注意：考試開始鈴響前，不得翻閱試題，

並不得書寫、畫記、作答。

國立清華大學 113 學年度學士後醫學系單招試題

系所班組別：學士後醫學系

科目代碼：0102

考試科目：生物與生化

—作答注意事項—

1. 請核對答案卡上之准考證號、科目名稱是否正確。
2. 作答中如有發現試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
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國立清華大學 113 學年度學士後醫學系單獨招生試題

考試科目（科目代碼）：生物與生化（0102）

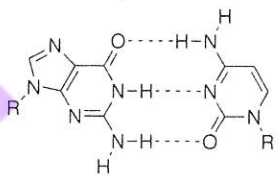
[單選題]每題 2.5 分，共計 150 分。答錯一題倒扣 0.625 分，未作答，不給分亦不扣分。

1. Consuming green tea may positively affect skin health, help with weight loss, and reduce the risk of cardiovascular disease. Which of the following components is **less likely** to be found in green tea extract?
   (A) Catechins
   (B) L-theanine
   (C) Caffeine
   (D) Quercetin
   (E) Lycopene

2. Which of the following descriptions about cyanobacteria is **NOT** correct?
   (A) They are Gram-negative bacteria.
   (B) Most species are not able to fix nitrogen.
   (C) They contain chlorophyll and beta-carotene pigments.
   (D) They are photosynthetic microbes.
   (E) They are able to establish symbiotic relationships with diverse plant species.

3. Which of the following descriptions about root nodules is **NOT** correct?
   (A) They are typical structures harbouring different types of bacteria.
   (B) Root exudates play a central role in recruiting beneficial microbes to form root nodules.
   (C) In root nodules, the bacteroids reduce N_2 to NH_3/NH_4^+ by nitrogenase.
   (D) The concentration of O_2 inside the nodules is high.
   (E) If mineral nitrogen (N) can satisfy the plant N demand, nodule formation is inhibited.

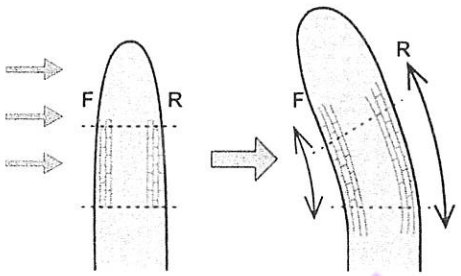
4. Which two DNA bases are held together by the hydrogen bonds below? (from left to right)



   (A) G and C.
   (B) A and T.
   (C) T and A.
   (D) C and G.
   (E) A and C.

5. Which of the following events does **NOT** engage double-stranded break repair?
   (A) Homologous recombination.
   (B) Non-homologous end joining.
   (C) CRISPR-Cas9 base editing.
   (D) DNA topoisomerases I
   (E) DNA topoisomerases II

6. Phototropism allows the plant to optimize photosynthetic light capture in the aerial portion. Which of the following descriptions of phototropism is correct?



   (A) The light on the left is red light; the concentration of auxin is higher on the R side
   (B) The light on the left is red light; the concentration of auxin is higher on the F side
   (C) The light on the left is red light; the concentration of cytokinin is higher on the R side
   (D) The light on the left is blue light; the concentration of cytokinin is higher on the F side
   (E) The light on the left is blue light; the concentration of auxin is higher on the R side

7. Which description of *Mycoplasma pneumoniae* is **NOT** correct?
   (A) It is predominantly transmitted by human-to-human contact
   (B) It primarily affects mucosal areas of the respiratory tract.
   (C) It is inherently sensitive to penicillin.
   (D) Clinicians can treat the disease with macrolide or tetracycline classes of antibiotics
   (E) It has most frequently presented as community-acquired pneumonia.

8. According to new research, patients with long COVID –long-term symptoms like brain fog, fatigue, or memory loss in the months or years following COVID-19 – can exhibit a reduction in circulating levels of serotonin. Which of the following

descriptions is **NOT** correct?

(A) Serotonin is a neurotransmitter.

(B) Serotonin is primarily produced in the GI tract

(C) Serotonin levels could be restored through treatment with serotonin precursors or selective serotonin reuptake inhibitors.

(D) Methionine is a building block for serotonin. When methionine absorption is reduced by persistent viral inflammation, serotonin is depleted.

(E) The finding could link depression with cognitive impairment in Long COVID.

9. Celiac disease (麥麩不耐症) is a T cell-driven intolerance to gluten ingestion in genetically predisposed people. The gluten-derived T cell epitopes are proline-rich and thereby highly resistant to proteolytic degradation within the gastrointestinal tract. Which of the following descriptions is **NOT** correct?

(A) Gluten is a mixture of water-insoluble prolamin protein.

(B) Prolamins constitute the significant endosperm storage proteins in mature cereal grains.

(C) Upon gluten ingestion, proteases in the gastrointestinal tract degrade gluten proteins into peptides.

(D) Increased prevalence of symptomatic celiac disease can be associated with gut microbiota changes and environmental modification.

(E) The primary therapeutic approach for celiac disease is oral enzyme therapy, employing gluten-degrading enzymes.

10. Cooking oils are lipids (fats) made from plants, animals, or synthetic compounds used when frying, baking, and preparing foods for consumption. Which description of cooking oils is **NOT** correct?

(A) Plant-based cooking oils are better than animal-based cooking oils.

(B) Unsaturated fats are known to lower our bodies' "bad" low-density lipoprotein (LDL).

(C) We often find polyunsaturated fats in foods like nuts and fish.

(D) We often find monounsaturated fats in oils like olive oil, canola oil, and peanut oil.

(E) Three lipids in cooking oils: triacylglycerols, phospholipids, and sterols. Triacylglycerols are the most common lipids in our foods.

11. Which method is most effective in determining if the song in bird populations is inherited from or taught by their parents?

(A) Mark and recapture
(B) Cross-fostering
(C) QTL mapping
(D) Long-term tracking
(E) Vocal cord examination

12. Which of the following is correct about Nerve nets?
(A) Exclusive to Sponge.
(B) The simplest form of the nerve system.
(C) Signal propagates in one direction.
(D) With myelination.
(E) None of the above.

13. Which of the following is **NOT** one of the assumptions for the Hardy–Weinberg principle, stating constant allele and genotype frequencies across generations?
(A) Large sample size.
(B) No mutation.
(C) Non-random mating.
(D) No selection.
(E) No gene flow.

14. Neural crest gives rise to diverse tissues **EXCEPT** for?
(A) Brain.
(B) Adrenal medulla.
(C) Epidermal pigment cells.
(D) Cartilage and connective tissue.
(E) Muscle.

15. Which option accurately describes a hormonal event during the luteal phase of the ovarian cycle?
(A) Estrogen is secreted by the pituitary gland.
(B) LH triggers the development of the corpus luteum.
(C) Progesterone levels decrease, leading to menstruation.
(D) FSH (follicle-stimulating hormone) peaks, promoting ovulation.
(E) GnRH (gonadotropin-releasing hormone) stimulates the release of progesterone.

16. Which reproductive barrier belongs to postzygotic isolation?
(A) Hybrid breakdown.

(B) Gametic isolation.
(C) Mechanical isolation.
(D) Behavioral isolation.
(E) All of the above.

17. During dehydration, the body maintains blood pressure through various mechanisms, and one of the key ways it does this is by
(A) Increase glomerular filtration rate (GFR).
(B) Decrease Cardiac output.
(C) Vasodilation
(D) Decrease Renin secretion.
(E) Increase vasopressin release.

18. How do glomerular filtration rate (GFR) and renal clearance differ?
(A) GFR measures substances completely removed by the kidneys, while renal clearance considers filtration, reabsorption, and secretion.
(B) GFR reflects the total volume of plasma cleared by the kidneys, while renal clearance evaluates only the filtration process.
(C) GFR evaluates only the filtration process, whereas renal clearance encompasses filtration, reabsorption, and secretion.
(D) GFR and renal clearance are synonymous terms, representing the efficiency of the kidney's waste removal.
(E) GFR represents the amount of urine produced, while renal clearance measures the concentration of waste in the urine.

19. Which description accurately characterizes the Vomeronasal organ?
(A) Located at the top of the nasal cavity in humans.
(B) Expresses a large number of olfactory receptors.
(C) Only exists in mammals.
(D) Specific for pheromone detection.
(E) All of the above.

20. What is the main function of Ia axon for muscle contraction?
(A) Innervates extrafusal muscle fibers, causing muscle contraction in response to signals from the spinal cord.
(B) Innervates intrafusal muscle fibers within muscle spindles, regulating their sensitivity to stretch and maintaining the spindle's function during muscle contraction.
(C) Conveys proprioceptive information from muscle spindles to the spinal cord,

providing feedback on muscle length and rate of change.
(D) Carries Golgi tendon organ information, signaling changes in muscle tension to prevent excessive force generation.
(E) None of the above.

21. Spina bifida leads to various symptoms, such as abnormalities in walking, leg weakness, or bladder control issues, and what is its primary cause?
(A) An incomplete closure of the spinal column.
(B) An abnormal opening in the abdominal wall.
(C) A congenital heart defect affecting the aorta.
(D) A genetic disorder causing abnormal limb development.
(E) A muscle defect due to abnormal function in mitochondria.

22. In a study of 100 oogonia undergoing gametogenesis (meiosis), the crossover events between two specific loci, A and B, on a chromosome were analyzed. It was found that 65 gametes show no crossover, 23 show one crossover, 10 show two crossovers, and 2 show three crossovers between loci A and B. What is the estimated genetic map distance between these loci?
(A) 3.5 centimorgans
(B) 6.5 centimorgans
(C) 35 centimorgans
(D) 49 centimorgans
(E) 65 centimorgans

23. Which of the following statements accurately reflects the impact of uniparental inheritance of organelle genes and mutations on traits and diseases in animals, plants, and fungi?
(A) In some species of fungi, mitochondrial DNA can be inherited either maternally, paternally, or biparentally, depending on the species.
(B) Mutations in mitochondrial DNA in humans can lead to diseases such as Leber's hereditary optic neuropathy, which is inherited paternally.
(C) In plants, mutations in chloroplast DNA, which is typically inherited from the mother, can not lead to variegated leaf patterns due to defects in photosynthesis.
(D) In most cases, both maternal and paternal mitochondrial DNA contribute equally to the offspring's mitochondrial function in plants.
(E) In animals, paternal inheritance of mitochondrial DNA is the norm, contributing significantly to traits related to energy metabolism.

24. Which of the following statements about the mechanisms and characteristics of $CD4^+$ regulatory T (Treg) cells is **NOT** correct?
(A) Treg cells are primarily known for their role in immune suppression through cytokine secretion and cell-cell interactions.
(B) Treg cells express high levels of CD28, which competes with CD28 on effector cells for binding to B7 molecules on antigen-presenting cells, thereby inhibiting T cell activation.
(C) Treg cells secrete perforin and granzyme A/B to kill target cells.
(D) The stability and suppressive function of Treg cells in peripheral tissues can be influenced by the local cytokine environment, including the presence of IL-6 and TGF-β.
(E) Treg cells can convert into effector T cells under certain inflammatory conditions, contributing to immune responses.

25. Which of the following statements about the physiology of gas exchange in humans and the properties of hemoglobin is **NOT** correct?
(A) Hemoglobin's affinity for oxygen decreases in the presence of high carbon dioxide levels, a phenomenon known as the Bohr effect, which enhances oxygen release in tissues where CO_2 is abundant.
(B) Fetal hemoglobin (HbF) has a higher affinity for oxygen compared to adult hemoglobin (HbA), facilitating the transfer of oxygen from the mother's bloodstream to the fetus.
(C) The Haldane effect describes how deoxygenated hemoglobin can carry more carbon dioxide, as oxygenation of blood in the lungs displaces carbon dioxide from hemoglobin, reducing its affinity for CO_2.
(D) Myoglobin, with its single oxygen-binding site, has a lower affinity for oxygen than hemoglobin, making it less effective in oxygen transport but more effective in oxygen storage.
(E) During intense exercise, the local increase in temperature and hydrogen ion concentration in muscles reduces hemoglobin's affinity for oxygen, enhancing oxygen delivery to active tissues.

26. What is a possible reason for an organ transplant rejection in identical twins, given their genetic similarity?
(A) Differences in blood type between the twins, as blood type compatibility is crucial for successful organ transplantation.
(B) Minor genetic mutations that occurred post-zygotically, leading to slight genetic differences between the twins.

(C) The presence of different sets of major histocompatibility complex (MHC) molecules, leading to immune recognition and rejection.
(D) Psychological stress in the recipient twin, which can indirectly trigger an immune response against the transplanted organ.
(E) Environmental factors leading to different gut microbiota in the twins, which can influence immune responses and organ compatibility.

27. Which of the following statements about the causes of acquired immunodeficiency is **NOT** correct?
(A) HIV infection leads to acquired immunodeficiency by progressively destroying the body's $CD4^+$ T cells.
(B) Malnutrition can cause acquired immunodeficiency by impairing the production and function of immune cells, leading to increased susceptibility to infections.
(C) Opportunistic infections are a primary cause of acquired immunodeficiency, directly leading to the weakening of the immune system.
(D) Acquired immunodeficiency differs from innate immunity in that it involves a weakened adaptive immune response, whereas innate immunity is present from birth and does not adapt or change in response to specific pathogens.
(E) Chronic exposure to environmental toxins can lead to acquired immunodeficiency by disrupting the normal function of the immune system.

28. Which of the following statements about Trypanosomes and their interaction with hosts and the immune system is correct?
(A) Trypanosomes have a simple life cycle that involves only one host and does not require a vector for transmission.
(B) The primary mechanism of immune evasion in Trypanosomes is the constant change of their surface glycoproteins (VSGs) through gene rearrangement, allowing them to avoid detection by the host's immune system.
(C) The gene rearrangement in Trypanosomes is triggered by the host's immune response, leading to a temporary suspension of VSG production and a dormant state in the parasite.
(D) Coevolution with humans has led to Trypanosomes becoming less virulent, resulting in a symbiotic relationship where the parasite does not harm the host.
(E) The immune system of secondary hosts, such as tsetse flies, plays a crucial role in the suppression and elimination of Trypanosomes, preventing their transmission to humans.

29. Which of the following statements about mitochondria is **NOT** correct?
(A) Mitochondria have their own DNA, which is circular and resembles bacterial DNA, supporting the endosymbiotic theory of mitochondrial origin.
(B) Mitochondria play a crucial role in the regulation of cellular apoptosis through the release of cytochrome c and other pro-apoptotic factors.
(C) Mitochondria are involved in the regulation of cellular calcium levels, which is important for various cellular functions including signal transduction.
(D) Balanced mitochondrial dynamics are crucial for neuronal health and function.
(E) Increased mitochondrial fusion is associated with aging and cellular senescence.

30. Which of the following statements about X-linked Severe Combined Immunodeficiency (X-SCID) is correct?
(A) X-SCID is an autosomal dominant disorder characterized by a fully functional immune system but increased susceptibility to autoimmune diseases.
(B) X-SCID is characterized by an overactive immune response, leading to chronic inflammation and autoimmunity due to the dysregulation of T and B lymphocytes.
(C) X-SCID is caused by a mutation in the IL2RG gene on the X chromosome, leading to a severe defect in both T and B lymphocyte function.
(D) The most effective treatment for X-SCID is long-term administration of antibiotics and antiviral medications to manage infections.
(E) X-SCID patients are generally resistant to common viral infections due to compensatory mechanisms in the innate immune system.

31. Which of the following biomolecules is at a crossroad between glycolytic pathway and pentose phosphate pathway?
(A) Glucose 6-phosphate.
(B) Glyceraldehyde 3-phosphate
(C) Pyruvate
(D) Acetyl-CoA
(E) Fructose 1,6-bisphosphate

32. Which of the following urine component can be used as a biomarker to monitor DNA turnover?
(A) beta-aminoisobutyrate.
(B) ammonium ion

(C) beta-alanine.
(D) cytidine.
(E) AMP

33. How many NADPH will be generated while one glucose is totally metabolized through the pentose phosphate pathway?
(A) 1
(B) 2
(C) 3
(D) 4
(E) 6

34. Which of the following enzymes is **NOT** located in mitochondria?
(A) carbamoyl-phosphate synthase 1
(B) voltage-dependent anion channel
(C) carnitine transporter
(D) carbamoyl-phosphate synthase 2
(E) DNA polymerase gamma

35. Tetrahydrobiopterin can be synthesized from:
(A) ATP
(B) CTP
(C) GTP
(D) UTP
(E) TTP

36. Which inhibitor can be used to inhibit complex III of electron transport chain in cells?
(A) cyanide
(B) oligomycin
(C) malonate
(D) rotenone
(E) none of the above

37. Acetyl-CoA is one of the major metabolic intermediates in cells. In case, 1 mole acetyl-CoA is completely oxidized in cells (to form carbon dioxide and water). How many moles of high-energy bond will be generated?
(A) 16
(B) 18

(C) 14
(D) 12
(E) 10

38. Which of the following amino acid biosynthesis shares the same pathway of urea cycle?
(A) Arginine
(B) Histidine
(C) Phenylalanine
(D) Cystine
(E) Lysine

39. Which of the following enzymes has two substrate catalytic properties?
(A) uricase
(B) deoxyribonuclease
(C) xanthine oxidoreductase
(D) xanthine oxidase
(E) guanine deaminase

40. Glutathione can do all of the following reactions **EXCEPT**
(A) trapping peroxides
(B) increasing the solubility of drug
(C) detoxifying endogenous compounds
(D) decreasing the stability of plasma membrane in erythrocytes.
(E) helping to maintain redox balance.

41. The resolution of gel filtration chromatography can be improved by _____.
(A) using a long column with a slow flow rate
(B) using a long column with a fast flow rate
(C) using a short column with a slow flow rate
(D) using a short column with a fast flow rate
(E) loading a large sample volume

42. When studying post-translational modifications of proteins, researchers often use amino acid substitutions to mimic modified or unmodified protein states. Which amino acid is the most appropriate to mimic phosphoserine by mutation?
(A) Thr
(B) Tyr
(C) Arg

(D) Lys
(E) Glu

43. A frameshift mutation is one that causes ____ , and often changes ____ of a protein.
(A) a deletion, the secondary structure
(B) all of the bases downstream to shift, activity
(C) all of the bases upstream to shift, the tertiary structure
(D) an insertion, the primary structure
(E) no change to amino acid sequence, nothing

44. Incubation of unilamellar liposomes composed of phosphatidylcholine and phosphatidic acid and trace amounts of phosphatidyl inositol (PI) with PI-specific phospholipase C (PLC) results in hydrolysis of PI to inositol phosphate and diacylglycerol. In the experiments, PI distributes equally between the two leaflets during the preparation of liposomes.
How much PI will be hydrolyzed by PI-specific PLC? And when an active scramblase is incorporated into the liposomes, how much PI will be hydrolyzed by PI-specific PLC?
(A) 25%; 50%
(B) 50%; 0%
(C) 100%; 0%
(D) 50%; 100%
(E) 100%; 100%

45. ClpB is an ATPase, functioning as a chloroplastic disaggregase. Biochemical characterization, including the SDS-PAGE and gel filtration chromatography of the purified ClpB, was performed to understand this enzyme better. Which of the following statements is most likely?

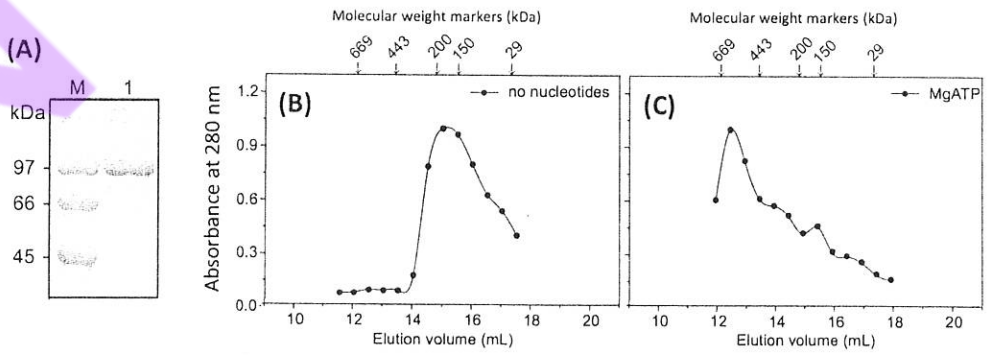


Figure legend: (A) Purified ClpB analyzed by SDS-PAGE. (B) Gel

filtration profile of ClpB without nucleotides. (C) Gel filtration profile of ClpB with Mg^{+2} and ATP. (Figure adapted from *Parcerisa et al. (2020) Plant Molecular Biology.*)

(A) The functional form of ClpB is a hexamer.
(B) ClpB is a monomer in solution.
(C) Mg^{+2} and ATP disaggregate ClpB.
(D) The molecular weight of ClpB monomer is 200 kDa.
(E) In the presence of Mg^{+2} and ATP, ClpB displays an ordered tertiary structure.

46. Pseudouridine, a C5-glycosidic isomer of uridine, plays a critical role in the success of mRNA vaccine development. How does pseudouridine contribute to stabilizing RNA duplexes relative to uridine?
(A) By reducing the formation of hydrogen bonds within RNA molecules.
(B) By increasing the flexibility of RNA secondary structures.
(C) By promoting the formation of additional hydrogen bonds in the RNA backbone.
(D) By enhancing the base pairing and stacking.
(E) By neutralizing the charge of RNA molecules.

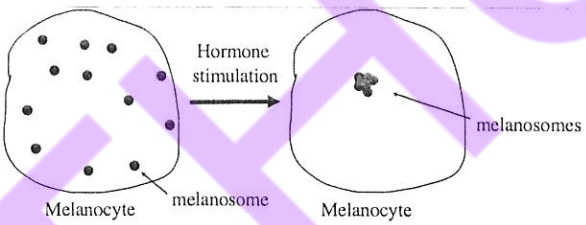
47. What is the primary inhibition mechanism of antimycin on oxidative phosphorylation, and what are the consequences?
(A) Inhibition of complex I, leading to decreased electron transport and reduced ATP production.
(B) Inhibition of complex II, causing disruption in the citric acid cycle and impaired generation of reducing equivalents.
(C) Inhibition of complex III, resulting in the blockade of electron transfer and a decrease in the proton motive force.
(D) Inhibition of ATP synthase, preventing the conversion of the proton motive force into ATP synthesis.
(E) Inhibition of complex IV, leading to the disruption of the final step in the electron transport chain and a decrease in oxygen consumption.

48. SiR-tubulin is a microtubule dye used for visualizing microtubule dynamics in live cells, but cannot be used to stain paraformaldehyde (PFA) and methanol-fixed cells. Why is this dye unsuitable for fixed cells?
(A) These fixation methods alter the structure of the SiR-tubulin binding site on microtubules.
(B) The pH of fixed cells is not optimal for SiR-tubulin binding.

(C) The SiR-tubulin is a crosslinker of microtubules. PFA and methanol interfere with the reactivity of the dye.
(D) PFA and methanol prevent dye penetration.
(E) PFA and methanol significantly quench the fluorescence signal of the dye.

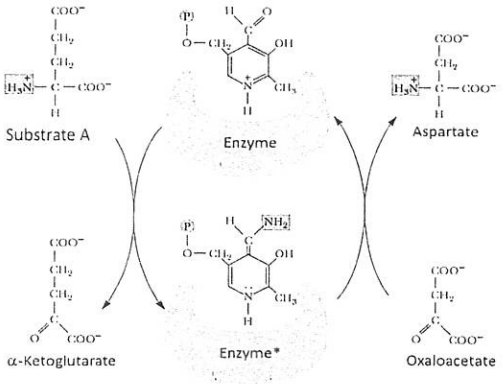
49. Which of the following statements regarding lipopolysaccharide (LPS) is true?
(A) LPS is a type of glycerolipid found in bacteria.
(B) Lipid A, one component of LPS, is responsible for its immunogenic properties.
(C) LPS is found exclusively in the inner membrane of bacterial cells.
(D) The O-specific polysaccharide region of LPS is the main virulence factor
(E) LPS is used for serotyping gram-positive bacteria.

50. The Xenopus melanocyte contains melanosomes, the site for the synthesis and storage of melanin, the most common light-absorbing pigment found in animals. As illustrated in the following diagram, these melanosomes aggregate around the perinuclear region upon hormonal stimulation. What kind of cytoskeletal motor is responsible for the movement of melanosomes from the diffusive pattern to the aggregated pattern near the perinuclear region?



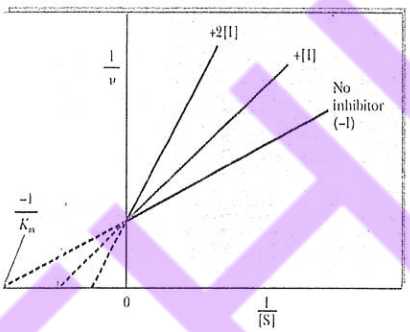
(A) ATP-driven Kinesin 1 moving on microtubules.
(B) GTP-driven Kinesin 5 moving on actin filaments.
(C) ATP-driven Myosin 4 moving on actin filaments.
(D) ATP-driven Dynein moving on microtubules.
(E) ATP-driven KIF2A moving on intermediate filaments.

51. Which of the following descriptions of the reaction shown in the figure is correct?



(A) The enzyme catalyzes a peptidyl-transferring reaction.
(B) The enzyme conforms to a single-displacement mechanism.
(C) The cofactor of the enzyme is a pyridoxal phosphate.
(D) Oxaloacetate is a competitive inhibitor of the enzyme.
(E) Substrate A is a glutamine.

52. This enzyme reaction plot reflects most likely a mechanism of _____.



(A) competitive inhibition
(B) uncompetitive inhibition
(C) pure non-competitive inhibition
(D) mixed noncompetitive inhibition
(E) irreversible inhibition

53. Which of the following descriptions of the Monod, Wyman, and Changeux model of allosteric enzyme regulation is **NOT** correct?
(A) The model proposes that an allosteric enzyme has two conformational states: R (Relaxed) and T (Tense or Tau).
(B) The model imposes functional and structural symmetry: all subunits of an enzyme oligomer share the same conformation.
(C) The model suggests that the enzyme exists predominantly in the R state when the substrate concentration is low.
(D) The model focuses on conformational equilibrium and population selection

by the ligands.

(E) The model puts less emphasis on ligand-induced conformational changes.

54. Which of the following descriptions of catecholamines is **NOT** correct?

(A) Catecholamine neurotransmitters are derived from tyrosine.

(B) Epinephrine and dopamine are catecholamine neurotransmitters.

(C) Defects in catecholamine processing are responsible for several neurological disorders, such as parkinsonism.

(D) Catecholamine neurotransmitters are frequently found in sympathetic neurons and adrenal glands.

(E) Because of the presence of the blood-brain barrier, catecholamine neurotransmitters only function in the circulation system.

55. Flagella are the major motility apparatus of bacteria. Which of the following descriptions of bacterial flagella is correct?

(A) Flagella in Gram-negative bacteria typically contain a multiple-ring structure. These rings, from the inside of the cell to the outside, are the L ring, P ring, M/S ring, and C ring.

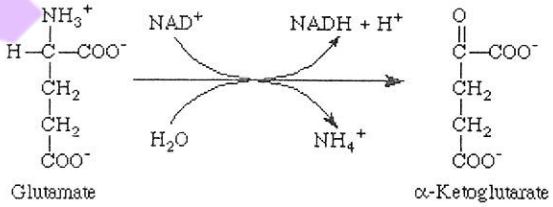
(B) ATP is the direct energy source of bacterial flagella rotation.

(C) The flagella filament is composed primarily of flagellin subunits and is assembled in cytoplasm.

(D) The flagellar rotor could self-assemble in a spontaneous process.

(E) Reversal of flagella rotation primarily concerns conformation change in the filament.

56. Glutamate dehydrogenase catalyzes the reaction shown below. In a reaction mixture containing a saturated quantity of glutamate and NAD^+, how many units (U) of glutamate dehydrogenase should be added to increase the absorption at 340 nm by 1.0 OD in one minute? Please note that the molar extinction coefficient (ε) of NADH is 6220 liter/mol/cm at 340 nm, and the volume of the reaction mixture is 1 ml.



(A) 16 U

(B) 1.6 U

(C) 0.16 U
(D) 0.016 U
(E) 0.0016 U

57. Metformin is a drug for the treatment of type 2 diabetes. The drug has a wide action. Which of the following mechanisms is most likely to be true?
(A) It improves the sensitivity of cells to insulin, primarily by stimulating glucose uptake by glucose transporters in peripheral tissues.
(B) It inhibits the activity of AMP-activated protein kinase.
(C) It activates AMP deaminase and decreases cellular AMP levels.
(D) It inhibits insulin binding to receptors and reduces the receptor's tyrosine kinase activity.
(E) It enhances gluconeogenesis in the liver.

58. The bacterium *Corynebacterium diphtheriae* produces a potent toxin to block host cell translation. Which of the following descriptions is **NOT** a property of diphtheria toxin?
(A) The toxin modifies a histidine residue on eEF-2 to form diphthamide.
(B) The toxin catalyzes an ADP-ribosylation reaction on eEF-2.
(C) One of the substrates of the toxin is NAD^+, and one nicotinamide is released in the reaction.
(D) The modified eEF-2 retains the ability to bind GTP but cannot function in protein synthesis.
(E) One toxin can catalytically modify many eEF-2 molecules.

59. Ribosomes are macromolecular machines that perform protein synthesis. Which of the following descriptions concerning ribosome is **NOT** correct?
(A) The prokaryotic ribosome is a ribozyme catalyzing a peptidyl-transfer reaction.
(B) Each prokaryotic ribosome is composed of a 30S and a 50S component. Here, S is the Svedberg unit.
(C) The 50S ribosomal component has mainly a decoding function and is bound to the mRNA.
(D) Typical prokaryotic ribosomes comprise ~52 different proteins and 3 major RNA.
(E) Ribosomes can self-assemble in vitro.

60. Which of the following descriptions about eicosanoids is **NOT** correct?
(A) Eicosanoids are named because they are derived from 20-carbon fatty acids

such as arachidonate.

(B) Many eicosanoids are local hormones and have signaling activities.

(C) Prostaglandins, thromboxanes, and leukotrienes are some subfamilies of eicosanoids.

(D) Acetaminophen is a nonsteroidal anti-inflammatory drug that blocks the interaction of eicosanoids and their receptors.

(E) Aspirin exerts its anti-inflammatory effects by acetylation of cyclooxygenase (COX), an enzyme responsible for prostaglandin synthesis.