Part I. 單選題（每題二分）

1. A multi-hit model of cancer induction is supported by several lines of evidence, but **NOT** including **(A)** A mutation in one cell would give it a slight growth disadvantages; **(B)** One of the progeny cells would then undergo a second mutation that would allow its descendants to grow more uncontrollably and form a small benign tumor; **(C)** A third mutation in a cell within this tumor would allow it to outgrow the others and overcome constraints imposed by the tumor microenvironment; **(D)** Its progeny would form a mass of cells, each of which would have these three mutations; **(E)** Cancer incidence should increase with age because it can take decades for the required multiple mutations to occur.

2. Programmed cell death occurs through apoptosis and **(A)** Dying cells swollen and then fragment, releasing small membrane-bound apoptotic bodies, which generally are engulfed by other cells **(B)** The nuclei diffuse and the DNA is fragmented; **(C)** Killer, destruction and engulfment proteins are required for a cell to begin the apoptotic process; **(D)** The intracellular constituents are related into the extracellular milieu where they might have deleterious effects on neighboring cells; **(E)** Pro-apoptotic regulator proteins (e.g., BAX, BAD) suppress caspase activation, and anti-apoptotic regulators (e.g., BCL2) promote activation.

3. Which one in the following molecules **NOT** involves in the control of entry into anaphase by APC-regulated degradation of the cohesion link between sister-chromatins? **(A)** APC; **(B)** CDC20; **(C)** Separase; **(D)** SKP2; **(E)** Securin.

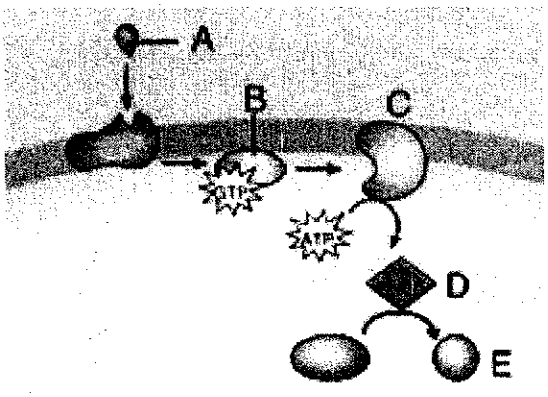
4. Actin uses what molecule as a motor protein? **(A)** Troponin; **(B)** Dynein; **(C)** Capping proteins; **(D)** Myosin; **(E)** Kinesin.

5. The functional linkage between oxidation and phosphorylation depends on **(A)** How many reducing equivalents are generated; **(B)** The magnitude of the proton motive force; **(C)** The integrity of the inner mitochondrial membrane; **(D)** the integrity of the outer mitochondrial membrane; **(E)** The integrity of both outer and inner mitochondrial membranes.

6. When might exocytosis occur? **(A)** When a cell finds a large food particle; **(B)** After a cell's lysosomes have digested a food particle; **(C)** Just before a cell's lysosomes digest a food particle; **(D)** When a cell is about to divide; **(E)** When a cell finds toxic chemicals.

7. The endoplasmic reticulum is best described as **(A)** A structure used for cell movement; **(B)** An organelle which produces protein; **(C)** A vacuole which contains digestive enzymes; **(D)** A network of tunnels extending from the nucleus to the Golgi bodies; **(E)** A energy plant for the cell.

8. Which one of these molecule acts as a second messenger? **(A)** A; **(B)** B; **(C)** C; **(D)** D; **(E)** E.



9. In TGFβ-Smad signaling pathway, TGFβ receptors directly activate Smads and **(A)** TGFβ is produced as an inactive precursor that is stored in the extracellular matrix, several mechanisms can release the active, mature dimeric growth factor; **(B)** Stimulation by TGFβ leads to activation of the serine/threonine kinase activity in the outside cytosolic domain of the type I receptor, which then phosphorylates an R-Smad, exposing a cytosolic-localization signal; **(C)** After phosphorylated R-Smad binds a co-Smad, the resulting complex translocates into the cytosol, where it interacts with various translation factors to induce expression of target proteins; **(D)** Tumor suppressor proteins (e.g., Ski and SnoN) and I-Smads (e.g., Smad7) act as negative regulators of TGFβ signaling; **(E)** TGFβ signaling generally promotes cell proliferation. Gain of various components of the signaling pathway contributes to abnormal cell proliferation and malignancy.

10. Several cytokines may have the same effect on the cells they bind. This is an example of **(A)** A cascade; **(B)** Antagonism; **(C)** Pleiotropsim; **(D)** Redundancy; **(E)** Synergy.

11. Interferons **(A)** Activate B cells to make virus-specific antibodies; **(B)** Are Th2 cytokines; **(C)** Are virus proteins that interfere with activation of cytotoxic T cells; **(D)** Block virus infection of host cells; **(E)** Inhibit virus replication by infected cells.

12. Continuous exposure of a G_s protein-coupled receptor to its ligand leads to a phenomenon known as **(A)** Desensitization; **(B)** Dominant negative; **(C)** Continuous signaling; **(D)** Toxicity; **(E)** Mutation.

13. Several different types of nuclear-export signal (NES) and nuclear-localization signal (NLS) have been identified. Each type of nuclear-transport signal is thought to interact with a specific receptor protein (exportin or importin) belonging to a family of homologous proteins terms **(A)** Nuclear pore complexes (NPCs); **(B)** Karyopharins; **(C)** FC-nucleoporins;**(D)** Ran; **(E)** SR proteins.

14. Amino acids are joined together into a protein chain by which of the following? **(A)** DNA polymerase; **(B)** RNA polymerase; **(C)** Transfer RNA; **(D)** Hydrogen bonds; **(E)** Bisulfite bonds.

15. Promoter-proximal elements occur within about how many bases pairs upstream of a start site? Several such elements, containing ~10-20 base pairs, may help regulate a particular gene. **(A)** ~500; **(B)** ~1000; **(C)** ~2000; **(D)** ~200; **(E)** ~100.

16. The interactions of several proteins with each other and with the **(A)** Hypoacetylated N-terminal tails of histones H3 and H4; **(B)** Hypoacetylated N-terminal tails of histone H2; **(C)** Hyperacetylated N-terminal tails of histones H3 and H4; **(D)** Hyperacetylated N-terminal tails of histone H2; **(E)** Hypoacetylated or hyperacetylated H1, are responsible for the chromatin-mediated repression of transcription that occurs in the telomeres and the silent mating-type loci in *S. cerevisiae*.

17. Scaffold-associated regions (SARs) or matrix-attachment regions in chromosomes are **(A)** Some regions with a lot of SARs; **(B)** Found between translation units; **(C)** Not required for transcription of neighboring genes; **(D)** In *Drosophila*, some SARs can insulate transcription units from each other; **(E)** Where the gene binding.

18. What is genomic imprinting for? **(A)** To increase genetic variation; **(B)** To decrease genetic variation; **(C)** To increase mutations; **(D)** To decrease sex-linked diseases; **(E)** To enhance the speed of evolution.

19. What was B. McClintock's hypothesis related to pigments in corn kernels? **(A)** Transposable elements move from one nucleotide to another during pigment production; **(B)** Transposable elements move in and out of genes involved in pigment production; **(C)** Trinucleotides repeat causing instability in pigment production; **(D)** mtDNA are encoded by different nuclear genes to produce pigment variations; **(E)** Phenotypes are affected by environments.

20. What is reverse genetics? **(A)** Phenotype is affected by other factors than genes; **(B)** Mutant organisms can used to identify the cause genes; **(C)** Once the target gene cloned, the protein sequence can be deduced; **(D)** Where a disease occurs, a mutation exists; **(E)** To identify disease-caused gene from sequence.

21. The Nobel prize in physiology or medicine **2007** granted to **(A)** Barry J. Marshall and J. Robin Warren **(B)** Mario R. Capecchi, Martin J. Evans and Oliver Smithies; **(C)** Andrew Z. Fire and Craig C. Mello; **(D)** Richard Axel and Linda B. Buck **(E)** Paul C Lauterbur and Peter Mansfield.

22. Mutations causing loss of growth-inhibiting and cell-cycle controls were evidenced by **(A)** Mutations that promote unregulated passage from G_1 to S phase are oncogenic; **(B)** Loss of p53 set up the DNA-damage checkpoint; **(C)** Apoptotic genes can function as tumor-suppressor genes but not proto-oncogenes; **(D)** Failure of cell-cycle checkpoints can also lead to aneuploidy in tumor cells; **(E)** Telomerase overexpression may contribute to immortalization of cancer cells.

23. In the electron transport chain, the final electron acceptor is **(A)** Oxygen; **(B)** Water; **(C)** Cytochrome oxidase; **(D)** Hydrogen ion; **(E)** Carbon dioxide.

24. Transmembrane proteins do **NOT** mediate transport of **(A)** Ions; **(B)** Sugar; **(C)** Amino acid; **(D)** Nucleic acids; **(E)** transporters.

25. **(A)** Hormones; **(B)** Receptors; **(C)** Gap junctions; **(D)** Ion channels; **(E)** Cytoplasmic pores, are specialized protein complexes that create an aqueous pore between the cytoplasms of two adjacent cells.

26. What kind of junction may protect a damaged cell through chemical gating? **(A)** Tight junction; **(B)** Gap; **(C)** Adherens; **(D)** Occluding; **(E)** Macular.

27. The transport of solutes between adjacent cells is **(A)** Intracellular transport; **(B)** Transcellular transport; **(C)** Paracellular transport; **(D)** Leaky transport; **(E)** Automatic transport.

28. What is the first protein in the sequence of cellular adhesion molecules (CAMs) that acts to slow down the white blood cell in the bloodstream? **(A)** Dynein; **(B)** Selectin; **(C)** Syndecan; **(D)** Integrain; **(E)** Laminin.

29. The intermediate filament protein that is closely associated with the inner nuclear membrane is **(A)** Porin; **(B)** Lamin; **(C)** Keratin; **(D)** Dynein; **(E)** Cadherin.

30. Why are some hair curly and some hair straight? **(A)** Hydrogen bonds; **(B)** Covalent bonds; **(C)** Disulfide bonds; **(D)** Non-covalent bonds; **(E)** ionic bonds.

Part II. 複選題（每題二分）

31. About stem cells, which of the following statements are **CORRECT**? **(A)** Cultured embryonic stem cells (ES cells) are capable of giving rise to many kinds of differentiated cell types; **(B)** Populations of stem cells associated with most tissues (e.g., skin, intestinal epithelium, blood), regenerate differentiated tissue cells that are damaged or sloughed or become aged; **(C)** Stem cells are prevented from differentiating by specific controls. A high level of beta-catenin, a component of the MAPK signaling pathway, has been implicated in preserving stem cells in the skin and intestine by directing cells toward division rather than differentiation states; **(D)** Stem cells give rise to stem cells but not differentiating cells; **(E)** Cells fates are progressively restricted during development.

32. Cholesterol is a multifunctional membrane lipid, about cholesterol, which of the following statements are **CORRECT**? **(A)** The initial steps in cholesterol biosynthesis take place in the ER, whereas the last steps are catalyzed by enzymes associated with the ER membrane; **(B)** The rate-controlling step in cholesterol biosynthesis is catalyzed by HMG-CoA reductase, whose transmembrane segments are embedded in the ER membrane and contain a sterol-sensing domain; **(C)** Cholesterol itself and isoprenoid intermediates in its synthesis are biosynthetic precursors of steroid hormones, bile acids, lipid-soluble vitamins, and numerous other bioactive molecules; **(D)** Golgi-independent vesicular transport, direct protein-mediated contacts between different membranes, soluble protein carriers, or all three may account for some interorganelle transport of cholesterol and phospholipids; **(E)** The NPC1protein, which has a hydrophobic cholesterol-binding pocket, plays a key role in moving cholesterol into mitochondrion for steroid hormone synthesis.

33. About synaptic vesicle formation and function, which of the following statements are **CORRECT**? **(A)** Transmission of nerve impulses at chemical synapses depends on the exocytosis of neurotransmitter-filled synaptic vesicles and the regeneration of empty vesicles by endocytosis; **(B)** Efficient recruitment of cesicles to the presynaptic membrane adjacent to the synaptic cleft requires cytosolic proteins, such as synapsin, a GTP-binding protein that is tethered to the vesicle membrane; **(C)** In resting neurons, synaptoagmin in the synaptic-vesicle membrane prevents fusion of docked vesicles with the membrane; **(D)** The influx of Ca^{2+} following arrival of an action potential at the axon terminus leads to Ca^{2+} binding by synaptotagmin, causing a change in its conformation that permits vesicle fusion to proceed; **(E)** Synaptic vesicles are slowly regenerated by endocytic budding of clathrin-coated vesicles from the plasma membrane, a process that requires dynamin. After the clathrin coat is shed, vesicles are refilled with neurotransmitter and move to the active zone for another round of docking and fusion.

34. Protein modifications, folding and quality control are processed in the endoplasmic reticulum (ER), therefore in the ER **(A)** Oligosaccharide side chains may assist in the proper folding of glycolproteins, help protect the mature proteins from proteolysis, participate in cell-cell adhesion and function as antibodies; **(B)** Disulfide bonds are added to many secretory proteins and the exoplasmic domain of membrane proteins in the ER. Protein disulfide isomerase, present in the ER lumen, catalyzes both the disruption and the rearrangement of disulfide bonds; **(C)** The chaperone BiP, the lectins calnexin and calreticulin, and peptidyl-prolyl isomerases work together to assure proper folding of newly made secretory and membrane proteins in the ER; **(D)** All folded proteins and assembled subunits are transported from the rough ER to the Golgi complex in vesicles; **(E)** The accumulation of abnormally folded proteins and unassembled subunits in the ER can induced increased expression of ER protein-folding catalysts via the unfolded protein response.

35. About priming of resting hepatocytes for later responses to signaling molecules that induce growth, which of the following statements are **CORRECT**? **(A)** Injury to the liver or removal of part of the liver leads to

priming of cells in response to interleukin-2 and tumor necrosis factor; **(B)** Primed cells increase their production of the indicated transcription factors and also divide; **(C)** Increase in the blood level of hepatocyte growth factor induces primed cells to produce cyclin D, which is required for cell division; **(D)** The hepatocyte growth factor acts in conjunction with epidermal growth factor and transforming growth factor α for growing hepatocytes; **(E)** The tumor necrosis factor effect can be apoptotic or proliferative, depending on glutathione content and reactive oxygen species.

36. In pathways that involve signal-induced protein cleavage, **(A)** The NF-κB transcription factor regulates many genes that permit cells to respond to infection and inflammation; **(B)** In unstimulated cells, NF-κB is localized to the cytosol, bound to an inhibitor protein, I-κB. In response to extracellular signal, acetylation-dependent ubiquitination and degradation of I-κB in proteasomes releases active NF-κB in proteasomes releases active NF-κB, which translocates to the nucleus; **(C)** The removal of I-κB unmasks the nuclear-localization signals in both subunits of NF-κB, allowing their translocation to the nucleus; **(D)** Upon binding to its ligand Delta on the surface of an adjacent cell, the Notch receptor protein undergoes two proteolytic cleavages. The released Notch cytosolic segment then translocates into the nucleus and modulates gene silencing; **(E)** Presenilin 1, which catalyzes the regulated intramembrane cleavage of Notch, also participates in the cleavage of amyloid precursor protein into a peptide that forms plaques characteristic of Alzheimer's disease.

37. In processing of eukaryotic pre-mRNA, which of the following steps are **NECESSARY**? **(A)** In the nucleus of eukaryotic cells, pre-mRNAs are associated with hnRNA proteins and processed by 5'capping, 3' cleavage and polyadenylation, and splicing after being transported to the cytoplasm; **(B)** In most protein-coding genes, a conserved AAUAAA poly(A) signal lies slightly upstream from a poly(A) site where cleavage and polyadenylation occur. A GU- or U-rich sequence downstream from the poly(A) site contributes to the efficiency to cleavage and polyadenylation; **(C)** SR proteins that bind to exonic splicing enhancer sequences in exons are critical in defining exons in the large pre-mRNAs of higher organisms. A network of interactions between SR proteins, snRNPs, and splicing factors form a cross-exon recognition complex that specifies correct splice sites; **(D)** For long transcription units in higher organisms, splicing of exons usually begins as the pre-mRNA is still being formed. Cleavage and polyadenylation to form the 3' end of the mRNA occur after the poly(A) site is transcribed; **(E)** Excised introns are degraded primarily by splicesome, multiprotein complexes that contain eleven 3' → 5' exonucleases as well as RNA helicases. Splicesomes also degrade improperly processed pro-mRNAs.

38. Transcription factors, which stimulate or repress transcription, bind to promoter-proximal regulatory elements and enhancers in eukaryotic DNA, i.e., they are activators and repressors of transcription. Therefore, **(A)** Among the most common structure motifs found in the DNA-binding domains of eukaryotic transcription factors are the C_2H_2 zinc finger, homeodomain, basic helix-loop-helix (bHLH), and basic zipper (leucine zipper). All these and many other DNA-binding motifs contain one or more α helices that interact with major grooves in their cognate site in DNA; **(B)** The transcription-control regions of most genes contain binding sites for multiple transcription factors. Transcription of such genes varies depending on the particular repertoire of transcription factors that are expressed and activated in a particular cell at particular time; **(C)** Combinatorial complexity in transcription control results from alternative combinations of monomers that form heterodimeric transcription factors and from cooperative binding of transcription factors to composite control sites; **(D)** Activation and repression domains in transcription factors exhibit a variety of amino acid sequences and three-dimensional structures. In general, these functional domains interact with co-activators or co-repressors, which are critical to the ability of transcription factors to modulate gene expression; **(E)** Cooperative binding of multiple activators to nearby sites in an enhancer forms a multiprotein complex called an enhancesome. Assembly of enhancesomes often requires small proteins that bind to the DNA major groove and bend the DNA sharply, allowing bound proteins on either

side of the bend to interact more readily.

39. Gene expression might be transcriptionally controlled, including the following activities **(A)** The activities of many transcription factor are indirectly regulated by binding of intercellular proteins and peptides to cell-surface receptors. These receptors activate intracellular signal transduction pathways that regulate specific transcription factors through a variety of mechanisms; **(B)** Steroid hormone receptors are heterodimeric nuclear receptors. In the absence of hormone, they are trapped in the cytoplasm by inhibitor proteins. When bound to their ligands, they can translocate to the nucleus and activate transcription of target genes; **(C)** Hormone binding to nuclear receptors induces conformational changes that modify their interactions with other proteins **(D)** Heterodimeric nuclear receptors (e.g., those for retinoids, vitamin D, and thyroid hormone) are found only in the nucleus. In the absence of hormone, they repress transcription of target genes with the corresponding response element. When bound to their ligands, they activate transcription; **(E)** Nuclear receptors constitute a super family of dimeric C_4, zinc-finger transcription factors that bind lipid-soluble hormones and interact with specific response elements in DNA.

40. In DNA cloning, recombinant DNA molecules are formed in vitro by inserting DNA fragments into vector DNA molecules. The recombinant DNA molecules are then introduced into host cells, where they replicate, producing large numbers of recombinant DNA molecules. Some technologies in recombinant DNA methodologies are **(A)** Restriction enzymes (endonucleases) typically cut DNA at specific 4- to 8-bp palindromic sequences, producing defined fragments that often have self-complementary single-stranded tails (sticky ends); **(B)** E. coli cloning vectors are small circular DNA molecules of replication, a drug-resistance gene, and a site where a DNA fragment can be inserted. Transformed cells carrying a vector grow into colonies on the selection medium; **(C)** In cDNA cloning, expressed mRNAs are reverse-transcribed into complementary DNAs, or cDNAs. By a series of reactions, single-stranded cDNAs are converted into double-stranded DNAs, which can then be ligated into a λ phage vector; **(D)** A cDNA library is a set of cDNA clones prepared from the mRNAs isolated from a particular type of tissue; **(E)** A genomic library is a set of clones carrying restriction fragments produced by cleavage of the entire genome.

41. During identifying and locating human disease genes, scientists found **(A)** Genes located on the same chromosome can be separated by crossing over during meiosis, thus producing new recombinant genotypes in the next generation; **(B)** Genes for human diseases and other traits can be mapped by determining their cosegregation with markers whose locations in the gnome are known. The closer a gene is to a particular marker, the more likely they are independent; **(C)** DNA polymorphisms useful in mapping human genes include restriction fragment length polymorphisms (RFLPs), single-nucleotide polymorphisms (SNPs), and simple sequence repeats (SSRs); **(D)** Linkage mapping often can locate a human disease gene to a chromosomal region that includes as many as 50 genes. To identify the gene of interest within this candidate region typically requires expression analysis and comparison of DNA sequences between wild-type and diseae-affected individuals; **(E)** Inherited diseases usually are resulted from mutations in the same genes in different individual (genetic homogeneity).

42. About movement of water, which statements are **CORRECT**? **(A)** Most biological membranes are semipermeable, less permeable to water than to ions or most other solutes; **(B)** Water moves by osmosis across membranes from a solution of lower solute concentration to one of higher solute concentration; **(C)** Animal cells swell or shrink when placed in hypotonic or hypertonic solutions, respectively; **(D)** By maintaining the normal osmotic balance inside and outside cells, the Ca^{2+} ATPase and other ion-transporting proteins in the plasma membrane control cell volume; **(E)** In response to the entry of water, protozoans maintain their normal cell volume by extruding water from contractile vacuoles.

43. Growth of vertebrate cells in culture requires rich media containing essential amino acids, vitamins, fatty acids, peptide or protein growth factors and **(A)** Most cultured vertebrate cells will grow only when attached to a positive charged substratum that is coated with components of the extracellular matrix; **(B)** Primary cells, which are derived directly from animal tissue, have unlimited growth potential in culture and may give rise to a cell strain; **(C)** Transformed cells, which are derived from animal tumors or arise spontaneously from primary cells, grow indefinitely in culture, forming cell lines; **(D)** The fusion of an immortal myeloma cell and a single B lymphocyte yields a hybrid cell that can proliferate indefinitely, forming a clone called a hybridoma; **(E)** Each individual B lymphocyte produces antibodies specific for one antigenic determinant (epitope), a hybridoma produces only the monoclonal antibody synthesized by its original B-lymphocyte parental cell.

44. About the structure and function of cytoskeleton, which of the following statement are **CORRECT**? **(A)** Two major types of protein filaments: microtubules and intermediate filaments, make up the cytoskeleton; **(B)** In all animal and plant cells, the cytoskeleton provides structural stability for the cell and contributes to cell movement; **(C)** Bacteria have not cytoskeleton at all; **(D)** Intermediate filaments are assembled into networks and bundles by various intermediate filament-binding proteins, which also cross-link intermediate filaments to the plasma and nuclear membranes, microtubules, and microfilaments; **(E)** Intact microtubules appear to be not necessary for endoplasmic reticulum and Golgi membranes to form into organized structures.

45. During DNA replication, **(A)** Replication begins at a sequence called an *origin*. Each eukaryotic chromosomal DNA molecule contains multiple replication origins; **(B)** DNA polymerases, like RNA polymerases, can unwind the strands of duplex DNA and can initiate synthesis of new strands complementary to the template strands; **(C)** At a replication fork, one daughter strand (the leading strand) is elongated continuously. The other daughter strand (the lagging strand) is formed as a series of discontinuous Okazaki fragments from primers synthesized every few hundred nucleotides; **(D)** Helicases use energy from ATP hydrolysis to separate the parental (template) DNA strands. Primase synthesizes a short DNA primer, which remains base-paired to the template DNA; **(E)** Most of the DNA in eukaryotic cells is synthesized by Pol β, which takes over from Pol α and continues elongation of the daughter strand in the 5' to 3'.

46. Post-translation modifications of proteins including **(A)** Acetylation; **(B)** hydroxylation; **(C)** Phosphorylation; **(D)** Glycosylation; **(E)** Sumolyation.

47. Which pairs in the following are matched **(A)** Chaperone and protein degradation; **(B)** Ubiquitin and proteasome; **(C)** Gastric cancer and *Helicobacter pylori*; **(D)** Homologous and paralogous; **(E)** TATA box and Goldberg-hogness box.

48. About biochemical energetics, which statements in the following are **CORRECT**? **(A)** Directly or indirectly, light energy captured by photosynthesis in plants and photosynthetic bacteria is the ultimate source of chemical energy for almost all cells; **(B)** A chemical reaction having a negative ΔG can proceed if it is coupled with a reaction have a positive of ΔG larger magnitude; **(C)** Many otherwise energetically unfavorable cellular processes are driven by hydrolysis of phosphoanhydride bonds in ATP; **(D)** An oxidation reaction (gain of electron) is always coupled with a reduction reaction (loss of electrons); **(E)** Biological oxidation and reduction reactions often are coupled by electron-carrying coenzymes such as NAD^+ and FAD.

49. Genomics is the genome-wide analysis of gene structure and expression, which methods in the following are helpful in genomic researches? **(A)** A computer algorithm known as BLAST rapidly searches databases of known proteins sequences to find those with significant similarity to a new (query) protein; **(B)** Proteins with common functional motifs may not be identified in a typical BLAST search; **(C)** Open reading frames (ORFs) are regions of genomic DNA containing at least 100 codons located between a start and a stop codon; **(D)** DNA microarray analysis simultaneously detects the relative level of expression of thousands of genes in different types of cells or in the same cells under different conditions; **(E)** Cluster analysis of the data from multiple microarray expression experiments can identify genes that are similarly regulated under various conditions. Such co-regulated genes commonly encode proteins that have biologically related functions.

50. Which of the following common inherited human diseases are autosomal recessive? **(A)** Huntington's disease; **(B)** Sickle-cell anemia; **(C)** Duchenne muscular dystrophy; **(D)** Cystic fibrosis; **(E)** Phenylketonuria.

I. Multiple choices (30%) 答案請寫於 答案紙 第一頁 (1)-(6) 格中

1. _____ **Choose the correct descriptions refer to the nature of a water molecule.**
   (1) The bonds between oxygen and hydrogen of water have different electronegativity.
   (2) The partial charge in the water molecule is a stronger charge than the one on an electron.
   (3) Water molecules are free to transfer into plasma membrane.
   (4) The hydrogen bond formed by the water molecules is stronger than the electrostatic bond formed between the water molecule and a magnesium ion.
   (5) An anion could attract the oxygen of the water molecule to form an electrostatic interaction.
   (6) The water solubility of uncharged molecules is determined by hydrogen bonds.

2. _____ **Choose the correct descriptions about the protein degrdation and targeting?**
   (1) Most proteins in cytosol were degraded by the matrix metallopeptidases.
   (2) The signal sequences of some eukaryotic ER targeting proteins consist the hydrophobic core with one or more basic residues on their N-termini.
   (3) Tunicamycin could inhibit protein degradation
   (4) The signal recognition particle (SRP) binds GTP and halts enlongation of the polypeptide when it is about 70 amino acids long.
   (5) Glycosylation plays a key role in protein degradation
   (6) Glycosylation plays a key role in protein targeting

3. _____ **Choose the correct descriptions concerning the major secondary structure properties for alpha helical bundles of proteins.**
   (1) Relatively rigid
   (2) Relatively mobile
   (3) Poor catalysts
   (4) Excellent catalysts
   (5) Signalling
   (6) Platform constructions

4. _____ **Point out the incorrect answers related to the action potential is carried in the membrane of axon of presynaptic neuron after stimulation.**
   (1) through waves of depolarization (voltage-gated K^+ channel open and K^+ influx) and followed by repolarization (voltage-gated Na^+ channel open and Na^+ influx)
   (2) through waves of depolarization (voltage-gated Na^+ channel open and Na^+ efflux) and followed by waves of repolarization (voltage-gated K^+ channel open and K^+ efflux)
   (3) through waves of depolarization (voltage-gated K^+ channel open and K^+ efflux) and followed by waves of repolarization (voltage-gated Na^+ channel open and Na^+ influx)
   (4) through waves of depolarization (voltage-gated Na^+ channel open and Na^+ influx) and followed by waves of repolarization (voltage-gated K^+ channel open and K^+ efflux)

5. _____ Choose the correct descriptions from the followings refer to the electric signal be transferred from the presynaptic neuron to the cell body of the postsynaptic neuron?

(1) The secretory vesicles containing neurotransmitters (acetylcholine) will be released to synaptic cleft
(2) The secretory vesicles containing neurotransmitters (acetylcholine) will be released to axon
(3) Acetylcholine binds its receptor (an ion channels) to influx the Na^+ and Ca^{+2} into cells
(4) Voltage-gated Cl^- channel open to decrease the cytosolic concentration of Cl^- ions leads to
(5) Voltage-gated Ca^{2+} channel open to increase the cytosolic concentration of Ca^{2+} ions
(6) Voltage-gated K^+ channel open to increase the cytosolic concentration of K^+ ions
repolarization of the membrane

6. _____ Choose the correct descriptions from the followings about human blood type

(1) Oligosaccharides —Glc—Gal—GlcNAc—Gal is for O antigen
|
Fuc

(2) Oligosaccharides —Glc—Gal—GlcNAc—Gal—GalNAc is for A antigen
|
Fuc

(3) Oligosaccharides —Glc—Gal—GlcNAc—Gal—Gal is for B antigen
|
Fuc

(4) Oligosaccharides —Glc—Gal—GlcNAc—Gal—Glc is for A antigen
|
Fuc

(5) Oligosaccharides —Glc—Gal—GlcNAc—Gal—Gal is for O antigen
|
Fuc

(6) Oligosaccharides —Glc—Gal—GlcNAc—Gal—GalNAc is for B antigen
|
Fuc

II. Extended Matching (30%)

1. Choose one answer (A) – (H) to match each description in the list (7) – (10)
答案請寫於 答案紙 第一頁 (7) – (10) 格中

A. Glucagon
B. Insulin
C. Perilipins
D. Serum albimin
E. Glucocorticoid
F. Triacylglycerol
G. Cholesterol
H. Fatty acids

(7) _____ an adenyl cyclase stimulated hormone released during low levels of glucose in the blood
(8) _____ a substrate on the surface of lipid droplets which would be activated by protein kinase A
(9) _____ the carrier protein of fatty acids in the blood
(10) _____ the major form of lipid stored in the lipid droplets of adipocyte

2. Regarding ATP synthesis in the eukaryotic cells, choose one answer (A) – (H) to match each description in the list (11) – (14). 答案請寫於 答案紙 第一頁 (11) – (14) 格中

A. Proton-motive force
B. Formation of cyclic GMP
C. Intermembrabe space
D. Lysosome
E. Mitochondria matrix
F. Mitochondria
G. Complex IV
H. Complex II

(11) _____ the major organel for ATP synthesis
(12) _____ ATP synthesis is driven by
(13) _____ protein complex interacted with cytochrome C
(14) _____ the site of electron flow

3. Choose one answer (A) – (H) to match each description in the list (15) – (18).
答案請寫於 答案紙 第一頁 (15) - (18) 格中

A. AUG
B. UAA
C. AG
D. GU
E. 5' terminus
F. 3' terminus
G. A
H. AAAAAA

(15) _____ stop codon
(16) _____ splice acceptor site
(17) _____ site of addition of 7-methylguananosine
(18) _____ site of polyadenylation

4. Choose one amino acid from the list (A) – (H) for the following definitions (19) – (22)
答案請寫於 答案紙 第一頁 (19) – (22) 格中

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

(19) _____ an amino acid with the smallest side chain
(20) _____ an amino acid with a basic side chain
(21) _____ an amino acid that is the precursor of adrenaline
(22) _____ an amino acid that prevents alpha helix formation

5. Choose one answer (A) – (H) to match each description in the list (23) – (26)
答案請寫於 答案紙 第一頁 (23) – (26) 格中

A. Ca^{2+} ions
B. Inositol triphosphate
C. Procaspase 8
D. Procaspase 9
E. Ceramide
F Histone
G. Caveolin
H. Epinephrin

(23) _____ one component in chromosome
(24) _____ one component in the apoptosome
(25) _____ one component in the activated protein kinase C complexes
(26) _____ one membrane protein involved in endocytosis

III. Match the functional property (a) – (e) to the related protein conformational motions (27) – (31) (10%) 答案請寫於 答案紙 第一頁 (27) – (31) 格中

FUNCTIONAL PROPERTY	PROTEIN CONFORMATIONAL MOTIONS
(a) Allosteric cooperativity	(27) _____ Very fast local bond movement around an ion site
(b) Enzyme catalysis	(28)_____ Movement of side chains with substrate
(c) Ion movement in chainnel	(29) _____ The whole structure is dependent on metal ion binding in some cases: relatively slow
(d) Electron transfer	(30)_____ Fast relaxation of conformation around site small change
(e) Folding	(31)_____ Segmental shift, especially of helices; relatively slow

IV. Arranging the sequences from (A) – (J) refer to the digestion and transport of dietary fats to tissues. (10%) 答案請寫於 第一頁 (32) – (41) 格中

(A) ApoC-II of chylomicron activates lipoprotein lipase in the capillary
(B) Lipoprotein lipase concerts triacylglycerols to fatty acids and glycerol
(C) Fatty acids and other breakdown products are taken up by the intestinal mucosa
(D) Fatty acids enter myocyte or adipocyte
(E) Fatty acids are converted into triacylglycerols
(F) Fatty acids are oxided as fuel or reesterified for storage
(G) Intestinal lipases degrade triacylglycerols
(H) Triacylglycerols are incorporated with cholesterol and apolipoproteins into chylomicrons
(I) Bile salts emulsify dietary fats
(J) Froming mixed micelles

Ans: _____→ _____→ _____→ _____→ _____→ _____→ _____→ _____→ _____→ _____

V. Answer the following questions

答案請寫於 答案紙 第二頁

1. Answer the following questions concerning plasma membrane. (10%)

(A) What kinds of phospholipids are most often found in the raft microdomains?
(B) What kind of phospholipid is the marker for the cytoplasmic layer of plasma membrane?
(C) What kinds of lipids are the markers for the external surfaces of plasma membrane?
(D) Why the cytoplasmic membrane curvature was formed by the aggregations of phosphatidylethanolamine (PE) but not by phosphatidylcholine (PC)?
(E) How does phosphatidylcholine (PC) transfer to the external surfaces of plasma membrane?

2. Name five protein posttranscriptional modifications in the eukaryote and the targeted amino acids during modification (10%) 答案請寫於 答案紙 第三頁