of arginine, which also regenerates ornithine (5) Some enzymatic deficiencies of the urea cycle can be bypassed by supplementing the diet with arginine or compounds that form conjugates with glycine and glutamine.
22. How do triacylglycerols go through the cell membrane of adipocytes or muscle cells? (1) Active transport (2) Through the action of a permerase (3) Diffusion (4) Through an antiport (5) They form micelles.
23. Acetyl CoA carboxylase plays a key role in controlling fatty acid metabolism. The essential control site is phosphorylated and inactivated by AMP-dependent kinase. Which of the following statement about this process is **NOT** correct? (1) The phosphorylation is reversed by a protein phosphatase (2) Citrate, which signals an abundance of building blocks and energy, partly reversed the inhibition by phosphorylation (3) The activity of acetyl CoA carboxylase is stimulated by glucagons (4) The activity of acetyl CoA carboxylase is inhibited by epinephrine (5) In times of plenty, fatty acyl CoAs do not enter the mitochondrial matrix, because malonyl CoA inhibit carnitine acyltransferase I.
24. McArdle's disease (a glycogen storage disease) results from a defect or deficiency in one of the enzymes in glycogen breakdown. Patients with this disease suffer from painful muscle cramping after strenuous exercise, yet recover after a brief rest. A deficiency in which enzyme would produce this symptom? (1)

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- Amylo-1,6-glucosidase activity of the debranching enzyme (2) Muscle glycogen phosphorylase (3) Liver glycogen phosphorylase (4) 4- α -glucanotransferase activity of the debranching enzyme (5) Glucose-6-phosphatase.
25. Which enzyme involves in the calvin cycle and the pentose phosphate pathway also plays a key role in protection against reactive oxygen species? (1) Glycogen synthase (2) Phosphorylase (3) Phosphoglucomutase (4) Glucose-6-phosphatase (5) Debranching enzyme.
26. Enzymes that regulated by thioredoxin **NOT** includes (1) Rubisco (2) Ferredoxin-thioredoxin reductase (3) Glyceraldehyde 3- phosphate dehydrogenase (4) Rbulose 5'-phosphate kinase (5) NADP+-malate dehydrogenase.
27. During noncyclic photophosphorylation, water is oxidized and the electrons from water pass through photosystem II and photosystem I before reducing (1) Carbon dioxide (2) NADP⁺ (3) Plastoquinones (4) FAD (5) Ribulose 1,5-bisphosphate.
28. For electron transport chain, which one of the following statements is correct? (1) Oxidation of pyruvate to carbon dioxide and water does not involve the TCA cycle (2) The major pathway for electron transfer to oxygen in the electron transport system does not involve pyridine nucleotides (3) An adequate supply of ADP is required for maximal respiration by mitochondria (4) Coenzyme Q is a prosthetic group of a flavoprotein (5) Substrate level phosphorylation cannot occur in the absence of oxygen.
29. Which vitamins participate, in coenzyme form, in reactions of the tricarboxylic acid cycle? (1) Pyridoxine and thiamine (2) Niacin and ascorbic acid (3) Riboflavin and niacin (4) Pantothenic acid and folic acid (5) Thiamine and biotin.
30. Which of the following compounds can freely pass through the inner mitochondrial membrane? (1) H⁺ (2) CO₂ (3) Acetate (4) ATP (5) Succinate.
31. Which one in the following is **NOT** involved in the respiratory assembly of the inner mitochondrial membrane (1) Quinones (2) Flavins (3) Iron-sulfur complexes (4) Copper ions (5) NADH-Q.
32. Which of the following is necessary for oxidative phosphorylation to occur? (1) ATP (2) Oxygen (3) Carbon dioxide (4) Lactic acid (5) Glucose.
33. The citric acid cycle is the final common pathway for the oxidation of fuel molecules. It also serves as a source of building blocks for biosynthesis. But which one of the following statement is **NOT** included in the process? (1) Pyruvate dehydrogenase links glycolysis to the citric acid cycle (2) The citric acid cycle reduces two-carbon units (3) The irreversible formation of acetyl CoA from pyruvate is an important regulatory point for the entry of glucose-derived pyruvate into the citric acid cycle (4) The activity of the pyruvate dehydrogenase complex is stringently controlled by reversible phosphorylation (5) The electron acceptors are regenerated when NADH and FADH₂, transfer their electrons to O₂ through the electron-transport chain, with the concomitant production of ATP.

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34. What kind of mechanism enables plants and bacteria to grow on acetate? (1) The citric acid cycle (2) Glycolysis (3) The Glyoxylate pathway (4) Cytochrome oxidase mechanism (5) Superoxide dismutase mechanism.
35. The formation of citric acid from oxaloacetate and an acetyl group begins (1) Glycolysis (2) The electron transport system (3) The Cori cycle (4) Fermentation (5) The TCA cycle.
36. If you purify endoplasmic reticulum vesicles from muscle cells, and add glucose-6-phosphate, what product would you expect to observe in the medium? (1) Glucose (2) Glucose-1-phosphate (3) Glucose-6-phosphate (4) Pyruvate (5) Fructose-6-phosphate.
37. Which in the following **NOT** involves in metabolic pathway? (1) A small number of recurring activated carriers, such as ATP, NADH and cetyl CoA (2) NADHP, which carries two electrons at a high potential, provides reducing power in the biosynthesis of cell components from more-oxidized precursors (3) Many activated carriers are derived from vitamins, small organic molecules required in the diets of many higher organisms (4) Each key reaction type is used only once in metabolic pathways (5) The catalytic activities of many enzymes are regulated by allosteric interactions (as feed back inhibition) and by covalent modification.
38. Only minor modifications are necessary to transform many signal transduction proteins from their inactive into their active forms. Epidermal growth factor (EGF) signals through (1) A receptor tyrosine kinase (2) β -adrenergic receptor (3) Estrogen receptor (4) Secretin receptor (5) GABA receptor.
39. In insulin signaling pathway, which one in the following **NOT** involves? (1) G proteins (2) Insulin receptor (3) Phosphorylated IRS proteins (4) Phosphatidylinositol-3,4,5-triphosphate (PIP₃) (5) AKT protein kinase.
40. The Na/K ATPase pump is an example of how molecules are transferred across the phospholipid bilayer by the process of (1) Simple diffusion (2) Facilitated transport (3) Secondary active transport (4) Primary active transport (5) Gap junction dependent.
41. Lipid bilayers are highly impermeable to ions and most polar molecules. About permeability (cm/s), which statement in the following is correct (1) $H_2O \gg Na^+$ (2) $K^+ \gg Cl^-$ (3) $Glucose \gg H_2O$ (4) $Cl^- \gg H_2O$ (5) $Tryptophan \gg H_2O$.
42. The type of bond that forms when a disaccharide is formed from two monosaccharides is called (1) A peptide bond (2) A carbohydrate bond (3) An ester bond (4) A glycosidic bond (5) A covalent bond.
43. Which is the correct blood-clotting cascade? (from damage surface to clotting) (1) Kininogen kallikrein, fibrin, tissue factor (2) Kininogen kallikrein, thrombin, tissue factor (3) Tissue factor, Kininogen kallikrein, thrombin (4) Fibrin, thrombin, tissue factor (5) Kininogen kallikrein, tissue factor, fibrin.
44. Enzymes use several basic strategies to form and stabilize the transition state, **EXCEPT** (1) The use of

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- binding energy (2) Deionization (3) General acid-base catalysis (4) Metal ion catalysis (5) Catalysis by approximation.
45. Why allosteric enzymes do not obey Michaelis-Menten Kinetics? (1) These enzymes consist of multiple subunits and multiple active sites (2) These enzymes evolve so fast and contain a large family members (3) These enzymes are easily inhibited by diets or drugs (4) The kinetics of these enzymes are liner (5) Too many competitive enzymes around.
46. Ripening of tomato fruits (1) Is an uncontrolled process of death and decay (2) Is regulated by the hormone ethylene (3) Does not involve changes in gene expression (4) Does not involve any changes in the composition of the fruit (5) Involves only the production of the red pigment lycopene.
47. What is an 'aldose'? (1) An active site in an enzyme (2) A monosaccharide sugar (3) Polysaccharide sugar (4) A protein (5) An amino acid.
48. What is an endergonic chemical reaction? (1) One that releases energy (2) One that requires energy (3) Both releases and requires energies (4) Only occurs in the endometrium (5) only occurs in the endoplasmic.
49. In endocrinology, what is meant by a 'second messenger'? (1) Optus (2) A subsidiary hormone that reinforces the message of the primary one (3) a chemical released within a cell when a hormone binds to a receptor site on the cell surface (4) a hormone with an opposite effect, giving the ability to more precisely control response of tissues (5) RNA that carries information from DNA to the ribosome sites of protein synthesis in a cell.
50. Gelatine is a modified form of collagen rich in glycine, proline and hydroxyproline linked together through covalent bonds to form long chains that are crosslinked through (1) Covalent bonds (2) Ionic bonds (3) Hydrogen bonds (4) Van der Waals interactions (5) Electrosis.

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I. Single Choice (20%)

1. Which portion of the ribosome matches the correct transfer RNA to messenger RNA codons in eukaryotic translation?
 - (A) Large subunit
 - (B) Small subunit
 - (C) 30S
 - (D) 50S
2. During eukaryotic protein translation the growing polypeptide chain remains attached to which of the following molecule?
 - (A) Eukaryotic initiation factor 3
 - (B) Eukaryotic initiation factor 4
 - (C) Messenger RNA
 - (D) Transfer RNA
3. What kinds of genes were transcribed by RNA polymerase II?
 - (A) Genes encoding pre-ribosomal RNA
 - (B) Genes encoding 5S ribosomal RNA
 - (C) Genes encoding transfer RNA
 - (D) Genes encoding messenger RNA
4. Methylation of DNA could prevent transcription. Usually which nucleotide was methylated?
 - (A) Adenine
 - (B) Cytosine
 - (C) Guanine
 - (D) Thymine
5. Which is incorrect about Elastin?
 - (A) Elastin has a highly ordered tertiary structure
 - (B) Polypeptides of elastin are covalently bonded together via lysine residues
 - (C) Elastin is rich in proline and glycine residues
 - (D) Elastin is found in arteries and lungs
6. Which main type of collagen could be found in the basement membrane?
 - (A) Collagen type I
 - (B) Collagen type II
 - (C) Collagen type IV
 - (D) Collagen type VIII

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7. Which of the following statements is correct concerning DNA structure and packing?
- (A) There are 5 base pairs per complete helical turn
 - (B) DNA binding proteins binds to the minor groove of the double helix
 - (C) Nucleosomes contain histone proteins
 - (D) Histone 4 links adjacent nucleosomes
8. Which procaspase could be recruited and activated by apoptosome
- (A) Procaspase 3
 - (B) Procaspase 8
 - (C) Procaspase 9
 - (D) Procaspase 7
9. Which is correct regarding tyrosine kinase receptors
- (A) They have no membrane spanning domains
 - (B) They cannot become autophosphorylated
 - (C) They move to the nucleus once bound to ligand
 - (D) They have an extracellular domain that binds to ligand
10. Protein kinase C could be activated directly by
- (A) Ca^{2+} ions
 - (B) Cyclic AMP
 - (C) Inositol triphosphate
 - (D) Ceramide

II. Multiple Choices (20%)

1. Which are correct concerning eukaryotic transfer RNAs
- (A) Usually they adapt a "sunflower leaf structure"
 - (B) They have an anticodon triplet which base with messenger RNA
 - (C) Usually they are longer than 1,000 bases in length
 - (D) They have an invariable sequence (CCA) at their 3' ends to which amino acids are attached)
2. Gene expression can be controlled at the level of
- (A) Transcription
 - (B) Messenger RNA modification
 - (C) Translation
 - (D) Protein degradation
3. Which of the following molecules involved in the protein ubiquitination
- (A) Ubiquitin
 - (B) SUMO-1
 - (C) Activating enzyme E1
 - (D) Conjugating enzyme E2

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4. DNA mutation can be caused by
 - (A) reactive oxygen species
 - (B) Ethidium bromide
 - (C) Ultraviolet radiation
 - (D) replication slippage during DNA synthesis
5. The structure activity and function of proteins can be modified by
 - (A) Glycosylation
 - (B) Phosphorylation
 - (C) pH
 - (D) Temperature
6. Which are correct concerning microtubules?
 - (A) Microtubules are component of the cytoskeleton
 - (B) Microtubules are present in flagella
 - (C) Microtubules are smaller than intermediate
 - (D) Microtubules are compose of actin molecules
7. Which are correct concerning the phospholipid components of the cell membrane?
 - (A) They may move freely in the plane of membrane surface
 - (B) They are amphipathic molecules
 - (C) They may freely leave the membrane
 - (D) They may flip from the intracellular to the extracellular surface occasionally.
8. Which are correct concerning facilitated diffusion across a cell membrane
 - (A) It do not require ATP expenditure
 - (B) It occurs against the concentration gradient
 - (C) It requires the action of specialized proteins
 - (D) It has a maximum rate at which diffusion can take place
9. Which is correct about antibodies
 - (A) Antibodies are produced by plasma B cells
 - (B) Antibodies are composed of two heavy and two light chain
 - (C) Antibodies can be cleaved by papain
 - (D) The antigen binding domain is located on the Fc protion
10. Which is correct regarding transporter of biological membranes?
 - (A) Uniporters move a single substance across a membrane
 - (B) The Na^+/K^+ ATPase is an example of an antiporter
 - (C) Biological membrane is not permeable for ATP
 - (D) The glucose transporter GLUT 1 is a symporter

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III. Extended matching (40%)

1. Choose one answer (A-H) to match each description in the list (1-4)

- | | |
|----------------------------|-----------------------------------|
| A. Ribose | B. Adenosine diphosphate |
| C. Adenosine monophosphate | D. Adenosine triphosphate |
| E. DeoxyATP | F. Purine |
| G. Deoxyribose | H. Cyclic adenosine monophosphate |

- (1) The sugar component of a nucleotide found in ribonucleic acid
- (2) An intracellular signaling molecule
- (3) A nucleotide molecule which is hydrolysed in cells to release energy
- (4) The nitrogen-containing part of nucleotides

2. Choose one answer (A-H) to match each description in the list (1-4)

- | | |
|-------|-------|
| A. 1 | B. 2 |
| C. 3 | D. 4 |
| E. 8 | F. 16 |
| G. 23 | H. 46 |

- (1) How many daughter cells are produced by one cell entering mitosis?
- (2) How many gametes are produced by one cell entering meiosis?
- (3) How many chromosomes are contained in a human diploid cell?
- (4) How many times does DNA replication take place in the process of meiosis?

3. Choose one amino acid from the list (A-H) for the following definitions (1-4).

- | | |
|------------------|--------------|
| A. Alanine | B. Aspartate |
| C. Glycine | D. Cysteine |
| E. Phenylalanine | F. Proline |
| G. Serine | H. Tyrosine |

- (1) An essential amino acid in humans
- (2) An amino acid with an acidic side chain
- (3) An amino acid that is the precursor of adrenaline
- (4) An amino acid that prevents alpha helix formation

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4. Choose the amino acid from the list (A-H) that would most likely be the target for the post-translational modifications indicated in each question (1-4).

- | | |
|------------------|---------------|
| A. Alanine | B. Asparagine |
| C. Glycine | D. Cysteine |
| E. Phenylalanine | F. Proline |
| G. Serine | H. Tyrosine |

- (1) N-glycosylation
- (2) Disulphide bond formation
- (3) Phosphorylation by protein kinases
- (4) Vitamine C-dependent hydroxylation

5. Choose one protein found in blood from the list (A-H) which is involved in the process indicated in each question (1-4).

- | | |
|-------------------------|-----------------------|
| A. Albumin | B. Gamma globulins |
| C. Ferritine | D. Transferrin |
| E. Fibrinogine | F. Interferon gamma |
| G. Alkaline phosphatase | H. Lipoprotein lipase |

- (1) Humoral response to a viral or bacterial infection
- (2) Transport of iron in plasma
- (3) Coagulation of blood
- (4) Maintaining colloid osmotic pressure of plasma

6. Pick the most appropriate outcome from option (A-H) on stimulation of the cell surface receptors (1-4).

- | | |
|---|---|
| A. Decrease in intracellular cyclic AMP | B. Efflux of Na^+ ions from the cell |
| C. Increase in intracellular cyclic GMP | D. Increase in intracellular aradidonic acid |
| E. Increase in intracellular cyclic AMP | F. Influx of Na^+ ions into the cell |
| G. Posophorylation of tyrosine resides | H. Posophorylation of serine resides |

- (1) Insulin receptor
- (2) Beta adrenergic receptor
- (3) Alpha-2 adrenergic receptor
- (4) Nicotinic acetylcholine receptor

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7. Choose one protein from the list (A-H) which matches to the description (1-4).

- | | |
|--------------------------------------|--------------------------------------|
| A. Selectin | B. Beta-catenin |
| C. N-cadherin adhesion molecules 180 | D. N-cadherin adhesion molecules 140 |
| E. N-cadherin adhesion molecules 120 | F. E-cadherin |
| G. Fibronectin | H. Integrins |

- (1) Calcium dependent homophilic cell-cell adhesion molecules
- (2) Containing the RGD domain
- (3) A transmembrane protein in hemidesmosome
- (4) Containing a lectin domain

8. Choose one organel from the list (A-H) which matches to the description (1-4).

- | | |
|---------------------------------|--------------------------|
| A. Smooth endoplasmic reticulum | B. Golgi complex |
| C. Rough endoplasmic reticulum | D. Vacuoles and vesicles |
| E. Mitochondria | F. Lysosomes |
| G. Nucleus | H. Peroxisomes |

- (1) The nuclear envelope and is studded (nailed) with ribosomes
- (2) Containing acid hydrolases
- (3) Containing oxidases and catalases
- (4) The primary function is to process proteins targeted to the plasma membrane

9. Choose one molecules from the list (A-H) which matches to the description (1-4).

- | | |
|---------------------------|---------------------------|
| A. Microtubules | B. Keratin |
| C. G-actin with bound ATP | D. G-actin with bound ADP |
| E. Desmin | F. Tubulin alpha |
| G. Lamins | H. Profilin |

- (1) The molecules are at same direction as the long axis of cells (cell polarity)
- (2) The intermediate filament anchored to the cytoplasmic plaque in desmosome
- (3) Involving in the fast growing end of actin filament assembly
- (4) Binding in the nuclear rim and nucleoplasm

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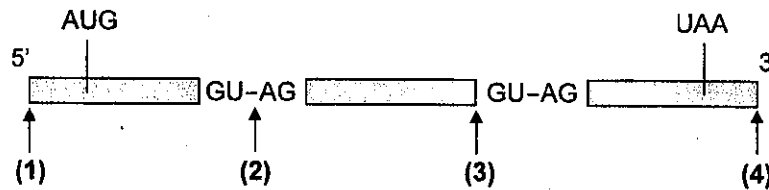
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10. The diagram below is a schematic representation of eukaryotic heteronuclear RNA.

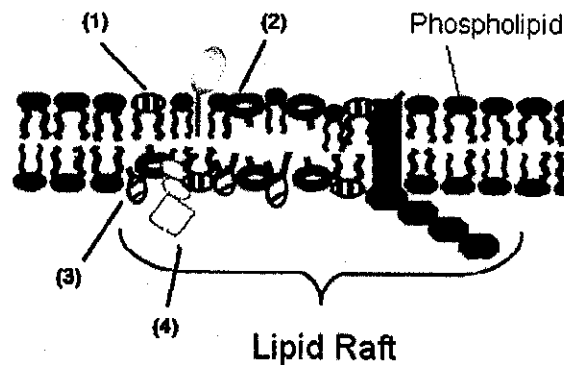
Choose one answer (A-H) to match each description in the list (1-4)

- | | |
|-------------------------|--|
| A. Start codon | B. Site of addition of 7-methylguanosine |
| C. Intron | D. Restriction enzyme site |
| E. Splice acceptor site | F. Splice donor site |
| G. Branching point | H. Site of polyadenylation |



IV. Answer the following questions (20%)

1. Why carbon monoxide can be lethal even at low concentration? (4%)
2. What is calmodulin and how does it activate its target protein? (6%)
3. How do phosphoglycerides give effect to the curvature on bimembrane? (4%)
4. What molecules can be found in lipid rafts of biomembrane? (4%)



(Hints were given in the figure.)

5. What roles was lipid rafts suggested to play? (2%)